



Tomas Bata University in Zlín
Faculty of Management and Economics

Doctoral Thesis

How green knowledge sharing enhances green product innovation in SMEs: the roles of customer involvement, absorptive capacity, and innovation climate

Jak sdílení zelených znalostí zlepšuje zelené inovace produktů v malých a středních podnicích: role zapojení zákazníků, absorpční kapacity a inovačního klimatu

Author: **Nosheen Qadeer**

Degree Program: P0413D050013 Economics and Management

Supervisor: doc. Ing. Jana Matošková, Ph.D.

Consultant: Talat Mehmood Khan, Ph.D.

Zlín, June 2026

© Nosheen Qadeer

Published by **Tomas Bata University in Zlín** in the Edition **Doctoral Thesis**.
The publication was issued in the year 2026

Keywords: *Green knowledge sharing, Absorptive capacity, Innovation climate, Customer involvement, Green product innovations.*

Klíčová slova: *sdílení zelemých znalostí, absorpční kapacita, inovační klima, zapojení zákazníků, zelené produktová inovace.*

Full text of the doctoral thesis is available in the Library of TBU in Zlín.

ACKNOWLEDGEMENT

Achieving success is not a solitary accomplishment. It is the outcome of the combined contributions of many people. These people are both directly and indirectly involved. I would like to express my deepest gratitude to my supervisor, Dr. Ing. Jana Matošková, Ph.D, and my consultant, Dr. Talat Mehmood Khan, for their extensive support and guidance in helping me achieve my academic objectives. Their support has extended beyond job-related matters. Throughout my Ph.D. program, they provided considerable mental support and encouragement, helping me overcome difficult challenges, boost my self-confidence, and enhance my productivity.

I would also like to express my gratitude to the Ph.D. course lecturers who taught me how to conduct effective research. I would like to thank Dr. Lubor Homolka and Professor Drahomíra Pavelková for sharing their experience and helping me develop a better understanding of research methodology and achieve well-defined outcomes. I would also like to thank Professor Pavelková. Boris Popesko for helping me publish my research.

I would like to express my sincere gratitude to my mentors, Dr. Shazia Nauman, Dr. Usama Awan, and Dr. Najam-ul-Zia. Their constant support, motivation, and collaboration enabled me to achieve my academic goals and grow as a researcher. I would also like to thank my friend and colleague, Dr. Shoaib, who was involved in my research work. My gratitude also goes to Professor María José Ruiz Ortega for her supervision at the UCLM - Universidad de Castilla-la Mancha in Spain through the Erasmus+traineeship program. Moreover, I would like to thank Dr. Bujdosó Zoltán for his supervision at the MATE-Hungarian University of Agriculture and Life Sciences in Hungary through the CEEPUS mobility program. These opportunities allowed me to gain new knowledge and expand my research network.

I would like to acknowledge the support given by the administrative staff at Tomas Bata University. I am particularly grateful for the help of Ms. Martina Drábková and Ms. Pavla Bartošová in managing all administrative aspects throughout my entire doctoral program. I would like to extend my thanks to Hana Toncrová and Ms. Eva Chmelařová for their assistance with my Erasmus+ traineeship and CEEPUS programs in Spain and Hungary. I would like to express my gratitude to Lucie Smolková and Simona Pekařová for their help with the IGA project's implementation.

Building and maintaining strong friendships and a solid social support network is of the utmost importance. I would like to express my gratitude to my friends for their invaluable assistance, which made this journey easier to manage. I would also like to thank Riphah International University and my colleague, Dr.Zain Tahir, for his continued support, which helped me in collecting data, achieving my goals, and increasing my efficiency.

Ultimately, the support and blessings of my parents (special to my Late Father), brothers, sister, and my husband played a crucial role in helping me navigate the most challenging phase of my Ph.D. journey. I extend my heartfelt gratitude to my nephews and nieces, whose selfless love enhanced this journey. Achieving ambitious goals often depends on the confidence gained from the support of those who believe in you. This dream turned reality is a testament to the collective support and faith you have shown me.

ABSTRACT

The manufacturing industries have a significant role in responding to environmental concerns that are becoming increasingly serious. To attain sustainable development goals, manufacturing enterprises must obtain a competitive advantage, and one way to achieve it is through green knowledge sharing and green product innovation.

Drawing on the indirect research streams of the Resource-Based View and Knowledge-Based View of the firm, as well as Social Exchange theories, this study examines the impact of green knowledge-sharing practices on green product innovation. Additionally, it explores the mediating effects of absorptive capacity and innovation climate between green knowledge sharing and green product innovation. Data was collected through a quantitative field survey conducted among 642 small and medium-sized enterprises in the developing country's context. The measurement and structural model were evaluated using SEM Smart-PLS.3.0. The findings provide valuable insights for firms, policymakers, practitioners, and managers seeking to enhance green knowledge-sharing practices, reduce industrial waste, and gain a competitive advantage. Regarding the theoretical contribution to the authors' knowledge, this study represents a pioneering effort to investigate the direct and indirect relationships between green knowledge-sharing practices and green product innovation, through absorptive capacity, innovation climate, and customer involvement, within a unified model. In general, practitioners and managers are recommended to implement green knowledge-sharing practices to attain a competitive advantage.

ABSTRAKT

Zpracovatelský průmysl hraje významnou roli v reakci na stále závažnější problémy životního prostředí. K dosažení cílů udržitelného rozvoje musí výrobní podniky získat konkurenční výhodu a jedním ze způsobů, jak jí dosáhnout, je sdílení zelených znalostí a zelených produktových inovací.

Tato studie se odvolává na nepřímý výzkumný proud pohledu založeného na zdrojích, pohledu na znalostní firmu a teorie sociální výměny a zkoumá vliv postupů sdílení zelených znalostí na inovace zelených produktů. Kromě toho zkoumá zprostředkující účinky absorpční kapacity a inovačního klimatu mezi sdílením zelených znalostí a zelených produktových inovací. Data byla shromážděna prostřednictvím kvantitativního terénního šetření provedeného mezi 642 víceodvětvovými výrobními podniky v kontextu rozvojové země. Měření a strukturální model byla vyhodnoceny pomocí SEM Smart-PLS. Zjištění nabízí cenné poznatky pro firmy, tvůrce politik, odborníky z praxe a manažery, jejichž cílem je zlepšit postupy sdílení zelených znalostí, snížit průmyslový odpad a získat konkurenční výhodu. Co se týče teoretického přínosu k poznání autorů, tato studie představuje průkopnické úsilí zkoumat přímé a nepřímé vztahy mezi postupy sdílení zelených znalostí a konkurenční výhodou prostřednictvím absorpční kapacity, inovačního klimatu a zapojení zákazníků v rámci jednotného modelu. Obecně se doporučuje, aby odborníci z praxe a manažeři zaváděli praktiky sdílení zelených znalostí za účelem dosažení konkurenční výhody.

TABLE OF CONTENTS

1	INTRODUCTION.....	1
2	THEORETICAL FRAMEWORK	3
2.1	Context of the study: Developed and Developing Economies and the Significance of SMEs.....	3
2.1.1	<i>Importance of SMEs.....</i>	7
2.1.2	<i>Socioeconomic impact of SMEs.....</i>	10
2.1.3	<i>Competitiveness among SMES and large enterprises.....</i>	12
2.2	Green Practice Implementation in Developed and Developing Countries	13
2.3	“Pakistan” a developing nation	15
2.4	Traditional knowledge sharing approach VS green knowledge sharing in developing countries’ SMEs	17
2.5	Research Background.....	22
2.6	Concepts development	24
2.6.1	<i>Green Product Innovation.....</i>	24
2.6.2	<i>Green Knowledge Sharing.....</i>	25
2.6.3	<i>Absorptive Capacity</i>	27
2.6.4	<i>Innovation Climate</i>	27
2.6.5	<i>Customer Involvement.....</i>	27
2.7	Underpinning Theories.....	28
2.8	Hypotheses Development.....	33
2.8.1	<i>Green knowledge sharing and Green product innovation.....</i>	33
2.8.2	<i>Green knowledge sharing and Absorptive capacity</i>	36
2.8.3	<i>Absorptive capacity and Green product innovation</i>	39
2.8.4	<i>Green knowledge sharing and Innovation climate</i>	42
2.8.5	<i>Innovation climate and Green product innovation</i>	44
2.8.6	<i>Absorptive capacity as a mediator.....</i>	46
2.8.7	<i>Innovation climate as a mediator.....</i>	48
2.8.8	<i>Customer involvement as a moderator.....</i>	50
2.9	Summary related to Green knowledge sharing and other variables	56
3	MOTIVATION AND NEED FOR STUDY, RESEARCH GAP, RESEARCH QUESTION, AND OBJECTIVES.....	67
3.1	Motivation and need for study.....	67

3.2	Research Gap.....	70
3.3	Main Research Goal, Research Question, and Objectives.....	71
3.4	Conceptual Framework.....	72
4	METHODOLOGY	73
4.1	Sample, Demographics, and Data Collection and Analytic Technique	75
4.2	Measures of Variables	79
5	RESULTS.....	81
5.1	Data Screening and Missing Values	81
5.2	Respondents' Profile	82
5.3	Common Method Variance Bias.....	83
5.4	Descriptive Analysis	83
5.5	Discriminant Validity	84
5.6	Construct Validity and Reliability	86
5.7	Model Estimation	87
5.8	Structural Model and Hypothesis Testing.....	87
5.8.1	<i>Hypothesis Testing and Path Coefficient for Direct Hypothesis</i>	88
5.8.2	<i>Testing Mediating Effects.....</i>	89
5.8.3	<i>Testing Moderating Hypothesis</i>	91
5.9	Summary of Hypotheses' Results	94
6	DISCUSSION	95
6.1	Direct Effects	95
6.2	Contributions and Implications.....	112
6.2.1	<i>Theoretical Contributions.....</i>	112
6.2.2	<i>Practical Implications.....</i>	114
6.3	Limitations and Future Research.....	115
7	CONCLUSION.....	116
	REFERENCES	117
	LIST OF PUBLICATIONS BY AUTHOR.....	152
	AUTHOR'S CURRICULUM VITAE	154

LIST OF TABLES

Table 2.9 Literature Review summary.....	56
Table 4.1 Summary of research methodology.....	73
Table 4.2 Constructs, items, and their sources.....	79
Table 5.2 Respondents' Profile.....	82
Table 5.4 Descriptive Statistics of the study variables.....	84
Table 5.5.1 Fornell-Larcker Criterion.....	84
Table 5.5.2 Discriminant Validity Analysis (HTMT).....	85
Table 5.6 Construct Validity and Reliability.....	86
Table 5.8.1 Direct Hypothesis.....	88
Table 5.8.2 R-Square and R- Square adjusted.....	89
Table 5.8.3 Results of Mediating Hypothesis.....	90
Table 5.8.4 Results of moderating Effects.....	91
Table 5.9 Summary of Hypotheses.....	94

LIST OF FIGURES

Figure 1: Publication trend of SMEs growth.....	6
Figure 2: SME growth literature by country: (a) developed country, (b) developing country.....	7
Figure 3. A heuristic model of importance of SMEs.....	9
Figure 4: Conceptual Framework.....	72
Figure 5: Research Onion.....	74
Figure 6: Research Process.....	78
Figure 7: Path Model Results.....	90
Figure 8: The interactive effect of green knowledge sharing and customer involvement on absorptive capacity.....	92
Figure 9: The interactive effect of green knowledge sharing and customer involvement on innovation climate.....	93

LIST OF ABBREVIATIONS

GKS	Green knowledge sharing
GPI	Green product innovation
AC	Absorptive capacity
IC	Innovation climate
CI	Customer involvement
RBV	Resource-based view theory
KBV	Knowledge-based-view theory
NPD	New product development
SMEs	Small and medium-sized enterprises
SDGs	Sustainable Development Goals
SEM	Structural equation modeling
SMEDA	Small and medium enterprises development authority

1 INTRODUCTION

Global attention has been increasingly directed towards the Sustainable Development Goals (SDGs) since 1987, following the introduction of sustainable development, with a notable emphasis from developed countries on addressing the scarcity of natural resources (Hajian & Kashani, 2021). In response to these concerns, manufacturing firms have started to prioritize "greenness," concentrating on adapting to environmental conditions and conserving resources (Rehman et al., 2024). Now a days the enactment of green practices is fundamental for businesses directing to minimize the negative effects of climate change and other environmental issues; therefore, forward-thinking manufacturing firms are more likely to incorporate sustainable practices into their business operations (Roberts et al., 2022). Alongside this shift, the conception of green product innovation emphasizes the significance of new product development and the strategic management of resource flows across organisational borders to improve innovation performance and attain competitive advantage (Qiu et al., 2020). Accordingly, organisations are embracing practices like green knowledge sharing (GKS), absorptive capacity (AC), innovation climate (IC), customer involvement (CI), and green product innovation to enhance performance and deliver lasting results for the firms' competitiveness.

In developing countries, manufacturing firms are important for economic growth, substantially contributing to job creation, poverty alleviation, and industrial expansion (Qiu et al., 2020). However, many manufacturing firms frequently operate under significant constraints, such as restricted resources, outdated technology, inadequate institutional backing, and high market instability. In such challenging environments, survival and long-term growth depend on building and maintaining a competitive advantage in difficult environments (Gomez-Trujillo et al., 2024). Traditional sources of competitiveness, such as low-cost labor and access to natural resources, are becoming insufficient in today's global market due to increasing competition, environmental concerns, and evolving consumer preferences. Consequently, the attention has been redirected towards knowledge-based strategies, especially green knowledge sharing (GKS), as a way to improve both economic performance and environmental sustainability. Knowledge sharing has been a cornerstone of organizational development and competitiveness for a long time (Zhang et al., 2025). Moreover, as industry 4.0 to reach its full potential, the use of advanced technologies

requires companies to continuously learn, exchange green knowledge, and improve their ability to absorb new information (Hashem, 2024).

The present study is motivated by the need to explore the impact of sharing green knowledge on the sustainable productivity of manufacturing firms in the framework of developing economies. As a developing economy, Pakistan's manufacturing sector plays a significant role, contributing substantially to its national GDP and employment generation, thus serving as a basis for sustainable economic growth (Humayun et al., 2025). However, manufacturing firms operate within a context characterized by demanding environmental concerns, such as pollution, dwindling resources, and the detrimental effects of climate change. These environmental challenges faced by society directly impact the manufacturing firm, and examining the role of green knowledge sharing in addressing these concerns provides valued insights (Alketbi & Ahmad, 2024). Accordingly, this study purposes to check the effect of GKS on the green product innovation of SMEs in developing countries. Absorptive capacity, innovation climate, and customer involvement will help to improve product innovation to attain competitiveness. Moreover, Pakistan has implemented a range of environmental protocols and procedures to encourage viable practices in various areas, such as manufacturing and analyzing the impact of green knowledge sharing on competitive advantage via green product innovation can offer valuable perceptions into the usefulness of these strategies and facilitate the development of more targeted and impactful interventions.

Building on this context, this study utilises the Resource-Based View (RBV), Knowledge-Based View (KBV), and Social Exchange Theory (SET) to explain how Pakistani manufacturing firms can obtain sustainable competitive advantage through green knowledge sharing and innovation. From the RBV perspective, intangible assets such as absorptive capacity, innovation climate, and green knowledge are valued, rare, inimitable, and non-substitutable, making them crucial for creating competitiveness in environments with limited resources (Akhtar et al., 2024). Complementarily, the KBV highlights knowledge as a strategic resource, reinforcing the idea that successful green knowledge sharing within and beyond organisational boundaries enables companies to improve innovation, operational efficiency, and the dynamic capabilities required to address environmental challenges (Jalil et al., 2025). In addition to this, Social Exchange theory emphasizes the significance of reciprocal relationships in promoting collaboration, with customer participation and employee enthusiasm for green practices reinforced by trust and mutual benefits (Zhou et al., 2024). Together, these perspectives collectively offer a comprehensive understanding of how green knowledge sharing, facilitated by customer engagement and an enabling

innovation environment, can boost green product innovation and ultimately yield a sustainable competitive edge for manufacturers in Pakistan.

For this, the structure of the thesis will be as follows: 1) Introduction, 2) Theoretical Framework, 3) Motivation, Research Question & Objectives, 4) Methodology, 5) Results, 6) Discussion and Implementations, 7) Conclusion.

2 THEORETICAL FRAMEWORK

This chapter consists of four main headings, including theoretical distinction, green practice implementation, research background, an explanation of basic terms, underpinning theories, and hypotheses development.

2.1 Context of the study: Developed and Developing Economies and the Significance of SMEs

Developing countries and developed countries have a lot of things in common. They share basic features that show how they are connected to each other in the world we live in today. Developing countries and developed countries are linked in ways, within our current global system (Narteh, 2008). We live in a time when the whole world is connected. Countries that are rich and countries that are poor are all part of trade. They are all linked to each other through trade networks, supply chains that cross borders and the flow of money, people and technology from one country to another. The World Trade Organization and the International Monetary Fund are like teams that help countries work together. The World Trade Organization and the International Monetary Fund make sure that countries follow the rules when they trade with each other. The World Trade Organization and the International Monetary Fund also help keep the money system stable. Countries, at stages of development are part of the World Trade Organization and the International Monetary Fund (Wouters & Odermatt, 2014). Global challenges like climate change, public health crises, food insecurity and digital transformation affect poor countries in different ways. Research shows that sustainable development is crucial. It is a goal that the United Nations outlined in the Sustainable Development Goals or SDGs. These challenges hit countries at levels. (Gyimah et al., 2025). These goals apply to all nations, regardless of economic standing (United Nations, 2023). There are a lot of problems that affect every country.

Inequality is one of them. Environmental decline is another issue. Then there are shifts. These problems are not just limited to developing nations. They also affect nations. So both developed and developing nations have to deal with the kinds of challenges, in the twenty-first century. The thing is, these problems do not fit into development categories. Inequality and environmental decline and demographic shifts are issues that every nation has to think about (Gyimah et al., 2025).

Governments in places are working on similar things to make peoples lives better and to help them have what they need. A lot of countries are trying to make their people smarter and healthier by spending money on schools, hospitals, computers and jobs. Even countries with a lot of money are changing how they take care of people and how they teach kids because they are dealing with problems like getting older machines doing jobs and people moving to new places. Governments are doing this to improve capital and social welfare, which is very important, for human capital and social welfare. Human capital and social welfare are things that governments care about so they are working hard to make them better (Behera & Sethi, 2022). Similarly many developing countries are now using policy ideas and digital governance systems to quickly improve how well their institutions work and how they provide services (Behera & Sethi, 2022). There are still differences in peoples lives when it comes to things like money and where they live. Some people like those from families or certain ethnic groups have a really tough time. Women also face a lot of problems. The place where you live can make a difference too. These problems affect communities, like poor people, women and people, from different ethnic backgrounds in many ways. Marginalized groups have to deal with a lot of issues because of their class, gender, ethnic background and location (Jetten et al., 2021). People have been looking at this stuff. They found out that the difference between how much money people make and how much wealth they have is getting bigger in a lot of countries that are already pretty well off. This is interesting because it goes against what we thought, which is that the problem of people not having the amount of money is mostly something that happens in places that are not as developed as others. The thing is, income and wealth disparities are actually getting worse, in developed countries, which is challenging our idea that inequality is mostly something that happens in less developed places (Chancel et al., 2022).

Developed countries and developing countries have some things in common.. There are still big differences between them. These differences are very noticeable when we look at the economy the government and technology. Developed countries usually have economies that are based on different things, like knowledge and new ideas.

They are also very good at making things. Have strong rules to follow. Additionally they have good roads, internet and other important systems that help everything run smoothly. Developed countries like these have a lot of things that developing countries do not have. The economy in developed countries is very strong. This is because they have a lot of knowledge and they are very productive. They also have rules and regulations that everyone follows. Developed countries have physical things like roads and they also have good digital things, like the internet (Moran, 2006). Countries with a lot of money tend to have an economy and more money per person. They also have stable banks and can handle money problems better. The pandemic that happened in the 2020s showed that rich countries and poor countries are very different when it comes to handling money problems and taking care of peoples health. Rich countries like the United States and Germany have a lot of money to spend on helping people. Poor countries do not have as much money to spend on healthcare and other important things. The pandemic was a test for countries and it showed that rich countries have better systems in place to handle big problems. The 2020s pandemic was a difficult time for many countries and it showed that countries with a lot of money like the United States have more power to help their people than countries, with less money (Clift, 2025). Furthermore rich countries are good at research and development. They have innovative systems and use a lot of green technology. This puts them ahead in the worlds move to digital economies (Singh et al., 2023). Conversely many developing countries still have problems. These problems include: not having kinds of industries, relying too much on exporting basic goods, like raw materials, having weak governments, and not having good enough roads and buildings. (Kenny, 2003). Some countries are growing fast. Using new technology. Their progress is not the same everywhere. They are trying to make people less poor. Things like climate disasters fights between countries and changes in the world market can stop them. Climate disasters can hurt their progress. Fights between countries can make it hard to make plans. Changes, in the world market can affect how much they can sell (YUSUF & OLUWAYEMI, 2025). Social protection systems are not very good at helping people because the organizations that run them are weak. They do not have a lot of money. Also some people have good internet and know how to use computers but others do not have good internet and do not know how to use computers. This makes a difference in peoples lives around the world. Social protection systems are supposed to help people. They are not doing a very good job because of these problems. The digital divide is an issue and it is making social protection systems even weaker because some people have access to broadband and are good, with technology but social protection systems are not using this to their advantage (Drori, 2010).

Developed countries are working hard to grow through ideas and make sure they do not hurt the climate. They also want to make sure their economies can handle times. On the hand many developing countries are still trying to achieve simple things like getting good education to more people. They want to make their healthcare services better fix their roads and buildings and help people who're extremely poor. Developing countries are really focused on these development goals, such as increasing access, to quality education and improving healthcare services. They also want to upgrade their infrastructure and reduce poverty (Srinivas & Sutz, 2008). The difference between poor countries is getting smaller. Some countries that are not very rich are becoming important in the world economy. At the time wealthy countries are having trouble growing and making sure everyone is treated fairly. They are also struggling to protect the environment. Nowadays people who study development are looking at things in a way. They want to know if a country is really making progress. To do this they look at how people are getting along with each other if the country is taking care of the environment and if the government is working well. They do not just look at how money people are making. Development is about more than money it is, about development and how countries are developing (Polasky et al., 2015).

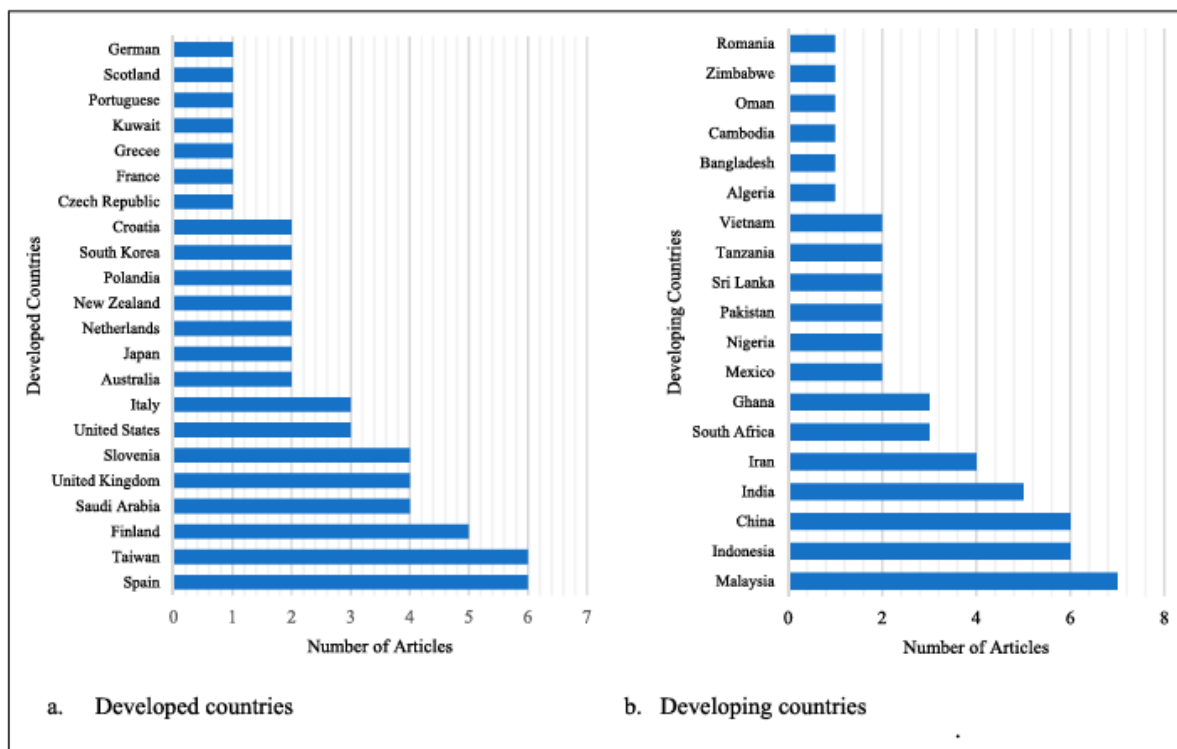


Figure 1: Publication trend of SMEs growth (source: (Fajarika et al., 2024))

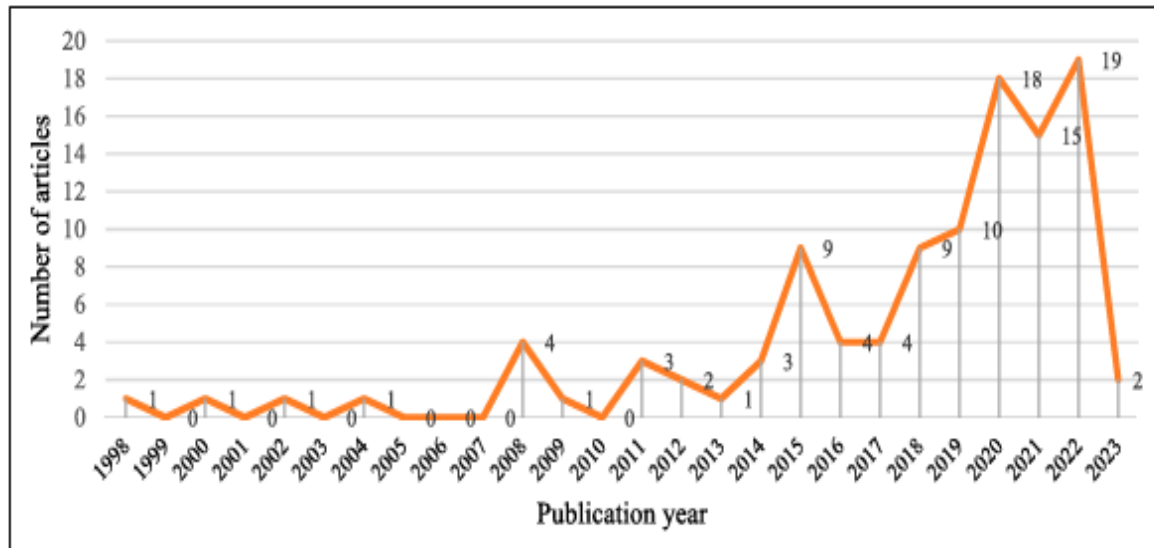


Figure 2: SME growth literature by country: (a) developed country, (b) developing country (source: (Fajarika et al., 2024))

2.1.1 Importance of SMEs

SMEs are really important for the economy. They help create jobs and give people money to live on. SMEs also help make sure we have many different types of industries and they come up with new technologies. SMEs make up a huge part of businesses. About 90 percent. And they give more than half of the jobs to people all around the world. This shows how important SMEs are for making sure everyone has a fair chance and that we can keep developing in a way that is good, for the planet (Tu et al., 2025). SMEs are really important in countries that are still growing and developing. They are like the backbone of the businesses that are not owned by the government. SMEs are a source of money for a lot of people, in these countries (Amoah et al., 2022). SMEs can really help the economy by getting more people to start their own businesses. This makes the market more competitive which is a thing. SMEs also help people come up with ideas and products which is called innovation. By doing all these things SMEs can help the economy get back on track and stay stable for a time. SMEs are important, for restructuring and long-term stability (Wonglimpiyarat, 2015).

SMEs are usually defined in different ways depending on the country or region. To figure out what makes a company SMEs people look at things like how employees it has how much money it makes each year and what kind of assets it owns. Sometimes they also consider what is typical for that industry. Even though there is no one way

to define SMEs these things help tell them apart from big companies. Small and medium-sized enterprises are different from enterprises because of how they operate how they are managed and how they get the money they need to run their business. SMEs have a smaller scale of operation a simpler management structure and less access to money, from investors and markets compared to large enterprises (Gyimah et al., 2025). The European Commission says that Small and Medium Enterprises or SMEs are businesses that have than 250 employees. Small and Medium Enterprises also have to have revenues that are not more than 50 million euros. SMEs have to have a balance sheet value that is not more than 43 million euros.. In developing economies the way they define SMEs is usually based on what their countrys industries are, like and what their government wants to focus on (Dorrucchi et al., 2009).

In Pakistan the SMEs Development Authority, also known as SMEDA says that Small and Medium Enterprises or SMEs are businesses that have no than 250 people working for them. These SMEs also have to follow rules about how much money they can make in a year and how much they can invest. The SMEs Development Authority, SMEDA is very clear, about what it means to be an SMEs (Matloob et al., 2023). The criteria for medium enterprises are made more specific by looking at the differences between different types of businesses. This is because the amount of money needed the number of workers required and market conditions are not the same for manufacturing, services, agriculture and trade. The definitions of SMEs are very important for making policies helping people get access to financial services and setting up rules to support SMEs. The Government of Pakistan wants to help SMEs in Pakistan do better become more formal and export products through the SMEDA organization and the rules that go along, with it so they can be a bigger part of regional and global trade networks (ud Din et al., 2023).

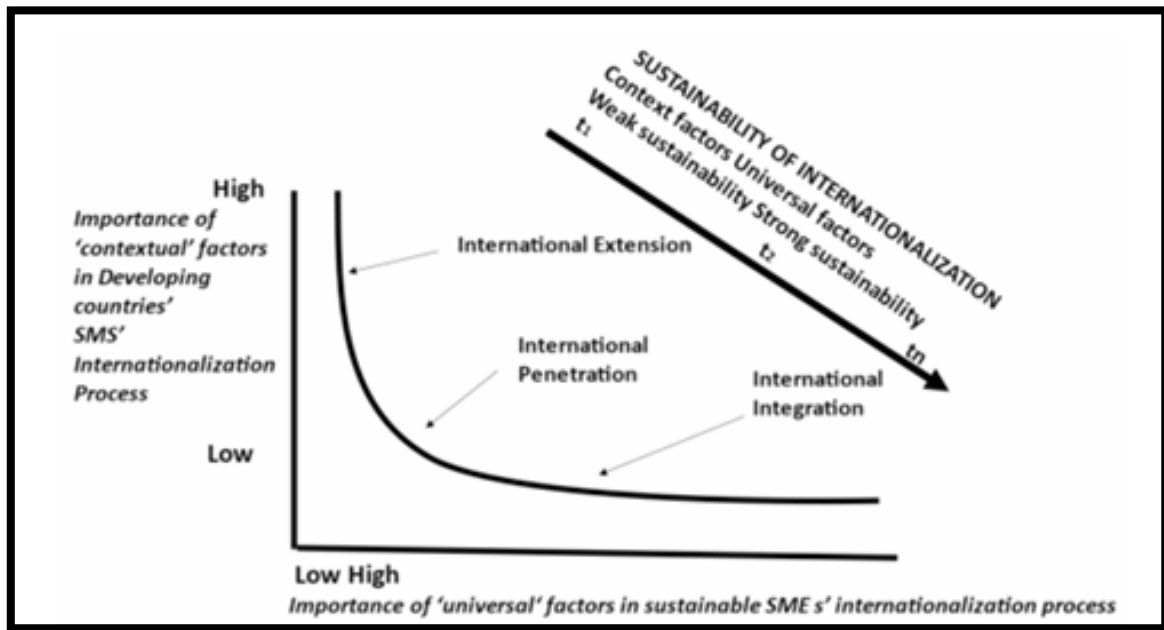


Figure 3. A heuristic model of importance of SMEs (Source: (Coldwell et al., 2022))

SMEs do many different things. They sell products on a small scale. These businesses also process food and other products from farms. Some are stores where people can buy things. Others help move goods from one place to another, which is called logistics. Many use computers and technology to provide services. Some offer services like law, medicine or consulting. These businesses are important, for the economy. They create jobs. Help communities grow (Boter & Lundström, 2005). SMEs are really good at changing and being flexible. This helps them to react fast to what's happening in the market and what people want to buy. Often SMEs are the first to come up with ideas for small groups of people and solutions that work well in specific areas. The importance of SMEs, in areas that rely on knowledge is becoming more and more clear (Narteh, 2008). They are playing a role in digital change using new technologies and creating innovation. This is happening because they work with universities and research institutions (ud Din et al., 2023).

SMEs have a big effect on people. They help make sure everyone gets a share of money and they help the local area grow. In places that're not very developed, SMEs help make things more equal between cities and countryside by giving people jobs in areas that are not right in the city. SMEs also often give women and young people a chance to start their own businesses, which helps everyone work together and makes people smarter and more skilled. SMEs are really good, for people (World Bank,

2023). Despite their SMEs often face big problems. These problems include not being able to get money not having the right technology and having to follow many rules. They are also at risk when the economy is not doing well. These businesses need to overcome these problems to succeed. The problems are like roadblocks that stop them from growing. They need to find ways to get the money they need. They also need to have the tools and technology to compete. (Akhtar et al., 2024). To make the most of their impact, on development it is crucial to give policy support. We also need to use technologies. The financial sector needs to be changed. Consistent policy support, digital technologies and a restructured financial sector are key.

2.1.2 Socioeconomic impact of SMEs

medium-sized enterprises are really important for the economy and society these days. They do a lot of things in many areas. For example they make a difference in the gross domestic product they create a lot of jobs and they help with changes in the economy. If you look at the world you will see that small and medium-sized enterprises make up about 90 percent of all businesses. They also give jobs to 70 percent of all workers and they contribute about 50 percent to the gross domestic product of the world. This shows that small and medium-sized enterprises have a lot of power in both poor countries. SMEs are very important, for everyone (ud Din et al., 2023). This big impact shows that SMEs play a role. They are not just helping out. Are actually leading the way in making economies grow. They create jobs. Help keep things stable when the economy is going through tough times.

SMEs are really important for economies. In Pakistan and other countries like it SMEs play a part in the economy. Some recent studies show that SMEs in Pakistan make up 40 percent of the countrys total economy. They also give jobs to than 70-80 percent of the people who do not work in agriculture.. They make about 25-31 percent of the total money the country gets from exporting things. SMEs are very important, for Pakistan. They help the country in many ways (Shaikh, 2025). SMEs are really important for the economy in areas where big companies do not have a lot of presence. SMEs help spread opportunities to places outside of cities and the formal economy. They bring together millions of entrepreneurs, artisans and service providers which's a big deal for Small and medium enterprises. SMEs are good, at doing this because they can operate in different areas (Abisuga-Oyekunle & Fillis, 2017).

SMEs do a lot to help the economy as a whole. SMEs also play an important role in dealing with big social and economic problems that affect the structure of our society. SMEs are essential, to addressing these issues and making things better (Amoah et al.,

2022). SMEs create different kinds of jobs. This is really important when a lot of people do not have jobs and there are not formal jobs available. SMEs usually hire people, women and other groups that have a tough time getting jobs at higher rates than big companies do. This helps to reduce the number of people who're poor and makes society more fair for small businesses and the people who work for SMEs. SMEs are very good at helping people who need jobs and small businesses are important for creating jobs, for people who work for businesses (Matloob et al., 2023). They work in both countryside and city outskirts areas. They help make regional growth fair. These businesses help reduce differences, between areas. They boost businesses and help them grow. Big companies might ignore these businesses otherwise. (Choi et al., 2021).

SME are really good, at changing with the times. This means they can deal with things that happen in the market. Because of this SMEs have become very important in the economy we have today. SMEs are able to do this. That is why they are doing so well (Varga, 2021). Larger companies usually have a time changing when things like what customers want getting goods and new technology change. This is different for businesses. They can change quickly. SMEs can come up with ideas that help their local area. They can also work with businesses from around the world. This helps their countrys economy have kinds of businesses. SMEs are good, at adjusting, which helps them work well with companies and helps their countrys economy. (Alexanian et al., 2024). SMEs really important in countries that are still developing. SMEs help these countries become more industrialized by bringing in businesses that were not formally part of the economy. This means SMEs can make these countries more productive and help them grow in ways. SMEs do this by making businesses a part of the formal economic system, which is a big deal for productivity growth and, for SMEs themselves (Bano & Shaikh, 2024).

These SMEs struggle with these institutional and operational issues. They find it hard to get the funding they need. They also struggle with workers who do not have the skills. The rules and regulations can be tough for them to follow. They are also, at risk when the economy changes. Small to sized enterprises want to grow but find it hard (Stiglitz, 2015). These barriers can really slow down growth. Limit expansion. This shows that public policies are needed to help improve market access. They should also make it cheaper to do transactions and support innovation ecosystems. The World Bank in the year 2023 and the World Economic Forum in the year 2026 have said that it is very important to help medium enterprises or SMEs by giving them better access to money and banking building up their digital infrastructure and teaching them new

skills. This will allow SMEs to do their part in making the world a better place and helping the global economy grow. SMEs need to be able to do these things so they can play a role in sustainable development and global economic integration. The World Bank and the World Economic Forum think that helping SMEs is a priority because SMEs are very important, for the economy (Matloob et al., 2023).

2.1.3 Competitiveness among SMES and large enterprises

Small businesses and sized businesses have to be creative with the resources they have. They need to find ways to compete with businesses. Small businesses and sized businesses are important, for the economy. They create jobs. Small businesses and sized businesses help the economy grow (Kersten et al., 2017). Investing in research, marketing or new technology gets harder for them because of their size but being small has its advantages. They can move quickly and easily. This means they can respond fast to changes in demand or new chances. Big companies can dominate markets because they are efficient and big. Smaller firms on the hand often succeed by focusing on specific areas. They provide services and build strong relationships, with their customers. By doing smaller firms can still achieve success. They concentrate on what they do and serve their customers well. Smaller firms rely on their customer connections (Offenberg, 2009). In Pakistan and other developing nations small businesses and sized enterprises face a lot of extra problems. They do not have infrastructure. They also do not get help from institutions. There are also rules and regulations that make it hard for businesses and medium-sized enterprises to compete with other companies and grow. Small businesses and sized enterprises, in these countries have to deal with these issues every day (Ahmad et al., 2022; Ali et al., 2024).

SMEs are really important for the economy to grow. They play a role in helping the country make more money even though SMEs have a lot of problems to deal with. SMEs are still, at the heart of plans to make the economy stronger (Naradda Gamage et al., 2020). SMEs create jobs they promote economic growth and they strengthen resilience during periods of economic instability. Supporting SMEs in Pakistan is really important for promoting inclusive development reducing poverty and encouraging innovation in Pakistan. Small and medium enterprises are very important, for the people of Pakistan (Kamran et al., 2023). Governments and financial institutions can really help medium sized businesses or SMEs become more competitive and integrate into global value chains. They can do this by making it easier for SMEs to get the money they need get the training and use the latest

technology. SMEs are very important for a country's growth. They help connect the formal and informal parts of the economy. This is a deal because SMEs contribute to development that is good for the long term and that is sustainable. SMEs play an important role, in helping a country grow in a dynamic way (Sultana et al., 2022).

2.2 Green Practice Implementation in Developed and Developing Countries

In places where the economy's really strong the performance of GKS and GPI is closely tied to the systems that are already, in place. These systems have good digital infrastructure a lot of people working together to do research and strong rules to make sure everything runs smoothly. The GKS and GPI performance is connected to these systems because they have been built up over time. The GKS and GPI rely on these established systems to work well (Banerjee, 2025). These countries have things in place to make new ideas work. They bring together schools, research places, businesses and government groups. The World Economic Forum says that rich countries stay competitive because they have systems that work together. These systems help turn research into businesses protect ideas and make it easy for people to share knowledge with each other. The World Economic Forum says this. These countries also spend a lot of money on research and development have rules and make sure everyone follows the law, which helps new ideas happen. This helps countries come up with things and stay ahead. The World Economic Forum thinks that is important for countries to keep growing.

Sweden, Finland and Switzerland are always at the top when it comes to how countries use knowledge to grow their economies. These countries have made a commitment to spend money on research and development for a time. They also use strategies and make sure their workers have the skills they need. This means Sweden, Finland and Switzerland can use the scientific discoveries to help them make decisions about industry and plan, for the future of their economies (AHUCHAOGU et al., 2025). The company's innovation is really strong. This is clear from the patents they have the high number of people with university degrees and the advanced technology they export. In places like this a company does well because it is innovative. This means the company needs to get better at what it does use technology and make sure its workers are skilled. The company's innovation is the key, to its success.

The Global Competitiveness Index is something that the World Economic Forum made. It helps us see that being competitive is not simple. The Global Competitiveness Index looks at things like how good the institutions are, the infrastructure and if the economy is stable. It also looks at peoples health, education, how the banks and financial systems work, how big the market is and if people can innovate. In countries being competitive is more about things, like what people know having internet and working together on new ideas instead of just having a lot of resources. The Global Competitiveness Index shows that these countries usually focus on working and coming up with new ideas to grow their economy, where people can be more productive and create value (Buka, 2024).

Conversely many developing countries face problems that hurt their knowledge systems and peace. Countries with problems like instability, weak leaders, internal conflicts and not enough security usually score low on the Global Peace Index. For example the 2024 Global Peace Index report shows a growing gap between the least peaceful countries. The 25 countries that are the peaceful have become 7.5% less peaceful since 2008. These countries really need to work on peace. The knowledge systems in these countries also suffer because of this. Countries need to focus on being more peaceful. Peace is important, for a countrys growth and development (Banerjee, 2025). Significant economic problems happen when peace declines. This is because unstable situations interrupt the flow of goods making it hard for businesses to operate. It also discourages investors from putting money into the country. Tourism suffers as people do not want to visit places that're not safe. Furthermore the government has to spend more on security and less on things like schools, hospitals and infrastructure. These changes in spending priorities can have long-term effects on the countrys development. The lack of peace hurts the economy in ways including declines, in foreign direct investment and increased security expenditures.

The deterioration of peace and institutional stability in emerging nations not only impedes economic performance but also exacerbates poverty, inequality, and social disintegration (Adenle et al., 2023). Private sector development is really tough in places that're not very strong. This is because medium sized businesses or SMEs have a hard time getting the money they need. SMEs also have to deal with rules that're not clear and a market that is hard to get into. Because of this many developing countries are still at a point where they are trying to grow by using things like cheap labor, natural resources and low costs. In this point of development countries try to beat each other by having a lot of workers who do not need skills a lot of natural resources and low costs, for making things. While these things might help countries grow a bit in

the short term they do not usually lead to real change that lasts, which is the kind of change that comes from new ideas and innovation or what we call innovation-driven change and this is what private sector development and SMEs need to really make a difference.

According to Yerimpasheva et al. (2024), the GCI framework says we should move from having natural resources to being more efficient and growing through new ideas. To make this happen we need to invest in education, vocational training, digital infrastructure, better governance and research institutions. We need to make investors feel confident and support entrepreneurs. This also means we need to strengthen the rule of law improve regulations and have political stability. Regions that are still developing can improve productivity by joining global value chains through technology and knowledge sharing. They can adopt technologies and learn from others to upgrade their productivity. This will help them grow and become more competitive. We should focus on GCI framework and growth through innovation. The GCI framework and innovation are key to success. Growth, through innovation needs GCI framework. The discrepancy between developed and developing economies, as measured by GKS, GPI, and competitiveness, is predominantly propelled by variations in institutional development, peace and stability, and the capacity to innovate. However, the developmental path is not static. By making ongoing changes, investing in people, and improving their institutions, developing countries can slowly move towards growth that is driven by efficiency and innovation (Banerjee, 2025). This will reduce the difference in competitiveness and improve long-term social and economic stability.

2.3 “Pakistan” a developing nation

Pakistan is like other developing countries. It is an example for studying sustainability issues in fast-growing markets. Pakistan has a population of over 240 million people. Its economy is worth around USD 340 billion. The countrys economy mainly depends on farming and making things that do not add much value. Pakistan also has a lot of people with a population growth rate. Many people in Pakistan are very poor. There is also a gap between the rich and the poor. The countrys economy is not very diverse. It faces challenges in terms of sustainability. These issues make Pakistan a great place to study sustainability. The countrys experiences can help developing nations. Pakistans situation is not unique. It is very representative. Many countries face challenges. So studying Pakistan can provide insights. It can help find

solutions to sustainability issues. The countrys development is crucial for the region. Pakistans growth will have an impact, on the world. The world is watching Pakistans progress. It is a country to study (Raza & Khan, 2025). The country also has some problems. The roads and buildings are not very good. There is not electricity and a lot of people work in jobs that are not official. All of these things together make it hard, for companies, small and medium-sized companies to make money and use clean technologies and sustainable practices. Development and taking care of the environment are also affected by these issues. The countrys development and environmental progress are slowed down by these problems (Zehra et al., 2025).

Pakistans environmental problems are very serious. Need a closer look. The countrys air and water are very polluted because of growth cities expanding, wasting energy and not following environmental rules. This makes Pakistan one of the countries most affected by climate change. Bad air is causing more people to get heart diseases. This is putting a lot of pressure on the healthcare system, which is already struggling. The environmental and health issues are getting worse. So there is international pressure, on Pakistan to meet the Sustainable Development Goals, to get climate finance and to meet the environmental standards of global markets and development partners. Pakistan needs to address these issues to protect its people and environment (Butt, 2021). Pakistan is in a place where South Asia, Central Asia and the Middle East all meet. This location of Pakistan and the fact that Pakistan has capabilities and a strong military plus Pakistan relies on money sent from other countries especially with big projects like the China-Pakistan Economic Corridor, which is also known as CPEC all affect what Pakistan thinks is important and what Pakistan wants to achieve with its policies. The CPEC is a deal for Pakistan. Pakistans nuclear capabilities and military power are important, to Pakistan. Pakistan needs to think about all these things when Pakistan makes its policies (Malik, 2025). Despite its features Pakistan still deals with usual development problems that many growing economies face. These problems are especially tough when trying to balance growing the economy with saving the environment. Pakistan faces these issues, like other countries. The countrys economy and environment are important. Balancing growth and environmental conservation is a big challenge (Malik, 2025).

The Pakistani government wants big companies and small businesses to do things that're good for the environment. They have been telling them to do this for a while. Even though some companies are not very good, at it the government still thinks it is an idea. The Pakistani government believes that all businesses, no matter how big or small should try to be more environmentally friendly. This means that the Pakistani

government is pushing for manufacturers and small to medium-sized businesses to use environmentally sustainable practices (Munir & Watts, 2025). Big companies usually have the money, technology and organization they need to use clean technologies and follow environmental rules. Medium sized enterprises or SMEs are really important to Pakistans industry but SMEs have a lot of problems. SMEs do not have money to borrow they do not have enough technical knowledge and they do not get enough help from institutions. This is an issue for SMEs in Pakistan. SMEs are very important, to Pakistans sector but SMEs need more help to deal with these problems (Malik, 2025). The Small and Medium Enterprises Development Authority, which is also known as SMEDA helps Medium Enterprises by providing energy efficiency training and technical advisory services. They also have the Energy Desk and self-assessment tools like ESPIRE. These tools are really helpful for Medium Enterprises because they help Small and Medium Enterprises find ways to save money and energy. The Small and Medium Enterprises Development Authority does all this work, within the rules of Pakistan the rules made by the Pakistan Environmental Protection Act of 1997 and the National Environmental Quality Standards (Nadeem & Hameed, 2008).

Big companies usually have systems that help them follow the rules. Smaller companies like SMEs often have a hard time with this. The reason is that SMEs do not have knowledge about the rules they do not have a lot of money and they do not have good ways to make sure people are following the rules. SMEs have to deal with a lot of things. Following the rules is really important for SMEs. SMEs need to find a way to make following the rules easier, for SMEs (Gupta et al., 2017). As a result SMEDA helps medium-sized enterprises (SMEs) through energy management initiatives, performance contracting models and partnerships with Energy Service Companies. This assistance plays a role in enabling SMEs to improve regulatory compliance increase operational efficiency and move towards environmental sustainability. However for green practices to really take hold in Pakistans SME sector more than just regulations are needed (Nadeem & Hameed, 2008).

2.4 Traditional knowledge sharing approach VS green knowledge sharing in developing countries' SMEs

In the past the way small and medium-sized businesses shared knowledge was pretty simple. They really wanted to do three things with the knowledge they shared. Medium-sized businesses wanted to make their operations more efficient. They also wanted to cut costs (Zhou, 2016). People also tried to find ways to get products to the

market faster. In some places like medium-sized enterprises in Pakistan, where they do not have a lot of resources the companies shared knowledge in a simple way mostly by talking about what they learned from their experience with the products. The companies in Pakistan shared this knowledge, about products to help each other (Sherani et al., 2023). The world is. People are thinking more about the environment and being sustainable. This means that companies have to be more open and share information with each other. They have to work to make sure they are doing things in a way that is good for the planet. The way companies think about sharing information has changed a lot. Before they just shared information. Now they have to use it to make their businesses better and more productive. This includes thinking about how their actions affect the environment. If they do not do this they will not be able to compete with companies. Sustainability and knowledge sharing are very important, for businesses now (Babayev & Balajayeva, 2023).

Traditional knowledge systems have helped create a kind of evolution. We call this way of sharing information reen knowledge sharing. The main goal of this project is to make, spread, combine and use again the knowledge that's about taking care of the environment. Traditional knowledge systems and reen knowledge sharing are very important, for this. Reen knowledge sharing is focused on learning about the environment and what we can do to protect it (Ul-Durar et al., 2023). This covers a lot of things like designing things in a way that's good for the earth making things in a cleaner way reducing waste keeping track of carbon looking at models of the circular economy and using renewable energy. The Green Knowledge System is different from sharing information because it is directly connected to making the earth a better place and measuring how well we are doing that. If we look at what's happening in the world from 2023 to 2025 we can see that the Green Knowledge System helps people be more creative in a green way come up with new eco-friendly ideas and make products that are better for the environment. The Green Knowledge System is really good, at helping us with creativity, eco-innovation and making earth friendly products (Fadillah et al., 2025). This includes things like pollution using resources in a better way and making products that are good for the environment. The good things about Green Knowledge Strategies are really increased when companies have Green Knowledge Strategies, systems that train people, about the environment and leaders who think sustainability is important (Varpahovskis, 2022). A study on medium-sized manufacturing businesses in Pakistan found that using GKS with green innovation and data-driven decision making really affects how environmental strategy leads to sustainable results.

Sharing green knowledge among different departments supply chain partners and top-level management is crucial for achieving real sustainability benefits. When environmental information is not shared properly or is scattered it limits the potential for eco-innovation and supply chain coordination. The study showed that GKS and green innovation practices can help businesses make decisions that support sustainability. Environmental awareness needs to be shared across all levels of a company and its supply chain to make an impact. This can help businesses become more eco-friendly and improve their supply chain operations. GKS and data-driven decision making are key, to achieving outcomes through environmental strategy. The findings of the study highlight the importance of integrating GKS with innovation practices. It also shows that data-driven decision making processes can lead to sustainability results. Businesses can benefit from sharing awareness and coordinating with their supply chain partners. This can lead to eco-innovative and sustainable practices (Awuah-Gyawu et al., 2025). Studies from South Asia, Southeast Asia and Sub-Saharan Africa show that having a system to manage green knowledge is really helpful. This system includes things like GKS getting knowledge and using green knowledge. When we have this kind of system it helps us come up with ideas for technology that are good for the earth and it also helps us stay ahead of others for a long time. The green knowledge systems and the whole process of getting and using knowledge are very important, for this. So having a green knowledge management system that includes GKS getting green knowledge and using green knowledge is very useful (Alexanian et al., 2024). These results show a change in the way we manage knowledge. We are moving away from using the same systems for all situations. We are now using special green knowledge frameworks. These frameworks try to balance environmental goals and economic goals at the same time. Businesses are progressively acknowledging that cultivating sustainability capabilities necessitates knowledge-based resources and formal institutional support rather than casual interactions (Bhardwaj et al., 2023).

It is shown by research that green knowledge management helps medium-sized businesses. This is because green knowledge management encourages businesses to come up with friendly ideas. These ideas include making products and finding new green ways to do things. The research, planned for 2024-2025 shows that going green helps businesses make money and reduces their impact on the environment. GKS helps businesses change the way they work to be more sustainable. It does this by encouraging green product innovation, green process innovation and sustainable business model transformation. This means businesses can make a profit while also being good for the planet. The term financial and environmental performance of

SMEs improves as a result. GKS is good, for both businesses and the environment. (Shahzad et al., 2021). Research, including a study by Shahbaz et al. (2025), says that Pakistani medium-sized businesses should make it easy for people to learn about being green. They can do this by starting groups where people can share ideas about taking care of the environment. These groups can be, like clubs where people who care about the earth can meet and talk. They can also have workshops where suppliers and customers can learn about things. There are websites that compare how green different companies are and these can be very helpful. Pakistani medium-sized businesses can also make websites where people can go to learn about being sustainable. The main idea is to make sure people have a way to learn about taking care of the environment. Pakistani medium-sized businesses want to make sure that people are not just relying on what they already know but are learning new things about being green. Nasir et al. (2024), The research showed that sharing knowledge is good for small and medium sized businesses. It helps them do better when it comes to being sustainable. This is especially true when companies work together on projects and do research with their teams. Just knowing about the environment does not mean that a company will automatically be more sustainable. To really make a difference companies need to make a plan and use the knowledge they have to come up with ideas and make changes. Green knowledge sharing is important, for this. It helps companies make green products and be more sustainable (Fadillah et al., 2025).

Additional theoretical viewpoints support this assertion from the perspectives of the resource-based view (RBV). Natural resource-based view (NRBV), green knowledge functions as a strategic, intangible resource that can produce a sustained competitive advantage if it is valuable, rare, non-imitable, and organizationally embedded (Narteh, 2008). The knowledge based view says that companies are like places where people store knowledge. This view also says that a companys ability to do well in the future depends on how the company uses knowledge and puts it into action. When we talk about sustainability, Green Knowledge Management System or GKS for short is an ability that helps small and medium sized companies or SMEs find problems that can hurt the environment. GKS helps SMEs find market opportunities that are good, for the environment and change the way they do things to be more sustainable. GKS is important for SMEs to be sustainable (Varpahovskis, 2022).

This change is really important for medium-sized businesses in Pakistan that make things to sell to other countries, like clothes, shoes and food products. These businesses, in Pakistan need to change the way they work so they can sell more of these things like textiles, leather goods and agro-processing to countries (Fadillah et

al., 2025). These days companies have to follow rules to protect the environment. They need to tell people how carbon they are emitting and follow special rules called Environmental, Social and Governance or ESG reporting. This is necessary for companies to be part of supply chains. Companies used to think that being good for the environment was something that made them special.. Now companies think that taking care of the environment is just something they have to do. So GKS is changing from something that just helps companies to something that's really important for them to survive. This is because there are many rules, about the environment that companies have to follow to stay in business. GKS is becoming a part of what companies do not just something extra (Ma et al., 2025).

There are things that can help. Pakistani Small and Medium Enterprises still have a lot of problems. Many Pakistani Small and Medium Enterprises have trouble getting money from people who care about the environment they do not get training on how to be kind, to the environment and they do not have good enough computers and internet to work properly. Pakistani Small and Medium Enterprises need these things to do better. Pakistani Small and Medium Enterprises are important. They need help with environmentally friendly financing and digital infrastructure (Ma et al., 2025). To make Green Knowledge Sharing successful organizations need to put money into managing their people in a way that's good for the environment. They also need to make sure their leaders are committed to Green Knowledge Sharing. Organizations also need to invest in tools. Finally they need to work with their suppliers in a way that helps the environment. Now digital tools are making it easier for small businesses to share information about being kind, to the environment. This is helping Green Knowledge Sharing (Fadillah et al., 2025). The process of sharing information is made easier when we use tools that are based in the cloud analyze data and use blockchain technology. We can share things easily with cloud-based tools and data analysis and blockchain technology. This makes it simple for people to share things with each other using cloud-based tools and blockchain technology and data analysis.

A lot of research is showing that switching from sharing knowledge to a more organized GKS can help small and medium-sized GKS transform vague sustainability goals into real results like eco-friendly innovations and improvements in performance at small and medium-sized businesses that do not have a lot of resources. The GKS can really help small and medium-sized businesses achieve their sustainability goals. SMEs can use GKS to make eco-friendly innovations and improvements in performance. This is a deal for small and medium-sized businesses that do not have a lot of resources. The GKS is very important, for medium-sized businesses (Khan et

al., 2022). GKS works best when its part of planning for the future. It helps create ideas, measure company performance and enables collaboration across organizations.

For SMEs in Pakistan GKS is crucial. They face increasing regulations, market changes and issues with groups. GKS helps these companies stay competitive and comply, with environmental rules. It ensures they can adapt to challenges and keep up with international standards. GKS is not a luxury it's a necessity for companies to succeed in today's changing business environment especially when it comes to GKS. By implementing GKS companies can improve their performance and make better decisions. This in turn helps them stay ahead of the competition and maintain a market presence. In Pakistan GKS is essential for companies to navigate the regulatory landscape and ensure environmental sustainability through GKS (Abbas & Khan, 2023).

2.5 Research Background

Today industries are working in a world that is always changing. The economy is getting bigger. There are big changes happening in how industries are transforming and growing. Industries are really. This is a big trend, in industrial transformation and expansion. Industries are. This is something that is happening everywhere (Gunasekaran et al., 2019). The industrial boom is having an impact on the environment. Manufacturing is a part of the problem. It is causing many of the issues we have today including plastic waste, chemical waste and carbon emissions from manufacturing operations. Manufacturing operations are really bad, for the environment. They make a lot of waste, chemical waste and carbon emissions from manufacturing (Qalati et al., 2025). These bad things in the air, water and soil are really bad for people and the earth. They make the air, water and soil dirty. Companies are now thinking more about taking care of the environment because of these problems, with contaminants. The contaminants are an issue (Gursoy et al., 2025). Companies are trying to find ways to reduce waste and pollution because they care about how they affect the environment. People who buy things from these companies want products that're good for the environment. The government is also telling companies to be more careful about the earth. Companies are starting to see that taking care of the environment is a thing, for a long time. So companies are spending money on technologies that're good for the environment they are using green manufacturing techniques and they are making plans to manage waste completely. Companies are doing these things because they want to reduce waste and pollution (Vangeri et al., 2024). Companies that care about the environment do a lot of good for the earth and, for themselves. They become more competitive. People think better of them. The environment is very important. Companies that prioritize the environment are doing

something great. The environment and these companies both benefit when they make choices that help the earth.

A lot of companies are now saying their products are good for the environment, which is becoming very popular. The Grocery Manufacturers Association and Deloitte did a study. They found that people really want to buy green products. The Grocery Manufacturers Association and Deloitte discovered that green products are in demand. People are looking for products that're good, for the environment and companies are taking notice of this trend the green products trend is really taking off (Luzi et al., 2019; Trinh et al., 2023). When we buy and sell things that're good for the environment like products and services that help keep our air and water clean business can really help us move to a green economy. This is especially true when the government makes rules to support it. The idea is that commerce can help us make this change by promoting the exchange of friendly products and services. Furthermore, de Castro Carvalho et al. (2025) noted that more than half of the members (60.1%) were prepared to pay a best for these kinds of goods. According to Lin and Chen (2017), 80% of customers who are ready to pay extra for green products will not do business with companies that violate environmental laws or falsely advertise non-green products as green. Generally, the focus is on sustainable consumption, efforts to protect the environment, and preventing risk to draw in new customers and keep the current ones entertained.

To resolve these environmental issues, manufacturing firms need to generate green knowledge and address environmental issues, and businesses need to construct green knowledge mechanisms (Shehzad et al., 2024). Businesses whose products can integrate both new and current environmental knowledge will find great success. Furthermore, firms are obligatory to observe to the highest standards of manner and carry legal obligations under applicable laws due to the implementation of stronger environmental rules and associated legal duties (Abbas et al., 2022). Thus, it's critical to abide by laws while creating eco-friendly items and recycling materials. Energy efficiency has been a prominent topic due to environmental rules and legal obligations (Wenlong et al., 2023). Market transformation is matched and even initiated by the company's capacity to use resources and manage knowledge, particularly in the areas of recognizing, producing, assembling, organizing, packaging, circulating, and using green knowledge (Sahoo et al., 2023).

Additionally, more involved participants in environmental protection activities find personal fulfillment in living a frugal lifestyle and taking part in environmental conservation (Obiora, 2025). Customers are therefore ready to pay more for green assets and services because they care about the environment and have certain moral

principles. Accordingly, in the environmental period, consumers choose to buy green items (Rahman, 2018). As the availability of green products keeps growing significantly, socially conscious or "green" products are becoming more and more significant for both retailers and consumers (Sun et al., 2022). Thus, innovation is crucial to an organization's distinctiveness and expansion (Riaz et al., 2024). Organizations can no longer afford to overlook innovation as a substitute; they must seek out ways to encourage it (Majchrzak et al., 2023). In this way, there is an increasing interest in examining how to boost innovation and competition in companies and studying the methods that lead to the growth of innovative skills (Dima et al., 2022) that lead organizations toward competitive advantage.

2.6 Concepts development

2.6.1 Green Product Innovation

Product innovation can be described as the creation and launch of significantly enhanced products that deliver improved value to endusers through advancements in design, functionality, performance, or technology (Tung, 2012). In manufacturing firms, product innovation is specifically significant as it consents organisations to gain a competitive edge in highly competitive markets, respond effectively to shifting consumer requirements, and capitalise on developing technologies. By promoting innovation in their products manufacturing companies can become more efficient, in their operations. This helps them to make quality products. They can also enter markets. Product innovation helps companies to improve how they work. It also enables them to make products that meet needs. Manufacturing companies that focus on product innovation can grow their business. (Alamro et al., 2018). When we think about it coming up with products is really important for companies. Product innovation helps companies keep growing. It makes customers happy and loyal to the company. This is how companies can stay ahead of others and be successful for a time, with product innovation.

GPI, which is precise as the expansion of products with reduced resource consumption, reduced environmental risks, and impacts (Maziriri & Maramura, 2022), and waste prevention from the outset, is acknowledged as the catalyst for a new economic paradigm and increased living standards through competitiveness and wealth creation. The seminal contribution of Helfat et al. (2023), establishes the foundational principles of the RBV of the firm, which conceptualizes the organization's product innovation as an administrative entity with a diverse array of

productive resources encompassing both physical and intangible resources. The firm has the potential to derive advantages from a diverse array of value-added services offered by its tangible assets (e.g., property and apparatus) as well as its human capital. The goals of identical assets can vary based on the intended utilization strategies.

The goal of green product innovation is to lessen exposure to harmful chemicals throughout the making of products (Ncube et al., 2023). That's why cutting-edge eco-goods outperform their less innovative counterparts in terms of the environment (Sk, 2024). These changes will make the final product better. They will also help the environment by following the rules. People will pay attention to what is happening around them. The cost of getting rid of waste will go down. Businesses will have an advantage when they sell things to countries. The changes will really help businesses, in the marketplace. They will make the environment better. Help the businesses at the same time (Tetteh et al., 2025). By using things again and making new things from old stuff companies can make money and find new ways to turn garbage into something useful. Green product innovation is really good, at helping companies do this. It helps them save money. It also helps them think of new ways to make old things into something valuable. Green product innovation is important because it shows companies that they can make money by reusing and recycling products (Karim et al., 2025).

2.6.2 Green Knowledge Sharing

Knowledge is really important. It is made up of lots of things we learn like facts and data and the skills we get from doing things. We get all this from our experiences from going to school and, from the information we find. Knowledge is basically everything we know. It comes from these things: our experiences, our education and the information (Hrdy, 2019). Knowledge sharing is really helpful to understand what is going on. It helps us make decisions and solve tough problems. Knowledge sharing is when people in a company share what they know their skills and what they're good at, with each other. This helps the whole company learn things make better decisions and do a better job. Knowledge sharing is important for the company to do well (Farooq, 2018). When we talk about sharing ideas and information that help the earth and keep our environment safe this is what we call green knowledge sharing. Green knowledge sharing is about sharing things that we know will help with taking care of the earth. The idea of green knowledge sharing is to share techniques and concepts that're good for the earth and help with sustainability. Green knowledge sharing is

important because it helps with conservation and sustainability. By sharing knowledge we can learn more, about how to keep the earth safe and healthy. Green knowledge sharing is a way to share what we know about taking care of the earth (Rasheed et al., 2025). It is, about sharing ideas, new discoveries and good ways of doing things to reduce the harm we do to the environment save resources and stop climate change from happening. We need to share these ideas and new discoveries to lessen the harm to the environment and preserve resources and this will also help prevent climate change (Alzyoud, 2021). People who really care about the environment and want to do what is best for it like individuals organisations and communities often share information with each other about friendly practices. These people are very dedicated, to adopting friendly practices and promoting environmentally friendly practices. They like to talk to each other and learn from each other about friendly practices (Lin et al., 2024).

The current study directed by Ma et al. (2025), The thing that was found out is that there is a connection, between using "GKS practices" and how well manufacturing organizations can compete. The ability of an organization to be better than others is affected by how it can get and share talented people. The competitiveness of manufacturing organizations is really helped by the use of "GKS practices". This is because "GKS practices" help organizations to attract people and share what they know with others (Anastasiou, 2019). According to the study conducted by Rahmat and Ahman (2025), The act of sharing friendly knowledge can make a company stand out from the rest. This is because the act of teaching people about friendly things can help a company gain an advantage over others. The act of disseminating friendly knowledge is a key part of a companys strategy to stay ahead of the competition. According to Javed et al. (2025), a corporation has an edge when it does well in taking care of the environment and coming up with new ideas. Other companies might find it hard to copy the environmental rules that big businesses with many locations around the world have put in place.. They can still learn from them and use similar methods to put those rules into action. The knowledge-based view or KBV says that knowledge is a resource for companies that make things. In this view knowledge helps businesses do better than others. It also helps them make environmental policies. Companies can use this knowledge to come up with ideas and do well in taking care of the environment. This is important, for businesses that want to do and be responsible. They can learn from each other. Get better at taking care of the environment and making new things (Al-Husain et al., 2025). People can learn about being green in a lot of ways. The green knowledge can be shared through paths. This helps people get

results, from the green knowledge. The green knowledge is important. It can be spread through these paths to achieve really good outcomes.

2.6.3 Absorptive Capacity

The term "absorptive capacity" defines a firm's ability to obtain, engage, and utilize new information and knowledge from outside sources, such as rivals, suppliers, customers, and research institutes (Song et al., 2020). A large number of studies have shown that AC is essential for absorbing and applying outside knowledge to improve revenue and business performance (Li et al., 2025). With environmental problems getting more severe, it's more important than ever for firms to learn up-to-date sustainable methods. Industries, as institutions, have to deal with environmental concerns. According to Marrucci et al. (2022), firms may advance their capacity for absorption by adopting environmental guidelines. The RBV (Barney, 2001) and, KBV (Grant, 2002), theories suggest that the primary determinant of a firm's ability to produce value lies in its key capability, which governs the efficient utilization of its resources. Given that innovation is a strategic approach commonly adopted by firms to advance their objectives, possessing a strong absorptive ability is seen as an essential need for achieving success.

2.6.4 Innovation Climate

The term "innovation climate," or "innovation-supportive climate," refers to the degree to which employees believe they work in an environment that fosters and rewards creative problem-solving (Newman, Round, Wang, & Mount, 2020). In a culture that encourages innovation, managers and staff members alike value and promote knowledge sharing as an action that serves the firm as a whole (Zhang et al., 2024). Workers are encouraged to think creatively and openly contribute to the conversation when they work in an atmosphere that fosters innovation (Ye et al., 2022). The Resource Based View and Knowledge Based View theories say that what really matters for a company to be innovative and create value is what the company is good at. This means the company needs to use its resources in a way. A lot of companies try to create an environment for innovation because it helps them reach their goals. So having an innovation environment is really important for a company to be successful. The Resource Based View and Knowledge Based View theories are all about how companies, like this can use their resources to innovate and The Resource Based View and Knowledge Based View theories show that this is a part of being successful.

2.6.5 Customer Involvement

The idea of customer involvement is about how companies work with people who might buy their products or use their services. Companies want to engage with

these individuals. Customer involvement is a way for companies to connect with people who're interested, in their products or services. This approach helps companies understand what people need from their customer involvement. Customer involvement is important for companies to get feedback from people who use their products or services (Reppmann et al., 2025). Customers are really important when it comes to getting information about what they like and do not like. This information is used to make things that people will really like. When people buy things the companies that make those things want to know what they think. So they ask people what they think. This helps them make new and better things that people will want to buy. Customer involvement is very important for companies to make people happy, with what they're selling.

To make customers happy companies use what customers say to help them design things. This is a way for companies to know what customers want and to make things that they will really like. Customer feedback is a good way for companies to get the information they need to make things that people will want to buy (Okeke et al., 2024). The main reason companies want customers to share what they know is that it helps them get information from customers. When a company asks customers for their ideas it means the company is going to use those ideas to make products. This is because when customers and companies work together they both get something out of it. Customers and companies exchange things like ideas and help. When customers are helpful and work well with the company the company feels happy. Wants to do more to make the customers happy. The company wants to find ways to make customers happy and give them good service. Customer knowledge is really important for companies to make products. Companies use customer knowledge to make products that customers will like (Abdulkareem et al., 2025).

2.7 Underpinning Theories

Three composite theories are related to this study: Resource-Based View (RBV) theory, Knowledge-Based View (KBV) theory, and Social Exchange theory.

Resource-Based View Theory: The Resource-Based View (RBV) theory was first developed by Wernerfelt (1984), and later expanded upon by Barney (1991). This is a plan that helps companies get ahead and stay ahead by using their resources in a smart way. Of just looking at where they stand in the market the Resource Based View says that what is inside the company is what really matters. This means things like equipment and buildings well as things you cannot touch like skills and knowledge are what make a company do better than others. The idea is that each company has its unique resources and these are hard to copy or take from someone else which is why

some companies can do better than others for a long time. The Resource Based View is about how companies can use their resources to get an edge over others. Companies that have resources, like really good employees or a great location can use these to make themselves better. The Resource Based View says that it is these resources that make a company special not just where it stands in the market (Barney, 1991).

At the heart of the resource-based view is the idea that resources must have key qualities. These qualities are value, scarcity, uniqueness and non-replaceability. They help create a lasting advantage. Companies, with resources can make plans that work better and are more efficient. Few other companies have resources that're hard to find. Resources that are one-of-a-kind are tricky to copy. This is because its hard to understand how they came to be they involve social interactions or they depend on a specific sequence of events (Camisón & Villar-López, 2014). Things that are really important to a company cannot be swapped out for things. This is because these things are very special and that is why some companies do better than others in the business. Companies that have these things are usually more successful than the others. Non-substitutable resources are hard to find. That is what makes them so valuable, to a company. Some companies just do better because they have these -substitutable resources and other companies do not (Camisón & Villar-López, 2014).

In todays economy things like learning within a company the knowledge we have knowing how to use technology and being good at managing have become super important. These are not just things we can touch but the skills and knowledge that help a company do well. (Sun et al., 2024). According to the Resource-Based View knowledge-based resources often bring in long-term returns compared to just physical or financial assets. This is because they are a part of how a company works and its culture. Firms can get better at innovating and adapting to changes by using their resources in a way. They can also work efficiently by adjusting their key resources. Some important resources include knowledge sharing and the ability to absorb new information. By focusing on these companies can improve their performance. The Resource-Based View helps firms understand how to make the most of what they have. It guides them in making decisions, about their resources (Zahra, 2021). When a company matches what it can do with what it wants to achieve it helps the company do well in the run. This means the company can find out what makes it special and use that to its advantage. The Resource-Based View is a way to understand how companies use what they have to make money and be successful, for a long time. It shows how companies use the things that make them different to get ahead and stay

ahead. The Resource-Based View helps us see how companies use their resources to achieve long-term success and be competitive (Riaz et al., 2024).

Knowledge-Based View Theory of the Firm: The Knowledge-Based View or KBV of a company is a step forward from the Resource-Based View or RBV. KBV says that knowledge is the important resource for a company. This is because knowledge helps a company make decisions and do things better than others. In a company knowledge is key to being successful. The Resource-Based View also talks about resources. Kbv focuses on knowledge specifically. Knowledge helps a company to grow and stay ahead. It is used to make strategies and plans, for the future. Companies use knowledge to solve problems and find opportunities. The knowledge a company has is very valuable. It can be used to create products or services. Knowledge can also help a company to work efficiently. This makes KBV an useful way to understand how companies work (Hoskisson et al., 1999; Marr, 2004; Roos et al., 1997; Stewart, 2007; Sveiby, 2001). The Resource Based View says that companies have things that set them apart and that is what makes them better than others. The Knowledge Based View takes this idea. Goes further. It says that companies are really about getting, making and using knowledge. From this point of view organizations are like systems that bring people and groups together to share what they know. The Knowledge Based View sees companies as more than a bunch of resources they are places where people work together and use their special knowledge. The Knowledge Based View is, about how companies use knowledge to succeed (Kero & Bogale, 2023).

KBV says that intellectual capital is really important. This intellectual capital includes capital, structural capital and relational capital. So intellectual capital is the foundation for having a competitive advantage. In words a company needs intellectual capital to stay ahead of the competition. This intellectual capital is what helps a company do better than others, in the run (Pereira & Bamel, 2021). Things that you can touch, like buildings and machines are very different from things that're in peoples heads like skills and knowledge. This is because knowledge is something that's hard to put into words and it is also connected to the people and the company. It is not something that you can just copy. Other companies will have a time copying what your company knows because it is stuck in the heads of your employees. They know how to do things because of what they have learned and experienced. So if a company is good at using the things that're in peoples heads like skills and knowledge it can do better than other companies for a long time. Companies that are good, at this can stay ahead of others because what they know is not something that others can easily copy.

Knowledge Based View is really important to companies. The idea is that sharing knowledge is very important for a company to do well. When people at levels of the company like bosses and employees share what they know it helps the whole company learn and come up with new ideas. Companies want to be good to the earth and last for a time so they are trying to be more sustainable. Knowledge about being green is becoming more and more important for Knowledge Based View. Knowledge Based View is, about sharing knowledge to make the company better. Green knowledge is a part of Knowledge Based View now (Putra et al., 2021). Sharing information about the environment with people inside a company helps the company make sure its plans for being eco- match its big goals. This makes the company stronger compared to others. Companies share environmental information with their people. This helps them make sure their eco-friendly plans match their long-term goals. It also makes them more competitive. They do this so they can be stronger, than companies.

Furthermore KBV stresses that knowledge integration is key. To make this happen organizations need to put in place coordinated processes. These processes include things like (guidelines, uniform protocols, decision-making methods, problem-solving tools). The goal is to combine the expertise of people and produce unified actions across the organization. By doing firms turn insights from individual people into organizational capabilities. This is achieved through coordination and collaboration among people. KBV is about making knowledge integration work, in organizations. Organizations must make sure that people work together effectively. This way they can produce actions and achieve their goals (Putra et al., 2021). This function helps people work together and come up with ideas. It also helps people adapt to changes and keep getting better. The Knowledge Based View or KBV for short is a way to understand how people in a company like managers and employees share what they know with each other and with people outside the company. This helps the company stay competitive and be the best it can be. The Knowledge Based View provides a framework that shows how this sharing of knowledge helps the company keep doing over time. The Knowledge Based View is important, for companies because it helps them understand how the Knowledge Based View can be used to make the company better.

Social Exchange Theory: When a company deals with people outside of it, like customers it is a two way thing. The company and the customers both get something from it. This happens over time. These dealings are based on the idea that when people interact with each other they both expect to get something. This idea is called social exchange theory. The company and the customers they both follow this idea when

they interact with each other (Kim & Qu, 2020). According to this theory relationships grow through interactions. These interactions are based on trust, commitment and expecting benefits for both sides. In this framework customer involvement is more, than buying and selling. It is a process where both parties share what they have such as resources, knowledge and skills. This back-and-forth helps create an environment for organizations to learn and come up with new ideas. The customer and the organization work together sharing resources, knowledge and capabilities to achieve benefits. This relational process, built on trust and commitment allows for learning and innovation to take place (Moten, 2021).

Customer involvement means customers take a part in what a company does. They do this by giving feedback helping create things working together to solve problems and sharing what they know. When customers and companies interact like this customers can share two kinds of knowledge with companies. One is clear and easy to understand. The other is more hidden but still very valuable. Companies often notice when customers are working with them in a way. For example customers might give feedback be loyal or take charge. When this happens companies usually try harder to make their services better. They also come up with ideas. Customer involvement is when customers help companies. Customers give feedback to companies. They help create things with companies. They solve problems, with companies. They share what they know with companies. Companies respond to customers. They make services better ideas (Singh et al., 2023). When people have feelings towards each other it makes their relationships better. This is because mutual goodwill helps people work together and try things. Mutual goodwill is really important for making a place where people feel safe to experiment and get better at things. Mutual goodwill is the key, to making this happen.

Customers give companies a lot of things besides money. They provide things like equipment and buildings which're physical resources. They also give companies their skills and the things they know from experience. Customers introduce companies to their friends and other people they know which helps companies a lot.. People who live near each other can work together to help companies too. When companies use all these things that customers give them they can make their services better. Come up with new ideas for products or services. When companies use what they learn from customers they can figure out what people need but cannot find. They can also guess what people will want to buy in the future. This helps companies make exciting things that people will want to buy. Customer knowledge helps companies make things that meet the expectations of the people who have a stake in the company like customers

and employees and owners. Companies can use customer knowledge to make things that people really want which's really important, for customer-derived products or services (Guarino et al., 2023).

To really make a company better the customers need to be involved all the time. This helps the company learn things from outside like what customers want and how to make things better. The company needs to be good, at finding out what customers think using that information changing it to fit their needs and then actually using it. Companies do this by talking to customers and building strong relationships with them. They find ways to capture what customers say and use it to make the company better (Vivek et al., 2012). This process helps technology and methods get better. It makes the people in the organization want to try new things. The organization is a place where people're open, willing to change and learn from each other. Customer involvement is very important for innovation. If we look at customer involvement it is a reason why companies can come up with new ideas and stay ahead of others. Customer involvement is, like a never-ending source of ideas that helps companies compete with others (Rajâa & Mekkaoui, 2025).

2.8 Hypotheses Development

2.8.1 Green knowledge sharing and Green product innovation

Green knowledge sharing, as defined by Uhlaner et al. (2007), involves the acquisition or generation of new knowledge with a focus on the environmental aspects of processes and products. An empirical study suggests that firms with knowledge-sharing practices utilize their resources more effectively and may be more innovative. As noted by Darroch (2005), firms' performance will improve in response. To encourage more innovative ideas, companies should establish green knowledge-sharing competitions within the firm. These competitions should be open to all staff members. However, there is a distinction between knowledge management in designing products, and showcasing the advantages of green products (Zhou et al., 2020). It is wrong to think that all companies really think about the environment when they make decisions. For companies that want to help the environment they need to figure out how to use environmental cleanliness principles in a way that helps their business. We can make the environment a better place, by gathering information and having events where we share what we know within our company. The environment is very important. Companies that want to protect the environment should do things that help the environment. We can make a difference by doing things like collecting data and sharing what we learn with each other at our company.

It is clear that sharing knowledge helps to create new green products. Green knowledge sharing is really important for making green product innovation happen (Khan et al., 2022). When we think about sharing knowledge that is related to the environment people usually look at it from the point of view of a product. They talk about the steps we take to get knowledge or to make knowledge. Sharing knowledge is something that we do often. We need to think about how we can share the knowledge we have about being green. Green knowledge is very important. We should share it with each other (Del Vecchio et al., 2023). To really get the word out about being green, inside a company the company needs to gather all the information and put it in order. Companies can learn a lot from people they work with by sharing and swapping information about being green. This way companies can use the skills and know-how of others to make their own green efforts better (Ibrahim & Khan, 2025). These practices help companies keep doing what they are good at by sharing the knowledge they already have and helping people come up with new ideas. To really achieve sustainability goals and reduce uncertainty businesses must work together with people, in their network sharing information, knowledge and skills with these network actors and these network actors will share their information, knowledge and skills with the businesses (Ma et al., 2025). Developing products or improving existing ones is what GPI aims for. They focus on parts and systems to make them better. The goal is to reduce the impact of a product from the time its made to when its thrown away. GPI wants to meet what the market needs by introducing products. They care about the effect of their products. Their aim is to make products that're good for the environment. GPI looks at the life of a product. They want their products to be good, for people and the planet (Verma & Khanna, 2023).

People have started to realize that this is very important for helping businesses grow and for taking care of the environment. This is something that's very good for businesses and for the earth at the same time. The fact that it helps with business expansion and environmental conservation is a deal. Business expansion and environmental conservation are two things that're very important, to a lot of people (Rahman et al., 2024). When we make products we should think about the earth. We need to share what we know about being kind to the environment when we design things. We also need to be honest and tell people about the things our products do for the earth. This can make a difference. Companies that make things should help their workers think about the earth too. They should start by getting all the information about being green and organizing it. Then they should use this information to make their business practices better for the environment. This way companies can do things that're good for the earth and good, for their business (Rasheed et al., 2025).

Companies that make things should try to teach their employees about taking care of the earth. Teaching employees about being green can be a way to make a big difference and get people to think of new ideas that are good, for the environment. The company can make green products. This can help reduce the things that companies do to the environment. Green product innovation can help companies make products that do not hurt the environment. Manufacturing firms should make green products to help the earth. The earth will be better if companies make products and teach employees about the environment (Abudaqa et al., 2022). SDGs (9,12, 13) include lowering resource consumption, promoting recycling, controlling waste, and reducing pollution (Koutoudjian et al., 2021). Through the application of environmental science and technology, green product innovation can develop new or enhanced products and procedures (Lv et al., 2021). Capitalizing on green product innovation (GPI) can also aid companies in avert ecological complaints and regulatory fines, and create new market opportunities, while boosting the success of biodegradable products (Xie et al., 2019). The green initiative also contributes significantly to developing a company's green capabilities, enhancing its reputation for environmental responsibility, and improving financial outcomes (Khan et al., 2021).

The Knowledge-Based View (KBV) of the company asserts that knowledge is the organization's most precious and strategically significant resource. According to the KBV, companies attain lasting competitive superiority through the creation, integration, and efficient use of knowledge, rather than solely through physical or financial assets. In this situation, knowledge about the environment that is good for the environment is an important thing that cannot be touched. This knowledge helps companies react quickly to increasing environmental rules, pressure from stakeholders, and the demand for products that are good for the environment. We can get good results for our organizations by sharing what we know about environmental sustainability. There are ways to do this. These ways include things like classes where we learn from teachers, groups of people from parts of the organization, email and other digital tools and teams where people work together on projects. We can share our knowledge, about sustainability through these teams and other methods to make our organizations better (Song et al., 2020; Wang et al., 2022). Systematically sharing such knowledge increases employees' awareness, skills, and commitment to achieving sustainability goals.

Green knowledge is about doing things that don't hurt the environment. This includes using energy from the sun and wind, putting solar panels on roofs, using less energy,

making less waste, and using the earth's resources in a way that doesn't hurt the environment. It also includes acting in a way that is good for the environment at work. Green knowledge is spread through a company, improving its employees' skills by encouraging learning, testing, and teamwork. As employees share their expertise on sustainability, companies become better equipped to create environmentally friendly processes and products. This process of working together to share knowledge makes things less uncertain, helps people solve problems better, and creates new eco-friendly solutions more quickly. Consequently, disseminating green knowledge plays a substantial role in green product innovation (GPI), enabling companies to develop products that mitigate environmental damage, optimize resource usage, and comply with environmental regulations.

Green knowledge sharing (GKS) has been shown to have a strong positive connection with green product innovation, as indicated by earlier research (Khan et al., 2022). This process involves providing and acquiring environmentally relevant information among organizational members (Sun et al., 2024). Employees are willing to share what they know about sustainability. They do this by donating their knowledge. They also collect knowledge by actively seeking it out from their colleagues. The combination of these two factors creates an environment where knowledge is shared, which encourages creativity and new ideas in the development of green products. Based on the Knowledge-Based View and empirical evidence from previous studies, it can be argued that effective green knowledge sharing significantly impacts a firm's capacity for green product innovation. Hence, the following hypothesis is:

H1: *Green knowledge sharing has a positive impact on green product innovation.*

2.8.2 Green knowledge sharing and Absorptive capacity

Green knowledge sharing is closely linked to absorptive capacity, which plays a dynamic role in promoting the creative potential of a firm (Kim et al., 2025). When a firm is better able and more motivated to take in knowledge, green knowledge sharing assists absorptive capacity (Chen et al., 2025). As prior information and experience make new knowledge easier to apply, the co-evolution of knowledge gained through experiential learning leads to absorptive capacity (Müller et al., 2021). Existing studies highlight the reputation of absorptive capacity in tackling environmental issues, providing different approaches to overcome green inertia (Baquero, 2025). Similarly the absorptive capacity helps a lot. It. Makes the most of the market knowledge that already exists. This gives businesses a boost. They can operate well in settings. The absorptive capacity is really important. It helps

businesses use existing market knowledge. This in turn helps them do well in settings (Alkalha et al., 2025).

Firms ability to recognize and use knowledge depends on their Absorptive Capacity (AC). They must also follow the rules and regulations that apply to them. In manufacturing companies can get access to the latest green knowledge and take part in it. This includes things like technical know-how and what green customers want. They do this by sharing knowledge on a regular basis. This helps create and grow an understanding of green knowledge (Dzhengiz & Niesten, 2020; Mahmood & Mubarik, 2020). When companies share what they know about being green it can really help create a place where new ideas can grow. To get people thinking outside the box companies can try things like brainstorming sessions and teaching people skills on purpose. This way green knowledge and creative thinking can go hand in hand. Companies can come up with new and innovative ideas. The practice of sharing knowledge among firms is very important because it helps to cultivate an environment where innovation can thrive and the sharing of green knowledge can lead to more green knowledge and more innovation (Song et al., 2020).

People who work for a company and have good skills are very important for helping the company learn and get better. The companys knowledge assets are improved by these employees with skills and abilities. They play a role in making the company smarter and more knowledgeable. Employees, with skills and abilities are the ones who help the company develop and improve its knowledge assets (Patwary et al., 2025). Shared knowledge helps businesses reach their goals when combined with capacity. This mix supports business ideas. Absorptive capacity is key. It lets businesses take in and use knowledge. This helps them achieve their goals. Businesses can use knowledge in new ways, with absorptive capacity. This helps them succeed. Shared knowledge and absorptive capacity are a mix. They help businesses do well and support business ideas (Stettler et al., 2025). When a company wants to deal with issues it really needs to listen to what its employees have seen and experienced. This is because employees are the ones who have first-hand knowledge of what's going on. The company can do this by sharing information, about how to be more green. This means that employees can learn from each other and the company can become better at dealing with issues. The exchange of knowledge is really important for a company to be able to take in and use new information. This is what is meant by capacity of the company and green knowledge is a big part of it. The companys absorptive capacity is what helps it to deal with issues and it is very important for the company to have a strong absorptive capacity (Javed et al., 2025).

According to the RBV theory, green knowledge and absorptive capacity are closely linked in a way that helps companies become more competitive. This happens when companies develop their capabilities. These capabilities improve how well the company performs. They also help companies deal with problems. This includes reducing their impact. Companies also focus on product responsibility. They aim for growth. The RBV theory shows that green knowledge is important. It helps companies absorb information. This information helps them make products. Companies, with absorptive capacity can use green knowledge. They use it to create opportunities. This leads to performance. Green knowledge and absorptive capacity help companies. They help companies reduce waste. Companies become more sustainable. They focus on product responsibility. This means making products that're safe. Products do not harm the environment. The goal is growth. Companies want to grow. They also want to be competitive. The RBV theory helps companies achieve this. It shows them how to use knowledge. They use it to improve performance (Li et al., 2025). The GKS is really helpful because it makes it easy for companies to share what they know about the environment with each other. This means companies can learn about ways to be kind, to the earth and follow the rules that're in place to protect it. The GKS also helps with something called GPI. When companies share this knowledge it shows how well they can take it in and use it to make good choices. The company's ability to get, absorb and use the GKS is very important. This is called the capacity of the company and it is a big deal because it helps the company use the GKS in a smart way. The GKS and the absorptive capacity of the company go hand in hand to help the company be more eco-friendly (Yoshino et al., 2025).

Collectively sharing knowledge and the ability to absorb it help companies grow their environmental skills. These skills let firms use knowledge change their processes and create innovations that focus on sustainability. This combination fits with what RBV says: companies can use their abilities to create long-term value. They do this by reducing their impact on the environment, which helps them get an advantage that lasts. Green knowledge and environmental skills are key, to making this happen. Firms that share and absorb knowledge can reorganise and innovate sustainably. This approach enables them to decrease their impact while securing a sustainable competitive advantage through environmental capabilities (McDougall et al., 2022). Therefore, it is hypothesized that:

H2: *Green knowledge sharing has a positive relationship with absorptive capacity.*

2.8.3 Absorptive capacity and Green product innovation

The ability to tell what information is really useful get that information add it to what the organisation knows and use it to do things is called absorptive capacity. This is, about finding information from outside getting it and using it to help the organisation do its job better with the absorptive capacity. The organisation uses its capacity to find out what it needs to know and make good use of that information, which was first characterised by Lewin et al. (2020). Learning things and using information from outside is really important for being creative and staying ahead of others. This is where absorptive capacity comes in. Absorptive capacity is a skill that helps us learn and apply new information from outside. It is essential for fostering creativity and building competitive capabilities. Having absorptive capacity means we can take in new ideas and use them to improve our skills and abilities which is crucial, for absorptive capacity and staying competitive (Daghfous, 2004; Zou et al., 2018). Manufacturing firms need to learn about things really fast. This is important for using strategies in their daily work. As the environment gets worse manufacturing firms have to make sure they are doing something about it. They have to think about how their company can help with problems. Manufacturing firms must make the environment a priority. Do something about it from their companys point of view. The environment is a deal, for manufacturing firms. According to Marrucci et al. (2022), Companies need to think about the earth when they do things. They should follow the rules that help keep the air and water clean. This is going to help businesses learn and do things better. Following regulations is a good idea, for businesses because it will help them get better at taking in new ideas and using them to make their company better. Businesses that do this will be able to learn and grow easily. Environmental regulations are important for businesses to follow so they can increase their ability to learn and use information.

Borah et al. (2023), The people in charge really need to have the skills to make green product innovation work. Green product innovation mostly depends on leaders skills and capacities to get information from inside and outside the company. So medium sized businesses should try to get knowledge from their own people and from outside to do things that are good, for the environment. This way they can put green product innovation into action in a way. Green product innovation is important. Leaders need to understand this to make it happen. According to Chen and Chang (2019), A company should be able to use the knowledge from outside to help the environment and grow in a way. The technology that a company has is the reason it can compete with others and it is also what helps the company to learn and use new green ideas. Green knowledge is a part of what helps a company to learn and use new things. The

ability of a company to get, understand, change and use the knowledge from outside is what we call absorptive capacity of the company. A company, with absorptive capacity can obtain green knowledge digest the green knowledge renovate the green knowledge assimilate the green knowledge and utilise the green knowledge to achieve green growth. Green knowledge is very important for a company to achieve growth and absorptive capacity is the key to get the green knowledge (Chen & Chang, 2019). This capability encompasses learning skills and a knowledge-based approach. This allows companies to incorporate fresh information into their current thought patterns (Denford, 2013). Firms create knowledge by mixing new and old tech info in new ways. They get this knowledge. It helps them make green products. This happens when they can absorb info and use it to make sustainable innovations that fit their goals. The firms use their ability to take in info called absorptive capacity to make green products that align with what they want to achieve. Firms make green products better when they get and use knowledge. Green knowledge helps firms make innovations. They link what they can absorb, new info and their goals to make products (Huang et al., 2018).

The Resource-Based View theory is really helpful for seeing how a companys ability to learn things is connected to making products that are good for the environment. The Resource-Based View theory shows us that when a company can get knowledge it can use this to make environmentally friendly products. This is important because companies need to make products that do not hurt the earth. The Resource-Based View theory is about how companies can use what they know to make better products, like environmentally friendly products (Andersén, 2021). According to RBV companies can. Keep an edge over others by using special resources and skills that are valuable hard to find one-of-a-kind and can't be easily replaced. A companys ability to learn from outside use that knowledge. Make it part of how it works is super important for dealing with environmental issues. This ability is called capacity. It helps manufacturing companies prepare for and respond to problems and changes in what customers want. By using their capacity companies can turn information, about the environment into useful knowledge. This knowledge helps them create products that're good for the environment.

The absorptive capacity enables them to respond proactively to challenges and evolving market demands. Companies can effectively transform information into useful knowledge that informs the development of eco-friendly products by utilizing their absorptive capacity and distinctive resources (Zhang et al., 2020), explain that absorptive capacity for environmental knowledge enables firms to incorporate green

insights into their product development processes in a systematic and efficient manner. It is about getting and understanding information on materials that're good for the environment. We should use energy in a way and make things that do not cause much pollution. Then we use that information to make products that're good for the environment. This way companies can come up with ideas that reduce harm to the environment. This happens from the time the product is made to when it is thrown away. This method is in line with what the Resource-Based View (RBV) says. The RBV says that companies should focus on creating value for a time. They should be responsible for the environment. Also make money.

The RBV is about making sure companies are good, for the environment and the economy. Also, as companies learn more about green knowledge, they get better at seeing new trends in sustainability, following environmental rules, and knowing what customers want when it comes to eco-friendly products (Sahoo et al., 2023). This feature lets companies be in charge and make things happen than just dealing with problems as they come up. It helps them come up with ideas that follow the rules and also make them stand out in the market. The Resource Based View or RBV for short says that absorptive capacity is like a tool that companies can use to get better at what they do and have success with new ideas. Companies can make green products that are good for the environment and also use the latest technology by combining what they are good at with information about the environment from outside the company. This way green products can be created by companies like these. They can be very successful, with the green products.

Absorptive capacity is really important for two reasons. First it helps companies make eco-friendly products. This is a deal because it allows them to be more environmentally friendly. Second it gives companies an edge over their competitors. This is huge because it helps them stand out in the market. Companies that use their capacity well especially when it comes to environmental knowledge can get great environmental results. For example they can reduce their carbon footprint. Use fewer resources by doing they can make a positive impact, on the environment. Absorptive capacity helps companies achieve these results by letting them take in and use information. This way they can make decisions and create new opportunities (Sahoo et al., 2023). They can also increase their economic performance by reducing costs, expanding their market share, and enhancing their brand reputation. This dual benefit underscores the strategic importance of absorptive capacity as a vital resource within the RBV framework. The effectiveness and scope of green product innovation is expected to be directly impacted by enhancing absorptive capacity in the

environmental knowledge domain. This, in turn, will support sustainable competitiveness and long-term organizational performance. Consequently, the hypothesis states that:

H3: *Absorptive capacity has a positive impact on green product innovation.*

2.8.4 Green knowledge sharing and Innovation climate

The term climate describes a system of shared beliefs, attitudes, and values that can impact an individual's behavior within a specific organization (Tanas et al., 2025). An innovative climate incorporates environmental concerns into the heart of the organisation's core values, guaranteeing that these concerns are accepted and put into effect across all levels of the organisation (Sposato et al., 2025). It is the arbitrary assessment and characterization of whether the organisational environment is conducive to innovation (Newman et al., 2020; Somech & Drach-Zahavy, 2013). An individual's attitude, beliefs, motivation, values, and innovative behaviour will all be impacted by this kind of perception, which will then have an impact on the manufacturing firm's overall performance and capacity for innovation (Popa et al., 2017).

In a resilient organizational IC, the practice of allocation and distributing information is extremely prized and familiar by both leaders and organizations. It is also promoted as an action that is advantageous to the interests of the group as a whole (Ye et al., 2022). Workers are also stimulated to envision and freely share their own opinions and ideas in a robust organisational innovation climate (Ren & Zhang, 2015). To attain outstanding performance, there must be an innovative climate in the organization for everyone so that they gain more knowledge from others (Uddin et al., 2019), absorb innovative skills (Zheng et al., 2021), create innovative products, and make the environment eco-friendly. Individuals with natural creative abilities may exist, yet others need structured and intensive education to foster their creativity (Ellerton & Kelly, 2022).

In organizational environments, knowledge sharing, which encompasses the discussion of concepts, skills, and knowledge, is viewed as a vital resource (Yi et al., 2021). Providing innovation climate acts as the underlying principle for all green initiatives and environmental management systems (Rezaei et al., 2021). This underpins innovation, eco-friendly product development, and sustainable production methods (Rehman et al., 2022). Any new concept, such as those associated with

environmental management systems, requires innovation to achieve success. A new way of thinking about the climate is really important. This means we need to come up with ideas that help the earth at the same time. We cannot make new ideas work if we do not think outside the box and try things. Environmental management systems need people to be creative and think of ideas to really succeed. The climate needs ideas to stay healthy. We have to be creative when we are working with environmental management systems. This is the way new concepts can really work (Riaz et al., 2024).

Previous study has investigated the importance of green knowledge in creating a creative organisational environment (Ma et al., 2025). The effectiveness of a creative idea often relies on the kind of knowledge used in its development and the environment they provide. Diverse knowledge frameworks can therefore support problem-solving and stimulate the generation of new ideas (Abbas & Khan, 2023). Employees' help-seeking and help-giving behaviors can foster innovation and idea creation (Riva et al., 2021). Moreover, environmental motivation and effective knowledge management are crucial in boosting organisational creativity, prompting proactive environmental projects (Polas et al., 2023). A manager's green knowledge will have little impact on team performance unless it is put into practice. Hence, complex environmental problems can be enriched by sharing green knowledge to improve the originality and novelty of ideas via providing innovative climate (Shehzad et al., 2024).

The resource-based view (RBV) and knowledge-based view (KBV) theories provide a thorough theoretical foundation that clarifies the link between green knowledge sharing (GKS) and intellectual capital (IC) within companies (Ali et al., 2025). According to the Resource-Based View, a company's unique resources which include its intellectual capital (IC), a term encompassing human, structural, and relational capital can provide a significant competitive edge when they are rare, valuable, distinct, and irreplaceable. Companies can stand out from the rest by having these things that set them apart. This means they can deal with environmental problems as they come up and stay ahead of the competition for a long time. The KBV is different because it says that what a company knows is the important thing it has. When it comes to the environment this knowledge is like a spark that helps companies come up with ideas and do better in a way that is good, for the planet. Green knowledge is really important for companies to keep doing over time. The KBV shows that green knowledge is a part of this (Cooper et al., 2023).

Green knowledge sharing is really important for organizations. It helps them use what they already know to come up with ideas. When organizations share knowledge with all their departments and levels it creates a team environment. In this environment employees are. They feel empowered and motivated to solve problems in a creative way. Organizations can make their employees better by hiring experts. They can also improve their structure by making their operations more sustainable.. They can improve their relationships by creating networks where people share ideas about how to help the environment. This means sharing what they know their skills and the best ways to do things when organizations share knowledge they can make their values more environmentally friendly. This helps them keep getting better be responsible for the environment and grow in a way over time. Green knowledge sharing is a part of this process. It allows organizations to prioritize the environment and make sure they are doing what is best for the planet. Green knowledge sharing is essential, for organizations that want to be sustainable (Rasheed et al., 2025).

Green knowledge sharing works well when it helps companies learn and absorb ideas. This means firms get better at finding, getting and using knowledge that fits their needs. As a result they create eco- solutions and green products. This also makes their organization more innovative. When a company includes being sustainable in how it handles knowledge it gains advantages in competition (Rasheed et al., 2025). This integration helps the company turn its ideas into results. The company can now see the impact of its intellectual resources. These resources are now being used for green product development. The company is working on reducing its impact. This in turn leads to business success, for the company. Based on theoretical insights from resource-based view (RBV) and knowledge-based view (KBV), it is posited that the systematic sharing of green knowledge acts as a key mechanism for leveraging intellectual capital to facilitate sustainable innovation. So the following hypothesis states that:

H4: *Green knowledge sharing has a positive impact on the innovation climate.*

2.8.5 Innovation climate and Green product innovation

Organisations have a variety of climates; crucially, these climates, which support particular organisational objectives (like safety and facility), are the most feasible to demonstrate how organisational factors affect particular organisational outcomes (Longo & Magnusson, 2024). An innovation climate, for example, is a type of

organisational climate that specifically supports innovation. According to earlier research, Song et al. (2020), SMEs become more inventive when an environment that is conducive to innovation is created, and demonstrated how an innovative climate encourages creativity in SMEs. The innovation atmosphere in the same location may have an influence on SMEs' output to establish green product innovation (Liu et al., 2022). Manufacturing organizations that foster a robust organizational IC reward risk-taking and lateral thinking (Liu et al., 2022). Innovation of green products allows companies to synchronize with environmental sustainability objectives, expand their market scope, and meet customer requirements, ultimately resulting in sustainable competitive benefits (Longo & Magnusson, 2024). As environmental concerns grow, companies are focusing more on creating a culture of ecological concern and an IC that enables effective environmental management, both of which are key drivers of green product innovation. Past research has analyzed green adaptive capabilities and organizational elements that improve companies' green product innovation results (Gull et al., 2024). The relationship between a creativity-supportive climate and the performance of green product innovation has been relatively understudied.

Most organisational innovation is driven by a climate of innovation within the organisation (Sethibe & Steyn, 2016). An environment that supports creativity promotes trust and teamwork among staff, leading to the sharing of knowledge and ongoing professional development. In these environments, both individual and team creative thinking and behavior are encouraged, which supports the effective development of biodegradable products and enhances green product innovation (GPI) (Begum et al., 2022). A strong innovation climate also enables companies to foster an organizational culture that embraces the risks, uncertainties, and potential setbacks frequently associated with green product innovation. Manufacturing firms need to be adaptable to develop innovative new products, which involves creating a culture that allows employees to take risks and cope with uncertainty and ambiguity (Kołodziej, 2022). An organisational innovative climate that fosters creativity supports this by promoting employee creativity, allowing freedom in creative thinking, and providing sufficient resources for the creative process. A favourable climate not only fuels innovation but also fosters an environment that promotes green creativity, thereby enhancing the firm's environmental commitment (Song & Yu, 2018). Manufacturing firms with a clear environmental vision or mission are more effectively able to design and implement green products that significantly decrease their environmental footprint.

According to the Resource-Based View theory, stakeholder involvement in product innovation processes is a valuable insubstantial resources that enables the creation of

innovative green products (Andersén, 2021). Firms that collaborate on the basis of trust and cooperation develop strategic assets that are hard to duplicate, thereby increasing their ability to sustainably innovate. Manufacturing firms that foster a culture that values creativity, marked by intellectual freedom, employee empowerment, and adequate resources, successfully utilize their internal strengths to develop innovative and saleable goods (Valaei et al., 2022). This kind of climate is really important for a company. It helps to come up with green ideas. When a company has an environment that helps people think of new things and be kind to the earth it makes the company care more about the earth and want to do what is right, for the environment. The climate and the company's green innovation go hand in hand. A company that fosters a climate and promotes green thinking will have a strong environmental focus and dedication to the earth (Le et al., 2024). When aligned with a clear environmental vision or mission, these internal resources and capabilities enable the company to create green products that meet sustainability targets and offer a long-term competitive edge (Liu, 2025). Consequently, the following hypothesis states that:

H5: *Innovation climate has a positive impact on green product innovation.*

2.8.6 Absorptive capacity as a mediator

According to Martínez-Ardila et al. (2025), a firm's competence to recognise, adapt, and utilise knowledge is stated as its absorptive capacity (AC). Acknowledging competencies enables businesses to analyse and comprehend fresh environmental knowledge and pinpoint the most pertinent and beneficial environmental knowledge for sustainable innovation (Chen & Chang, 2019). By combining new green information with their existing expertise, organisations can create new blueprints for green innovation using assimilation skills. By effectually and proficiently utilising and updating this knowledge, enterprises can transform new knowledge into green product innovation (GPI) (Fan et al., 2023), because of this, a manufacturing firm's capability to absorb green innovation depends on it. To connect GKS and GPI, it is vibrant that AC plays a vital role. Learning in organizations (green knowledge sharing) is important, but newly acquired knowledge may be useless if it isn't integrated with current data and used to improve business operations (green product innovation) (Song et al., 2020). Benefiting from green innovation requires a company to understand, integrate, and synthesize the collective green body of knowledge in ways that surpass the capabilities of its competitors.

Moreover, green knowledge sharing is vital for boosting a company's drive to develop its ability to absorb new information (He et al., 2024). The effectiveness of AC is dependent not only on an indestructible knowledge base but also on an organisational climate that actively encourages internal knowledge sharing (Iqbal et al., 2025). A company that promotes a distinct knowledge-sharing culture, separate from that of its rivals, stimulates all operational departments to regularly exchange fresh, environmentally friendly knowledge (Azeem et al., 2021). The knowledge gained also supports its use, absorption, and implementation (Azeem et al., 2021). Consistent external sharing of market and business information further underscores the significance of knowledge sharing and experiential learning, thereby solidifying the knowledge-sharing environment within the organisation (Shehzad et al., 2023). A culture of this kind fosters collaboration among departments, enabling them to jointly interpret and apply knowledge more effectively, thus enhancing the manufacturing firm's capacity to assimilate new knowledge (Iqbal et al., 2025).

The recognition capabilities of firms allow them to understand and assess new green knowledge, thereby assisting in the identification of the most relevant and valuable information essential for driving GPI (Sahoo et al., 2023). The assimilation capabilities enable the merging of fresh green knowledge with established knowledge bases, consequential in the development of novel concepts and frameworks for sustainable development. This knowledge can be transformed into practical green product innovation by firms with the right exploitation capabilities, which involve efficient use and reorganisation (Aboelmaged & Hashem, 2019). Thus, a company's capacity to achieve environmentally friendly innovation heavily relies on its absorptive capacity. These arguments emphasize the crucial role that AC plays in connecting GKS with GPI. Integrating newly developed knowledge with a firm's current knowledge is crucial for organisational learning through green knowledge sharing to effect in GPI (Cui et al., 2021). The integration's absence would undermine the value of the knowledge, particularly in its capacity to influence firm performance and innovation results. The key benefit of achieving green product innovation stems from a firm's skill to understand, absorb, and apply shared green knowledge more proficiently and quickly than its competitors, ultimately resulting in greater green innovation outcomes (Qiu et al., 2020).

The absorptive capacity performances as a central mediator in the connection between GKS and innovative green products (Makhloufi, 2024), in accordance with both the RBV and the KBV theories. From the RBV perspective, AC is a valuable, rare, and inimitable organisational ability that permits firms to convert shared environmentally friendly knowledge into a source of competitiveness through innovative,

environmentally sustainable products. Under the Knowledge-Based View, knowledge is regarded as the most strategically vital asset, and AC serves as the dynamic competencies that permit this asset to be identified, absorbed, and utilised (Baquero, 2024). The success of innovation does not just depend on Green Knowledge System. It is the company's ability to take in and use this knowledge that really makes a difference in their innovation results. When a company puts together green knowledge and the knowledge they already have they can come up with new ideas that are good for the environment and improve their Green Performance Index outcomes. This is how companies can make a difference with Green Knowledge System and improve their Green Performance Index. Green Knowledge System is important for companies to make innovative things that are good, for the environment (Kong et al., 2020). Consequently, absorptive capacity is crucial in turning shared green knowledge into practical innovation, thereby reinforcing its mediating function in attaining sustainable competitiveness. This leads to the resulting hypothesis:

H6: *Absorptive capacity mediates the relationship between green knowledge sharing and green product innovation.*

2.8.7 Innovation climate as a mediator

The innovation climate within an organisation is the primary role of organisational innovation (Ye et al., 2022). Employee trust and cooperation are two factors that can foster an innovative environment and foster learning and knowledge sharing. Businesses that foster this kind of environment encourage both individual and collective creativity (Zhou et al., 2018), which helps to successfully develop new green products and improve the performance of GPI. Second, firms that substitute a culture of innovation are fit to create an environment within their organization that can withstand the risk, uncertainty, and even failure that come with developing new green products (Peng et al., 2023). To develop novel products, these companies require adaptable workers who take chances and are prepared to put up with ambiguity and uncertainty (Zou et al., 2024).

Previous researches have highlighted the substantial impact of organisational context in fostering resource exchange and knowledge sharing (Park & Kim, 2018). As a result, knowledge management is likely to interact with contextual factors, such as organisational climate, to affect a company's innovativeness. Effective knowledge sharing may necessitate a supportive organisational climate to access and utilise the

tacit knowledge embedded within individual employees (Ganguly et al., 2019), thereby facilitating the creation of innovative products. Organizational climate sets the context in which employees view knowledge management efforts and innovation initiatives, and it is crucial for encouraging their participation in developing knowledge into innovative products. Jiang et al. (2025), proposes that knowledge management has a greater influence on innovation when it is supported by aspects of organisational climate that are favourable, including an innovative or supportive environment. Innovation climate refers to the collective observations among members concerning mutual practices, measures, and value associations within the organisation (Swathi & Johnpaul, 2025). From a social capital viewpoint, workers use this shared climate to understand organisational measures, form suitable attitudes, and recognise anticipated behaviours and their consequences (Kirori, 2025).

An innovative climate is marked by a workplace setting that is exciting, demanding, challenging, creative, and receptive to taking calculated risks (Tager et al., 2025). Despite implementing robust knowledge management practices, a company may still face difficulties in enhancing green product innovation unless it cultivates an innovative environment that motivates staff to convert knowledge into novel products. Organizations that foster innovation, promote creativity, and accept failure tend to decrease employee uncertainty and boost commitment to green product innovation initiatives (Bhuiyan et al., 2025). During the new product development process, an innovative work environment motivates employees to take risks and become involved in creative and challenging projects that require applying knowledge in new and innovative ways. In these situations, staff are more likely to actively share and exchange knowledge in order to stimulate imaginative thinking and pursue novel and unconventional methods in their work (Jiang, 2025). This boosts their capacity to combine knowledge obtained through knowledge management activities, ultimately fuelling higher levels of innovation. In the absence of a pioneering climate, attempts to create and disseminate knowledge are less apt to yield significant innovation (Schulze, 2024).

The research suggests that introducing an innovative climate can substantially boost the success of GPI, provided it is backed by green knowledge sharing, which in turn increases employees' awareness and assurance to environmental objectives. According to the RBV, both green knowledge and an innovative climate are viewed as strategic intangible resources valuable, rare, and hard to replicate—that contribute to a firm's competitiveness (Liu, 2025). Manufacturing firms that have shown a pattern of incorporating environmental knowledge can use mechanisms like the Office of Green Collaboration (OGC) (who collaborate with industry alliance) to inspire

more workers to partake in green innovation enterprises. From a Knowledge-Based View perspective, knowledge is the central deliberate source for a manufacturing firm, and its capability to share, participate, and apply green knowledge is crucial for innovation (Kumar et al., 2024). The innovation climate acts as a facilitating aspect that enables the transformation of collective green knowledge into practical results, promoting creativity, experimentation, and risk-taking behaviours. Therefore, the suggestion between GKS and GPI is moderated by a firm's innovative climate (Kumar et al., 2024). Furthermore, it is anticipated that a forward-thinking climate will facilitate the connection between knowledge management and organisational innovation by enhancing a firm's ability to acclimate environmental knowledge into sustainable, marketable green innovations (Shehzad et al., 2024). Therefore, it can propose the subsequent hypothesis:

H7: *The relationship between green knowledge sharing and green product innovation is mediated by the innovation climate.*

2.8.8 Customer involvement as a moderator

In collaborative product development, organisations frequently partner with external companies to create new products (Lu et al., 2025). Involving outside parties in the development process has become more crucial, as shown by various research studies. Collaborations between different organisations may involve a diverse array of partners, including suppliers, universities, customers, competitors, or other businesses. Studies have shown (Opoku et al., 2024; Seow et al., 2024), suggest that the greater a firm's variety of external partnerships, the greater the probability of creating effective new or enhanced products. Melnychuk et al. (2021), stress that collaboration with external partners in product development greatly enhances innovation and leads to successful product outcomes.

In interactions between companies (developer-customer in this case), absorptive capacity is a crucial component that helps developers recognise and integrate relevant green knowledge for use in New Product Development (NPD) and innovation procedures (Aliasghar & Haar, 2023; Naqshbandi & Tabche, 2018; Seepana et al., 2021). As a matter of fact, absorptive capacity gives the developer the ability to efficiently integrate external and internal knowledge as well as create and enhance procedures and practices that make it easier to apply both new and experimental knowledge in the NPD project (Morgan et al., 2018). Therefore, according to Wang et al. (2025), absorptive capacity is essential to enhance inter-firm learning and

knowledge transfer. Therefore, 1) helping the developer to discern and identify useful from non-useful external information and 2) promoting the outside knowledge's embedding in organizational processes, absorptive capacity can lower the states of knowledge- and knowledge-related uncertainty. Nowadays, every customer demands eco-friendly products (Mageswaran et al., 2025) Insights from customers are widely recognized as one of the most important sources of innovation because they can suggest new ideas and viewpoints that are radically different from those of the developer (Cui & Wu, 2016; Zhou et al., 2021).

Customer involvement can play a significant moderating role in the connection between GKS and absorptive capacity, particularly when viewed through the framework of Social Exchange Theory (Fan et al., 2023). This theory depicts the interdependent feature of relationships, where the presence of mutual trust and cooperation can facilitate productive exchanges. Active customer involvement in the innovation process enables them to contribute valuable information, feedback, and insights that enhance the company's existing knowledge database (Storey & Larbig, 2018). Active engagement enhances the quality and pertinence of collectively shared environmental knowledge, making it more accessible and significant for the organization. Consequently, companies with significant customer engagement are better suited to identifying, processing, and utilising this knowledge, crucial elements of absorptive capacity (Sjödin et al., 2019). By involving customers a company can better use knowledge to make green innovations work well. This helps companies make green products. Customers help companies know what is happening outside and make changes. Green innovation results are better when customers are involved. Social Exchange Theory gives us a way to understand how customers getting involved affects the relationship between sharing knowledge about being green and being able to absorb new information. The idea behind Social Exchange Theory is that people act in ways because of the way they interact with each other. Social Exchange Theory helps us see that when people do things for each other it creates a kind of exchange. This exchange is what shapes the way people behave around each other. So when we talk about green knowledge sharing and absorptive capacity Social Exchange Theory is really useful. It shows us that when customers participate it can make a difference, in how well companies can absorb new green knowledge (Storey & Larbig, 2018). These interactions are driven by the perceived benefits of sharing resources, which outweigh the associated costs. People interact with each other because they think sharing things will be good for them. They believe the good things they get from sharing are more important than the things. This helps people trust each other and work together. When we talk about sustainability and innovation customers are not

just sitting there doing nothing. They are actually helping to share knowledge with sustainability and innovation. Customers play a role in sharing knowledge, about sustainability and innovation (Cropanzano & Mitchell, 2005).

When customers are really into our stuff they can tell us things that're really important about green products and how we do things. If all the people who work with us are paying attention the good things we know about being green gets shared around the company. We get to know more, about products and green processes from our customers who care about this (Wei et al., 2018). Knowledge is shared openly by companies through interactions. This happens because firms know that customers who are involved can help them gain insights. These insights help firms to be better at absorbing knowledge. Customer involvement helps a company to find, understand and use knowledge. This is because both the company and customer think it is an exchange. This fair exchange reduces uncertainty. It also makes companies more confident. They become confident, in using sustainable practices. The companies and customers work together. They share knowledge. The customers help companies. Companies get better at being sustainable (Tseng & Hung, 2013).

When customers are not very involved it is harder for companies to share information about being green in a way that's interesting and relevant. This can make it tough for the company to really understand and use this information in the way possible. SET says that a company's desire to learn from customers and use that knowledge depends on how much the company thinks it will benefit from working with the customer. The company needs to think that it will get something out of the relationship with the customer. If the company does not think it will get benefit then it will not be very motivated to learn from the customer. The company will not try hard to share green knowledge with the customer when the customer is not very involved. Green knowledge is important, for the company. It is not very effective when the customer is not participating (Tseng & Wu, 2014). High customer involvement makes the effect of GKS on learning even better. This happens when customers are really involved. It creates a situation where knowledge shared is more useful and relevant to the market.

H8: *Customer involvement moderates the relationship between green knowledge sharing and absorptive capacity.*

Customer involvement in environmentally-friendly product innovation is important as customers contribute valuable knowledge, insights, and ideas that can drive more

effective and sustainable solutions (Awwad et al., 2025). Their direct experience and environmental concerns enable companies to advance a better consideration of market requirements and preferences, thereby ensuring green innovations are both practical and effective. Manufacturing firms can boost the success and acceptance of their eco-friendly products by actively incorporating customer suggestions and ideas, thereby facilitating more effective cooperation and better environmental results (Awwad et al., 2025).

Consequently, In an innovative work environment, providing resources and incentives to marketing personnel who directly interact with customers supports knowledge sharing and encourages the desired behavior (Tsai, 2018). Marketing staff who are fully committed to their jobs tend to feel more inspired, active, and passionate about their work, and this positive attitude is reflected in their interactions with customers (Tsai, 2018). Effective product service can be enhanced by improved customer service performance, which assesses how well a product satisfies customer needs in its service capacity (Hussain et al., 2025). When the marketing staff members are actively involved and engaged in sharing green knowledge, they tend to have a more positive attitude towards their work and display a stronger commitment to fulfilling their job duties (Tsai, 2018). Marketing staff who are highly invested in their work typically respond quickly to customers, actively listen to their concerns, and pinpoint unspoken needs. As a result, they are able to effectively communicate product features and benefits in order to address and overcome customer objections (Arora, 2024).

According to Chang (2021), earlier research has indicated that the innovation climate may be affected by supposed customer involvement, organizational status and firm culture. Employees feel appreciated when clients exhibit cooperative behavior, such as adhering to rules, and they look for opportunities to enhance their work attitude (Ma et al., 2022). In addition, clients have the ability to provide staff with resources including financial, human, cultural, informational, and social capital in order to foster better ideas and output. Three categories of physical resources were distinguished (strength, energy, and emotion) (Agrawal & Rahman, 2015; Arora, 2024). These tools offer psychological support for the creative environment among staff members. Cooperating with customers, such as those who follow instructions, leaves a positive impression on staff and encourages them to look for methods to enhance their performance (Zhou et al., 2021). Clients can help employees who are working on improving their innovative ideas and output by providing material, economic, interpersonal cultural, knowledgeable, and social assets (Agrawal & Rahman, 2015; Hussain et al., 2025).

When we think about how customers are involved it can really affect the relationship between GKS and IC. This is especially true if we look at it from the viewpoint of Social Exchange theory. Customer involvement is a part of this. It can help us understand how GKS and IC work together and how customers play a role in this process. The Social Exchange theory helps us see that customer involvement is important, for GKS and IC (Zhou et al., 2024). The idea here is that when people work together in a way it is very important. This means that companies and customers need to trust each other and help each other out. When customers are really involved they bring ideas about being green and seeing things from a different point of view. This helps the company share knowledge with others. The company and the customers are working together. This is a very good thing.

The customers are giving the company ideas and the company is learning from the customers. This is what the company needs to do to be good, at sharing knowledge. The company and the customers are working together to make this happen (Ojha et al., 2023). The exchange that happens here really helps to make a place for new ideas to grow. This is because it makes people work together and share what they know to make things more sustainable. When people work in a place that likes ideas they are more likely to use and build on the things they know about being green. When customers are involved it makes the connection between Green Knowledge Sharing and Innovation Creation stronger. This is because it creates a place where people can work together and make things in a way that is good, for the planet. Green Knowledge Sharing and Innovation Creation can really make a difference when people work together (Naim et al., 2024).

Social Exchange Theory provides a solid theoretical foundation for comprehending how customer participation influences the connection between green knowledge sharing and innovation climate. According to the SET model, social interactions are defined by reciprocal exchanges in which individuals and groups engage in actions that are expected to yield mutual benefits. When one party offers valuable resources, such as knowledge, support, or feedback, the other party likely feels obligated to return the favor. This enhances cooperation, trust, and commitment to the relationship in the long term (Naim et al., 2024).

In an organization green knowledge sharing is about staff members sharing knowledge, skills and best practices about the environment with each other. This helps team members work together better. They share information openly. Learn from each other. Green knowledge sharing helps create an environment for new ideas to grow. Staff members learn from each other. They get to know practices related to

environmental issues. This process makes teamwork and openness stronger. It helps organizations become more innovative. Green knowledge sharing is vital, for organizations. It helps them work better together on issues (Agrawal & Rahman, 2015; Hussain et al., 2025). An innovation climate in a company is when all employees understand that creativity, trying things and developing new ideas are supported and encouraged. When managers and colleagues openly share knowledge it shows that they support initiatives that focus on being sustainable. This helps create a culture that values innovation and taking care of the environment. Employees feel that their ideas for sustainability matter and that they are encouraged to think about environmental accountability. Sharing knowledge makes it clear that sustainability is a priority. It also shows that the company is serious, about innovation and making an impact. In this kind of culture employees are more likely to come up with ideas that support sustainability. The company's focus on innovation and environmental accountability helps to drive growth and success.

The relationship between the company and the customers is really important. It depends on how customers use the app. The customers are like partners who help the company by giving them ideas, information about the market and feedback. When customers use the app a lot the company gets a lot of benefits from the exchange of ideas about being eco-friendly (Naim et al., 2024). Customers who help create products by giving suggestions about sustainability or working together with the company provide really useful information. This information helps the company share knowledge about the environment with its employees. When customers and the company work together like this it makes the employees feel like their knowledge about the environment is important and that people outside the company care about it. This can make the employees more motivated, trustworthy and dedicated to coming up with innovative ideas. The customers and the company both benefit from this relationship. It is especially good, for the company when the customers are really engaged with the app and the company's eco-friendly concepts.

A cycle of support happens when customers are involved. When companies share information with customers they give more comments and participate more. Companies also react to customer suggestions. This exchange helps create an innovative work environment. It encourages openness, safety and teamwork in solving problems. Employees see initiatives as supported not just by their company but also by customers. This makes them feel safe to try things and innovate sustainably.. When customers are not involved the exchange of ideas is weaker. Even if employees share practices with each other they might not get feedback from

customers (Agrawal & Rahman, 2015; Hussain et al., 2025). Without customer involvement the positive effect of practices on innovation may not be clear. It is crucial for customers to participate. When customers are involved it helps employees. They get validation and feedback from customers. This makes a difference, in creating a positive and innovative work environment. Customers play a role. They help create a cycle. Companies should involve customers. This involvement is essential. It fosters a culture of openness and teamwork. Employees feel supported. They are more likely to experiment and innovate. In this way customer involvement is vital. It helps create a work environment. Companies and customers work together. They share ideas and feedback. This helps drive innovation (Hussain et al., 2025). People think that when we share what we know about the environment it is a thing. This helps us create things. When customers are part of this the environment knowledge gets shared in a way. This means employees feel like they have help when they try to come up with new ideas about the environment. So the environment innovation climate gets stronger. That is good, for the environment. Hence, it can be hypothesized that:

H9: *Customer involvement moderates the relationship between green knowledge sharing and innovation climate.*

2.9 Summary related to Green knowledge sharing and other variables

Following is the summary related to the present research:

Table 2.9 Literature Review summary (Source: author's own)

Author	Purpose	Finding	Journal
(Ma et al., 2025)	The aim is to examine how green knowledge sharing and green dynamic capabilities influence green creativity and green innovation directly and through green creativity.	Green knowledge sharing and green dynamic capabilities have a substantial and beneficial effect on green innovation. They have both direct and indirect influences.	Kybernetes

(Badar & Siddiquei, 2025)	This study looks at how green knowledge is acquired and shared, and green innovation, how internal corporate social responsibility, communication is influenced.	The research suggests that leaders who include green ideas and who create new green ideas are good at connecting with each other. Green knowledge and green knowledge sharing help connect people in this way.	Journal of Business & Industrial Marketing
(Achmad & Wiratmadja, 2025)	This study looks at how well knowledge management helps green innovation and how it affects how well SMEs do and how well they compete.	The findings of the study demonstrate that knowledge management exerts a considerable influence on green innovation, which in turn exerts a favorable impact on organizational performance. Additionally, organizational performance supports competitive advantage. However, the relationship between organizational performance and green innovation is not significantly influenced by innovation capability.	Journal of Open Innovation: Technology, Market, and Complexity
(Abbas & Khan, 2023)	The aim of this study is to investigate whether organizational green innovation capabilities are enhanced by green knowledge management, resulting in improved green performance.	Research has demonstrated that GKM is a significant positive indicator of organizational green innovation and green performance, and improves their capacities in these domains.	Journal of Knowledge Management

(Wang et al., 2022)	The study examines green knowledge management and green innovation. This includes green technological and management innovation.	green knowledge management strengthens organizations' abilities to implement green innovation and SDG strategies, aligning with the findings of research studies.	Journal of Innovation & Knowledge
(Shehzad et al., 2023)	To study the effects of a company's environmental efforts on new ideas that are also environmentally friendly, the role of managing knowledge about these efforts, and the impact of managing resources effectively.	The results of the mediation show that green knowledge management's role in connecting green entrepreneurial orientation and ambidextrous GIs is more important when there is a strong ability to manage resources.	Journal of Cleaner Production
(Sahoo et al., 2023)	The results of the moderated mediation show that green knowledge management plays a more important role in connecting green entrepreneurial orientation and ambidextrous GIs when companies have highly developed resource orchestration capability.	Studies show that new ideas for green technology can help companies do a better job of protecting the environment.	Business Strategy and the Environment
(Ul-Durar et al., 2023)	The study focuses on forging links with several crucial yet often overlooked aspects of knowledge dynamics and company perspectives. The aim is to establish organizational circular economy activities through eco-innovation.	This paper talks about a plan that explains how people learn and get used to a company's ways. It also gives companies a new way to share what they know.	Journal of Knowledge Management

(Song et al., 2020)	We created a mediation model that includes a way to share knowledge about the environment. This model looks at how the pressure from stakeholders affects the way green knowledge is shared and how it leads to new ideas.	The findings from multiple regression and bootstrapping analyses suggest that absorptive capacity fully mediates the connection between green knowledge sharing and green innovation. Stakeholder pressure positively impacts this mediation effect.	Business Strategy and the Environment
(Shafait & Huang, 2024)	This study looked at how leaders' choices affect teachers' learning about the environment. This includes how teachers think, how they act with others, how they grow as people, and how happy they are. This study also looked at stakeholder theory. It also examined the mediating role of green knowledge sharing in relation to sustainable leadership and its impact on green learning outcomes.	The existence of a direct and positive impact of sustainable leadership on green learning outcomes was confirmed, but the presence of green knowledge sharing as a direct mediator without any additional influence between sustainable leadership and green learning outcomes was also confirmed.	Journal of Cleaner Production
(Abbas & Sağsan, 2019)	This study investigates the function of knowledge management. It looks at green innovation and corporate sustainable development practices.	Knowledge management has a significant impact on green innovation and corporate sustainable development activities. Green innovation was found to have a positive effect on corporate sustainable development.	Journal of Cleaner Production

(Makhloufi, 2024)	This research is the first study to look at how big data and sharing green knowledge can help companies be more environmentally friendly and how they can help people start new businesses that are also environmentally friendly.	The research showed that big data capabilities positively impact both green absorptive capacity and green entrepreneurship orientation. Green entrepreneurship orientation and green knowledge sharing also positively contribute to green innovation. The green knowledge sharing project had a positive impact on both green absorptive capacity and green entrepreneurship orientation.	Industrial Management & Data Systems
(Aboelmaged & Hashem, 2019)	This research uses knowledge capability studies and the natural resource-based view of the business to look at how absorptive capacity affects the use of green innovation.	The adoption of green innovation is driven by key factors, including sustainable orientation and collaboration capabilities. Absorptive capacity has a significant impact on this adoption.	Journal of Cleaner Production
(Albort-Morant et al., 2018)	This paper looks closely at how the knowledge that a company has inside the company and the knowledge that comes from outside the company affect how well a company creates new ideas that are environmentally friendly. Subsequently, the study examines the	The results of the study show that being able to learn from experience and building relationships have a big positive effect on the result we are studying. Building relationships helps explain the connection between being able to learn from experience and	Journal of Knowledge Management

	relationships between absorptive capacity, relationship learning, and green innovation performance.	how well green innovation works.	
(Lin & Chen, 2017)	This study looks at the connection between sharing knowledge about the environment, the ability to change quickly, creating new services, and having an advantage over other companies because of environmental concerns.	Studies have demonstrated that eco-friendly dynamic capabilities and eco-friendly service innovation function as intermediaries in the beneficial connection between eco-friendly knowledge sharing and eco-friendly competitive advantage.	Quality & Quantity
(Sun et al., 2025)	We will look at how green knowledge sharing, the creative environment, and better artificial intelligence information can help people use circular economy practices. This will give people better ways to work together and create new green practices.	The results show a connection between sharing green knowledge and a green creative environment and circular economy practices. A green creative climate is a crucial intermediary between green knowledge sharing and circular economy practices.	Journal of Manufacturing Technology Management
(Ye et al., 2022)	The effects of innovative employee behavior and knowledge sharing within the workplace are investigated by this study. The factors that are considered include organizational climate, creative leadership skills, and emotional	Innovation climate and innovation behavior have been found to be regulated by knowledge sharing, which is defined as the transfer of information, skills, and expertise from one individual or group to another, facilitating the exchange of ideas, best	European Journal of Innovation Management

	responses to imposed change.	practices, and knowledge, and enhancing collaboration, innovation, and creativity.	
(Akhtar et al., 2024)	The study's foundation is the natural resource-based view with development of a mediation-moderation framework. This framework examines the impact of green intellectual capital on green innovation performance and environmental performance. Green absorptive capacity acts as a mediator and the green innovation climate serves as a moderator.	This research demonstrates a positive correlation between green absorptive capacity, green innovation climate, green intellectual capital, and environmental performance in business settings.	Environmental Science and Pollution Research
(Maitlo et al., 2022)	This study investigates green transformational leadership. It also investigates green innovation climate and green autonomy. These are precursors to green creativity.	The research results show that the green innovation climate has a partial mediating effect on the green creativity of employees in China, through both direct and indirect effects of green transformational leadership. Green autonomy also mediates the relationship between the green innovation climate and green creativity.	Frontiers in Psychology

(Zhou et al., 2021)	It's really important to think about how the environment is a part of this, and how companies can take in and use new ideas in a green way. But not a lot of research has been done on how these things affect green innovation in mining companies.	They also have a positive mediating effect on the relationship between environmental legitimacy and green innovation, which is important for understanding how environmental factors influence the adoption of innovative green practices. Green absorptive capacity can positively moderate the relationships between senior management cognition and green innovation and between green strategic orientation and green innovation.	Resources Policy
(Zhang et al., 2020)	The study examined how external knowledge acquisition and green absorptive capacity influenced the outcome.	Green absorptive capacity reinforces the positive impact of market-based regulation on external knowledge adoption.	Business Strategy and the Environment
(Cui & Wu, 2017)	An increasing number of companies are actively incorporating their customers into the product development process for new items, which allows companies to create products that customers want and meet their needs.	So, what we're saying is that these two types of customer involvement each have their own perks and are better suited for different situations. When adopting CIC, businesses should consider their learning methods and the efficiency of CIS for developing new products.	Journal of product innovation management

(Agrawal & Rahman, 2015)	The goal of this article is to identify the various roles that customers play and the resources they provide in the creation of value through collaboration.	This research examines value co-creation from the customer's viewpoint, detailing the resources customers contribute, and provides a conceptual framework for value co-creation.	International Strategic Management Review
(Elshaer et al., 2024)	The extent to which customers' eco-friendly behavior is influenced by social commerce practices within the context of eco-friendly hotels is aimed to be investigated by this study.	Research results showed how important social commerce is in getting customers to be more eco-friendly and choosing hotels that are also eco-friendly. The findings also validated the moderating effect of green customer citizenship in facilitating the relationship between social commerce and environmentally friendly behavior in hotel settings.	Sustainability
(Amoah et al., 2022)	The socio-economic problems being encountered by rapidly developing economies present a vast yet unrealized potential for small and medium-sized enterprises (SMEs). This study examined the role of SMEs in an emerging economy.	It is shown by the findings that significant support and contributions to Gross Domestic Product (GDP) are continued to be offered by small to medium-sized enterprises (SMEs), and roughly 70 percent of the country's entire working population is employed by them.	Journal of International Studies
(Idrees et al., 2023)	This study wants to show that knowing how to manage what you know is an important	This study delves into the intricacies of knowledge management within the	Journal of Innovation & Knowledge

	part of a business's plan and can help high-tech companies make new products more quickly.	ambit of National Development Project initiatives. The article presents several thought-provoking findings and provides an in-depth analysis of their potential long-term implications. It also offers a theoretical structure for the research and a practical approach based on existing literature.	
(Paparoidamis & Tran, 2019)	It is sought to be investigated in this study whether different kinds of eco-innovations are reacted to variably by consumers and to be explored how and under what circumstances consumers' perception and adoption intentions are influenced by eco-friendly consumer innovativeness.	Consumers have more positive attitudes towards products, show stronger preferences, and are more likely to adopt innovations that eliminate resource use compared to other eco-innovations across two product categories. While consumers are unwilling to pay a higher price, they would increase their consumption levels to offset the cost.	European Journal of Marketing
(Awan et al., 2021)	The investigation's primary focus is on how export companies organize knowledge management and improve product innovation outcomes.	Our research shows that when buyers share their knowledge, it is very important for companies that want to sell their products in other countries. This sharing of knowledge helps these companies get the resources they need and use them in new ways, which in	Business Strategy and the Environment

		turn helps them create new products.	
(Abu-Shanab & Subaih, 2019)	This research tried to examine the factors that lead to new ideas in a company. The study looked at six important factors: the company's culture, its rules and policies, how employees feel, what makes them want to work there (both the good and the bad), how happy the employees are, and how much they share what they know.	Both internal and external incentives must be focused on by businesses to shape employees' perceptions and subsequently encourage knowledge sharing. They should place a greater focus on rules and policies that foster a culture of knowledge sharing.	Journal of Information & Knowledge Management
(Martínez-Ardila et al., 2025)	A competitive edge can be established by alliances through the improvement of an organization's ability to find, absorb, and implement new knowledge, which is often called its absorptive capacity for knowledge.	The results of technology transfer in cooperative partnerships are enhanced by increasing a company's ability to absorb knowledge, according to research findings. Strong relationships between organizations are shown to be very important for sharing knowledge.	Problems and Perspectives in Management
(Martínez-Ardila et al., 2025)	This paper investigates how an emerging market multinational enterprise (EMNE) incorporates sustainability into its business strategy to achieve and sustain long-term corporate legitimacy. Specifically, the study examines how implementing a	When a company includes sustainability in its plan, its subsidiaries can successfully meet global needs by considering internal and external pressures. This integration fosters the development of unique capabilities and the adoption of	European Business Review

	corporate sustainability strategy can strengthen a company's long-term competitive position by establishing and maintaining its legitimacy and promoting sustainable development practices within the organization.	standards, mitigates risks in overseas markets, and provides a competitive advantage while safeguarding corporate credibility among stakeholders.	
(Chaparro-Banegas et al., 2024)	The paper looks at how countries are grouped based on how well they've met the SDGs and the presence of innovation facilitators.	The findings accentuate the necessity of incorporating the limitations of economic growth with regard to innovation drivers to nurture sustainable development.	Environment, Development and Sustainability
(Durán-Romero et al., 2020)	The idea of a circular economy was created to enhance the efficiency of how we use resources while decreasing the need for new resources, reducing waste, and lowering emissions.	A suggested plan for studying the topic and ideas for future research questions are presented. It explores technologies incorporating eco-innovation from the energy, waste, transportation, construction, and manufacturing industries.	Technological Forecasting and Social Change

3 MOTIVATION AND NEED FOR STUDY, RESEARCH GAP, RESEARCH QUESTION, AND OBJECTIVES

3.1 Motivation and need for study

To gain a competitive advantage and promote green products with a focus on sustainability has become more critical (Chen & Cao, 2025). This study is situated

within the manufacturing industry of developing countries, where firms experience in integrating and knowledge management problems. Past research (Fishbein et al., 2015; Pisano, 1989) suggests that an appropriate governance structure, such as promoting GKS and enhancing AC, is important for a firm's performance. However, there is little understanding of customer involvement as a novel addition in manufacturing firms, it could significantly reduce the transaction cost to enhance the firm green product innovation while having a good knowledge about customers' demands (Reppmann et al., 2025).

Green product innovation is a significant interest in developed countries' industry to compete in the market. The sustainability gap between developed and developing nations is caused by differences in historical trajectories, governance structures, technological accessibility, and economic capabilities (Neale et al., 2021). Rich countries frequently have greater resources available to them for enforcing laws, investing in sustainable practices, and creating clean technology (Bejakovic, 2020). On the other hand, developing nations deal with issues including scarce financial resources, poor infrastructure, and conflicting development agendas (Masudi et al., 2025). Moreover, past industrialization trends in rich nations have added to the accumulation of wealth and knowledge in the field of sustainability (Okonkwo et al., 2025). Addressing these disparities requires concentrated efforts to reduce economic inequality, improve technology transfer, fortify governance, and foster global collaboration to close these gaps (Kurniawati, 2020).

Within this context, it is necessary to develop eco-innovations to make good and innovative products in manufacturing industries. Eco-innovations reduce inequality by making essential services and jobs more accessible, as it enhance technology transfer by creating open and adaptable systems (Atiku et al., 2024). Furthermore, eco-innovations promote sustainability, enhance governance, and encourage international cooperation by establishing shared goals and diplomatic innovations (Chaparro Banegas, 2024). Despite their importance, few research studies exist from the developing countries' perspective, with a few exceptions (Awan et al., 2021), in the emerging country context, to manufacture eco-friendly products.

A significant knowledge gap in research on competitive advantage in SMEs exists due to the limited incorporation of traditional cost- and quality-based benefits with developing factors, including digital transformation, environmental sustainability, and supply chain robustness (ZHANG, 2025) while many studies concentrate on operational efficiency or innovation individually, yet there is inadequate investigation into how these capabilities interact and adapt in response to changing market circumstances. In particular, the significance of intangible assets, including green knowledge sharing, employee skills, and organisational climate, in maintaining a

competitive edge remains largely unexplored, particularly within the developing countries' context (Shahbaz et al., 2025).

Against a backdrop of discussion on climate change, environmental issues, and sustainable economics. The perception of GPI in SMEs has changed in recent years (Durán-Romero et al., 2020). These ecological challenges allow the investigation of specific mechanisms that will enable manufacturing firms from developing countries to increase green product innovation performance (Shahbaz et al., 2025). Even though the concept of GPI is not new, research varies across different countries. No research study investigated customer involvement as a moderator between GKS and GPI from a developing country perspective. The main stream studies don't adequately address the role of IC and AC for firm green product innovation, which leads to companies' competitiveness (Ma et al., 2025).

Research on the unique dynamics and difficulties developing nations confront when incorporating consumer input and preferences into green product innovation processes may be lacking (Barwant et al., 2025). Furthermore, investigating the role of customer involvement (CI) in GPI within developing countries' contexts may not receive as many resources or research priority as other components of sustainable development, such as resource management or economic growth (Hashem & Aboelmaged, 2023). As in developing countries, most SMEs do not give value to their customers; they just follow tradition, and the knowledge-sharing level is also not up to the mark (Sampaio, 2025). So, these firms needed to introduce these practices and create an innovative climate.

Futhermore,due to the institutions' lack of infrastructure support, many manufacturing firms face a lack of research and development resources (Junejo et al., 2025). As a result, to overcome these problems, firms often rely on external knowledge sources to increase the firm's green product innovation. However, there is little understanding of how manufacturers in developing countries can improve a firm's GPI (Ullah et al., 2022). There is an essential need to look at how green product innovation and knowledge exchange techniques may be used to advance competitiveness in the context of developing countries' manufacturing SMEs. Although sustainability practices are becoming more and more important worldwide, many SMEs in developing countries find it difficult to incorporate eco-friendly initiatives into their daily operations (Hussain, 2023).

Therefore, in this environment, little is known about the functions of crucial elements like consumer involvement, absorptive capacity, and innovation atmosphere. For manufacturing SMEs in developing countries to successfully negotiate the difficulties of international competition and concurrently contribute to environmental

sustainability. They must have a detailed understanding of these dynamic forces. To gain a thorough understanding of manufacturing firms' practical suggestions for policymakers, it is important to consider the significant impact that customer involvement can have on a firm's knowledge generation activities, enhance absorptive capacity, and create an innovation climate. This, in turn, can influence the firm's green product innovation, which leads toward competitive advantage.

3.2 Research Gap

Currently, climate change, environmental concerns, and sustainable economics are major topics of discussion. Manufacturing firms in developing nations are facing mounting pressure to implement environmentally sustainable methods without sacrificing competitiveness in swiftly evolving markets. Increasing emphasis is being placed on promoting eco-friendly products with a focus on long-term sustainability. The manufacturing industry of developing countries experience in integrating and tackling knowledge-sharing problems (Awan et al., 2021). Previous study indicates that a suitable governance framework, including the promotion of GKS and the enhancement of green products, is crucial for a company's success (Shehzad et al., 2024). Most of the research concentrates on developed economies, leaving a substantial knowledge gap regarding how these interconnected factors function within resource-scarce, institutionally fragile, and environmentally developing country contexts. Closing this gap is vital for developing strategies that not only increase green innovation but also improve firms' market positioning in emerging economies.

The main research problem in manufacturing firms is to share green knowledge within the organization, which is very important nowadays due to eco-friendly product demands, which may lead organizations towards a competitive advantage (Chaithanapat et al., 2022). Thus, green product innovation is facilitated by aspects like GKS, customer involvement, and innovation-supportive climates, yet many firms find it challenging to convert these elements into lasting competitive advantages. Hindrances like low absorptive capacity, disjointed collaboration channels, and underutilized customer feedback integration into innovation processes impede the efficient development and commercialization of eco-friendly products. For this, the firm must have an innovative climate (Abu-Shanab & Subaih, 2019), so that its employees may be more capable of absorbing innovative skills and enhancing the green product innovation of a firm (Riaz et al., 2024). There is a limited study about customer involvement that has the potential to substantially decrease transaction costs and thereby boost a company's green product innovation. Product innovation in environmentally friendly products is a major concern for businesses to remain competitive. Developing eco-innovations is essential in the manufacturing sector.

Concurrently, various prior research studies have originated from the viewpoint of developing countries, with a few notable exceptions (Awan et al., 2021), within the context of a developing country.

3.3 Main Research Goal, Research Question, and Objectives

Consequently, the *main goal* of this study is to create and validate a thorough model to look at how green knowledge sharing affects manufacturing enterprises' ability to compete.

To close the research gap in the form of current literature, the following research problems should be investigated in light of the *research question and objectives*.

RQ: What are the specific mechanisms through which green knowledge sharing enhances green product innovation in SMEs, and how do factors such as customer involvement, absorptive capacity, and innovation climate mediate or moderate these relationships?

RO1: To identify the direct effect of green knowledge sharing on green product innovation, absorptive capacity, and innovation climate.

RO2: To analyze the mediating roles of absorptive capacity and innovation climate between green knowledge sharing and green product innovation.

RO3: To analyze the moderating effect of customer involvement between green knowledge sharing, absorptive capacity, and innovation climate.

RO4: To study the interactive effects of green knowledge sharing, absorptive capacity, innovation climate, and customer involvement to enhance green product innovation of manufacturing firms.

3.4 Conceptual Framework

In short, there has been a emergent awareness among scholars and manufacturing firms in the employment of green knowledge sharing and green product innovation. So there is still a need for research on this topic. The following is the conceptual framework of the current study.

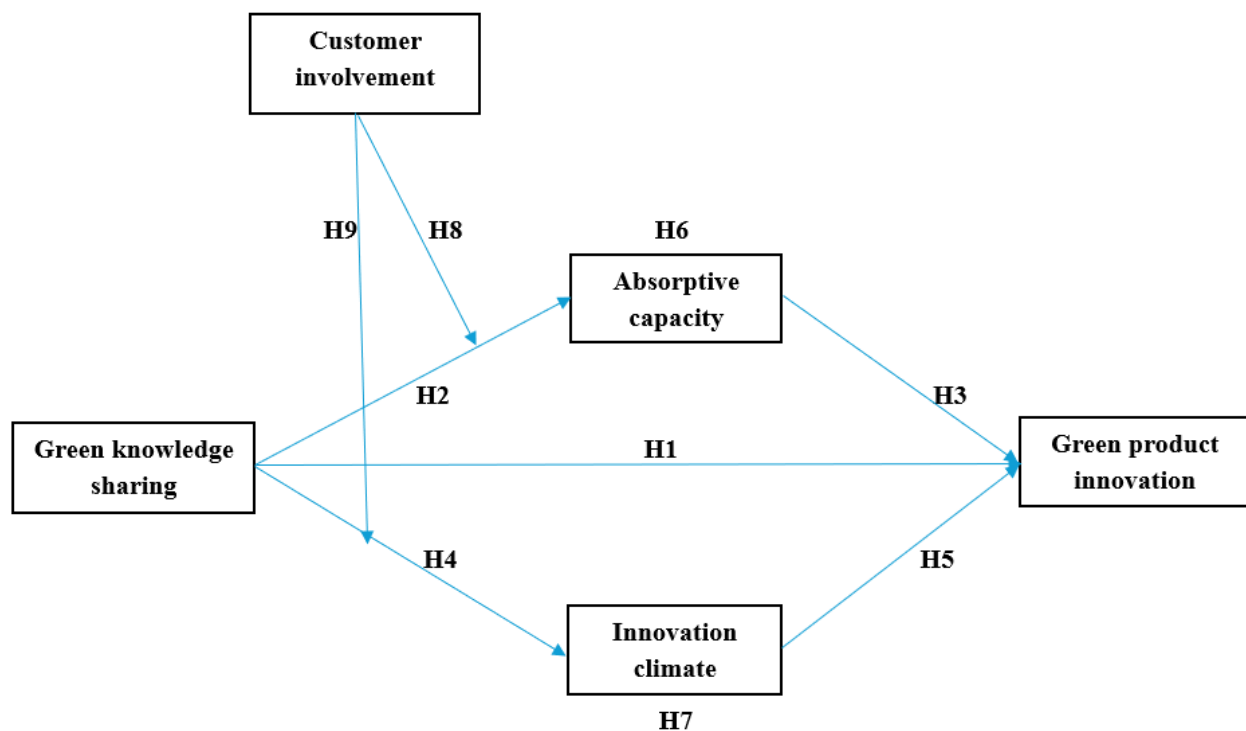


Figure 4: Conceptual Framework (Source: Author's own)

This study is important in numerous ways. Initially, it expands knowledge management skills to produce green products with additional value and preserve the environment, giving businesses a competitive advantage. Second, in the framework of green innovation, this study complements the form of knowledge concerning the relationship among GKS, GPI, IC, and CI. Third, the research contributes to the worldwide initiative to execute the Sustainable Development Goals (SDGs), which comprise addressing climate change (SDG-13), guaranteeing sustainable production patterns (SDG-12), and encouraging innovation (SDG-9). Lastly, the research's findings will assist managers in accepting social responsibility for environmental

protection while creating eco-friendly products. To fulfill the needs of customers within the context of ecological manufacturing firms.

4 METHODOLOGY

This chapter proposals a detailed clarification of the research methods used in the current study. This section comprehensively covers research design, variable operationalization, population and sampling approaches, data collection procedures, instrumentation protocols, data sources and collection methods, analytical techniques, the rationale for using structural equation modeling, and data analysis. Table 4.1 shows a summary of the research methodology.

Table 4. 1 Summary of research methodology (Source: author's own)

Research paradigm	Positivist
Research approach/ methodology	Quantitative study
Research strategy/ methods	Survey
Research techniques	Questionnaire
Object of analysis	SMEs (Metallurgy and non-metallurgy) in Pakistan.
Respondents/Participants	The respondents (Senior Managers, Executives, Middle Level Managers, and Other Professionals) are working in such manufacturing firms.
Data analysis	Smart-PLS, SPSS, Amos Respondents' profile Measurement assessment Common method <u>Variance</u> Mean, standard deviations, and correlation Direct influences

	Indirect influences <u>Analysis</u> Data visualization
--	---

The **philosophy of the current study** is positivism (basic research). People are going to realise that the beliefs expressed through words are constructive and reliable. Thus, credentials must confirm and then illustrate how this specific objective is converted into a completed state (Warelow, 2013). Variables are included in the current study to clarify and illuminate the objective truth.

According to Daniel and Auriac (2011), quantitative research is preferable. In the current dissertation, a **deductive approach** is used. Based on universal evidence, the opinions are consistent in the interim which further are admitted or taken to be identified in progress: in the direction of a more definite or ambiguous idea.

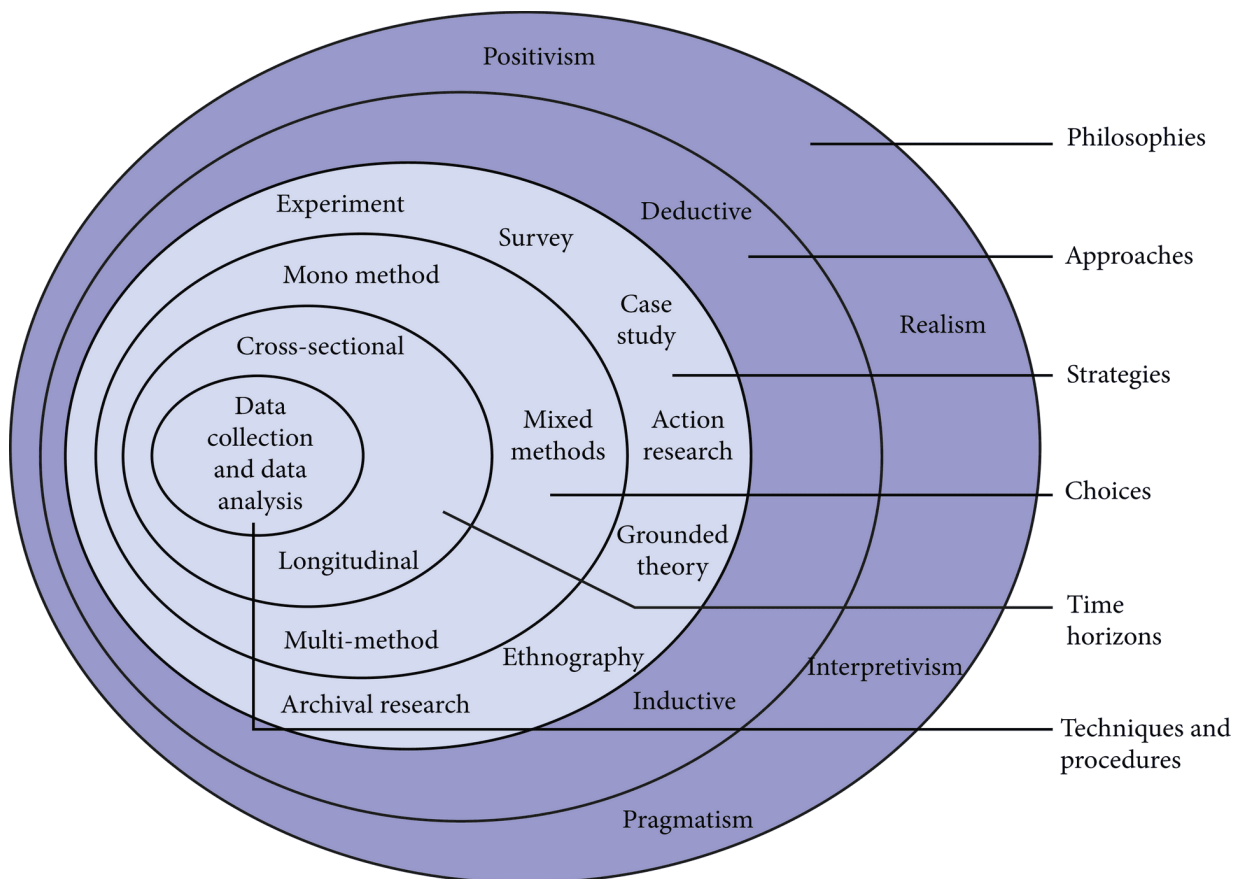


Figure 5: Research Onion (Saunders' 2007)

One-time **cross-sectional data collection** is a survey approach that is used to quantify the associations between variables and propose a model of relationships. Saunders et al. (2009) emphasise that the survey strategy is suitable to use quantitative data collection. When we want to look at how things are related to each other at a certain time we need to collect cross-sectional data. This way we get a picture of what's happening with the organization what people are doing and what is happening as a result. Cross-sectional data collection is useful for finding patterns seeing how things are connected and finding out if there are any relationships, between things without having to watch what is happening for a long time. This makes cross-sectional data collection a good way to save time and money (Bell et al., 2022; Sekaran & Bougie, 2016). Researchers can get information from a lot of people at the time with cross-sectional studies. This means they get a diverse group of people. Cross-sectional studies make the results more believable. They help researchers test their ideas. Cross-sectional studies are really good, for this because they give researchers a foundation to work.

4.1 Sample, Demographics, and Data Collection and Analytic Technique

This study employs a **quantitative** research approach to achieve its objectives by collecting data from senior managers, executives, and middle-level managers at SMEs in Pakistan, as well as from other professionals. **Pakistan** was selected as the case study context for several reasons. First, it is one of Asia's fastest-growing economies, with nearly 90% of businesses being SMEs that play a significant role in contributing to pollution and climate change (Aftab et al., 2022). Extensive research has been done on sustainability practices among large companies in developed and developing nations. Despite this research, the literature remains relatively limited. The focus has been on how large companies can adopt sustainability initiatives. The question has not been asked how small businesses in developing countries can do the same. This is important because small businesses are a significant source of economic activity in developing countries. They often lack the financial stability to adopt sustainability initiatives (Roxas et al., 2017).

Significant difficulties are encountered by SMEs in Pakistan due to the rapid pace of technological advancements and their comparatively low levels of innovation (Raes, 2021). These challenges come from SMEs not having a good handle on how to manage what they know and innovate. This keeps them from getting sustainable

results (Vitale et al., 2020). Characteristics such as competitiveness, risk-taking, and proactiveness are crucial for improving green product innovation within small and medium-sized firms (Idrees et al., 2023). There is a pressing need to comprehend how external pressures from customer involvement affect SME performance. Rising customer demand for halal certification, ISO standards, and quality assurance is pushing SMEs in Pakistan to adopt regulatory frameworks, embrace technology, and innovativeness (SHAH, 2019). While these changes improve quality, governance, and international compliance, they also pose survival risks for firms unable to adapt. Despite increasing research on environmental openness and sustainable business strategies (Amankwah-Amoah et al., 2024) relatively little attention has been given to the role of absorptive capacity and innovation climate as a threshold in the relationship between GKS and GPI.

The sample size ($N = \text{min. } 200$) for this study was calculated from an online calculator suggested by (Cohen, 2013; Soper, 2021; Westland, 2010). The proposed methodology questionnaires were distributed in manufacturing enterprises in both paper and digital modes. Questionnaires were created in English (as English is the second known language in Pakistan) and given to respondents, which included senior managers, executives, middle-level managers, and other professionals in connected departments. Managers were considered more relevant respondents for this research since they make strategic decisions; therefore, in the current study, data from them were gathered. In addition, they were more knowledgeable about pertinent evidence and at the same time played a crucial role in the sharing of knowledge across sectors (Ooi, 2014; Yusr et al., 2017). Initially compiled a list of 300 selected SMEs from one region of Pakistan (Lahore) through their connections with the appropriate SMEDA. Then contacted the directors of human resources departments of these 300 SMEs, asking if they offered education or training programs for environmental sustainability, to see if the organizations were implementing green practices within their workplaces. In sum, due to firms being disqualified or turning down the opportunity to participate, the authors narrowed the 300 firms down to 250. After getting consent forms and emails from those firms' HR, the researcher distributed 750 questionnaires from January 2024 to June 2024. The collection of data was carried out with the explicit consent of the HR management. Data was collected in hard (paper) and soft (google form) form as well. There were a minimum of three to four responses from each company. Respondents from 250 SMEs received a sealed packet containing a survey questionnaire and a cover letter that explained the study's main objectives and guaranteed the anonymity of their feedback. A total of 670 data points were collected from completed questionnaires of respondents at SMEs in Pakistan after three

reminders were sent out every two weeks, though some data were missing. In total, 642 completed questionnaires were used for analysis. It is worth noting that the original survey was conducted in English because English is an official language.

The analysis of the data involves the application of Partial Least Squares and Structural Equation Modelling (PLS-SEM) techniques for a quantitative study. Structural Equation Modelling (SEM) is an academic approach to causal modelling that utilizes statistical approaches to enhance the alignment between the network of constructs and the data. The utilization of SEM in multivariate statistical analysis qualifies researchers to investigate the associations and coefficients of correlation between observable variables and latent components that are not directly measurable (Thakkar, 2020). These diverse and interconnected dependencies can be assessed through a single statistical analysis. This approach is widely used, especially in the social sciences, because it is practical and can figure out relationships between things that you can't see (latent constructs) based on things you can see (observable variables). The framework of structural equation modeling (SEM) encompasses a variety of techniques, including path analysis, partial least squares, path modeling, and latent growth modeling. These techniques have been extensively discussed and supported by various scholars (Chin, 1998; Hair Jr et al., 2021; Ullman & Bentler, 2012).

When evaluating the results of the study item's production during the plan science phase, the Structural Equation Modelling (SEM) statistical test is seen to be beneficial. As part of the model assessment process, it is now expected that a questionnaire based on the model will be created, including pertinent hypotheses that will be assessed for validity and reliability (McIntosh, 2007). In this phase of the study, partial least squares structural equation modelling (PLS-SEM) was justified. These methods are effective in aiding the development of theoretical frameworks, exploring relationships between variables, assessing the one-dimensionality of constructs, evaluating the validity of measurement scales, and ultimately validating or disproving proposed theories (Cloud & Granfield, 2008). The following figure shows the proposed research design, which explains the whole process of this research and how to fulfil the research objectives, data collection, analysis, and discussion. Figure 3.1 shows the research process of the current study. There were three main software were used. Spss was used for demographics and baisnese test, for regression analysis Smart PLS, for model fit Amos software was used.

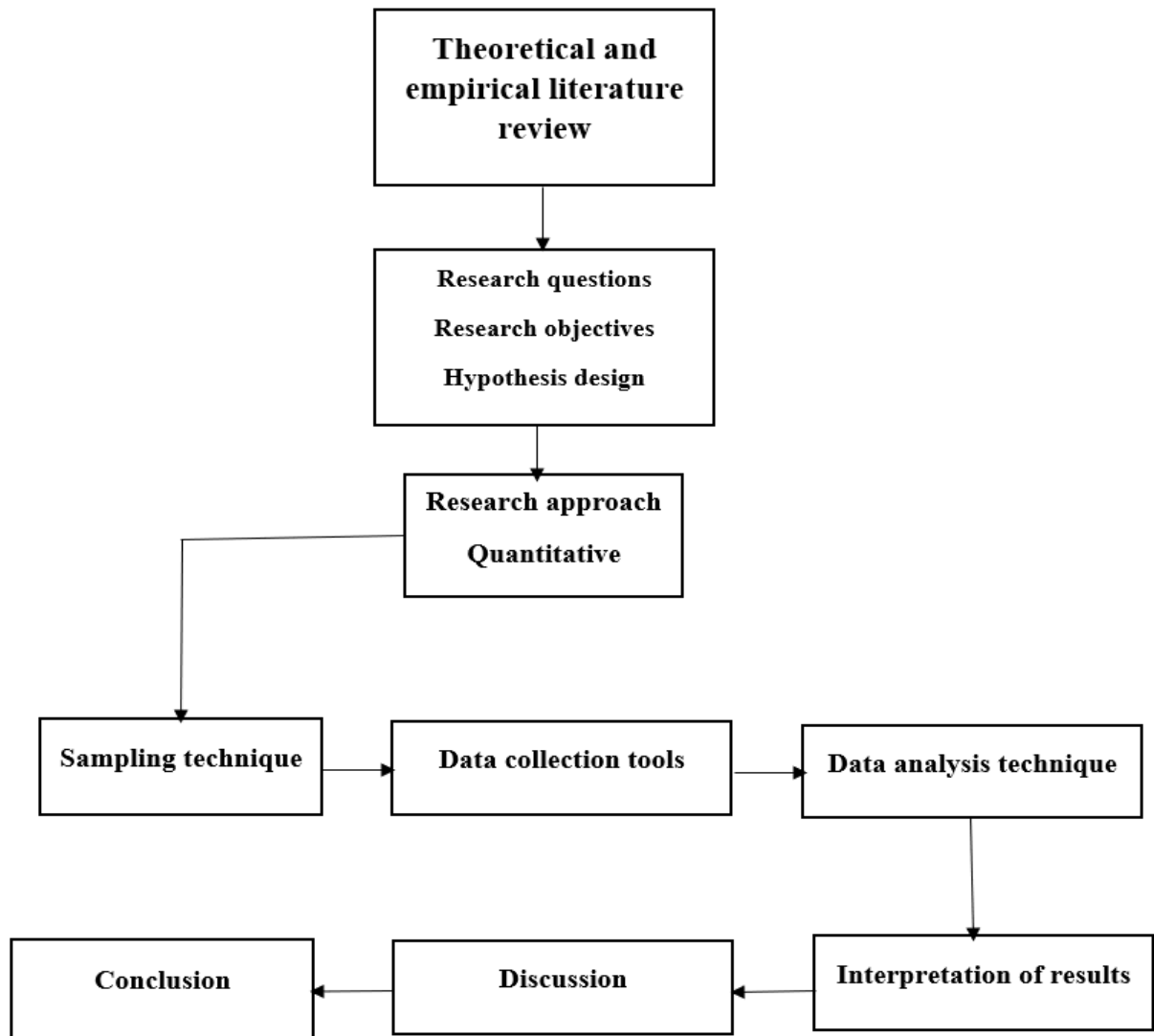


Figure 6: Research Process: (Source: author's own)

4.2 Measures of Variables

All variables were measured with a 7-point Likert scale as shown in Table 4.2.

Table 4. 2: Constructs, items, and their sources (Source: author's own)

Constructs	Operationalization of construct items	Literature adopted/adapted from
Green knowledge sharing	1. Members of our team share their environmental knowledge and expertise. 2. If a member of our team has some environmental knowledge about how to perform the team task, he/she will tell other members about it. 3. There is virtually no exchange of environmental knowledge or sharing of green skills among members of the team. (reverse coded) 4. More knowledgeable team members freely provide other members with hard-to-find green/environmental knowledge or environmental/green skills. 5. Members of our team provide a lot of work environment-related suggestions to each other. 6. There is a lot of constructive discussion about green practices implementation during team meetings. 7. Members of our team provide their green experience and knowledge to help other members find solutions to their problems	(Chuang et al., 2016)
Absorptive capacity	1. The organizational structure of the company can understand, analyze,	(Song et al., 2020)

	and interpret knowledge from external environmental knowledge. 2. The company can communicate environmental knowledge across its units. 3. The company can combine existing environmental knowledge with newly acquired and assimilated environmental knowledge. 4. The company can recognize, value, and acquire external environmental knowledge that is critical to its operations. 5. The company can successfully commercialize new external environmental knowledge.	
Innovation climate	1. My company rewards technological innovation and R&D achievements. 2. My company encourages employees to adapt flexibly to the changing market. 3. In my company, new ideas can easily get support and help. 4. My company will publicly recognize those people who come up with new ideas.	(Ye et al., 2022)
Customer involvement	1. Our firm used customers as a key knowledge source. 2. Our firm actively transferred knowledge gathered from our customers to the development team 3. In our firm the transfer of knowledge about customers' needs and preferences took place frequently. 4. Our firm used knowledge about our customers' needs in the	(Cui & Wu, 2016)

	development of the new product.	
Green product innovation	1. Our firm chooses the materials of the product that produce the least amount of pollution for conducting the product development or design. 2. Our firm uses the fewest amounts of materials to comprise the product for conducting the product development or design 3. Our firm would circumspectly deliberate whether the product is easy to recycle, reuse, and decompose for conducting the product development or design.	(Chang, 2011)

5 RESULTS

This chapter offerings the analytical findings that match the research objectives set out in chapter two. The study also aims to report the results of the hypotheses proposed in chapter two. This chapter is divided into nine main sections, starting with data screening and missing values. The second section focuses on the respondents' profiles. Section 3 offers a concise overview and explanation of the primary data attributes via descriptive statistical analysis.

5.1 Data Screening and Missing Values

Before conducting the analysis, this study carried out data screening, mainly to handle missing values. Structural equation modeling techniques cannot handle datasets with missing data (Lomax, 2013). Moreover, the accuracy and trustworthiness of data analysis are heavily reliant on the quality of data organisation and its transformation into an appropriate analysis format (Eskildsen et al., 2010). Data screening is considered a vital process to ensure the accuracy and authenticity of data input. Respondents may fail to answer questions accurately due to misinterpretation, difficulty in responding, or reluctance to participate (Ibrahim & Mahmood, 2016). Data analysis is often complicated by the presence of missing data, as Hair et al. (2017) have observed. Several approaches have been suggested to solve

this issue, one of which entails entirely deleting cases with missing data (Tabachnick & Fidell, 2007). So this study also follows the same strategy.

5.2 Respondents' Profile

Table 4.1 shows demographic information of the survey respondents, listed down into different categories: gender, age, qualification, firm size, firm age, and work experience. Each category is further divided into specific indicators that detail the number of individuals (frequency) in each group and the corresponding percentage (%) of the total respondents. For this study top level managers, engineers, supervisors and team leaders were selected as they have more environmental knowledge and authority to make green products to gain competitive advantage. For this study around 250 SMEs were included and total four responses were collected. The final data analysis included 642 valid responses from participants.

Table 5.2: Respondents' Profile

Demography	Indicator	Frequency	Percentage
Gender	Male	453	70.1
	Female	189	29.2
Age	20-30	472	73.3
	31-40	149	23.3
	41-50	16	2.5
	50 or more	4	0.6
Qualification	12 years	71	11
	14 years	323	50.0
	16 years	244	37.8
	18 years	4	0.6
Firm Size	100-500	163	25.3
	500-1000	128	19.8
	1000-1500	129	20.0
	1500 or more	222	100
Firm Age	Less than 1	36	5.6
	1-10	151	23.4
	11-20	214	33.1
	21 or more	241	37.3
Working Experience	Less than 1 year	4	.6
	1-5 years	518	80.0
	6-10 years	56	8.8
	11 or more	65	10.2

Job Designation	Top Manager	244	38.0
	Team Leader	143	22.1
	Engineer	90	15.1
	Project Supervisor	165	24.8

Note: N=642

The demographic table reveals that the respondents are male (70.1%) and female (29.2%), and mostly the employees were within the 20–30 age range (73.3%). The majority of respondents possess either a 14-year (50%) or 16-year (37.8%) educational background. Most organizational attributes were found in firms with greater than 1500 employees; however, there appears to be a possible inconsistency in that data point. Most of the respondents were working in manufacturing firms that had been set up more than 21 years (37.3%) or between 11 and 20 years (33.1%). A substantial 80% of workers have between 1 and 5 years of professional experience, demonstrating a mostly early-career workforce. Most of the respondents were top managers (38.0%), 24.8% were project supervisors, 22.1% were team leaders, and engineers were only 15.1%. For the most part, the respondents were predominantly youthful, moderately educated, and at an early stage in their careers, employed by well-established and large corporations.

5.3 Common Method Variance Bias

To reduce the likelihood of common method variance (CMV) bias, technical and statistical countermeasures were employed. In line with Schoenherr and Swink (2012), suggestions for inter-firm studies, a two-informant approach was employed: the dependent variable was obtained from one respondent, whereas the other variables were collected from a second respondent. The design of the measurement items was for clarity and straightforwardness to ensure accuracy in responses. Statistically, CMV was assessed using Harman's single-factor test, as recommended by Podsakoff et al. (2003). The outcomes of the study suggested that none of the individual factors were significant, indicating that common method bias was not a primary concern.

5.4 Descriptive Analysis

This study employed descriptive analysis to summarize and comprehend the essential features of the dataset, examining respondents' viewpoints across all considered variables. Descriptive statistics, including the mean and standard deviation, were selected because they offer a comprehensive summary of how participants reacted to the survey instrument providing significant insights into overall response trends (Salman et al., 2016).

Table 5.4: Descriptive Statistics of the Study Variables

Sr#	Construct	Mean	Std.Deviation
1	Green knowledge sharing	4.02	1.44
2	Customer involvement	4.87	1.40
3	Absorptive capacity	4.89	1.37
4	Innovation climate	4.42	1.67
5	Green product innovation	4.47	1.57

Note: N=642

5.5 Discriminant Validity

Discriminant validity is used to confirm the construct validity of the measurement model. This is done by verifying that constructs that are theoretically unrelated do not display significant correlations in the analysis. Essentially, each measurement item should have a stronger relationship with its respective construct than with any other construct. The square roots of the Average Variance Extracted (AVE) are compared with the inter-construct correlations, according to the recommendations outlined by (Fornell & Larcker, 1981) shown in Table 5.5.1.

Table 5.1.1: Fornell-Larcker Criterion

Variables	GKS	CI	AC	IC	GPI
Green knowledge sharing	0.839				
Customer involvement	0.588	0.847			
Absorptive capacity	0.566	0.665	0.844		
Innovation climate	0.505	0.578	0.528	0.794	
Green product innovation	0.608	0.638	0.510	0.593	0.894

Note: N=642, Green knowledge sharing (GKS), Customer involvement (CI), Absorptive capacity (AC), Innovation climate (IC), Green product innovation (GPI).

Table 5.5.2: Discriminant Validity Analysis (HTMT)

Variables	GKS	CI	AC	IC	GPI
Green knowledge sharing					
Customer involvement	0.654				
Absorptive capacity	0.617	0.751			
Innovation climate	0.551	0.680	0.636		
Green product innovation	0.668	0.733	0.574	0.672	

Note: N=642, Green knowledge sharing (GKS), Customer involvement (CI), Absorptive capacity (AC), Innovation climate (IC), Green product innovation (GPI).

As demonstrated in Table 5.5.2, the diagonal elements in this study are below the respective values contained within their respective rows and columns. Achievement of discriminant validity for the measurement model has been demonstrated, leading to the establishment of the construct validity of the outer model, thereby supporting the concept that subsequent hypothesis testing results are both valid and reliable. It is based on evidence that well-defined constructs enable conclusions with significance that can be broadly applicable. The study's construct validity was confirmed by establishing content validity, convergent validity, and discriminant validity.

5.6 Construct Validity and Reliability

Table 5.6 shows construct validity and reliability (Mata-López et al., 2021) Provides evidence in support of the reliability and convergent validity of all constructs employed in the study.

Table 5.6: Construct Validity and Reliability

Variables	Items	Factor loadings	CA (α)	CR	AVE
Green knowledge sharing	GKS1	0.857	0.927	0.942	0.704
	GKS2	0.866			
	GKS3	0.563			
	GKS4	0.872			
	GKS5	0.876			
	GKS6	0.898			
	GKS7	0.890			
Customer involvement	CI1	0.813	0.868	0.910	0.717
	CI2	0.857			
	CI3	0.859			
	CI4	0.857			
Absorptive capacity	AC1	0.786	0.899	0.925	0.712
	AC2	0.841			
	AC3	0.863			
	AC4	0.880			
	AC5	0.846			
Innovation climate	IC1	0.715	0.810	0.872	0.631
	IC2	0.773			
	IC3	0.847			
	IC4	0.837			
Green product innovation	GPI1	0.889	0.874	0.923	0.799
	GPI2	0.908			
	GPI3	0.885			

Note: N=642, Green knowledge sharing (GKS), Customer involvement (CI), Absorptive capacity (AC), Innovation climate (IC), Green product innovation (GPI).

As shown in Table 5.6, the factor loadings of all constructs were greater than 0.70. One item under green knowledge sharing (GKS3) has a relatively low loading of 0.563, implying it may not fully represent the construct and should be reconsidered. All constructs had high internal consistency reliability, with Cronbach's Alpha (CA) values between 0.810 and 0.927, and Composite Reliability (CR) values greater than 0.87, each exceeding the minimum acceptable standard of 0.70. The Average Variance Extracted (AVE) values for all constructs are well above 0.50, indicating adequate convergent validity. Notably, innovation in green products shows the highest average variance extracted (0.799), which signifies a strong explanatory power of its measurement items.

5.7 Model Estimation

The model's overall goodness-of-fit was evaluated using AMOS software, which applied multiple fit indices to assess how well the hypothesized model matches the observed data. The final model produced a Chi-square/degrees of freedom ratio of 3.760, far below the suggested threshold of 5, suggesting a strong model fit (McIver & Carmines, 1981). The Goodness of Fit Index (GFI) was 0.875, and the recommended threshold is greater than 0.90 (Mulaik et al., 1989). The Comparative Fit Index (CFI) value of 0.930, the recommended threshold is between 0.90 and 0.94, set by Hu and Bentler (1999). The Normed Fit Index (NFI) value of 0.907, the recommended threshold would be between 0.90 and 0.94, set by Sahoo (2019). Furthermore, the Root Mean Square Error of Approximation (RMSEA) was 0.066, placing it within the acceptable parameters between 0.05 and 0.08 threshold (Browne, 1993). These findings collectively suggest that the proposed model aligns well with the data observed.

5.8 Structural Model and Hypothesis Testing

The previous step confirmed the model's goodness of fit. The next step was to examine the standardized path coefficients. This was done to assess the hypothesized relationships postulated in the study. The hypotheses were tested using Smart PLS 3.0 software. Conventional t-tests are not calculated as part of the PLS-SEM algorithm to establish statistical significance for loadings or path coefficients, since the method does not assume that the underlying data follows a normal distribution (Barclay & Smith Jr, 1995). (Chin, 2009; Tenenhaus et al., 2005), suggested employing nonparametric resampling methods, such as bootstrapping, to evaluate the precision of estimates and produce significance test outcomes. This study used the bootstrapping procedure, incorporated within the Smart PLS software, to evaluate the statistical significance of the path coefficients.

5.8.1 Hypothesis Testing and Path Coefficient for Direct Hypothesis

The PLS algorithm was first run to produce the path coefficients, as shown in Figure 7. Next, bootstrapping using 5000 bootstrap samples was conducted, surpassing the study's actual sample size, which met the criteria specified by (Hair et al., 2013). This study aimed to assess the direct relationships between independent and dependent variables by running the model with all variables.

Results from the path model, as shown by the β and t-values in Figure 7, which were obtained through the bootstrapping technique, were used to calculate p-values for all direct relationships (H1–H5). These p-values formed the foundation for deciding whether each hypothesis was supported or not. Table 5.8.1 provides the ultimate findings of the structural model. Hypothesis H1, which suggests a substantial positive relation between green knowledge sharing (GKS) and green product innovation (GPI), is substantiated at a 0.001 significance threshold ($\beta = 0.365$, $t = 7.977$, $p < 0.001$). Hypothesis H2 is also confirmed, showing a substantial positive correlation between green knowledge sharing and absorptive capacity ($\beta = 0.269$, $t = 6.831$, $p < 0.001$). Hypothesis H3, which suggests a substantial positive correlation between absorptive capacity (AC) and green product innovation (GPI), is also validated ($\beta = 0.122$, $t = 2.635$, $p < 0.001$). Additionally, both hypotheses H4 and H5 have been accepted. The findings specify a significant positive relationship between green knowledge sharing and innovation climate ($\beta = 0.258$, $t = 6.473$, $p < 0.001$) as supported by H4, and a link between the innovation climate and GPI ($\beta = 0.345$, $t = 9.021$, $p < 0.001$) as indicated by H5.

Table 5.8.1: Direct Hypothesis

Hypothesis No.	Hypothesized Effect	β	S.E	T	P	LLCI	ULCI	Decision
H1	GKS $\rightarrow$ GPI	0.365	0.046	7.977	$P < 0.001$	0.271	0.450	Supported
H2	GKS $\rightarrow$ AC	0.269	0.039	6.831	$P < 0.001$	0.192	0.346	Supported
H3	AC $\rightarrow$ GPI	0.122	0.046	2.635	$P < 0.01$	0.032	0.212	Supported
H4	GKS $\rightarrow$ IC	0.258	0.040	6.473	$P < 0.001$	0.181	0.335	Supported
H5	IC $\rightarrow$ GPI	0.345	0.038	9.021	$P < 0.001$	0.271	0.421	Supported

Note: N=642, Green knowledge sharing (GKS), Green product innovation (GPI), Absorptive capacity (AC), Innovation climate (IC), ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

R-squared and adjusted R-squared are statistics that evaluate the extent to which independent variables explain the variation in dependent variables. In theory, their values range from 0 to 1. A higher value of this variable is associated with a greater amount of variability in the dependent variable being explained. The research model explains 48.9% of the variation in green product innovation (GPI) through its R^2 measure and 48.6% through its R-squared adjusted measure. The R^2 value for absorptive capacity (AC), indicates that the model explains 49% and 48.7% R^2 -adjusted explains the variability in AC. The R^2 values for innovation climate (IC) indicate that approximately 38.3% and 38% R^2 -adjusted variance is attributed to the independent variables. As shown by the provided statistics, the selected model's explanatory power is moderate, aligning with the guidelines set by (Hair et al., 2017). Table 5.8.2 presents the R-squared statistics associated with the evaluated models.

Table 5.8.2: R-square of the assessed model

	R-Square	R-Square adjusted
GPI	0.489	0.486
AC	0.490	0.487
IC	0.383	0.380

Note: N=642, Green product innovation (GPI), Absorptive capacity (AC), Innovation climate (IC).

5.8.2 Testing Mediating Effects

It is stated that a mediating effect takes place when the relationship between two interconnected constructs is affected by a third intervening factor (Hair et al., 2013). The study used Smart PLS for data analysis and the bootstrapping method, known for its robustness in estimating mediation effects (Hair et al., 2013), was implemented. Mediation was also evaluated using the method outlined by Baron and Kenny (1986), with the associated findings shown in Table 4.8.

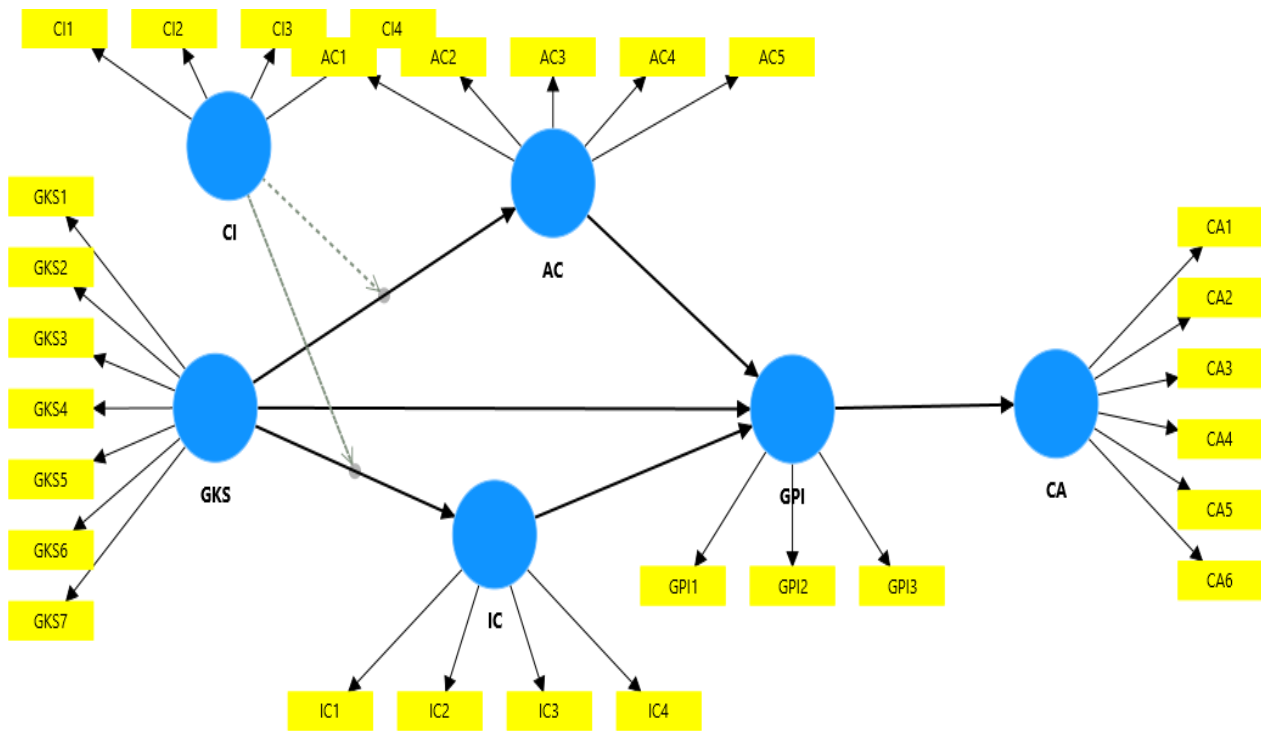


Figure 7: Path Model Results

Table 5.8.3: Results of Mediating Hypothesis

Hypothesis No.	Hypothesized Effects	β	T	P	LLCI	ULCI	Decision
H6	GKS → AC → GPI	0.033	2.416	P<0.05	0.008	0.062	Supported
H7	GKS → IC → GPI	0.089	5.280	P<0.001	0.058	0.124	Supported

Note: N=642, Green knowledge sharing (GKS), Absorptive capacity (AC), Innovation climate (IC), Green product innovation (GPI), ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively..

The hypotheses (H6 and H7) are supported, indicating that GKS has a positive impact on GPI, which is mediated by both absorptive capacity ($\beta = 0.033$, $t = 2.416$, $p < 0.05$) and innovation climate ($\beta = 0.089$, $t = 5.280$, $p < 0.001$) with partially significant paths with small values of effect size or beta. These outcomes emphasize the partial significance of organizational capabilities and culture in transforming shared knowledge into eco-friendly innovations. The findings suggest that Pakistani manufacturing firms are feeling the effects of structural and institutional constraints, like limited resources, an incremental approach to innovation, and weak environmental governance. This is based on the observation that the coefficient is low

but statistically significant. These conditions make it hard to use green knowledge to create new ways of making things, but this is a first step toward making manufacturing more sustainable.

5.8.3 Testing Moderating Hypothesis

A dependent variable is impacted by an external factor, the level or value of which is determined by that of a related variable. In such cases, the moderator can affect the benefit or direction of the relationship between the independent and dependent variables (Hair et al., 2013). It was proposed in this study that customer involvement would function as a moderating variable in the connections between green knowledge sharing (GKS) and absorptive capacity (AC), as well as between green knowledge sharing (GKS) and innovation climate (IC), as stated in hypotheses H8 and H9.

Table 5.8.4: Results of Moderating Effects

Hypothesis No.	Hypothesized Effects	β	T	P	LLCI	ULCI	Decision
H8	CI* GKS $\rightarrow$ AC	-0.024	0.738	P>0.05	-0.083	0.045	Not Supported
H9	CI* GKS $\rightarrow$ IC	-0.078	2.323	P<0.05	-0.142	-0.009	Supported

Note: N=642, Green knowledge sharing (GKS), Absorptive capacity (AC), Innovation climate (IC), Customer involvement (CI), **, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The data in Table 4.9 reveal that Hypothesis H8 was not supported ($\beta = -0.021$, $t = 0.738$, $p < 0.05$), suggesting that customer involvement (CI) does not significantly affect the relationship between green knowledge sharing (GKS) and absorptive capacity (AC), contrary to expectations. Customer involvement (CI) was discovered to influence the relationship between green knowledge sharing (GKS) and innovation climate (IC), with partial significance, but the effect size is less with a negative sign in hypothesis H9 ($\beta = -0.078$, $t = 2.323$, $p < 0.05$) supported as shown in Table 4.9. The beta value of -0.021 for H8 indicates that customer involvement has a minimal impact on the GKS–AC relationship in Pakistani manufacturing companies, where internal absorptive capacity is the main driver. The negative beta value of -0.078 for H9 implies that customer involvement may hinder the innovation climate due to cost sensitivity and limited environmental awareness.

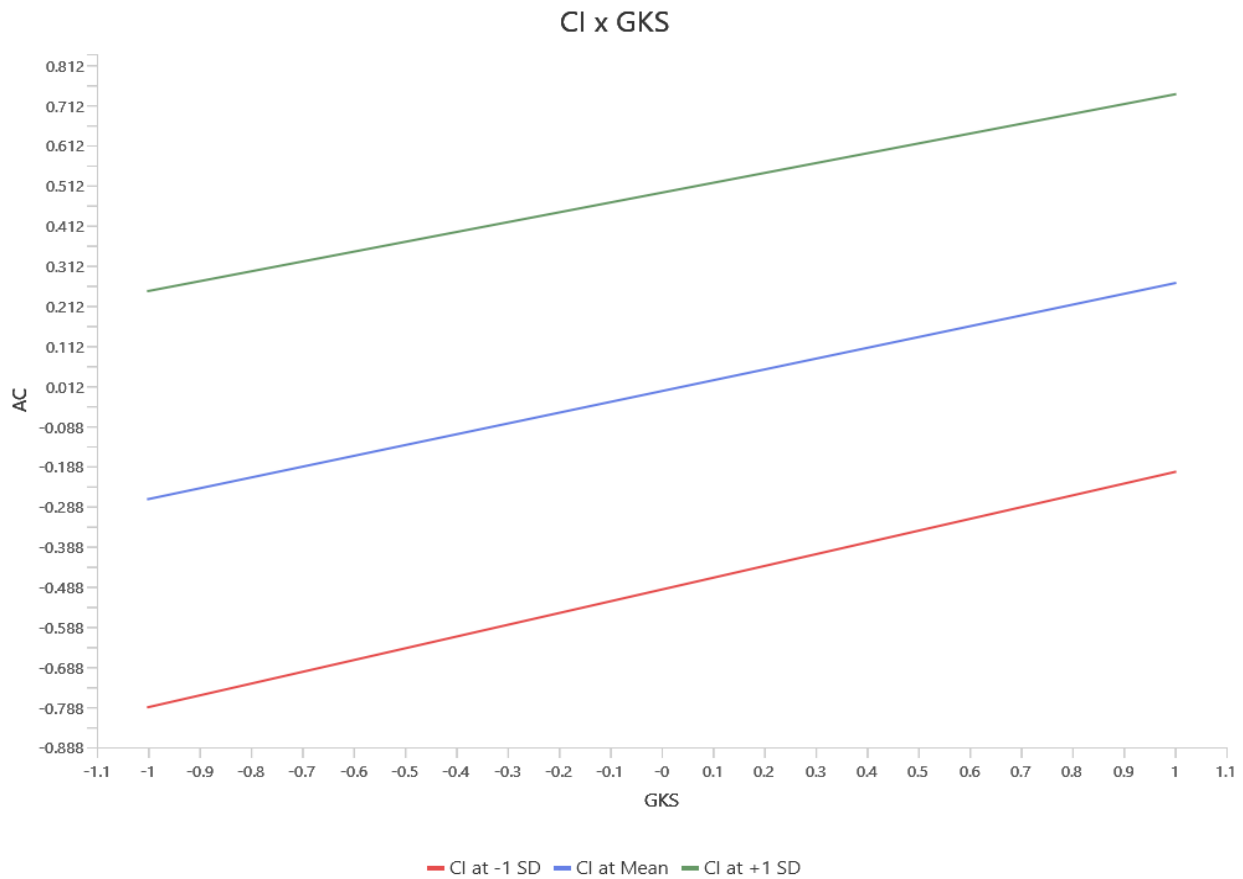


Figure 8: The interactive effect of green knowledge sharing and customer involvement on absorptive capacity

Figure 4.2 illustrates the relationship between CI and GKS in predicting AC. The three lines have a positive slope, showing that AC rises as GKS grows, regardless of the CI level. The lines seem to be almost parallel, suggesting that CI mostly leads to AC going up or down instead of changing the strength of the GKS–AC connection. Higher cognitive indices have been demonstrated to be consistently associated with higher levels of accuracy across all levels of difficulty, while lower indices correspond to lower levels of accuracy. It is suggested by the data that a cumulative influence on AC is had by CI, with a positive and relatively stable correlation between GKS and AC being maintained across CI levels.

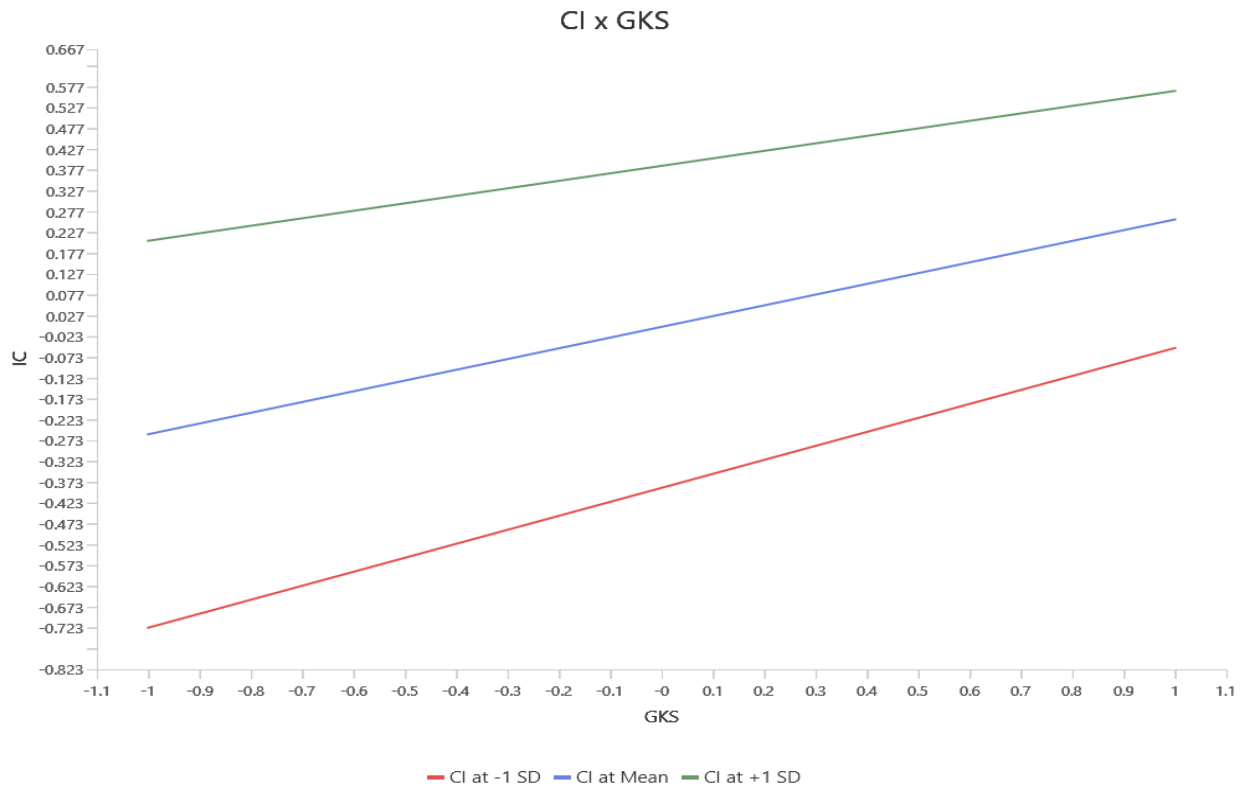


Figure 9: The interactive effect of green knowledge sharing and customer involvement on innovation climate

Figure 4.3 illustrates the interaction between CI and GKS. This interaction is used to predict IC. All lines have a positive slope, indicating that IC increases as GKS rises, regardless of the CI level. The lines are almost parallel, which suggests that CI mostly affects IC's direction (up or down) without greatly altering the strength of the relationship between GKS and IC. Higher CI is always associated with higher IC values, no matter how GKS is measured. On the other hand, lower CI is linked to lower IC values. This pattern reveals a stable positive correlation between GKS and IC, with an additive impact of CI on IC across varying levels.

5.9 Summary of Hypotheses' Results

The results of the hypothesis testing are summarised in Table 5.9. The Table 5.9 illustrates that hypotheses H1–H2, H3, H4, H5, H6, and H7–H9 received support, whereas hypotheses H8 were unsupported.

Table 5.9: Summary of Hypotheses

Hyp	Hypothesized Path	Decision
Direct Hypotheses		
H1	Green knowledge sharing → Green product innovation	Supported
H2	Green knowledge sharing → Absorptive capacity	Supported
H3	Absorptive capacity → Green product innovation	Supported
H4	Green knowledge sharing → Innovation climate	Supported
H5	Innovation climate → Green product innovation	Supported
Indirect Hypotheses		
H6	Green knowledge sharing → Absorptive capacity → Green product innovation	Supported
H7	Green knowledge sharing → Innovation climate → Green product innovation	Supported
H8	Customer involvement*Green knowledge sharing → Absorptive capacity	Not Supported
H9	Customer involvement*Green knowledge sharing → Innovation climate	Supported

6 DISCUSSION

The main contribution of this dissertation is to understand the relationship between green knowledge sharing and competitive advantage via green product innovation, absorptive capacity, innovation climate, and customer involvement, underlying the mechanisms of RBV, KBV, and Social Exchange theories. These results are highlighted and discovered with reverence to the developed research objectives.

6.1 Direct Effects

The direct effect of green knowledge sharing on green product innovation, absorptive capacity, and innovation climate.

Regarding the first objective of this dissertation, the present study analysed the direct effects of green knowledge sharing on – **H1**, green product innovation – **H2**, absorptive capacity – **H4**, and innovation climate. Based on RBV and KBV theories, it was expected that green knowledge sharing would affect green product innovation, absorptive capacity and innovation climate. After analyzing the results it shows **-H1** ($\beta = 0.365$, $t = 7.977$, $p < 0.05$), **H2** ($\beta = 0.269$, $t = 6.831$, $p < 0.05$) and, **H4** ($\beta = 0.258$, $t = 6.831$, $p < 0.05$) have a significant effect respectively.

Hypothesis 1 posited that Green Knowledge Sharing (GKS) significantly and positively affects Green Product Innovation (GPI). The empirical findings of this study offer robust substantiation for the aforementioned proposition, unveiling a statistically significant positive correlation between GKS and GPI within the ambit of manufacturing enterprises. As is highlighted by this result, sustainable product development and organizational competitiveness are driven by systematic exchange of environmental knowledge.

Enabling the exchange of knowledge about the environment helps to develop, improve, and put into action ideas that are good for the environment. In order for green ideas to be effective, companies must first learn about environmentally friendly concepts, new technology, and practices that do not harm the environment (Odeyemi et al., 2024). This knowledge is cultivated and shared through ongoing communication among employees, managers, and cross-functional teams, rather than in solitude. Formal and informal social interactions provide opportunities to share knowledge and skills and to learn from each other about managing the environment, using materials sustainably, and manufacturing products without harming the environment. By working together, companies can turn general sustainability goals into real, eco-friendly product developments.

The results of this study align with those of existing empirical studies (Khan et al., 2021; Rehman et al., 2024), which support the idea that sharing green knowledge significantly impacts green product innovation within organizations. Problems are solved more effectively in a collective manner by firms when insights related to sustainability are actively shared by employees, and innovative solutions to environmental issues are developed more skillfully. This collective cognisance curtails redundancy, expedites the cadence of learning cycles, and consolidates the incorporation of ecological elements into product design and development methodologies (Odeyemi et al., 2024).

You can understand the theoretical results by thinking about the RBV and KBV of the organization. According to the RBV, a sustainable competitive advantage stems from valuable, rare, imitable, and non-substitutable resources. In this situation, eco-friendly expertise is a vital non-tangible resource that differentiates businesses in markets that are progressively motivated by sustainability concerns (Odeyemi et al., 2024). According to the KBV, knowledge is a firm's most valuable strategic resource, and organizational success depends on efficiently creating, transferring, and utilizing knowledge. Therefore, knowledge sharing related to environmental sustainability is a crucial mechanism for companies to leverage their internal strengths and develop innovative, eco-friendly products.

Manufacturing firms, in particular, operate in environments that demand substantial resources and are subject to heightened scrutiny regarding their environmental impact. Participating in green knowledge-sharing activities is a way for firms to identify methods to reduce resource consumption, decrease waste, and implement cleaner technologies. This helps them keep their products the same high quality or make them even better. According to Zhang (2024), a sustainable competitive advantage is achieved when green product innovation is implemented, and this innovation is substantially aided by efficient green knowledge transfer within organizational units.

The importance of sharing knowledge is really clear in countries that are still developing. This is because it is necessary for taking care of the environment and helping people. Companies that work in these countries often do not have money or resources and they have to deal with a lot of rules and regulations. They also have to catch up with the technology. In these cases it is very important for the different teams within a company like the green knowledge teams to work together and share knowledge with each other. This way the green knowledge teams can help each other. Make sure that the company is doing its part for the environment. Sharing knowledge

is crucial, for companies and green knowledge sharing can make a big difference (Odeyemi et al., 2024). This helps them solve problems caused by the company's structure and encourages ideas. When they share knowledge they learn together become more flexible and find sustainable solutions that work well locally. This helps them create eco-friendly products. It also helps them achieve their goals of being environmentally friendly and growing their economy (Khan et al., 2021; Rehman et al., 2024).

Hypothesis 2 posited that green knowledge sharing (GKS) positively and significantly impacts absorptive capacity (AC). The empirical findings of this study offer robust support for this hypothesis, indicating a substantial and statistically significant association between GKS and AC. The findings suggest that systematically exchanging environmentally focused information among employees and executives improves a company's ability to identify, integrate, modify, and utilize valuable internal and external knowledge. In essence, green knowledge-sharing practices serve as a key mechanism through which companies develop and improve their ability to absorb information.

Green knowledge sharing fosters organizational learning by encouraging the spread of sustainability-related insights, excellent methods, and technical know-how across departmental divides. Small and medium-sized businesses can get better at using new information about the environment. They can do this by having meetings where people share ideas, seminars for different departments, environmental training courses, and projects where they work together to solve problems (Jia et al., 2022). These activities do two things. They make people more aware of environmental issues. They also help employees learn to come up with and use ideas that are good for the environment. Consequently, GKS acts as a catalyst for the recombination of knowledge and the development of capabilities within organizations.

Earlier studies Makhloufi (2024) and Song et al. (2020) show that a company shares its knowledge with people inside the company. This is a big part of how it learns. When a company shares what it knows about the environment it helps the company get used to rules and changes in technology and what people want to buy. The company does this by sharing what it knows every day. This helps the company keep learning and turn what it knows into things that're really useful. The company can then use these things to make products and services that people will want for a long time. This is how companies can compete with others and be successful for a time. A company that shares its knowledge and keeps learning is a company that can make

things and sell them to people. The company can use its knowledge to make things that people want and need. This is important, for a company because it helps the company stay in business and be successful. In accordance with the tenets of the Resource-Based View (RBV) theory, organizational capability is regarded as a precious, uncommon, and arduous-to-replicate asset that confers enduring competitive advantage. AC development is a long-term, cumulative process that requires continuous investment in knowledge acquisition and learning systems. In this situation, sharing green knowledge is a smart move that makes a company's own knowledge stronger and helps it use outside environmental information in the right way. Therefore, manufacturing companies must prioritize spreading green knowledge effectively and adopting new learning methods to develop and maintain the ability to absorb new information (Rezaei Zadeh et al., 2022).

Like earlier research, the current study shows that sharing environmental knowledge is important for developing the ability to absorb new information, especially in manufacturing industries where adhering to environmental regulations and generating lasting ideas are becoming increasingly important (Jia et al., 2022). Nevertheless, the efficiency and range of GKS can differ across different national contexts. Developed countries tend to benefit greatly from their robust digital infrastructure, well-established institutional frameworks, and greater access to financial resources. These factors enable them to formalize, codify, and disseminate green knowledge more broadly (Kalinowski, 2020). These structural benefits enable companies to incorporate sustainability into their strategic and operational processes more systematically, allowing them to integrate environmental, social, and governance considerations into their business models and decision-making processes.

Many countries that are still growing have a lot of problems to deal with. These countries have to face the fact that they do not have money they need more skilled people they are behind when it comes to technology and they have issues, with how they are run. The emerging nations have to deal with these issues. That makes it hard for them to move forward. Emerging nations are struggling with these problems. It is affecting their progress (Junejo et al., 2025). firms in developing economies have a lot of knowledge and work well together because they need to. Their unique situations can help them come up with ideas and learn in a practical way.. It's hard to get companies and industries to care about the environment without a clear plan to share knowledge and support each other. It is vital for absorptive capacity to be established and enhanced via structured green knowledge-sharing projects by companies operating in developing regions. These abilities help organizations deal with limited

resources, respond well to environmental challenges, and stay competitive in global markets that are focused on sustainability. Long-term growth, resilience, and market leadership depend on developing absorptive capacity (Chaparro-Banegas et al., 2024). So basically the results of this study show that sharing knowledge is really important for developing the ability to learn and grow. This is something that can help you get ahead and stay ahead. The study shows that sharing knowledge is very important for learning and growing which is how you get a lasting competitive advantage with green knowledge.

Hypothesis #4 proposes that GKS has a considerable effect on the innovative climate. These assumptions align with those of Vann Yaroson et al. (2024), within a larger contextual framework. The connection between GKS and IC is really important. It shows that when people work together to learn about the environment it helps create a workplace where new ideas are welcome. Companies that share information about being green like ways to be sustainable and friendly to the earth do a lot of good. They help their employees understand how to take care of the earth. They also help people work well together be honest with each other and support one another. GKS is important because it helps people learn about the environment and IC is important because it helps people work together. When companies focus on GKS and IC they make a workplace where people feel comfortable sharing their ideas and trying things. This is good for the earth. It is also good, for the company (Jalil et al., 2025). To grow a climate that helps new ideas happen some conditions need to be in place. The idea behind RBV theory is that GKS helps people be creative and come up with ideas especially when we need to solve environmental problems in a green way. Manufacturing firms that use GKS are more likely to create a space where people can try things make changes as they go and come up with new eco-friendly innovations. GKS is really important for innovation. When companies use it they can make a bigger impact, on the environment with their new ideas. Companies that want to be need to make sure they have GKS in place so they can keep coming up with new solutions to environmental issues (Abbas & Khan, 2023). The study's findings match research that shows GKS is important for improving a company's ability to learn and innovate. GKS helps firms in developed countries in one way. It helps firms in developing countries in a different way. The way GKS works and how much it helps firms is not the same. GKS is essential for enhancing firms absorptive capacity and innovative performance. Firms in developed countries and developing countries have experiences, with GKS.

In countries that're well developed they have systems in place that work really well. They also have digital infrastructure and it is easy to get money for green projects.

This makes it easy for people in industries to share information, about being green. They do this by making rules and writing things down so everyone knows what is going on and they can tell others about it. This way people can share information across industries. The green information is shared by making sure everyone knows about it and by following the rules that're in place. Developed countries are able to do this because they have systems and infrastructure in place. They can share information across industries easily (Chaparro-Banegas et al., 2024). This place helps us learn all the time and bring in sustainable technologies. We can then use these sustainable technologies to make things better, for the environment. This means we can start using innovations very quickly. The main thing is that we get to use sustainable technologies and green innovations.

In contrast, structural challenges often hinder consistent knowledge flows in developing countries. These challenges include limited R&D spending, weaker institutional support, and inadequate digital infrastructure (He et al., 2024; Nasir et al., 2024). Nonetheless, in such circumstances, GKS assumes a pivotal function in fostering absorptive capacity from external sources and catalyzing the emergence of locally adapted innovations, which serve as pivotal catalysts for sustainable development and competitiveness (America, 2024).

The direct effect of absorptive capacity and innovation climate on green product innovation.

Alternatively, based on the first research objective, this study confirms that the direct effects of absorptive capacity **H3**-($\beta = 0.122$, $t = 2.635$, $p < 0.05$) and innovation climate **H5**-($\beta = 0.345$, $t = 9.021$, $p < 0.05$) on GPI, respectively. According to the **third hypothesis**, GPI is positively and significantly impacted by absorptive capacity. The conclusions of this study support this RBV theory by showing a significant and robust correlation between absorptive capacity and green product innovation (Akhtar et al., 2024). The development of absorptive capacities has a higher chance of success when corporate leadership recognizes the status of sharing green knowledge. The outcomes also show that a company's lack of knowledge and adoption of green practices can result in less green product innovation, which in chance can lead to employee discontent and abrasion. These findings are in line with (Aboelmaged & Hashem, 2019; Wang et al., 2023) assertion that AC is a key factor in promoting green product innovation since it establishes how many staff members can contribute to and increase awareness of environmentally friendly innovations. Therefore, consistent with previous studies (Aboelmaged & Hashem, 2019; Du & Wang, 2022), the findings confirm that absorptive capacity plays an important role in enhancing green product

innovation in developing nations, where building such capabilities is essential for organizational competitiveness.

The **fifth hypothesis** stated the innovation climate would have a statistically significant and positive impact on Green Product Innovation (GPI). Green innovation is something that a lot of companies are trying to do. They want to make products that're good for the earth. When a company has a team and a boss who wants to try new things they can make really great eco-friendly products. This is what makes green innovation work. It is not about having the right machines or following the rules. It is, about the people who work at the company and how they work together. Green innovation is what the staff do every day. The company is what makes green innovation possible. Green innovation is a part of what the staff do. They do it every day. It is just a part of their job. The company makes it easy for them to do this.

An innovation climate is constituted by shared perceptions among employees of an organization's practices, procedures, and behaviors. This climate fosters creativity, experimentation, and risk-taking. The positive correlation between an innovation climate and GPI underscores the importance of cultivating a work environment that encourages creative thinking, continuous improvement, and sustainability-focused values (Begum et al., 2022). Companies that help people come up with ideas and let them try new things are more likely to have employees who look for new ways to do things. This is important for making products and ways of working that're good for the environment. When a company is like this it makes people feel safe to suggest ideas for helping the environment. They do not have to worry about being told their ideas are bad or that they will get in trouble if they try something. Organizations like this are really good, at helping people come up with eco- products and processes. They let people take risks to find eco-friendly solutions.

Having an innovation climate is really important for an organization. This means that people in the organization have access to the things they need to do their jobs. They need things like time, money, the right technology and support from management to turn ideas about the environment into products that are good for the environment. When people from parts of the organization work together it is called cross-functional collaboration. This is helpful because it brings together people with skills and knowledge such as research and development production, marketing and environmental management to work on green products. The organization uses innovation climate to make sure that people from these areas can work together and share their ideas. This helps the organization make products that are practical and

good, for the environment (Begum et al., 2022). The exchange of sustainability-related knowledge across organizational levels is further facilitated by open communication channels and participative decision-making processes. These elements work together to create an environment that encourages proactive problem-solving and environmentally responsible innovation (Paparoidamis & Tran, 2019).

The results of this study align with previous empirical research Owusu et al. (2024), showing that a robust innovation climate improves overall innovative output and substantially contributes to green product innovation. Companies can make sustainability a big part of what they do by making sure their values are in line with taking care of the environment. This helps companies be more responsible when it comes to the environment. It also helps them be more competitive in the market. Sustainability is important, for companies because they have to follow environmental rules. Sustainability is also important because more and more people want products that're good for the environment. Companies that focus on sustainability can do a job of giving people what they want.

Innovation is really important for countries that are still developing. When businesses operate in these countries they have to deal with a lot of problems. They do not have a lot of resources. They have to compete with a lot of other businesses. The innovation of businesses in developing countries is very important. Businesses in developing countries need to be able to innovate to succeed. Innovation is key for businesses, in developing countries (Owusu et al., 2024). When things get tough a supportive climate for innovation is really important. This helps organizations balance what is good for the environment, with making money. Innovation is what makes this balance possible for organizations. Previous research by Paparoidamis and Tran (2019) has indicated that Businesses that work in creative ways are more likely to use green technologies. They can do things efficiently and respond well to people who want products that are good, for the environment. When businesses make these changes they help the environment. They also get better at what they do. This helps them stay strong for a long time. Green technologies are a part of this. Businesses that use technologies are the ones that can really make a difference and stay strong in the long run.

Green innovation is really good for making products stand out from the rest. Green innovation also helps companies save money by using resources in a way. The thing, about innovation is that it helps companies follow the rules that the whole world agrees on for the environment. This makes it easier for companies to sell their products

around the world because of green innovation. According to Owusu et al. (2024), The outcomes of green product innovation offer dual benefits, providing both ecological and economic value. When companies incorporate sustainability into their innovation strategies, they can reap two benefits: reduced environmental impact and a strengthened competitive edge. According to current research, an innovation climate is a vital organizational tool that translates sustainability goals into tangible results (Paparoidamis & Tran, 2019).

Indirect Effects

The mediating effect of absorptive capacity and innovation climate between green knowledge sharing and green product innovation.

The second goal of this study is to look at how absorptive capacity and innovation climate affect the relationship between GKS and GPI. This is based on the RBV and KBV theories. We want to see how these things help manufacturing firms, in developing countries have an advantage. This study aims to fill in the gaps that other research has not covered and answer the questions that people have been asking about GKS and GPI by Borah et al. (2023) and Makhoulfi (2024). Additionally, the hypothesis **H6**- ($\beta = 0.033$, $t = 2.416$, $p < 0.05$) and **H7**- ($\beta = 0.089$, $t = 5.280$, $p < 0.05$) are accepted. A low but statistically significant beta value shows that Pakistani manufacturing companies face institutional problems. These problems include resources, a slow approach to innovation and weak environmental rules. As a result Pakistani manufacturing firms struggle to turn knowledge into new ideas and practices. This struggle is a step, toward manufacturing but progress is still limited. Pakistani manufacturing firms are still working to overcome these challenges and adopt sustainable practices.

Hypothesis # 6 suggests that there is a positive and partial significant association between GKS and GPI, with absorptive capacity acting as the mediating factor. The research results confirm this idea, which matches what a previous study found. It shows that absorptive capacity has an positive effect on linking GKS to GPI. This means absorptive capacity really helps connect GKS and GPI in a way. The studys findings support the idea that absorptive capacity's key to making GKS and GPI work well together and GKS and GPI benefit from having strong absorptive capacity. Absorptive capacity plays a role in making this connection, between GKS and GPI (Shehzad et al., 2023). In todays changing world a company needs to be able to change and come up with new ideas to stay around for a long time and be better than others.

For companies that make things it is very important to keep getting better at coming up with ideas. This will help these companies make and use ideas that are good for the environment more easily. The Resource Based View or RBV says that companies must be able to change and come up with ideas to stay competitive. Companies that make things need to keep working on their ability to come up with ideas like the Resource Based View says, so they can make new products and ways of doing things that are good, for the environment (Mohaghegh et al., 2024).

As a result, absorptive capacity statistically acts as a mediator between GKS and GPI. However, a low beta for this indirect effect is theoretically and contextually feasible in emerging economies. Research from developing economies indicates that AC is often necessary, though not always sufficient, for converting collective environmental information into tangible product improvements. Song et al. (2020), demonstrate the complete mediation of GKS on GPI through AC in Chinese manufacturing, while also identifying limitations that restrict the extent of the impact. In many developing countries, limited resources, inadequate technological infrastructure, and evolving knowledge management systems can hinder firms' ability to implement green practices, which can diminish the observed impact of the AC pathway (Bhaumik et al., 2025). Inconsistencies in environmental regulations and their inadequate enforcement create an environment in which managers are less incentivized to apply green knowledge to product innovation. This means that even when access to green knowledge exists, external pressures and short-term priorities hinder its application to generate product innovation (Wang & Si, 2025).

Hypothesis 7 proposed that the innovation climate is really important because it helps green knowledge sharing turn into green product innovation. This study found out that the innovation climate is a part of making this happen. Even if the effect is small it is still important. So making the innovation climate at a company a little better can make a difference in creating green products. This means that for green knowledge sharing to work and lead to green product innovation the company needs to be supportive and care about innovation. The innovation climate has a role, in this. Green knowledge sharing and green product innovation depend on the innovation climate.

The innovation climate is really important because it shows us that the things around us and the culture we are in can affect how we come up with ideas. When we talk about a climate we mean a place where people are open to new ideas, where managers are supportive and where different departments work together. This kind of place also says it is okay to try things even if they do not work out and that we should always be looking for ways to do things better. The innovation climate makes people feel safe

so employees can think about ideas that are good for the environment without being scared of making mistakes. The innovation climate is what helps us make this happen by letting employees be creative and try things in a safe space, which is really important, for the innovation climate. Nasir et al. (2024), argue that companies seeking to foster a robust innovation environment should prioritize green knowledge-sharing practices, as these social and behavioral processes often have a more significant impact on innovation culture than structural or procedural changes alone.

The results show the existence of a link between a supportive environment for innovation and the enhancement of the connection between GKS and GPI. There is also evidence of a direct promotion of the development of green product innovation by a supportive environment for innovation (Popa et al., 2017). Organizations with a well-established climate for innovation are better able to integrate sustainability principles into their product development strategies (Ma et al., 2025). The incorporation of environmental objectives into a firm's core innovation strategy is a strategy for improvement of ecological and economic performance. The study also shows that GPI helps companies compete better. It shows that making new products that are good for the environment helps companies stand out, find their place in the market, and be better than other companies in the long term.

The results of the study are really important for managers, managers who work for small and medium-sized companies in developing countries. Managers of medium-sized companies should know that making their workplace a place where new ideas are welcome is a very important goal, for creating green products. Managers of medium-sized companies need to understand that creating green products is a big deal and they should focus on making their workplace a place where new ideas are welcome (Ma et al., 2025). In markets where there is a lot of competition and people care about the environment, companies that do not support a culture of new ideas will probably not do well. Previous research Popa et al. (2017), suggests that companies must implement proactive, innovation-driven strategies to remain competitive and adapt to evolving environmental and market demands.

So, when you look at it from a theoretical point of view, you can understand the results using the Resource-Based View, or RBV. The innovation climate can be viewed as a beneficial internal asset that enables companies to efficiently utilize and maximize their knowledge assets. According to the RBV, sustainable competitive advantage arises not only from having knowledge, but also from an organization's ability to harness and apply that knowledge in ways competitors struggle to imitate. Polas et al.

(2023), argue that knowledge sharing alone is insufficient to foster innovation without a supportive organizational framework. The innovation climate acts as a complementary capability that enhances the effect of GKS on GPI.

In nations with underdeveloped economies, where business enterprises often encounter institutional impediments, resource deficits, and technological challenges, the importance of an Innovation Climate becomes particularly salient. Organizational environments that provide support can compensate for external shortcomings by fostering teamwork, innovation, and adaptability. The current study confirms previous research Popa et al. (2017), showing that an innovation climate serves as a facilitating mechanism that supports green knowledge-sharing initiatives and increases their conversion into sustainable product innovations.

The moderating effect of customer involvement on green knowledge sharing, absorptive capacity, and innovation climate.

This study examined the moderating effect of customer involvement (CI) on the relationship between green knowledge sharing (GKS) and green product innovation (GPI), based on the theoretical framework of social exchange theory. The study aimed to address a research gap identified by Najafi-Tavani et al. (2023), who emphasized the need for more empirical research on the effects of external stakeholder involvement on internal knowledge-innovation processes. **Hypothesis 8** posited that CI would affect the relationship between GKS and absorptive capacity (Makhloufi, 2024), thereby influencing the pathway to green product innovation.

The moderation analysis showed that there was a non-significant interaction between Green Knowledge Sharing and Customer Involvement. This means that the interaction term actually reduced the relationship's strength. This finding differs from earlier empirical studies, such as those by Asamoah et al. (2024), which revealed a positive and growing moderating impact of customer involvement on innovation-related outcomes. The current findings suggest that customer involvement's role in sustainable innovation processes may depend on the context, particularly in small to medium-sized businesses operating in emerging markets.

This discrepancy can be explained by the structural and resource limitations that Pakistani small and medium-sized enterprises face. Many small, local manufacturing businesses lack the financial, technological, and managerial capabilities to process,

integrate, and respond effectively to varied customer inputs. It has been suggested by Social Exchange Theory that trust, mutual value, and collaborative innovation are created through reciprocal interactions between firms and customers (Awan et al., 2022). However, external feedback must be turned into a strategic advantage by organizational readiness and absorptive structures through these exchanges. In settings with limited resources, excessive or unstructured customer engagement can overwhelm internal systems rather than improve them (Elf et al., 2022).

Due to high levels of customer involvement, firms may face additional procedural and policy-related demands. According to Migdadi (2021), involving customers in product development requires modifying organizational processes, governance structures, and decision-making procedures. The operational complexity may be increased and the efficiency may be decreased for smaller businesses with limited flexibility by these adjustments. In these cases, instead of encouraging new ideas, customer engagement can sometimes get in the way of important plans and make people focus less on long-term technology improvements.

In places where the economy is growing companies are trying to make money and be kind to the environment at the time. This can cause problems for companies because customers are getting more and more involved with the companies. The companies in these emerging economies have to deal with this strain, which is called tension because the customers in these emerging economies are very involved, with the companies. Manufacturing companies may prioritize short-term customer demands over long-term sustainability objectives. According to Zhong et al. (2025), If a company thinks about what customers like much when making new products it might make small changes instead of big ones. This company may spend many resources trying to do what the customers want so it does not have enough time to think about new ideas and make new technology that is good for the environment. The company focuses on what the customers like so it does not make exciting products. The company spends a lot of time and money on what the customers want. This stops the company from making new technology that is good, for the environment like green innovations.

Studies by Carbonell et al. (2009), suggest that excessive dependence on customer feedback can impede progress by constricting strategic flexibility and decelerating the decision-making process. Firms that place too much value on customer input may overlook the worth of their technological capabilities and accumulated expertise. In

these situations, new ideas are slow to happen instead of happening quickly. This can make it hard for the company to stay competitive and successful in the long term.

So Social Exchange Theory says that when companies and customers work together it can be really good for both parties.. What we found out is that getting customers involved is not always a good thing. If a company wants to try this it needs to be able to do it and its goals have to match up with what it is trying to do. For companies like SMEs getting customers involved will only help with green innovation if the company is really good at learning new things and has a formal system in place for coming up with new ideas. Social Exchange Theory and customer involvement are important for companies, like SMEs to think about when they want to try new things.

The results partially support the suggested hypotheses but weaken the relationship in response to the emphasized research gaps and address the third research objective regarding the moderating effect of CI between GKS and GPI, underlying the mechanism of Social Exchange theory. **Hypothesis # 9** shows that customer involvement is partially significant in the connection between GKS and innovation climate, but weakens the relationship. By offering insights into the intricate processes of external stakeholder involvement in producing an environment that encourages innovation in the developing countries' context. The inclusion of actively engaged customers significantly boosts the effectiveness of green knowledge sharing by integrating diverse perspectives, environmentally friendly preferences, and practical expectations that facilitate internal discussion and collaborative innovation initiatives (Zhang, 2024). This aligns with previous research (Nair & Manohar, 2024), which stresses reciprocal value creation, where firms profit from customer input while customers feel valued in co-creating eco-friendly solutions. According to Social Exchange theory, meaningful engagement with customers can lead to their feedback and environmental concerns augmenting an internal culture that emphasizes openness, trust, and experimentation (Nair & Manohar, 2024), all of which are fundamental components of an innovation environment. Strategically managed customer involvement not only improves the content and significance of shared green knowledge but also fosters an organisational climate that is essential for transforming that knowledge into innovative, sustainable results (Velasco et al., 2024). In emerging economies, manufacturing companies frequently encounter resource limitations and the need to innovate in an environmentally sustainable manner. When we work with customers to create products that people want and that are also good for the environment we can solve some big problems. The Social Exchange Theory says that when we do this it helps build trust between us and our customers. This is because we are working together and both sides are getting something they want. We get to make

products that people will buy and customers get products that're good for them and the environment. This way of working is really helpful because it makes customers happy and it is also good for the earth. Creating products with customers is a great way to make sure we are making things that people want and that are also good, for the environment. Studies have found that customer involvement leads to improved green product innovation by filling the knowledge gaps of SMEs (Chen & Liu, 2020), with boundary-spanning capabilities acting as a partial mediator of this relationship (Ma et al., 2022), underscoring the vital role of customer engagement in resource-constrained situations. The results, matched with previous research (Centobelli et al., 2018; Gruner & Homburg, 2000), support the idea that carefully managed customer participation enhances the connection between green knowledge sharing and an innovative work environment, especially in developing countries where engaging external stakeholders is crucial for promoting sustainable and collaborative innovation.

The fourth research objective is to study the interactive effects of green knowledge sharing, absorptive capacity, innovation climate, and customer involvement to enhance green product innovation of manufacturing firms.

This study was mainly about understanding how sharing knowledge about being affects creating new green products. The study looked at how staff and executives share knowledge about the environment and how that helps develop products in developing countries. It checked both government and companies that make things. The study found that a company's ability to learn and use information and a workplace that encourages new ideas are important for making green products. It also showed that when customers are involved it helps companies in developing countries to create products because of environmental pressures. Green knowledge sharing helps companies to make products. The study is about green product innovation and green knowledge sharing. Green knowledge sharing is important, for green product innovation.

People have found that when we talk about things that're good for the earth like saving water or using less energy it really helps us learn new things. The environment around us is also very important for coming up with ideas and trying new things. Studies show that sharing knowledge about topics is very helpful for learning and for the environment that supports innovation. This means that when we share what we know about topics it helps us and it helps the environment, around us to be more innovative. Green topics are very important. We should keep talking about them. The improvement of companies' capacity to obtain, process, and utilize external

environmental information is achieved through the engagement of employees and managers in active knowledge exchange about sustainability (Shahzad et al., 2020). This helps create a workplace where people can think of ideas. In this case GKS helps share knowledge and supports the organizations learning and cultural change. GKS makes it possible for organizations to learn and adopt ways of working. It also helps organizations change their culture to be more innovative. GKS is important, for knowledge sharing and learning. Organizations can use GKS to improve their culture.

The investigation also shows that a companys ability to absorb information and its approach to innovation play a big role in the relationship between Green Knowledge Sharing and Green Performance Improvement. When a company shares knowledge it gets better at taking in new information, about the environment. This helps the company to see what is coming next in terms of sustainability use friendly technology and try out new green ideas. Green Knowledge Sharing really helps a company to do these things and Green Performance Improvement is the result (Shahzad et al., 2020). A company gets better at learning things when it has a good way of taking in new information. This means the company can use the knowledge it already has to create useful things. When a company wants to come up with ideas it needs to make sure people feel safe to share their thoughts. The company also needs to have a structure in place and managers who support new ideas. This helps the company turn the things it learns from the world around it into products that are good for the environment and can make money. The company can make products that people want to buy. A company that wants to make green products needs to have an environment for innovation. This environment helps the company learn things and turn those things into products that are good, for the environment (Zhou et al., 2024).

The Knowledge-Based View or KBV fits well with what we found out. This is because knowledge is seen as the important asset for a company. The KBV says that a company can stay ahead of others if it can make, share and use knowledge in a way. This means that companies need to focus on creating and using knowledge to get an edge. The KBV is about how knowledge helps companies succeed. It shows that knowledge is key, to a companys strategy. Companies that use knowledge well can gain a lot. The KBV helps us understand how knowledge works in a company (Boota et al., 2025). In this context, green knowledge sharing emerges as a core organizational capability that enables collective learning and innovation. The findings also support the idea that companies can do better than other companies for a long time by developing important, rare, different, and one-of-a-kind skills. When nurtured through continuous knowledge exchange and learning processes, absorptive capacity

(AC) becomes a strategic resource. AC becomes a part of the way organizations do things and the way people interact, which makes it hard for competitors to copy it. This helps keep the company competitive over time.

The study also highlights the impact of customer involvement on the relationship between GKS and green product innovation. Involving customers can improve knowledge-sharing project outcomes by incorporating external viewpoints into the product development process (Boota et al., 2025). Customers share ideas when they work together. They make products together. Tell us what they like and dislike about these products. Customers talk about the products. How they can be better for the environment. They also discuss how easy the products are to use and how they affect the environment. The customers and the company work together in this way. This way of working is similar to Social Exchange Theory. Social Exchange Theory says that when people help each other they trust each other more. They also become more dedicated to each other. They work together more actively. Customers and the company are stakeholders in this process. Social Exchange Theory is relevant, to customers and the company because they exchange value with each other (Zhou et al., 2024). Companies can really work well with green innovation initiatives when they team up with customers. This means customers are not just getting something from the company they are actually helping the company. When companies and customers work together like this it is good, for the environment. It is also what people want from companies. This is a way for companies to make green innovation initiatives better. Green innovation initiatives are important. Companies can make them work by working with customers.

The combination of GKS, AC IC and CI shows how internal and external collaborations work together to drive innovation. On-site methods for sharing knowledge and settings that encourage innovation help people learn and grow their skills. Externally working with customers leads to ideas and helps stay relevant in the market. These approaches lead to environmental results and improved financial performance, like being more competitive, specialized and sustainable over time with GKS, AC, IC and CI. The internal collaborations with GKS, AC, IC and CI and external collaborations are essential. They improve skills and knowledge with the help of GKS, AC, IC and CI. The combination of GKS, AC, IC and CI results, in long-term success.

These findings are particularly significant in the context of less developed countries. Institutional hurdles, inadequate technological infrastructure, and resource limitations

are common challenges for companies operating in such settings. Under these circumstances, utilizing in-house knowledge networks and cultivating collaborative partnerships with customers can offset organizational constraints and accelerate long-term growth. Manufacturing companies can protect the environment and make more money by using green knowledge-sharing practices, developing the ability to learn, creating an environment that supports new ideas, and working with customers to create products and services.

6.2 Contributions and Implications

Projected contributions of this research to theory and practice are the focus of discussion in this chapter.

6.2.1 Theoretical Contributions

The current study has numerous theoretical contributions. The study's contributions include proposing and empirically testing a research framework that is well-suited for use in green business contexts. First of all, this study improves the literature on RBV, KBV, and Social Exchange theories, and the performance of GKS and GPI (Rahmat et al., 2024). The RBV and KBV theories help the firm to utilize its resources in a well-mannered way and improve competitive advantage via green product innovation. Social Exchange theory also helps organizations with their innovative ideas, from valued customers to make more eco-friendly products, and to enhance their competitive advantage (Elshaer et al., 2024). To gain an edge in the market, organizations need to do a thorough evaluation of their environmental initiatives (Rehman et al., 2021). This study expands on prior research into knowledge sharing and sustainability, examining the indirect influences of absorptive capacity, innovation climate, and customer involvement with GPI as the antecedents to gain competitiveness in SMEs (Rehman et al., 2024).

The current study answers the call for research to examine the mediating and moderating variables to support the GKS and GPI to gain competitiveness. Firstly, this research supports the existing literature by providing practical evidence for the mediating effect of absorptive capacity (AC) in the connection between GKS and GPI. The research findings demonstrate how AC facilitates the translation of GKS into enhanced GPI, thereby contributing to a deeper theoretical understanding of knowledge-based and innovation management perspectives within the context of

sustainability (Makhloufi, 2024). A firm's AC refers to its ability to take in new knowledge, combine it with existing knowledge, and convert it into usable solutions. These applications are subsequently used for commercial objectives. From the perspective of the RBV, absorptive capacity serves as a groundwork for the advancement of dynamic abilities that allow firms to acclimate to diverse business environments (Aboelmaged & Hashem, 2019). Consequently, this study's results underscores the importance of AC to a manufacturing firm's achievement. This study clarifies the conflicting findings on the relationship between GKS and green innovation, where scientists have shown both positive and negative relationships (Song et al., 2020; Weng et al., 2015; Wu, 2013).

A mediating effect of innovation climate (IC) complementarity was discovered in the relationship between GKS and circular economy performance (Riaz et al., 2024). The GPI underscored the substantial performance value of green innovation. Therefore, this study highlights the joint connection between GKS and IC in advancing green product innovation to achieve competitiveness. The broad adoption of eco-friendly and innovative materials is an advantage. The study suggests establishing a variety of innovative platforms for disseminating green knowledge within teams and with external parties, simplifying open communication and teamwork to inspire innovative and imaginative solutions (He et al., 2024). The widespread implementation of eco-friendly and innovative materials in manufacturing demonstrates the industry's shift from a high-carbon-emitting sector to a greener, more sustainable economy by addressing key cost challenges (Chen et al., 2024).

This research suggests a new perception that CI plays a very low role as a moderator in the connection between GKS and organisational outcomes (absorptive capacity and innovation climate). This research also adds to present literature by demonstrating that, under specific circumstances, customer involvement does not substantially influence this relationship. Within Pakistan's manufacturing sector, where many companies face weak environmental protocols and struggle to meet the demands of biologically mindful customers, this study highlights the difficulties these firms encounter in upgrading their innovation and knowledge development capabilities (Mehmood et al., 2024). Manufacturing firms must engage customers to help reduce the impact of market uncertainty, as technological investments can be very expensive (Saleem et al., 2023). The research results confirm that formalization is linked to increased customer participation in product development, whereas decentralization is linked to decreased customer involvement. Overall, the study provides a more detailed understanding of the environmental features that affect the effectiveness of green knowledge sharing in driving green product innovation, particularly through the

perspective of absorptive capacity and providing innovation climate (Shah et al., 2025).

6.2.2 Practical Implications

There are numerous practical implications of our findings for manufacturing firms. The Sustainable Development Goals (SDGs) have driven worldwide initiatives to implement natural and ecologically friendly rules and engage in eco-friendly practices as a way to boost market competitiveness through sustainable products (Udodiugwu et al., 2025). The combination of environmental factors into product development has suggestively transformed how companies engage with competition and gain a competitive advantage. Companies will increasingly concentrate on gaining a competitive edge through environmentally friendly products (Rehman et al., 2024). For businesses to fully benefit from environmental efforts like conservation, recycling, and lowering emissions, they need to link their corporate environmental goals to their overall business strategies.

First, to align manufacturing practices with the Sustainable Development Goals (SDGs), managers should implement green product innovation strategies that consider resource constraints from the RBV perspective (Castellani et al., 2024). They should also integrate green knowledge into organisational operations to boost innovation capabilities by effectively acquiring, assimilating, and utilizing new knowledge. Second, when it comes to reaping the benefits of GKS and GPI, this research indicates that AC was also an underlying leverage mechanism but in the case of manufacturing firm of developing countrys' context. There is need to enhance firms abilities (Makhloufi, 2024). In light of developing country context, it is crucial for managers to not only promote the conversation of green knowledge but also to actively absorb it. Thirdly, providing an innovative climate in a developing country's context is difficult nowadays as its too weak, and sharing green knowledge is a more critical factor in achieving success with an innovative climate than with traditional innovation methods (Ma et al., 2025). So, the expectation is that manufacturing companies will invest in GKS and GPI to bolster the mediating effect of the innovation climate. For this, managers should ensure that their organisations are active in green innovation practices by prioritising understanding, utilising, and integrating existing knowledge on green technology and green consumer needs (Ullah et al., 2024). In order to optimise the use of knowledge sharing, managers must keep a close eye on the constantly changing environmental regulations and green requirements, as well as identify and accurately interpret stakeholder pressure and customer demand on time.

Fourthly, the present study found that the moderating impacts of customer involvement on green knowledge sharing, absorptive capacity, and innovation climate were weak for manufacturing firms. So there is need to collaborate with their valued customers. Companies may better serve their customers (especially environmentally conscious customers) by staying up to date on the latest product trends through sharing their knowledge (Zhang, 2024). However, without proper placement, the green product that a company has developed using absorptive capacity will not do well in the marketplace. Important practical consequences are suggested by the study when involving influential customers (Cuesta-Valiño et al., 2024), who can improve the effectiveness of a product's launch. While a high degree of customer involvement can be beneficial in the NPD (new product development) process, managers should be wary of the potential risks posed by unknowns in the data. Firms can better handle such uncertainties by improving their knowledge transfer and learning skills, both internally and externally (Mubarak et al., 2025). To better recognize, absorb, and apply knowledge provided by crucial consumers, managers will need to create a system of inbound learning processes (Najafi Tavani et al., 2013). But managers also need to pay attention to external knowledge transfer mechanisms and establish methods that might boost such mechanisms to assist the organizational knowledge transfer and to secure the obtaining of appropriate inputs from their consumers. Managers need to remember that there may be times when optimal absorptive capacity levels simply cannot be attained owing to a lack of resources (both monetary and otherwise). So, managers should think about adjusting the customer involvement level as another way to ensure the success of product development projects. This means that the level of customer involvement can be adjusted at any time based on the circumstances and the managers' assessment.

6.3 Limitations and Future Research

Despite its contributions, there exist a few limitations to the performance of this research within the given environmental context. The data was collected during a singular instance, and the research methodology employed a cross-sectional design. To address this limitation, future researchers could do longitudinal studies that can better see an organizational abilities in a long term.

Second, the generalizability of our study is limited due to its focus on manufacturing (SMEs) only in the developing country and only from one region, Punjab, Pakistan. The geographic and sectoral concentration of this study may limit the relevance of its results to other firm or areas. Future studies should replicate and expand the suggested

model to include various areas and sectors, as well as both developed and developing countries. This would enable cross-cultural and institutional comparisons.

Third, the study's results suggest that a more thorough examination of customer involvement policies and procedures is necessary. So future researchers must undertake a comprehensive analysis of customer involvement policies and processes across multiple nations, encompassing diverse cultural norms.

Additionally, it is suggested that future researchers take into explanation any additional moderating factors. Future researcher should take employee related factors such as employees' dynamic and personal green values as well as their personality traits (introvert/extrovert), and supervisor support, as these factors are crucial for the sharing and acquisition of knowledge, both of which are final goals of an efficient knowledge management process. Moreover, introducing mediators like green creativity and green social capital into the existing model to understand different results or according to your organization's problem or gap. Future researchers should therefore examine the existing model with the suggested variables.

Finally, the study's limitations are due to a lack of research on knowledge-based capabilities in developing countries, which may affect the generalizability of the study's results. Future research should therefore investigate these capabilities in various developing countries, aiming to gather more in-depth empirical evidence and further solidify theoretical understandings of their part in promoting innovation and sustainability. Consequently, further research is essential to close this knowledge gap. Furthermore, the roles of knowledge combination and protection can be investigated using existing data to gain a more inclusive understanding. It is advised to replicate this model in a broader variety of regions to gain a more detailed understanding of eco-friendly knowledge-sharing projects focused on minimising the utilisation of limited material resources via recycling and material retrieval from waste streams.

7 CONCLUSION

The issue around sustainable and green product innovation (GPI) is gathering steam as many developing countries are working to meet their sustainable development objectives swiftly. Green practices are becoming an increasingly important part of any business or corporation. Thus, this study develops the rising field of study by examining the impact of GKS and AC on the GPI of the manufacturing firm. This study adopts a quantitative (no-probability-convenience) sampling technique. The data was collected only from manufacturing firms. This study find a positive relationship between GKS and GPI. Additionally, the results show a positive mediation effect of

AC and innovation climate (IC) on GPI to enhance competitive advantage for firms. Moreover, customer involvement (CI) as a moderator shows a non-significant and weak impact on AC, but with IC shows a positive impact. The current conceptual framework may help to advance the manufacturing firm's ability and also add value to the environment.

REFERENCES

1. Abbas, D. S., Rahandri, D., Kismanah, I., & Ardiyanti, A. (2022). Competitive Advantage as Role Moderation Between System-Driven Performance and Economic Performance. *Quantitative Economics and Management Studies*, 3(2), 235-244.
2. Abbas, J., & Khan, S. M. (2023). Green knowledge management and organizational green culture: an interaction for organizational green innovation and green performance. *Journal of Knowledge Management*, 27(7), 1852-1870.
3. Abbas, J., & Sağsan, M. (2019). Impact of knowledge management practices on green innovation and corporate sustainable development: A structural analysis. *Journal of Cleaner Production*, 229, 611-620.
4. Abdulkareem, A. K., Ishola, A. A., Abdulkareem, Z. J., Oladimeji, K. A., Adejumo, A., & Ayinla, A. A. (2025). Ethical behaviour, organisational support and employee outcomes in driving public sector organisational performance. *RAUSP Management Journal*.
5. Abisuga-Oyekunle, O. A., & Fillis, I. R. (2017). The role of handicraft micro-enterprises as a catalyst for youth employment. *Creative Industries Journal*, 10(1), 59-74.
6. Aboelmaged, M., & Hashem, G. (2019). Absorptive capacity and green innovation adoption in SMEs: The mediating effects of sustainable organisational capabilities. *Journal of Cleaner Production*, 220, 853-863.
7. Abu-Shanab, E., & Subaih, A. (2019). The role of knowledge sharing and employees' satisfaction in predicting organisational innovation. *Journal of Information & Knowledge Management*, 18(03), 1950026.
8. Abudaqa, A., Alzahmi, R. A., Almujaani, H., & Ahmed, G. (2022). Does innovation moderate the relationship between digital facilitators, digital transformation strategies and overall performance of SMEs of UAE? *International Journal of Entrepreneurial Venturing*, 14(3), 330-350.
9. Achmad, F., & Wiratmadja, I. I. (2025). Organizational performance and competitive advantage in SMEs: The role of green innovation and knowledge management. *Journal of Open Innovation: Technology, Market, and Complexity*, 11(2), 100532.

10. Adenle, A. A., De Steur, H., Mwongera, C., Rola-Rubzen, F., de Barcellos, M. D., Vivanco, D. F., Timilsina, G. R., Possas, C., Alders, R., & Chertow, M. (2023). Global UN 2030 agenda: how can science, technology and innovation accelerate the achievement of sustainable development goals for all? *PLOS Sustainability and Transformation*, 2(10), e0000085.
11. Aftab, J., Veneziani, M., Sarwar, H., & Ishaq, M. I. (2022). Entrepreneurial orientation, entrepreneurial competencies, innovation, and performances in SMEs of Pakistan: Moderating role of social ties. *Business Ethics, the Environment & Responsibility*, 31(2), 419-437.
12. Agrawal, A. K., & Rahman, Z. (2015). Roles and resource contributions of customers in value co-creation. *International strategic management review*, 3(1-2), 144-160.
13. Ahmad, I., Ghani, M. U., Anwar, S., & Butt, F. K. (2022). SME sector in Pakistan: mapping the policy framework, opportunities and constraints. *Evaluations of Regulatory Authorities, Government Packages, and Policies*, 145.
14. AHUCHAOGU, N., OKWU, G. C., & UGODIEGWU, E. J. (2025). KNOWLEDGE ECONOMY: A NEW PARADIGM FOR PRODUCTIVITY. *Journal of Management Science and Career Development*.
15. Akhtar, S., Li, C., Sohu, J. M., Rasool, Y., Hassan, M. I. U., & Bilal, M. (2024). Unlocking green innovation and environmental performance: the mediated moderation of green absorptive capacity and green innovation climate. *Environmental Science and Pollution Research*, 31(3), 4547-4562.
16. Al-Husain, R. A., Jasim, T. A., Mathew, V., Al-Romeedy, B. S., Khairy, H. A., Mahmoud, H. A., Liu, S., El-Meligy, M. A., & Alsetoohy, O. (2025). Optimizing sustainability performance through digital dynamic capabilities, green knowledge management, and green technology innovation. *Scientific Reports*, 15(1), 24217.
17. Alamro, A. S., Awwad, A. S., & Anouze, A. L. M. (2018). The integrated impact of new product and market flexibilities on operational performance: The case of the Jordanian manufacturing sector. *Journal of Manufacturing Technology Management*, 29(7), 1163-1187.
18. Albort-Morant, G., Leal-Rodríguez, A. L., & De Marchi, V. (2018). Absorptive capacity and relationship learning mechanisms as complementary drivers of green innovation performance. *Journal of Knowledge Management*, 22(2), 432-452.
19. Alexanian, M., Padmanabhan, A., Nishino, T., Travers, J. G., Ye, L., Pelonero, A., Lee, C. Y., Sadagopan, N., Huang, Y., & Auclair, K. (2024). Chromatin

- remodelling drives immune cell–fibroblast communication in heart failure. *Nature*, 635(8038), 434-443.
20. Ali, N., Butzbach, O. K., Katohar, H. A., & Afridi, H. I. (2024). Structural and External Barriers to Pakistan's Economic Growth: Pathways to Sustainable Development. *World*, 5(4), 1120-1129.
 21. Ali, U., Ahmad, H. Z., & Sabir, S. A. (2025). The Influence of Green Intellectual Capital on Green Product and Process Innovation: The Mediating Role of Green Knowledge Sharing in the Pakistani SMEs. *The Critical Review of Social Sciences Studies*, 3(3), 160-185.
 22. Aliasghar, O., & Haar, J. (2023). Open innovation: Are absorptive and desorptive capabilities complementary? *International Business Review*, 32(2), 101865.
 23. Alkalha, Z., Dehe, B., & Reid, I. (2025). How absorptive capacity mediates supply chain effectiveness: a quality integration approach to boosting operational performance. *Operations Management Research*, 1-21.
 24. Alketbi, M. S., & Ahmad, S. Z. (2024). Corporate social responsibility and sustainability practices: mediating effect of green innovation and moderating effect of knowledge management in the manufacturing sector. *International Journal of Organizational Analysis*, 32(7), 1369-1388.
 25. Alzyoud, A. A. Y. (2021). The impact of green human resource management practices and knowledge sharing on sustainable performance: a conceptual framework. *International Journal of Education Humanities and Social Science*, 4(2), 115-132.
 26. Amankwah-Amoah, J., Boso, N., Adomako, S., & Danso, A. (2024). Editorial to the special issue "International entrepreneurial behaviors of African firms: Emerging issues, challenges and opportunities". *Journal of Business Research*, 182, 114763.
 27. America, C. D. B. o. L. (2024). *Latin American Economic Outlook 2024 Financing Sustainable Development: Financing Sustainable Development*. OECD Publishing.
 28. Amoah, J., Belas, J., Dziwornu, R., & Khan, K. A. (2022). Enhancing SME contribution to economic development: A perspective from an emerging economy. *Journal of International Studies*.
 29. Anastasiou, M. (2019). Analysing the implications of hospitality and culinary educators' tacit knowledge utilization. *Journal of Tourism, Hospitality and Culinary Arts*, 11(1), 34-44.
 30. Andersén, J. (2021). A relational natural-resource-based view on product innovation: The influence of green product innovation and green suppliers on

- differentiation advantage in small manufacturing firms. *Technovation*, 104, 102254.
- 31.Arora, M. (2024). Encapsulating Role of Persuasion and Skill Development in Marketing Communication for Brand Building: A Perspective. In *International Handbook of Skill, Education, Learning, and Research Development in Tourism and Hospitality* (pp. 415-431). Springer.
 - 32.Asamoah, D., Acquah, I. N., Nuerter, D., Agyei-Owusu, B., & Kumi, C. A. (2024). Unpacking the role of green absorptive capacity in the relationship between green supply chain management practices and firm performance. *Benchmarking: An international journal*, 31(8), 2793-2818.
 - 33.Atiku, S. O., Jeremiah, A., Semente, E., & Boateng, F. (2024). *Eco-innovation and sustainable development in industry 5.0*. IGI Global.
 - 34.Awan, U., Arnold, M. G., & Gölgeci, I. (2021). Enhancing green product and process innovation: Towards an integrative framework of knowledge acquisition and environmental investment. *Business Strategy and the Environment*, 30(2), 1283-1295.
 - 35.Awan, U., Bhatti, S. H., Shamim, S., Khan, Z., Akhtar, P., & Balta, M. E. (2022). The role of big data analytics in manufacturing agility and performance: moderation–mediation analysis of organizational creativity and of the involvement of customers as data analysts. *British Journal of Management*, 33(3), 1200-1220.
 - 36.Awan, U., Nauman, S., & Sroufe, R. (2021). Exploring the effect of buyer engagement on green product innovation: Empirical evidence from manufacturers. *Business Strategy and the Environment*, 30(1), 463-477.
 - 37.Awuah-Gyawu, M., Fianko, A. O., Halidu, O. B., Gyamfi, B. A., & Asongu, S. A. (2025). Corporate Governance Practices and Circular Supply Chain Management Relationship: Eco-Innovation Leadership and the Perceived Urgency Paradox Based on a Three-Way Interaction Model. *Business Strategy & Development*, 8(3), e70188.
 - 38.Awwad, A., Anouze, A. L. M., & Elbanna, S. (2025). Green product innovation: influences on environmental sustainability performance. *Management decision*.
 - 39.Azeem, M., Ahmed, M., Haider, S., & Sajjad, M. (2021). Expanding competitive advantage through organizational culture, knowledge sharing and organizational innovation. *Technology in Society*, 66, 101635.
 - 40.Babayev, F., & Balajayeva, T. (2023). Ways of increasing the competitiveness of. *International Journal*.

41. Badar, K., & Siddiquei, A. N. (2025). Unleashing green innovation: navigating the path with green inclusive leadership, green knowledge management and internal CSR communication. *Journal of Business & Industrial Marketing*, 40(2), 298-312.
42. Banerjee, R. (2025). ECONOMIC EMPOWERMENT AND FINANCIAL LITERACY. *Voices for Change*, 98.
43. Bano, A., & Shaikh, E. K. Z. (2024). Assessing Impact of Minimum Wages Policy on The Industrial Sector Worker's Well-being: A Case Study of Hyderabad Industrial Sector. *International Research Journal of Management and Social Sciences*, 5(2), 739-748.
44. Baquero, A. (2024). Unveiling the path to green innovation: the interplay of green learning orientation, knowledge management capability and manufacturing firm's capability to orchestrate resources. *Journal of Business & Industrial Marketing*, 39(10), 2205-2221.
45. Baquero, A. (2025). Organizational factors, ambidextrous innovation, absorptive capacity, and a firm's green competitive advantage. *Management Decision*.
46. Barclay, M. J., & Smith Jr, C. W. (1995). The maturity structure of corporate debt. *the Journal of Finance*, 50(2), 609-631.
47. Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, 17(1), 99-120.
48. Barney, J. B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of management*, 27(6), 643-650.
49. Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, 51(6), 1173.
50. Barwant, M. M., Ogidi, O. I., Yogita, C., & Munje, R. (2025). Study of consumers choices on pesticides use and sustainability. In *The Interplay of Pesticides and Climate Change: Environmental Dynamics and Challenges* (pp. 469-516). Springer.
51. Begum, S., Xia, E., Ali, F., Awan, U., & Ashfaq, M. (2022). Achieving green product and process innovation through green leadership and creative engagement in manufacturing. *Journal of Manufacturing Technology Management*, 33(4), 656-674.

52. Behera, P., & Sethi, N. (2022). Nexus between environment regulation, FDI, and green technology innovation in OECD countries. *Environmental Science and Pollution Research*, 29(35), 52940-52953.
53. Bejakovic, P. (2020). GLOBAL ECONOMIC PROSPECTS: DARKENING SKIES: International Bank for Reconstruction and Development/The World Bank. *Revija za Socijalnu Politiku*, 27(1), 99-104.
54. Bell, E., Harley, B., & Bryman, A. (2022). *Business research methods*. Oxford university press.
55. Bhardwaj, R., Srivastava, S., Mishra, H. G., & Sangwan, S. (2023). Exploring micro-foundations of knowledge-based dynamic capabilities in social purpose organizations. *Journal of Knowledge Management*, 27(4), 1016-1041.
56. Bhaumik, S., Driffield, N., Lavoratori, K., Song, M., & Vahter, P. (2025). Multinational strategy, institutions and spillovers: the role of institutions in knowledge spillovers in emerging markets. *The Journal of Technology Transfer*, 1-33.
57. Bhuiyan, F., Adu, D. A., Ullah, H., & Islam, N. (2025). Employee organisational commitment and corporate environmental sustainability practices: mediating role of organisation innovation culture. *Business Strategy and the Environment*, 34(4), 4485-4506.
58. Boota, M., Khan, M., Ali, S., Rafiq, M., Khan, W., Zahid, A., & Maqbool, S. (2025). Green Knowledge Management as a Catalyst for Green Organizational Performance: Unraveling the Mediation of Green Innovation Under the Lens of RBV. *Journal of the Knowledge Economy*, 1-28.
59. Borah, P. S., Dogbe, C. S. K., Pomegbe, W. W. K., Bamfo, B. A., & Hornuvo, L. K. (2023). Green market orientation, green innovation capability, green knowledge acquisition and green brand positioning as determinants of new product success. *European Journal of Innovation Management*, 26(2), 364-385.
60. Boter, H., & Lundström, A. (2005). SME perspectives on business support services: The role of company size, industry and location. *Journal of small business and enterprise development*, 12(2), 244-258.
61. Browne, M. W. (1993). Structured latent curve models. In *Multivariate analysis: Future directions 2* (pp. 171-197). Elsevier.
62. Buka, S. (2024). Assessment of mechanisms of regulation of innovative activity in the global competitiveness system. *OF THE INNOVATIVE UNIVERSITY OF EURASIA*, 2021(2022), 129.
63. Butt, M. J. (2021). A comparative analysis of the environmental policies in China and Pakistan: developing a legal regime for sustainable China-Pakistan

- economic corridor (CPEC) under the Belt and Road Initiative (BRI). *Ipri Journal*.
64. Camisón, C., & Villar-López, A. (2014). Organizational innovation as an enabler of technological innovation capabilities and firm performance. *Journal of business research*, 67(1), 2891-2902.
 65. Carbonell, P., Rodríguez-Escudero, A. I., & Pujari, D. (2009). Customer involvement in new service development: An examination of antecedents and outcomes. *Journal of product innovation management*, 26(5), 536-550.
 66. Castellani, P., Rossato, C., Giaretta, E., & Vargas-Sánchez, A. (2024). Partner selection strategies of SMEs for reaching the Sustainable Development Goals. *Review of Managerial Science*, 18(5), 1317-1352.
 67. Centobelli, P., Cerchione, R., & Esposito, E. J. J. o. K. M. (2018). How to deal with knowledge management misalignment: A taxonomy based on a 3D fuzzy methodology. 22(3), 538-566.
 68. Chaithanapat, P., Punnakitikashem, P., Oo, N. C. K. K., & Rakthin, S. (2022). Relationships among knowledge-oriented leadership, customer knowledge management, innovation quality and firm performance in SMEs. *Journal of Innovation & Knowledge*, 7(1), 100162.
 69. Chancel, L., Piketty, T., Saez, E., & Zucman, G. (2022). *World inequality report 2022*. Harvard University Press.
 70. Chang, C.-H. (2011). The influence of corporate environmental ethics on competitive advantage: The mediation role of green innovation. *Journal of business ethics*, 104, 361-370.
 71. Chang, W. (2021). Configurational Paths to Generating Knowledge Benefit through Customer Participation. *Asia Marketing Journal*, 23(2), 2.
 72. Chaparro-Banegas, N., Ibañez Escribano, A. M., Mas-Tur, A., & Roig-Tierno, N. (2024). Innovation facilitators and sustainable development: a country comparative approach. *Environment, Development and Sustainability*, 26(4), 8467-8495.
 73. Chaparro Banegas, N. (2024). Driving sustainable development: eco-innovation systems and public policies.
 74. Chen, J., & Liu, L. (2020). Customer participation, and green product innovation in SMEs: The mediating role of opportunity recognition and exploitation. *Journal of business research*, 119, 151-162.
 75. Chen, L., Hu, Y., Wang, R., Li, X., Chen, Z., Hua, J., Osman, A. I., Farghali, M., Huang, L., & Li, J. (2024). Green building practices to integrate renewable energy in the construction sector: a review. *Environmental Chemistry Letters*, 22(2), 751-784.

- 76.Chen, M.-N., & Chang, Y.-C. (2019). Absorptive capacity, appropriability depth and new product development in Taiwanese service firms. *Asian Journal of Technology Innovation*, 27(1), 108-133.
- 77.Chen, R., & Cao, L. (2025). How do enterprises achieve sustainable success in green manufacturing era? The impact of organizational environmental identity on green competitive advantage in China. *Kybernetes*, 54(1), 71-89.
- 78.Chen, X., Chen, Y., Zhang, X., & He, Q. (2025). Green transformational leadership and green innovation in megaprojects: is green knowledge sharing a missing link? *Engineering, Construction and Architectural Management*, 32(1), 194-213.
- 79.Chin, W. W. (1998). Commentary: Issues and opinion on structural equation modeling. In (pp. vii-xvi): JSTOR.
- 80.Chin, W. W. (2009). Bootstrap cross-validation indices for PLS path model assessment. In *Handbook of partial least squares: Concepts, methods and applications* (pp. 83-97). Springer.
- 81.Choi, T. Y., Narayanan, S., Novak, D., Olhager, J., Sheu, J. B., & Wiengarten, F. (2021). Managing extended supply chains. In (Vol. 42, pp. 200-206): Wiley Online Library.
- 82.Chuang, C.-H., Jackson, S. E., & Jiang, Y. (2016). Can knowledge-intensive teamwork be managed? Examining the roles of HRM systems, leadership, and tacit knowledge. *Journal of Management*, 42(2), 524-554.
- 83.Clift, B. (2025). Global economic governance and environmental crisis: the widening repertoire of IMF economic ideas and limits of its climate policy advocacy. *Climate Policy*, 25(8), 1266-1280.
- 84.Cloud, W., & Granfield, R. (2008). Conceptualizing recovery capital: Expansion of a theoretical construct. *Substance use & misuse*, 43(12-13), 1971-1986.
- 85.Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic press.
- 86.Coldwell, D., Venter, R., Joosub, T., & Duh, H. (2022). The tension between SMEs' growth and sustainability in emerging and developed countries' internationalization: towards a conceptual model. *Sustainability*, 14(8), 4418.
- 87.Cooper, C., Pereira, V., Vrontis, D., & Liu, Y. (2023). Extending the resource and knowledge based view: Insights from new contexts of analysis. In (Vol. 156, pp. 113523): Elsevier.
- 88.Cropanzano, R., & Mitchell, M. S. (2005). Social exchange theory: An interdisciplinary review. *Journal of management*, 31(6), 874-900.

89. Cuesta-Valiño, P., Gutiérrez-Rodríguez, P., García-Henche, B., & Núñez-Barriopedro, E. (2024). The impact of corporate social responsibility on consumer brand engagement and purchase intention at fashion retailers. *Psychology & Marketing*, 41(3), 649-664.
90. Cui, A. S., & Wu, F. (2016). Utilizing customer knowledge in innovation: antecedents and impact of customer involvement on new product performance. *Journal of the academy of marketing science*, 44, 516-538.
91. Cui, A. S., & Wu, F. (2017). The impact of customer involvement on new product development: contingent and substitutive effects. *Journal of product innovation management*, 34(1), 60-80.
92. Cui, R., Wang, J., Xue, Y., & Liang, H. (2021). Interorganizational learning, green knowledge integration capability and green innovation. *European Journal of Innovation Management*, 24(4), 1292-1314.
93. Daghfous, A. (2004). Absorptive capacity and the implementation of knowledge-intensive best practices. *SAM Advanced Management Journal*, 69(2), 21.
94. Daniel, M. F., & Auriac, E. (2011). Philosophy, critical thinking and philosophy for children. *Educational Philosophy and Theory*, 43(5), 415-435.
95. Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of knowledge management*.
96. de Castro Carvalho, G., Carneiro, J. d. D. S., Rocha, R. A. R., & Pereira, E. (2025). Plant-based trends: consumer's perception and factors that influence the purchase of plant-based products. *British Food Journal*.
97. Del Vecchio, P., Mele, G., Passiante, G., & Serra, D. (2023). Knowledge generation from Big Data for new product development: a structured literature review. *Knowledge Management Research & Practice*, 21(4), 892-907.
98. Denford, J. S. (2013). Building knowledge: developing a knowledge-based dynamic capabilities typology. *Journal of Knowledge Management*, 17(2), 175-194.
99. Dima, A., Bugheanu, A.-M., Dinulescu, R., Potcovaru, A.-M., Stefanescu, C. A., & Marin, I. (2022). Exploring the research regarding frugal innovation and business sustainability through bibliometric analysis. *Sustainability*, 14(3), 1326.
100. Dorrucchi, E., Meyer-Cirkel, A., & Santabárbara, D. (2009). *Domestic financial development in emerging economies: Evidence and implications*.
101. Drori, G. S. (2010). Globalization and technology divides: Bifurcation of policy between the “digital divide” and the “innovation divide”. *Sociological inquiry*, 80(1), 63-91.

102. Du, Y., & Wang, H. (2022). Green innovation sustainability: how green market orientation and absorptive capacity matter? *Sustainability*, 14(13), 8192.
103. Durán-Romero, G., López, A. M., Beliaeva, T., Ferasso, M., Garonne, C., & Jones, P. (2020). Bridging the gap between circular economy and climate change mitigation policies through eco-innovations and Quintuple Helix Model. *Technological Forecasting and Social Change*, 160, 120246.
104. Dzhengiz, T., & Niesten, E. (2020). Competences for environmental sustainability: A systematic review on the impact of absorptive capacity and capabilities. *Journal of business ethics*, 162(4), 881-906.
105. Elf, P., Werner, A., & Black, S. (2022). Advancing the circular economy through dynamic capabilities and extended customer engagement: Insights from small sustainable fashion enterprises in the UK. *Business Strategy and the Environment*, 31(6), 2682-2699.
106. Ellerton, P., & Kelly, R. (2022). Creativity and critical thinking. In *Education in the 21st century: STEM, creativity and critical thinking* (pp. 9-27). Springer.
107. Elshaer, I. A., Alyahya, M., Azazz, A. M., Mansour, M. A., Mohammad, A. A., & Fayyad, S. (2024). Understanding the nexus between social commerce, green customer citizenship, eco-friendly behavior and staying in green hotels. *Sustainability*, 16(4), 1409.
108. Eskildsen, J., Kristensen, K., & Gjesing Antvor, H. (2010). The relationship between job satisfaction and national culture. *The TQM Journal*, 22(4), 369-378.
109. Fadillah, M. I., Hadijah, H. S., & Gunawan. (2025). Navigating Green Knowledge Management: A Systematic Literature Review on Implementation, Challenges and Best Practices. *Journal of Information & Knowledge Management*, 2550113.
110. Fajarika, D., Trapsilawati, F., & Sopha, B. M. (2024). Influential factors of small and medium-sized enterprises growth across developed and developing countries: A systematic literature review. *International Journal of Engineering Business Management*, 16, 18479790241258097.
111. Fan, Q., Abbas, J., Zhong, Y., Pawar, P. S., Adam, N. A., & Alarif, G. B. (2023). Role of organizational and environmental factors in firm green innovation and sustainable development: Moderating role of knowledge absorptive capacity. *Journal of Cleaner Production*, 411, 137262.
112. Farooq, R. (2018). A conceptual model of knowledge sharing. *International Journal of Innovation Science*, 10(2), 238-260.

113. Fishbein, S., Van Wyk, N., Warren, R., & Sampson, S. (2015). Phylogeny to function: PE/PPE protein evolution and impact on *Mycobacterium tuberculosis* pathogenicity. *Molecular microbiology*, 96(5), 901-916.
114. Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, 18(1), 39-50.
115. Ganguly, A., Talukdar, A., & Chatterjee, D. (2019). Evaluating the role of social capital, tacit knowledge sharing, knowledge quality and reciprocity in determining innovation capability of an organization. *Journal of knowledge management*, 23(6), 1105-1135.
116. Gomez-Trujillo, A. M., Gonzalez-Perez, M. A., & Baena-Rojas, J. J. (2024). Sustainable strategy as a lever for corporate legitimacy and long-term competitive advantage: an examination of an emerging market multinational. *European Business Review*, 36(1), 112-139.
117. Grant, R. M. (2002). The knowledge-based view of the firm. *The strategic management of intellectual capital and organizational knowledge*, 17(2), 133-148.
118. Gruner, K. E., & Homburg, C. J. J. o. b. r. (2000). Does customer interaction enhance new product success? , 49(1), 1-14.
119. Guarino, A., Barbieri, I., Compare, C., & Albanesi, C. (2023). Facilitating assets-based development in rural communities through service-learning. *Community development journal*, 58(3), 512-538.
120. Gull, M., Rashid, M., Hassan, S., & Rehman, S. (2024). Role of top management green commitment, adaptability culture and green product innovation in boosting organizational green performance in Pakistan. *Research Journal of Textile and Apparel*, 28(4), 1066-1090.
121. Gunasekaran, A., Subramanian, N., & Ngai, W. T. E. (2019). Quality management in the 21st century enterprises: Research pathway towards Industry 4.0. In: Elsevier.
122. Gupta, S., Misra, S. C., Singh, A., Kumar, V., & Kumar, U. (2017). Identification of challenges and their ranking in the implementation of cloud ERP: A comparative study for SMEs and large organizations. *International Journal of Quality & Reliability Management*, 34(7), 1056-1072.
123. Gursoy, D., Başer, G., & Chi, C. G. (2025). Corporate digital responsibility: navigating ethical, societal, and environmental challenges in the digital age and exploring future research directions. *Journal of Hospitality Marketing & Management*, 34(3), 305-324.

124. Gyimah, P., Appiah, K. O., & Appiagyei, K. (2025). Unraveling contemporary trends on United Nations sustainable development goals: A new global bibliometric and literature review analysis. *Sustainable development*, 33(2), 2579-2598.
125. Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Industrial management & data systems*, 117(3), 442-458.
126. Hair, J. F., Ringle, C. M., & Sarstedt, M. (2013). Partial least squares structural equation modeling: Rigorous applications, better results and higher acceptance. *Long range planning*, 46(1-2), 1-12.
127. Hair Jr, 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: A workbook*. Springer Nature.
128. Hajian, M., & Kashani, S. J. (2021). Evolution of the concept of sustainability. From Brundtland Report to sustainable development goals. In *Sustainable resource management* (pp. 1-24). Elsevier.
129. Hashem, G. (2024). Adopting Industry 4.0 through absorptive capacity and innovation ambidexterity with the moderation of learning capability. *Business process management journal*, 30(6), 1995-2024.
130. Hashem, G., & Aboelmaged, M. (2023). Leagile manufacturing system adoption in an emerging economy: an examination of technological, organizational and environmental drivers. *Benchmarking: An International Journal*, 30(10), 4569-4600.
131. He, M., Chang, T.-C., Chenggang, W., & Pham, V. K. (2024). Does green knowledge management build successful green ventures in the presence of innovative practices and knowledge-sharing behaviour. *Journal of Innovation & Knowledge*, 9(4), 100618.
132. Helfat, C. E., Kaul, A., Ketchen Jr, D. J., Barney, J. B., Chatain, O., & Singh, H. (2023). Renewing the resource-based view: New contexts, new concepts, and new methods. *Strategic Management Journal*, 44(6), 1357-1390.
133. Hoskisson, R. E., Wan, W. P., Yiu, D., & Hitt, M. A. (1999). Theory and research in strategic management: Swings of a pendulum. *Journal of management*, 25(3), 417-456.
134. Hrdy, C. A. (2019). The general knowledge, skill, and experience paradox. *BCL Rev.*, 60, 2409.
135. Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, 6(1), 1-55.

136. Huang, D., Chen, S., Zhang, G., & Ye, J. (2018). Organizational forgetting, absorptive capacity, and innovation performance: A moderated mediation analysis. *Management Decision*, 56(1), 87-104.
137. Humayun, T., Li, S., Niazi, G. R., Humayun, S., & Younas, W. (2025). An empirical analysis of Pakistan's economic growth from the perspective of strong sustainability. *Natural Resources Forum*,
138. Hussain, M., Javed, A., Khan, S. H., & Yasir, M. (2025). Pillars of customer retention in the services sector: Understanding the role of relationship marketing, customer satisfaction, and customer loyalty. *Journal of the Knowledge Economy*, 16(1), 2047-2067.
139. Hussain, Z. (2023). Green Entrepreneurial Practices Among Small and Medium Enterprises in Karachi, Pakistan. In *Entrepreneurship and Green Finance Practices: Avenues for Sustainable Business Start-ups in Asia* (pp. 47-76). Emerald Publishing Limited.
140. Ibrahim, N. M. N., & Mahmood, R. B. (2016). Factors influencing small and medium enterprises' performance. *International Journal of Economic, Commerce and Management*, 4(1), 379-391.
141. Ibrahim, S., & Khan, R. U. (2025). From Sharing To Shaping: Investigating The Link Between Knowledge Exchange And Innovative Work Behaviour Among Educators. *Journal of Business and Management Research*, 4(3), 1-14.
142. Idrees, H., Xu, J., Haider, S. A., & Tehseen, S. (2023). A systematic review of knowledge management and new product development projects: Trends, issues, and challenges. *Journal of Innovation & Knowledge*, 8(2), 100350.
143. Iqbal, S., Ullah, S., Rizwan, A., Nazeer, N., Rasheed, M., & Siddiqi, A. F. I. (2025). Building competitive advantage: How organizational culture shapes absorptive capacity through knowledge sharing. *Journal of Organizational Effectiveness: People and Performance*.
144. Jalil, M. F., Md Isa, A. H. B., Awang Marikan, D. A. B., & Jais, M. b. (2025). Sharing is caring: Exploring digital knowledge sharing and SMEs' green innovative performance through the mediating role of green technology dynamism. *International Journal of Engineering Business Management*, 17, 18479790251359378.
145. Javed, A., Latif, K. F., Sahibzada, U. F., & Aslam, N. (2025). Knowledge management towards sustainable competitive advantage in higher education: an analysis of productive and counter-productive behaviors. *Journal of Organizational Effectiveness: People and Performance*, 12(3), 712-735.

146. Javed, A., Li, Q., & Basit, A. (2025). Enhancing ambidextrous green innovation: the role of green supply chain integration, knowledge capabilities and technology dynamism in manufacturing. *Journal of Manufacturing Technology Management*, 36(2), 431-454.
147. Jetten, J., Peters, K., Álvarez, B., Casara, B. G. S., Dare, M., Kirkland, K., Sánchez-Rodríguez, Á., Selvanathan, H. P., Sprong, S., & Tanjitpiyanond, P. (2021). Consequences of economic inequality for the social and political vitality of society: A social identity analysis. *Political Psychology*, 42, 241-266.
148. Jia, M., Hendry, L. C., & Stevenson, M. (2022). Supplier absorptive capacity: learning via boundary objects in sustainability-oriented supplier development initiatives. *International Journal of Operations & Production Management*, 42(8), 1173-1199.
149. Jiang, Y. (2025). Why do employees (not) share innovative knowledge, and how does this sharing influence career interest? *Knowledge Management Research & Practice*, 23(1), 26-39.
150. Jiang, Z., Huo, M.-L., Jones, J., Cheng, Z., Manoharan, A., & Spoehr, J. (2025). Thriving in future work: knowledge management and innovation perspectives. In (Vol. 23, pp. 1-12): Taylor & Francis.
151. Junejo, I., Sohu, J. M., Alwadi, B. M., Ejaz, F., Nasir, A., & Hossain, M. B. (2025). Green supply chain management and SMEs sustainable performance in developing country: role of green knowledge sharing, green innovation and big data-driven supply chain. *Discover Sustainability*, 6(1), 1-19.
152. Kalinowski, T. (2020). Institutional innovations and their challenges in the green climate fund: Country ownership, civil society participation and private sector engagement. *Sustainability*, 12(21), 8827.
153. Kamran, M., Rafique, M. Z., Nadeem, A. M., & Anwar, S. (2023). Does inclusive growth contribute towards sustainable development? Evidence from selected developing countries. *Social Indicators Research*, 165(2), 409-429.
154. Karim, R., Waaje, A., Roshid, M. M., & Yeamin, M. B. (2025). Turning the waste into wealth: Progressing toward global sustainability through the circular economy in waste management. In *Sustainable waste management in the tourism and hospitality sectors* (pp. 507-552). IGI Global Scientific Publishing.
155. Kenny, C. (2003). The Internet and economic growth in less-developed countries: A case of managing expectations? *Oxford Development Studies*, 31(1), 99-113.

156. Kero, C. A., & Bogale, A. T. (2023). A Systematic Review of Resource-Based View and Dynamic Capabilities of Firms and Future Research Avenues. *International Journal of Sustainable Development & Planning*, 18(10).
157. Kersten, R., Harms, J., Liket, K., & Maas, K. (2017). Small Firms, large Impact? A systematic review of the SME Finance Literature. *World development*, 97, 330-348.
158. Khan, K., Shams, M. S., Khan, Q., Akbar, S., & Niazi, M. M. (2022). Relationship among green human resource management, green knowledge sharing, green commitment, and green behavior: a moderated mediation model. *Frontiers in Psychology*, 13, 924492.
159. Khan, S. J., Dhir, A., Parida, V., & Papa, A. (2021). Past, present, and future of green product innovation. *Business Strategy and the Environment*, 30(8), 4081-4106.
160. Kim, H., & Qu, H. (2020). Effects of employees' social exchange and the mediating role of customer orientation in the restaurant industry. *International Journal of Hospitality Management*, 89, 102577.
161. Kim, J., Ali, M., & Roh, T. (2025). When Do Green Absorptive Capacity and Ambidextrous Open Innovation Foster Sustainable Performance. *Business Strategy and the Environment*.
162. Kirori, G. N. (2025). RELATIONSHIP BETWEEN SOCIAL CAPITAL AND MICRO, SMALL, AND MEDIUM ENTERPRISES (MSMES) RESILIENCE: A THEORETICAL FOUNDATIONAL MODEL. *African Journal of Emerging Issues*, 7(17), 18-35.
163. Kołodziej, D. (2022). The flexibility of organizational culture in shaping strategy under uncertainty. *Zeszyty Naukowe, s. Organizacja i Zarządzanie*(163), 213-222.
164. Kong, T., Feng, T., Huang, Y., & Cai, J. (2020). How to convert green supply chain integration efforts into green innovation: A perspective of knowledge-based view. *Sustainable Development*, 28(5), 1106-1121.
165. Koutoudjian, G., Diniz, L., Cespedes, R., & UNDP, V. G. (2021). About IRENA The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the. *IRENA promotes the*, 24.
166. Kumar, M., Raut, R. D., Mangla, S. K., Moizer, J., & Lean, J. (2024). Big data driven supply chain innovative capability for sustainable competitive

- advantage in the food supply chain: Resource-based view perspective. *Business Strategy and the Environment*, 33(6), 5127-5150.
167. Kurniawati, M. A. (2020). The role of ICT infrastructure, innovation and globalization on economic growth in OECD countries, 1996-2017. *Journal of Science and Technology Policy Management*, 11(2), 193-215.
 168. Le, T. T., Tran, P. Q., Lam, N. P., Tra, M. N. L., & Uyen, P. H. P. (2024). Corporate social responsibility, green innovation, environment strategy and corporate sustainable development. *Operations Management Research*, 17(1), 114-134.
 169. Lewin, A. Y., Massini, S., & Peeters, C. (2020). Absorptive capacity, socially enabling mechanisms, and the role of learning from trial and error experiments: A tribute to Dan Levinthal's contribution to international business research. *Journal of International Business Studies*, 51, 1568-1579.
 170. Li, C., Akhtar, S., Sohu, J. M., Shaikh, S. N., Junejo, I., & Iatzaz-Ul-Hassan, M. (2025). Navigating the SMEs Green Path: Exploring the Role of Green Absorptive Capacity, Green Innovation, and Environmental Regulation in Enhancing Environmental Performance. *SAGE Open*, 15(2), 21582440251342496.
 171. Li, S., Yang, M., Um, K.-H., & Kang, M. (2025). Knowledge absorption from customers and its interplay with supplier adaptability for better operational and innovation performance. *Journal of Manufacturing Technology Management*, 1-21.
 172. Lin, C.-Y., Chau, K. Y., & Moslehpour, M. (2024). Bridging the gap: The nexus of sustainability innovation, knowledge sharing, and green volunteerism for manufacturing entrepreneurial triumph. *Journal of Innovation & Knowledge*, 9(4), 100570.
 173. Lin, Y.-H., & Chen, Y.-S. (2017). Determinants of green competitive advantage: the roles of green knowledge sharing, green dynamic capabilities, and green service innovation. *Quality & Quantity*, 51, 1663-1685.
 174. Lin, Y.-H., & Chen, Y.-S. (2017). Determinants of green competitive advantage: the roles of green knowledge sharing, green dynamic capabilities, and green service innovation. *Quality & Quantity*, 51(4), 1663-1685.
 175. Liu, S. (2025). Green management promotes long-term business competitive advantage through the resource-based view. *Total Quality Management & Business Excellence*, 1-28.
 176. Liu, X., Yu, X., & Xing, W. (2022). Green Product Innovation via Green Transformational Leadership and employees' OCBE: The Moderating Role of

- Green Organizational Climate-Empirical Evidence from China'Manufacturing Enterprises. *Polish Journal of Environmental Studies*, 31(5).
177. Lomax, R. (2013). Introduction to structural equation modeling. In *Applied quantitative analysis in education and the social sciences* (pp. 245-264). Routledge.
 178. Longo, D., & Magnusson, M. (2024). Combining Innovation and Sustainability: Exploring Green Marketing Strategies in SMEs. In.
 179. Lu, C., Qi, Y., Hao, S., & Yu, B. (2025). How and when collaborative innovation networks influence new product development performance in SMEs: evidence from China. *Journal of Business & Industrial Marketing*, 40(1), 188-201.
 180. Luzi, F., Torre, L., Kenny, J. M., & Puglia, D. (2019). Bio-and fossil-based polymeric blends and nanocomposites for packaging: Structure–property relationship. *Materials*, 12(3), 471.
 181. Lv, C., Shao, C., & Lee, C.-C. (2021). Green technology innovation and financial development: do environmental regulation and innovation output matter? *Energy Economics*, 98, 105237.
 182. Ma, L., Ali, A., Shahzad, M., & Khan, A. (2025). Factors of green innovation: the role of dynamic capabilities and knowledge sharing through green creativity. *Kybernetes*, 54(1), 54-70.
 183. Ma, X., Qing, L., Ock, Y.-S., Wu, J., & Zhou, Y. (2022). The effect of customer involvement on green innovation and the intermediary role of boundary spanning capability. *Sustainability*, 14(13), 8016.
 184. Ma, X., Qing, L., Ock, Y., Wu, J., & Zhou, Y. (2022). The Effect of Customer Involvement on Green Innovation and The Intermediary Role of Boundary Spanning Capability. *Sustainability* 2022, 14, 8016. In: s Note: MDPI stays neu-tral with regard to jurisdictional claims in
 185. Mageswaran, J., Tamilselvan, P., Tamilarasu, J., & Sivasubramani, K. (2025). Analyzing the Effect of Eco-Friendly Branding on Consumer Purchasing Decisions on Sustainability in Marketing using Data Analytics. 2025 International Conference on Automation and Computation (AUTOCOM),
 186. Mahmood, T., & Mubarik, M. S. (2020). Balancing innovation and exploitation in the fourth industrial revolution: Role of intellectual capital and technology absorptive capacity. *Technological Forecasting and Social Change*, 160, 120248.
 187. Maitlo, Q., Wang, X., Jingdong, Y., Lashari, I. A., Faraz, N. A., & Hajaro, N. H. (2022). Exploring green creativity: The effects of green

- transformational leadership, green innovation climate, and green autonomy. *Frontiers in Psychology*, 13, 686373.
188. Majchrzak, A., Bogers, M. L., Chesbrough, H., & Holgersson, M. (2023). Creating and capturing value from open innovation: humans, firms, platforms, and ecosystems. *California Management Review*, 65(2), 5-21.
 189. Makhloufi, L. (2024). Do knowledge sharing and big data analytics capabilities matter for green absorptive capacity and green entrepreneurship orientation? Implications for green innovation. *Industrial Management & Data Systems*, 124(3), 978-1004.
 190. Malik, N. (2025). Guns better than education: political economy of defence, radical education policies, textbooks, and teachers' outlook in Pakistan. *Journal of Education Policy*, 40(4), 716-738.
 191. Marr, B. (2004). Is it impossible to benchmark intellectual capital. Conference Proceedings of the 25th McMaster World Congress,
 192. Marrucci, L., Daddi, T., & Iraldo, F. (2022). The circular economy, environmental performance and environmental management systems: the role of absorptive capacity. *Journal of Knowledge Management*, 26(8), 2107-2132.
 193. Martínez-Ardila, H. E., Duenas, M., & Becerra, L. (2025). The impact of knowledge absorptive capacity on the success of knowledge transfers in alliances: the mediating role of interorganizational link strength. *Problems and Perspectives in Management*, 23(2), 572.
 194. Masudi, M., Rahimi, A., Ejaz, E., Kargar, A. A., Hasin, B. A., & Shayan, N. A. (2025). Evaluating the Effectiveness and Challenges of Climate Change Policies in Afghanistan. *Environmental Quality Management*, 34(4), e70086.
 195. Mata-López, W. A., Juárez-Hernández, L. G., Tobón, S., & Montesinos-López, O. A. (2021). ANALYSIS OF CONSTRUCT VALIDITY AND RELIABILITY OF TWO INSTRUMENTS TO EVALUATE PROFESSIONAL ORIENTED ACTIVITIES. *Revista Española de Orientación y Psicopedagogía (REOP)*, 32(2).
 196. Matloob, S., Limón, M. L. S., Montemayor, H. M. V., Raza, A., & Rodriguez, J. C. C. (2023). Does strategic change enhance the relationship between firms' resources and SMEs performance in Pakistan? *Sustainability*, 15(3), 1808.
 197. Maziriri, E. T., & Maramura, T. C. (2022). Green innovation in SMEs: The impact of green product and process innovation on achieving sustainable competitive advantage and improved business performance. *Academy of Entrepreneurship Journal*, 28(1), 1-14.

198. McDougall, N., Wagner, B., & MacBryde, J. (2022). Leveraging competitiveness from sustainable operations: frameworks to understand the dynamic capabilities needed to realise NRBV supply chain strategies. *Supply Chain Management: An International Journal*, 27(1), 12-29.
199. McIntosh, C. N. (2007). Rethinking fit assessment in structural equation modelling: A commentary and elaboration on Barrett (2007). *Personality and Individual Differences*, 42(5), 859-867.
200. McIver, J., & Carmines, E. G. (1981). *Unidimensional scaling*. sage.
201. Mehmood, S., Nazir, S., Fan, J., & Nazir, Z. (2024). Navigating sustainability: the role of government regulations and management commitment in enhancing environmental performance in Pakistan's manufacturing sector. *Environment, Development and Sustainability*, 1-30.
202. Melnychuk, T., Schultz, C., & Wirsich, A. (2021). The effects of university–industry collaboration in preclinical research on pharmaceutical firms' R&D performance: Absorptive capacity's role. *Journal of Product Innovation Management*, 38(3), 355-378.
203. Migdadi, M. M. (2021). Knowledge management, customer relationship management and innovation capabilities. *Journal of Business & Industrial Marketing*, 36(1), 111-124.
204. Mohaghegh, M., Åhlström, P., & Blasi, S. (2024). Agile manufacturing and transformational capabilities for sustainable business performance: a dynamic capabilities perspective. *Production Planning & Control*, 35(16), 2273-2285.
205. Moran, T. H. (2006). *Harnessing foreign direct investment for development: policies for developed and developing countries*. CGD Books.
206. Morgan, T., Obal, M., & Anokhin, S. (2018). Customer participation and new product performance: Towards the understanding of the mechanisms and key contingencies. *Research Policy*, 47(2), 498-510.
207. Moten, A. R. (2021). *Humanising Education Maqasid Al-Shari'ah and Sustainable Development (IIUM PRESS)*. IIUM PRESS.
208. Mubarak, M. F., Jucevicius, G., Shabbir, M., Petraite, M., Ghobakhloo, M., & Evans, R. (2025). Strategic foresight, knowledge management, and open innovation: Drivers of new product development success. *Journal of Innovation & Knowledge*, 10(2), 100654.
209. Mulaik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equation models. *Psychological bulletin*, 105(3), 430.

210. Müller, J. M., Buliga, O., & Voigt, K.-I. (2021). The role of absorptive capacity and innovation strategy in the design of industry 4.0 business Models- A comparison between SMEs and large enterprises. *European management journal*, 39(3), 333-343.
211. Munir, T., & Watts, S. (2025). Exploring eco-friendly business practices and corporate innovation in Pakistan. *International Journal of Innovation Science*, 17(4), 786-802.
212. Nadeem, O., & Hameed, R. (2008). Evaluation of environmental impact assessment system in Pakistan. *Environmental Impact Assessment Review*, 28(8), 562-571.
213. Naim, M. F., Shehzad, N., Al Nahyan, M. T., Jabeen, F., & Usai, A. (2024). The impact of knowledge sharing on employee engagement through the mediating role of competency development and moderating role of social climate. *Journal of knowledge management*, 28(7), 1889-1916.
214. Nair, A. J., & Manohar, S. (2024). Green service consumption: unlocking customer expectations on technological transformations enhancing purchase experience in retail store. *International Journal of Information Management Data Insights*, 4(2), 100277.
215. Najafi-Tavani, S., Naudé, P., Smith, P., & Khademi-Gerashi, M. (2023). Teach well, learn better-Customer involvement and new product performance in B2B markets: The role of desorptive and absorptive capacity. *Industrial Marketing Management*, 108, 263-275.
216. Najafi Tavani, S., Sharifi, H., Soleimanof, S., & Najmi, M. (2013). An empirical study of firm's absorptive capacity dimensions, supplier involvement and new product development performance. *International Journal of Production Research*, 51(11), 3385-3403.
217. Naqshbandi, M. M., & Tabche, I. (2018). The interplay of leadership, absorptive capacity, and organizational learning culture in open innovation: Testing a moderated mediation model. *Technological Forecasting and Social Change*, 133, 156-167.
218. Naradda Gamage, S. K., Ekanayake, E., Abeyrathne, G., Prasanna, R., Jayasundara, J., & Rajapakshe, P. (2020). A review of global challenges and survival strategies of small and medium enterprises (SMEs). *Economies*, 8(4), 79.
219. Narteh, B. (2008). Knowledge transfer in developed-developing country interfirm collaborations: a conceptual framework. *Journal of Knowledge Management*, 12(1), 78-91.

220. Nasir, A., Zakaria, N., Do, N., & Velasquez, S. (2024). The impact of knowledge management on sustainable performance with mediation effect of green innovation in Malaysian SMEs. *VINE Journal of Information and Knowledge Management Systems*.
221. Ncube, A., Mtetwa, S., Bukhari, M., Fiorentino, G., & Passaro, R. (2023). Circular economy and green chemistry: the need for radical innovative approaches in the design for new products. *Energies*, 16(4), 1752.
222. Neale, R. E., Barnes, P. W., Robson, T. M., Neale, P. J., Williamson, C. E., Zepp, R. G., Wilson, S. R., Madronich, S., Andrady, A. L., & Heikkilä, A. M. (2021). Environmental effects of stratospheric ozone depletion, UV radiation, and interactions with climate change: UNEP Environmental Effects Assessment Panel, Update 2020. *Photochemical & Photobiological Sciences*, 20(1), 1-67.
223. Newman, A., Round, H., Wang, S., & Mount, M. (2020). Innovation climate: A systematic review of the literature and agenda for future research. *Journal of occupational and organizational psychology*, 93(1), 73-109.
224. Obiora, A. C. (2025). ADDRESSING ENVIRONMENTAL DEGRADATION: ADOPTING FRUGALITY AS AN ECO-THEOLOGICAL APPROACH TO SUSTAINABILITY. *JOURNALS*.
225. Odeyemi, O., Usman, F. O., Mhlongo, N. Z., Elufioye, O. A., & Ike, C. U. (2024). Sustainable entrepreneurship: A review of green business practices and environmental impact. *World Journal of Advanced Research and Reviews*, 21(2), 346-358.
226. Offenberger, D. (2009). Firm size and the effectiveness of the market for corporate control. *Journal of Corporate Finance*, 15(1), 66-79.
227. Ojha, D., Dayan, M., Struckell, B., Dhir, A., & Pohlen, T. (2023). Social exchange in buyer-supplier relationships and innovation speed: the mediating and moderating role of information sharing and knowledge channels. *Journal of knowledge management*, 27(6), 1509-1533.
228. Okeke, N. I., Alabi, O. A., Igwe, A. N., Ofodile, O. C., & Ewim, C. P.-M. (2024). Customer journey mapping framework for SMEs: Enhancing customer satisfaction and business growth. *World Journal of Advanced Research and Reviews*, 24(1), 2004-2018.
229. Okonkwo, E. R., Umeokafor, C. C., & Nwosu, I. C. (2025). Industrialization and Sustainable Development in Nigeria:: Issues and Prospects. *Review of Public Administration and Management Journal (ROPAMJ)*, 22(1), 225-256.

230. Ooi, K.-B. (2014). TQM: A facilitator to enhance knowledge management? A structural analysis. *Expert Systems with Applications*, 41(11), 5167-5179.
231. Opoku, E., Okafor, M., Williams, M., Aribigbola, A., & Olaleye, A. (2024). Enhancing small and medium-sized businesses through digitalization. *World Journal of Advanced Research and Reviews*, 23(2), 222.
232. Owusu, E. A., Zhou, L., Kwasi Sampene, A., Sarpong, F. A., & Arboh, F. (2024). Fostering Environmental Performance Via Corporate Social responsibility and Green Innovation initiatives: examining the moderating influence of competitive advantage. *Sage Open*, 14(2), 21582440241242847.
233. Paparoidamis, N. G., & Tran, H. T. T. (2019). Making the world a better place by making better products: Eco-friendly consumer innovativeness and the adoption of eco-innovations. *European Journal of Marketing*, 53(8), 1546-1584.
234. Park, S., & Kim, E.-J. (2018). Fostering organizational learning through leadership and knowledge sharing. *Journal of knowledge management*, 22(6), 1408-1423.
235. Patwary, A. K., Azam, N. R. A. N., Ashraf, M. U., Muhamed Yusoff, A., Mehmood, W., & Rabiul, M. K. (2025). Examining employee performance through knowledge management practices, organisational commitment and capacity building in the Malaysian hotel industry. *Global Knowledge, Memory and Communication*, 74(3/4), 733-752.
236. Peng, X.-Y., Zou, X.-Y., Zhao, X.-X., & Chang, C.-P. (2023). How does economic policy uncertainty affect green innovation? *Technological and Economic Development of Economy*, 29(1), 114–140-114–140.
237. Pereira, V., & Bamel, U. (2021). Extending the resource and knowledge based view: A critical analysis into its theoretical evolution and future research directions. *Journal of Business Research*, 132, 557-570.
238. Pisano, G. P. (1989). Using equity participation to support exchange: Evidence from the biotechnology industry. *JL Econ. & Org.*, 5, 109.
239. Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of applied psychology*, 88(5), 879.
240. Polas, M. R. H., Tabash, M. I., Bhattacharjee, A., & Dávila, G. A. (2023). Knowledge management practices and green innovation in SMES: the role of environmental awareness towards environmental sustainability. *International Journal of Organizational Analysis*, 31(5), 1601-1622.

241. Polasky, S., Bryant, B., Hawthorne, P., Johnson, J., Keeler, B., & Pennington, D. (2015). Inclusive wealth as a metric of sustainable development. *Annual Review of Environment and Resources*, 40, 445-466.
242. Popa, S., Soto-Acosta, P., & Martinez-Conesa, I. (2017). Antecedents, moderators, and outcomes of innovation climate and open innovation: An empirical study in SMEs. *Technological Forecasting and Social Change*, 118, 134-142.
243. Putra, I., Wiagustini, N. L. P., Ramantha, I. W., & Sedana, I. B. P. (2021). Financial sustainability based on resource based view theory and knowledge based view theory. *Academic of Accounting and Financial Studies Journal*.
244. Qalati, S. A., Siddiqui, F., Kumari, S., Badwy, H. E., Wu, Q., & Lu, M. (2025). Linking carbon footprint methodologies and environmental protection via sustainable product development with a moderating role of regulatory compliance. *Scientific Reports*, 15(1), 28594.
245. Qiu, L., Jie, X., Wang, Y., & Zhao, M. (2020). Green product innovation, green dynamic capability, and competitive advantage: Evidence from Chinese manufacturing enterprises. *Corporate Social Responsibility and Environmental Management*, 27(1), 146-165.
246. Raes, S. (2021). Understanding SME heterogeneity: towards policy relevant typologies for SMEs and entrepreneurship: an OECD Strategy for SMEs and Entrepreneurship.
247. Rahman, H. A. (2018). Green Consumerism (Kepenggunaan Hijau). *Asian journal of environment, History and heritage*, 2(2).
248. Rahman, M. H., Tanchangya, T., Rahman, J., Aktar, M. A., & Majumder, S. C. (2024). Corporate social responsibility and green financing behavior in Bangladesh: Towards sustainable tourism. *Innovation and Green Development*, 3(3), 100133.
249. Rahmat, T., & Ahman, E. (2025). Green Knowledge Sharing for Sustainable Competitive Advantage in The Halal Industry Through an HRM Perspective. *Jurnal Nusantara Aplikasi Manajemen Bisnis*, 10(1), 99-116.
250. Rahmat, T., Ahman, E., & Apriliani, D. (2024). Strategies to improve sustainable competitive advantage in the halal industry through knowledge sharing: HR perspective. *Equity: Jurnal Ekonomi*, 12(2), 116-130.
251. Rajâa, O., & Mekkaoui, A. (2025). Revealing the impact of social exchange theory on financial performance: a systematic review of the mediating role of human resource performance. *Cogent Business & Management*, 12(1), 2475983.

252. Rasheed, M., Liu, J., & Ali, E. (2025). Incorporating sustainability in organizational strategy: A framework for enhancing sustainable knowledge management and green innovation. *Kybernetes*, 54(4), 2363-2388.
253. Raza, S. H., & Khan, L. (2025). Beyond numbers: Mapping poverty disparities in Pakistan through a spatial lens. *Applied Spatial Analysis and Policy*, 18(1), 28.
254. Rehman, A., Ma, H., Ozturk, I., Murshed, M., & Dagar, V. (2021). The dynamic impacts of CO2 emissions from different sources on Pakistan's economic progress: a roadmap to sustainable development. *Environment, Development and Sustainability*, 23(12), 17857-17880.
255. Rehman, S., Asif, T., Nasir, A., Ullah, A., & Noor, N. (2024). Harnessing knowledge management for green product competitive advantage with green process innovation as a mediator. *Journal of Open Innovation: Technology, Market, and Complexity*, 10(2), 100274.
256. Rehman, S. U., Bresciani, S., Ashfaq, K., & Alam, G. M. (2022). Intellectual capital, knowledge management and competitive advantage: a resource orchestration perspective. *Journal of Knowledge Management*, 26(7), 1705-1731.
257. Ren, F., & Zhang, J. (2015). Job stressors, organizational innovation climate, and employees' innovative behavior. *Creativity Research Journal*, 27(1), 16-23.
258. Reppmann, M., Harms, S., Edinger-Schons, L. M., & Foege, J. N. (2025). Activating the sustainable consumer: The role of customer involvement in corporate sustainability. *Journal of the academy of marketing science*, 53(2), 310-340.
259. Rezaei, F., Khalilzadeh, M., & Soleimani, P. (2021). Factors affecting knowledge management and its effect on organizational performance: Mediating the role of human capital. *Advances in Human-Computer Interaction*, 2021(1), 8857572.
260. Rezaei Zadeh, M., Hackney, R., & Zeng, J. (2022). Augmenting learning processes of absorptive capacity for innovation: Insights for effective leadership within global pharmaceutical companies. *European Management Review*, 19(2), 263-284.
261. Riaz, M., Jie, W., Ali, S., & Chang, S. (2024). Assessing the role of organizational strategic factors in stimulating green innovation performance: moderating effects of green absorptive capacity. *Business Process Management Journal*, 30(4), 1013-1043.

262. Riaz, M., Jie, W., Sherani, Ali, S., & Chang, S. (2024). Assessing the role of organizational strategic factors in stimulating green innovation performance: moderating effects of green absorptive capacity. *Business Process Management Journal*, 30(4), 1013-1043.
263. Riva, F., Magrizos, S., & Rubel, M. R. B. (2021). Investigating the link between managers' green knowledge and leadership style, and their firms' environmental performance: The mediation role of green creativity. *Business Strategy and the Environment*, 30(7), 3228-3240.
264. Roberts, L., Nandy, M., Hassan, A., Lodh, S., & Elamer, A. A. (2022). Corporate accountability towards species extinction protection: insights from ecologically forward-thinking companies. *Journal of Business Ethics*, 178(3), 571-595.
265. Roos, J., Edvinsson, L., & Dragonetti, N. C. (1997). *Intellectual capital: Navigating the new business landscape*. Springer.
266. Roxas, B., Chadee, D., de Jesus, R. M. C., & Cosape, A. (2017). Human and social capital and environmental management in small firms: a developing country perspective. *Asian Journal of Business Ethics*, 6(1), 1-20.
267. Sahoo, M. (2019). Structural equation modeling: Threshold criteria for assessing model fit. In *Methodological issues in management research: Advances, challenges, and the way ahead* (pp. 269-276). Emerald Publishing Limited.
268. Sahoo, S., Kumar, A., & Upadhyay, A. (2023). How do green knowledge management and green technology innovation impact corporate environmental performance? Understanding the role of green knowledge acquisition. *Business Strategy and the Environment*, 32(1), 551-569.
269. Saleem, F., Zhang-Zhang, Y., Gopinath, C., & Malik, M. I. (2023). Antecedents of environmental strategies: a study of the manufacturing industry in Pakistan. *International Journal of Emerging Markets*, 18(10), 3616-3639.
270. Salman, R., Arshad, D., & Abu Bakar, L. J. (2016). Factors contributing to SMEs innovative culture in Punjab, Pakistan: a pilot study. *International Journal of Academic Research in Business and Social Sciences*, 6(8), 54-64.
271. Sampaio, M. (2025). Gamifying Knowledge Management Systems in Small and Medium-Sized Enterprises: Development and Validation of a Data Collection Tool. *Human Resources Development in a Digital Age*, 282.
272. Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. Pearson education.

273. Schoenherr, T., & Swink, M. (2012). Revisiting the arcs of integration: Cross-validations and extensions. *Journal of operations management*, 30(1-2), 99-115.
274. Schulze, K. (2024). The soft channels of policy diffusion: Insights from local climate change adaptation policy. *Policy Studies Journal*, 52(4), 881-906.
275. Seepana, C., Huq, F. A., & Paulraj, A. (2021). Performance effects of entrepreneurial orientation, strategic intent and absorptive capacity within coopetitive relationships. *International Journal of operations & production management*, 41(3), 227-250.
276. Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach*. John Wiley & sons.
277. Seow, A. N., Choong, Y. O., Low, M. P., Ismail, N. H., & Choong, C. K. (2024). Building tourism SMEs' business resilience through adaptive capability, supply chain collaboration and strategic human resource. *Journal of Contingencies and Crisis Management*, 32(2), e12564.
278. Sethibe, T., & Steyn, R. (2016). Organizational climate, innovation and performance: A systematic review. *Journal of Entrepreneurship and Innovation in Emerging Economies*, 2(2), 161-174.
279. Shafait, Z., & Huang, J. (2024). Examining the impact of sustainable leadership on green knowledge sharing and green learning: Understanding the roles of green innovation and green organisational performance. *Journal of Cleaner Production*, 457, 142402.
280. Shah, A. J., Anwar, M. N., & Naseem, M. A. (2025). Beyond the Fabric: How Consumer Awareness and Demand can shape Sustainable Textile Supply Chains in Pakistan. *International Journal of Management Research and Emerging Sciences*, 15(1), 156-175.
281. SHAH, S. A. R. (2019). INTEGRATED QUALITY AND ENVIRONMENTAL MANAGEMENT FRAMEWORK FOR SMALL AND MEDIUM FOOD PROCESSING ENTERPRISES IN PAKISTAN.
282. Shahbaz, M. H., Ahmad, S., & Malik, S. A. (2025). Green intellectual capital heading towards green innovation and environmental performance: assessing the moderating effect of green creativity in SMEs of Pakistan. *International Journal of Innovation Science*, 17(3), 683-704.
283. Shahzad, M., Qu, Y., Zafar, A. U., & Appolloni, A. (2021). Does the interaction between the knowledge management process and sustainable development practices boost corporate green innovation? *Business Strategy and the Environment*, 30(8), 4206-4222.

284. Shahzad, M., Qu, Y., Zafar, A. U., Rehman, S. U., & Islam, T. (2020). Exploring the influence of knowledge management process on corporate sustainable performance through green innovation. *Journal of knowledge management*, 24(9), 2079-2106.
285. Shaikh, S. S. (2025). The Influence of Social Media Literacy and Challenges on Youth Small Medium Entrepreneurs in Sindh, Pakistan. *International Journal of Media and Information Literacy*, 10(1), 75-90.
286. Shehzad, M. U., Jianhua, Z., Naveed, K., Zia, U., & Sherani, M. (2024). Sustainable transformation: an interaction of green entrepreneurship, green innovation, and green absorptive capacity to redefine green competitive advantage. *Business Strategy and the Environment*, 33(7), 7041-7059.
287. Shehzad, M. U., Zhang, J., Alam, S., Cao, Z., Boamah, F. A., & Ahmad, M. (2023). Knowledge management process as a mediator between collaborative culture and frugal innovation: the moderating role of perceived organizational support. *Journal of Business & Industrial Marketing*, 38(7), 1424-1446.
288. Shehzad, M. U., Zhang, J., Dost, M., Ahmad, M. S., & Alam, S. (2023). Linking green intellectual capital, ambidextrous green innovation and firms green performance: evidence from Pakistani manufacturing firms. *Journal of Intellectual Capital*, 24(4), 974-1001.
289. Shehzad, M. U., Zhang, J., Dost, M., Ahmad, M. S., & Alam, S. (2024). Knowledge management enablers and knowledge management processes: a direct and configurational approach to stimulate green innovation. *European Journal of Innovation Management*, 27(1), 123-152.
290. Shehzad, M. U., Zhang, J., Latif, K. F., Jamil, K., & Waseel, A. H. (2023). Do green entrepreneurial orientation and green knowledge management matter in the pursuit of ambidextrous green innovation: a moderated mediation model. *Journal of Cleaner Production*, 388, 135971.
291. Sherani, Zhang, J., Riaz, M., Boamah, F. A., & Ali, S. (2023). Harnessing technological innovation capabilities by the mediating effect of willingness to share tacit knowledge: a case from Pakistani software SMEs. *Kybernetes*, 52(12), 6590-6616.
292. Singh, V., Sharma, M., Jayapriya, K., Kumar, B. K., Chander, M., & Kumar, B. (2023). Service quality, customer satisfaction and customer loyalty: A comprehensive literature review. *Journal of Survey in Fisheries Sciences*, 10(4S), 3457-3464.
293. Sjödin, D., Frishammar, J., & Thorgren, S. (2019). How individuals engage in the absorption of new external knowledge: A process model of

- absorptive capacity. *Journal of Product Innovation Management*, 36(3), 356-380.
294. Sk, M. A. (2024). Sales strategy and marketing policy of Butterfly Marketing Limited.
 295. Somech, A., & Drach-Zahavy, A. (2013). Translating team creativity to innovation implementation: The role of team composition and climate for innovation. *Journal of Management*, 39(3), 684-708.
 296. Song, M., Yang, M. X., Zeng, K. J., & Feng, W. (2020). Green knowledge sharing, stakeholder pressure, absorptive capacity, and green innovation: Evidence from Chinese manufacturing firms. *Business Strategy and the Environment*, 29(3), 1517-1531.
 297. Song, W., Wang, G. Z., & Ma, X. (2020). Environmental innovation practices and green product innovation performance: A perspective from organizational climate. *Sustainable Development*, 28(1), 224-234.
 298. Song, W., & Yu, H. (2018). Green innovation strategy and green innovation: The roles of green creativity and green organizational identity. *Corporate Social Responsibility and Environmental Management*, 25(2), 135-150.
 299. Soper, D. (2021). A-priori sample size calculator for structural equation models [Software]. 2021. URL: <https://www.danielsoper.com/statcalc> [accessed 2023-05-25].
 300. Sposato, M., Dittmar, E. C., & Vargas Portillo, J. P. (2025). Navigating AI integration in sustainability-oriented organisations: balancing technological innovation with environmental and social values. *International Journal of Organizational Analysis*.
 301. Srinivas, S., & Sutz, J. (2008). Developing countries and innovation: Searching for a new analytical approach. *Technology in Society*, 30(2), 129-140.
 302. Stettler, T. R., Moosauer, E. J., Schweiger, S. A., Baldauf, A., & Audretsch, D. (2025). Absorptive capacity in a more (or less) absorptive environment: A meta-analysis of contextual effects on firm innovation. *Journal of Product Innovation Management*, 42(1), 18-47.
 303. Stewart, T. A. (2007). *The wealth of knowledge: Intellectual capital and the twenty-first century organization*. Currency.
 304. Stiglitz, J. E. (2015). Macroeconomic fluctuations, inequality, and human development. In *Macroeconomics and human development* (pp. 31-58). Routledge.

305. Storey, C., & Larbig, C. (2018). Absorbing customer knowledge: how customer involvement enables service design success. *Journal of service research*, 21(1), 101-118.
306. Sultana, N., Rahman, M. M., & Khanam, R. (2022). The effect of the informal sector on sustainable development: Evidence from developing countries. *Business Strategy & Development*, 5(4), 437-451.
307. Sun, W., Chen, K., & Mei, J. (2024). Integrating the resource-based view and dynamic capabilities: a comprehensive framework for sustaining competitive advantage in dynamic markets. *EPRA International Journal of Economic and Business Review*, 12(9), 1-8.
308. Sun, Y., Li, T., & Wang, S. (2022). "I buy green products for my benefits or yours": understanding consumers' intention to purchase green products. *Asia Pacific Journal of Marketing and Logistics*, 34(8), 1721-1739.
309. Sun, Y., Shahzad, M., Ali, A., & Razzaq, A. (2025). Synergistic effect of green knowledge sharing and green creative climate for circular economy practices: role of artificial intelligence information quality. *Journal of Manufacturing Technology Management*, 36(5), 1074-1095.
310. Sveiby, K. E. (2001). A knowledge-based theory of the firm to guide in strategy formulation. *Journal of intellectual capital*, 2(4), 344-358.
311. Swathi, A., & Johnpaul, M. (2025). Eco-friendly practices impact on organizational climate: Fostering a sustainable work culture. In *Green Management Approaches to Organizational Behavior* (pp. 145-174). IGI Global Scientific Publishing.
312. Tabachnick, B. G., & Fidell, L. S. (2007). *Experimental designs using ANOVA* (Vol. 724). Thomson/Brooks/Cole Belmont, CA.
313. Tager, A. G., Safwat, B. M., & Ibrahim, A. R. (2025). The Impact of Charismatic Leadership on Employee Creative Climate in Hospitality and Tourism Organizations. *International Journal of Tourism and Hospitality Management*, 8(1), 146-167.
314. Tanas, J., Fulmer, G. W., Hansen, W. E., & Ashley Fulmer, C. (2025). Using the Lenses of Organizational Culture and Climate for Research on Science Teacher Professional Learning. *Science Education*, 109(4), 1114-1128.
315. Tenenhaus, M., Pages, J., Ambroisine, L., & Guinot, C. (2005). PLS methodology to study relationships between hedonic judgements and product characteristics. *Food quality and preference*, 16(4), 315-325.
316. Tetteh, F. K., Owusu Kwateng, K., Nuertey, D., & Mensah, J. (2025). Unveiling the pathways to greening logistics: the interplay between supply

- chain pressures, green strategic alliance and corporate green culture. *The International Journal of Logistics Management*, 1-31.
317. Thakkar, J. J. (2020). Structural equation modelling. *Application for Research and Practice*.
 318. Trinh, B. M., Chang, B. P., & Mekonnen, T. H. (2023). The barrier properties of sustainable multiphase and multicomponent packaging materials: A review. *Progress in Materials Science*, 101071.
 319. Tsai, S.-p. (2018). Innovative behaviour of knowledge workers and social exchange attributes of financial incentive: implications for knowledge management. *Journal of knowledge management*, 22(8), 1712-1735.
 320. Tseng, S.-C., & Hung, S.-W. (2013). A framework identifying the gaps between customers' expectations and their perceptions in green products. *Journal of Cleaner Production*, 59, 174-184.
 321. Tseng, S.-M., & Wu, P.-H. (2014). The impact of customer knowledge and customer relationship management on service quality. *International journal of quality and service sciences*, 6(1), 77-96.
 322. Tu, Y.-X., Kubatko, O., Melnyk, L., Li, R., Kovalov, B., & Yaremenko, A. (2025). Economic, institutional and environmental drivers of SMEs' development in the EU: sustainable development goals perspective. *Environment, Development and Sustainability*, 27(8), 20101-20119.
 323. Tung, J. (2012). A study of product innovation on firm performance. *International Journal of Organizational Innovation (Online)*, 4(3), 84.
 324. ud Din, M. I., Hussain, K., Aftab, M., Fardos, M., Tayyab, S. M. A. M., & ul Islam, M. (2023). Critical evaluation of current policies and practices of SMEs and its impact on economy and women led enterprises in Pakistan. *Journal of Public Policy*, 2(2).
 325. Uddin, M. A., Priyankara, H. R., & Mahmood, M. (2019). Does a creative identity encourage innovative behaviour? Evidence from knowledge-intensive IT service firms. *European Journal of Innovation Management*, 23(5), 877-894.
 326. Udodiugwu, M. I., Obiakor, U. J., Eneremadu, K. E., Onwuegbuchulem, N. C., & Anyaegbunam, C. E. (2025). Promoting environmental sustainability through eco-friendly products: A critical review for sustainable development. *Annals of Management and Organization Research*, 6(3), 247-252.
 327. Uhlaner, L., Wright, M., & Huse, M. (2007). Private firms and corporate governance: An integrated economic and management perspective. *Small Business Economics*, 29(3), 225-241.

328. Ul-Durar, S., Awan, U., Varma, A., Memon, S., & Mention, A.-L. (2023). Integrating knowledge management and orientation dynamics for organization transition from eco-innovation to circular economy. *Journal of Knowledge Management*, 27(8), 2217-2248.
329. Ullah, S., Ahmad, T., Shafiq, M., Mehmood, T., Kukreti, M., & Shaukat, M. R. (2024). Improving green innovation performance: the role of integrating green customers and suppliers, government regulations, green knowledge integration capability. *Environment, Development and Sustainability*, 1-19.
330. Ullah, S., Khan, F. U., & Ahmad, N. (2022). Promoting sustainability through green innovation adoption: a case of manufacturing industry. *Environmental Science and Pollution Research*, 1-21.
331. Ullman, J. B., & Bentler, P. M. (2012). Structural equation modeling. *Handbook of Psychology, Second Edition*, 2.
332. Valaei, N., Rezaei, S., Bressolles, G., & Dent, M. M. (2022). Indispensable components of creativity, innovation, and FMCG companies' competitive performance: a resource-based view (RBV) of the firm. *Asia-Pacific Journal of Business Administration*, 14(1), 1-26.
333. Vangeri, A. K., Bathrinath, S., Anand, M. C. J., Shanmugathai, M., Meenatchi, N., & Boopathi, S. (2024). Green Supply Chain Management in Eco-Friendly Sustainable Manufacturing Industries. In *Environmental Applications of Carbon-Based Materials* (pp. 253-287). IGI Global.
334. Vann Yaroson, E., Chowdhury, S., Mangla, S. K., Dey, P., Chan, F. T., & Roux, M. (2024). A systematic literature review exploring and linking circular economy and sustainable development goals in the past three decades (1991–2022). *International Journal of Production Research*, 62(4), 1399-1433.
335. Varga, J. (2021). Defining the economic role and benefits of micro, small and medium-sized enterprises in the 21st century with a systematic review of the literature. *Acta Polytechnica Hungarica*, 18(11), 209-228.
336. Varpahovskis, E. (2022). Thousands of dormant ambassadors: Challenges and opportunities for relationship-building between Global Korea Scholarship (GKS) recipients and South Koreans. *Journal of Contemporary Eastern Asia*, 21(1), 1-32.
337. Velasco, C., Reinoso-Carvalho, F., Barbosa Escobar, F., Gustafsson, A., & Petit, O. (2024). Paradoxes, challenges, and opportunities in the context of ethical customer experience management. *Psychology & Marketing*, 41(10), 2506-2524.

338. Verma, J., & Khanna, A. (2023). Digital advancements in smart materials design and multifunctional coating manufacturing. *Physics Open*, 14, 100133.
339. Vitale, C., Bitetti, R., Wanner, I., Danitz, E., & Moiso, C. (2020). The 2018 edition of the OECD PMR indicators and database: Methodological improvements and policy insights.
340. Vivek, S. D., Beatty, S. E., & Morgan, R. M. (2012). Customer engagement: Exploring customer relationships beyond purchase. *Journal of marketing theory and practice*, 20(2), 122-146.
341. Wang, C., Zhang, X. e., & Teng, X. (2023). How to convert green entrepreneurial orientation into green innovation: the role of knowledge creation process and green absorptive capacity. *Business Strategy and the Environment*, 32(4), 1260-1273.
342. Wang, L., & Si, Y. (2025). Analysis of the Inverted “U” Relationship Between R&D Intensity and Green Innovation Performance: A Study Based on Listed Manufacturing Enterprises in China. *Sustainability*, 17(17), 7625.
343. Wang, S., Abbas, J., Sial, M. S., Álvarez-Otero, S., & Cioca, L.-I. (2022). Achieving green innovation and sustainable development goals through green knowledge management: Moderating role of organizational green culture. *Journal of Innovation & Knowledge*, 7(4), 100272.
344. Wang, Y., Li, Y., Ding, P., & Guo, B. (2025). Technology transfer and innovation efficiency in a large emerging economy: an integrative perspective of absorptive capacity and the technology ladder. *The Journal of Technology Transfer*, 1-37.
345. Warelow, P. J. (2013). Changing philosophies: A paradigmatic nursing shift from Nightingale. *Australian Journal of Advanced Nursing*, The, 31(1), 36-45.
346. Wei, S., Ang, T., & Jancenelle, V. E. (2018). Willingness to pay more for green products: The interplay of consumer characteristics and customer participation. *Journal of Retailing and Consumer Services*, 45, 230-238.
347. Weng, H.-H., Chen, J.-S., & Chen, P.-C. (2015). Effects of green innovation on environmental and corporate performance: A stakeholder perspective. *Sustainability*, 7(5), 4997-5026.
348. Wenlong, Z., Tien, N. H., Sibghatullah, A., Asih, D., Soelton, M., & Ramli, Y. (2023). Impact of energy efficiency, technology innovation, institutional quality, and trade openness on greenhouse gas emissions in ten Asian economies. *Environmental science and pollution research*, 30(15), 43024-43039.

349. Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic management journal*, 5(2), 171-180.
350. Westland, J. C. (2010). Lower bounds on sample size in structural equation modeling. *Electronic commerce research and applications*, 9(6), 476-487.
351. Wonglimpiyarat, J. (2015). Challenges of SMEs innovation and entrepreneurial financing. *World Journal of Entrepreneurship, Management and Sustainable Development*, 11(4), 295-311.
352. Wouters, J., & Odermatt, J. (2014). Comparing the ‘four pillars’ of global economic governance: A critical analysis of the institutional design of the FSB, IMF, World Bank, and WTO. *Journal of International Economic Law*, 17(1), 49-76.
353. Wu, J. (2013). Landscape sustainability science: ecosystem services and human well-being in changing landscapes. *Landscape ecology*, 28, 999-1023.
354. Xie, X., Huo, J., & Zou, H. (2019). Green process innovation, green product innovation, and corporate financial performance: A content analysis method. *Journal of business research*, 101, 697-706.
355. Ye, P., Liu, L., & Tan, J. (2022). Creative leadership, innovation climate and innovation behaviour: the moderating role of knowledge sharing in management. *European Journal of Innovation Management*, 25(4), 1092-1114.
356. Yerimpasheva, A. T., Medukhanova, L. A., Delovarova, L. F., & Brauweiler, H.-C. (2024). Exploring the competitiveness of Central Asian economies: a comparative analysis. *R-Economy*. 2024. Vol. 10. Iss. 1, 10(1), 105-118.
357. Yi, L., Wang, Y., Upadhaya, B., Zhao, S., & Yin, Y. (2021). Knowledge spillover, knowledge management capabilities, and innovation among returnee entrepreneurial firms in emerging markets: does entrepreneurial ecosystem matter? *Journal of Business Research*, 130, 283-294.
358. Yoshino, M., Sadlek, B., Yarime, M., & Ali, A. (2025). Knowledge absorption pathways for eco-innovation: an empirical analysis of small and medium-sized enterprises in the European Union. *European Journal of Innovation Management*, 28(2), 426-453.
359. Yusr, M. M., Mokhtar, S. S. M., Othman, A. R., & Sulaiman, Y. (2017). Does interaction between TQM practices and knowledge management processes enhance the innovation performance? *International Journal of Quality & Reliability Management*, 34(7), 955-974.
360. YUSUF, J. A., & OLUWAYEMI, S. A. (2025). CLIMATE CHANGE AS A DUAL POLITICAL AND ECONOMIC CRISIS: IMPLICATIONS FOR

361. Zahra, S. A. (2021). The resource-based view, resourcefulness, and resource management in startup firms: A proposed research agenda. *Journal of management*, 47(7), 1841-1860.
362. Zehra, S., Javed, M., & Zaki, S. (2025). Urban expansion and infrastructure strain in Pakistan: navigating the road to sustainable development. *Policy Journal of Social Science Review*, 3(4), 104-112.
363. ZHANG, B. (2025). Research on the relationship between manufacturing process digitalization and product quality performance: A case study of discrete manufacturing.
364. Zhang, J., Jehangir, F. N., Yang, L., Tahir, M. A., & Tabasum, S. (2024). Competitive advantage and firm performance: The role of organizational culture, organizational innovation, and knowledge sharing. *Journal of the Knowledge Economy*, 1-27.
365. Zhang, J., Jehangir, F. N., Yang, L., Tahir, M. A., & Tabasum, S. (2025). Competitive advantage and firm performance: The role of organizational culture, organizational innovation, and knowledge sharing. *Journal of the Knowledge Economy*, 16(1), 3081-3107.
366. Zhang, J., Liang, G., Feng, T., Yuan, C., & Jiang, W. (2020). Green innovation to respond to environmental regulation: how external knowledge adoption and green absorptive capacity matter? *Business Strategy and the Environment*, 29(1), 39-53.
367. Zhang, Z. (2024). Exploring the green edge: the role of market orientation and knowledge management in achieving competitive advantage through creativity. *Humanities and Social Sciences Communications*, 11(1), 1-16.
368. Zheng, L. J., Xiong, C., Chen, X., & Li, C.-S. (2021). Product innovation in entrepreneurial firms: How business model design influences disruptive and adoptive innovation. *Technological Forecasting and Social Change*, 170, 120894.
369. Zhong, H., Zheng, Z., Chu, M., & Gao, X. (2025). Digitalization, Managerial Preference, and Corporate Innovation in Transition Economies: Long-Term Evidence From Chinese 4,001 Listed Companies. *Sage Open*, 15(3), 21582440251360505.
370. Zhou, B. (2016). Lean principles, practices, and impacts: a study on small and medium-sized enterprises (SMEs). *Annals of Operations Research*, 241(1), 457-474.

371. Zhou, C., Xia, W., & Feng, T. (2024). Adopting relationship trust and influence strategy to enhance green customer integration: a social exchange theory perspective. *Journal of Business & Industrial Marketing*, 39(8), 1669-1686.
372. Zhou, J., Yang, J., & Zhou, X. (2021). Customer cooperation and employee innovation behavior: The roles of creative role identity and innovation climates. *Frontiers in Psychology*, 12, 639531.
373. Zhou, M., Govindan, K., & Xie, X. (2020). How fairness perceptions, embeddedness, and knowledge sharing drive green innovation in sustainable supply chains: An equity theory and network perspective to achieve sustainable development goals. *Journal of cleaner production*, 260, 120950.
374. Zhou, M., Govindan, K., Xie, X., & Yan, L. (2021). How to drive green innovation in China's mining enterprises? Under the perspective of environmental legitimacy and green absorptive capacity. *Resources Policy*, 72, 102038.
375. Zhou, S., Zhang, D., Lyu, C., & Zhang, H. (2018). Does seeing “mind acts upon mind” affect green psychological climate and green product development performance? The role of matching between green transformational leadership and individual green values. *Sustainability*, 10(9), 3206.
376. Zou, T., Ertug, G., & George, G. (2018). The capacity to innovate: A meta-analysis of absorptive capacity. *Innovation*, 20(2), 87-121.
377. Zou, X.-Y., Peng, X.-Y., Zhao, X.-X., Ma, J., & Chang, C.-P. (2024). Does income inequality affect green innovation? A non-linear evidence. *Technological and Economic Development of Economy*, 30(3), 578–602-578–602.

LIST OF PUBLICATIONS BY AUTHOR

1. Journal Publications

- **Qadeer, N., Zain Tahir, Maria Jose; (2025)** – “Ambidextrous Leadership: Driving Sustainable Project Performance through product Innovativeness and Environment features as a boundary condition”; *Measuring Business Excellence journal*, **IF:2.5, AIS: Q2, ABDC: B.**

- **Qadeer, N.,** Noureen Fatima; (2025) –“The intersection of Ecological leadership and GHRM: A blue print for a circular economy; E & M Economics and Management”, **IF:1.4, AIS: Q2, Scopus.**
- Muhammad Shoaib, **Qadeer, N.,** Roman Zámečník, Mohsin Javed, Ayesha Nawal; (2024) – “Towards a greener tomorrow: investigating the nexus of GHRM, technology innovation, and employee green behavior in driving sustainable performance”; Cogent Business & Management, **IF:3.0, AIS: Q2, Scopus.**
- **Qadeer, N.,** , Shazia Nauman, Mohsin Malik., (2025) – “Towards explaining green innovation from a knowledge-based dynamic capabilities perceptive”; Business strategy and the Environment, **IF:12.5, AIS: Q1, ABDC: A.**
- **Qadeer, N.,** Junaid Aftab, (2025) –“How Ambidextrous Leadership Drives Sustainable Project Performance through Green Knowledge and Innovation”; International Journal of Managing Projects in Business, **IF:3.4, AIS: Q2, ABDC: C.**
- **Qadeer, N.,** (2025) –“Artificial Intelligence and CEO Dismissal: The Influence of CEO Technological Background on Dismissal Outcomes” [Under Review]; Technology Analysis & Strategic Management, **IF:2.8, AIS: Q2, ABDC: B.**

2. Conferences

- **Qadeer, N.,** (2024) – “Eco-Empowerment: Maximizing Environmental Performance through Green Culture, GHRM, and Innovative Processes” 8th ICFE Zlin, Czech Republic.
- **Qadeer, N.,** (2024) – “How green organizational capital enhances environmental performance: roles of green human resource management practices, green dynamic capabilities, and green innovation” *Fostering innovation to address grand challenges* EURAM Bath, UK.
- **Qadeer, N.,** (2023) – “Opting the green culture in manufacturing firms and its Impact on organizational performance” MIC Conference Trieste, Italy.

3. Proceedings

- Shoaib Iqbal, **Qadeer, N.,**(2025) – Paris, France; Role of megaprojects in sustainability transition: How project governance and technological

integration impacts megaproject performance through stakeholder engagement, 8th European IEOM Conference in Paris, (Conference Proceedings Citation Index by Web of Science-Clarivate Analytics)

- **Qadeer, N.**, Doc. Ing. Jana Matošková, Ph.D., Shoaib Iqbal,(2025) – Paris, France; Integrating Environmental Features for Green Knowledge-Driven Sustainability, ; 8th European IEOM Conference in Paris, (Conference Proceedings Citation Index by Web of Science-Clarivate Analytics)
- Shoaib Iqbal, S. Ping Ho, **Qadeer, N.**, (2025) – Piacenza, Italy; Role of Megaprojects in Achieving Sustainability Transition, and How Do Project Governance and Technological Integration Impacts Megaproject Performance Through Stakeholder Engagement, 6th Conference of Megaproject Research interdisciplinary Team (MeRIT), (Conference Proceedings Citation Index by Web of Science-Clarivate Analytics)
- **Qadeer, N.**,(2024), Huelva, Spain; How green knowledge sharing and green product innovation enhance competitive advantage in SMEs: the roles of customer involvement, absorptive capacity, and innovation climate; Poster Presentation at university of Huelva, (Sustainable Horizons Shes)
- **Qadeer, N.**, (2023) – “Modeling green organizational capital and environmental performance: mediating and moderating the role of green knowledge sharing and GHRM practices”BM Conference Vilnius, LITHUANIA.
- **Qadeer, N.**, Shazia Nauman; (2021) – “How Green Knowledge Sharing Enhances Green Innovation: The Roles of Innovation Capacity and Knowledge Creation”, International Scientific Conference, Contemporary Issues in Business, Management and Economics Engineering, Sri Lanka (Conference Proceedings Citation Index by Web of Science-Clarivate Analytics)

AUTHOR'S CURRICULUM VITAE

Full name: Nosheen Qadeer

Nationality: Pakistani

E-mail: gadeer@utb.cz , nosheenqadeer1@gmail.com

WORK EXPERIENCE

2021-2022

Lecturer

Riphah international university, Riphah school of
Business and Management, Lahore. Pakistan

2020-2021

Production Engineer

Pure Foods Company, Lahore. Pakistan

2019-2020

Maintenance Engineer

MGA group of industries, Lahore. Pakistan

EDUCATION

10/01/23-Current

PhD in Management & Economics

Tomas Bata university Zlin, Czech Republic

2019-2021

M.S. Engineering Management

Riphah international university Lahore, Pakistan

2015-2019

BSc. Mechanical Engineering

University of Central Punjab Lahore, Pakistan

ADDITIONAL KNOWLEDGE

- Leader of the research project – IGA/FaME/2025/010 - Enterprise performance and innovation: the role of corporate social responsibility, digitalization, servant leadership, and uncertainty,
- Team member of the research project – IGA/FaME/2024/013 -Assessment of green knowledge sharing, risk management, green consumerism and enterprise competitiveness in the aviation and tourism industry: The Czech context.

- Member of the research team – IGA/FaME/2024/013 - How green knowledge sharing enhances competitive advantage in SMEs: unpacking the missing links- Zlin. Czech Republic
- Team member of the research project – IGA/FaME/2023/012 - Closed and open innovation: role of human resource, servant leadership, digitalization, and uncertainty.

LANGUAGE SKILLS

English	C1
Urdu	Native Language

Nosheen Qadeer

How green knowledge sharing enhances green product innovation in SMEs: the roles of customer involvement, absorptive capacity, and innovation climate

Jak sdílení zelených znalostí zlepšuje zelené inovace produktů v malých a středních podnicích: role zapojení zákazníků, absorpční kapacity a inovačního klimatu

Doctoral Thesis

Published by: Tomas Bata University in Zlin,
nam. T.G.Masaryka 5555, 760 01 Zlin.

Edition: 5 pcs

Typesetting by: Nosheen Qadeer

This publication has not undergone any proofreading or editorial review.

Publication Year: 2026