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Green Innovation, Business Opportunities and Managerial Environmental Concern in the Performance of Jordanian Agri-Food Firms: A Conceptual Framework

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ABSTRACT

The agri-food sector in developing countries like Jordan plays a critical role in economic development but faces growing environmental challenges due to resource inefficiencies, ecological degradation, and increasing sustainability pressures. Green innovation (GI) has emerged as a vital strategy to enhance both environmental and financial performance. However, existing research has largely overlooked how the dimensions of GI, namely green product, green process, and green organizational innovation, interact with internal and external drivers in low-technology, resource-constrained sectors. In particular, the mediating role of business opportunities and the moderating role of managerial environmental concern remain underexplored. To address this gap, this conceptual study proposes an integrative framework that synthesizes insights from the Porter Hypothesis, Ecological Modernization Theory, the Resource-Based View, the Natural Resource-Based View, Stakeholder Theory, and Institutional Theory. The framework incorporates four key drivers: market demand, environmental collaboration, regulation, and firm capabilities, and examines their influence on the three dimensions of GI. It also positions business opportunities as a mediating mechanism and managerial environmental concern as a moderating factor in the relationship between GI and firm performance. Tailored to the context of Jordan's agri-food sector, the proposed model offers a foundation for future empirical research and provides strategic insights for firms and policymakers seeking to advance sustainable innovation in developing economies.

1. Introduction

The world is facing multiple interlinked crises, including environmental degradation, political instability, economic hardship, and wars. These issues threaten diplomatic relations and cause serious economic difficulties. Such economic challenges impact nearly all sectors - including political and environmental spheres - by restricting the financial resources needed for development, especially in the agri-food sector (Cueto et al., 2022). These difficulties are further intensified by geopolitical tensions, such as the Russian-Ukrainian war, which has disrupted global markets and driven up prices, prompting governments to seek strategies that enhance productivity and resource efficiency (Bluszcz & Valente, 2022). In Jordan, global crises are compounded by domestic pressures, including the influx of refugees from Syria and Iraq, which has increased unemployment and strained public services (Mugableh, 2021). Although the economy is slowly recovering from the impacts of COVID-19, high inflation and unemployment remain major concerns (World Bank, 2023).

The agri-food sector faces additional challenges related to environmental sustainability, food security, and intensifying competition shaped by evolving consumer perceptions. In this context, innovation is more urgent than ever, particularly with the rise of disruptive technologies like the Internet of Things (IoT) and data-driven platforms (big data) (Bresciani, 2017). Growing environmental concerns are pushing governments and firms to pursue green innovation (GI) as a means to build long-term competitive advantages (Cai & Li, 2018). Sustainable development in Jordan must aim to minimize natural resource consumption while aligning economic growth with environmental objectives (Dai et al., 2018). Recent and impending legislation is pushing firms to adopt green practices—not only to meet regulatory requirements but also to respond to consumer demand for sustainable products and fulfill broader environmental responsibilities (Dangelico, 2015). Although GI is attracting increasing interest, scholars remain divided on its actual impact on firm performance (Trump & Gunther, 2017).

While Crabbé et al. (2013) noted that most GI research has focused on the industrial sector, there is growing recognition of the need to explore other sectors—particularly agri-food—due to its considerable environmental footprint (Shearmur & Doloreux, 2015). Research in this area is essential for advancing green practices, informing regulations and policy, and supporting sustainable development goals (Gente & Pattanaro, 2019). Small businesses often struggle to gain competitive benefits from green practices (Del Ro González, 2005) and therefore tend to deprioritize environmental considerations in their management strategies (Revell & Rutherfoord, 2003). Moreover, there is a lack of research on these issues in traditional sectors like agri-food, which, despite being classified as low-tech, exhibit significant potential for innovation (Triguero et al., 2018). Consequently, the impact of green practices on the performance of firms in low-tech sectors like agri-food remains poorly understood.

Most green innovations in the agri-food sector are acquired externally, with limited internal development (Cuerva et al., 2014). This gap is especially relevant for green organizational innovation, which is understudied in low-tech sectors like agri-food (Rabadán et al., 2020). Additionally, much of the existing literature emphasizes green product and process innovation, with limited focus on the organizational dimension (Molthan-Hill et al., 2017), resulting in a fragmented understanding of GI across industries (Rodriguez & Wiengarten, 2017). Thus, this study seeks to address a key gap by focusing on green organizational innovation within the Jordanian agri-food sector, a context marked by limited access to advanced technologies and high implementation costs (Vazquez et al., 2016). Moreover, there is a lack of studies examining the relationship between business opportunities (BO), financial and environmental performance, and the three dimensions of GI in this sector. This research investigates how GI influences firm performance in this context, particularly the mediating role of BO. The study also examines the moderating role of MEC in the relationship between GI and performance. Furthermore, it explores four key drivers of GI (regulation, market demand, environmental collaboration, and resources and dynamic

capabilities). The three GI dimensions (green product innovation, green process innovation, and green organizational innovation) are analyzed in relation to environmental and financial performance.

The purpose of the work is to examine how GI, in its various forms (green product, green organizational, and green process innovation), influences Firm performance. The possible contributions of BO and MEC are also focused on this analysis. This study adopts a conceptual research approach, synthesizing existing literature to develop a theoretical framework without the use of empirical data. In doing so, the study will seek to:

- Explore the business opportunity and firm performance driven by integrating a green innovation framework in the Jordanian agri-food industry.
- Investigate the moderating role of MEC on the impact of GI on performance.
- Examine the underlying factors driving business opportunity and firm performance using the green innovation framework in the Jordanian agri-food industry.

The rest of this work is organized thus: The literature review is presented in Section 2, while the underpinning theories are presented in Section 3. The framework of the study is presented in Section 4, then the discussion is presented in Section 5, while the conclusion and recommendations are presented in Section 6.

2. Literature Review

2.1 Overview of the Agri-food Sector in Jordan

The agri-food sector in Jordan plays a crucial role in public health, impacting nutrition and food safety. Employing over 52,000 people, the sector generated 4.1 billion Jordanian dinars in income in 2015, contributing 6.3% of GDP, and 6.2% in 2021. Exports in 2021 reached JD541.1 million, equivalent to more than 10% of the Kingdom's industrial exports. This sector is predominantly composed of MSMEs, which account for more than 95% of organizations and contribute about 25.9% of the net value added in the commercial field (Alawdin et al., 2023; Hundaileh & Fayad, 2019).

Jordan's food sector contributes nearly 30% of the country's total greenhouse gas (GHG) emissions and faces acute water stress (Crippa et al., 2021). In response, the government has implemented its National Strategy for Food Security (2021–2030), supported by the FAO and World Food Program (WFP). The Council for Food Security was also formed under the Ministry of Agriculture's oversight (Rabboh et al., 2023).

2.2 Green Innovation (GI)

Green innovation integration improves efficiency and synergy, opening doors for market access, higher sales, and increased profitability (Wang et al., 2022). It relies on technologies that focus on energy savings, pollution prevention, recycling, and the development of eco-friendly products to reduce environmental risks, especially those tied to resource and energy use (Tang et al., 2018; Tarigan et al., 2021).

The GI framework includes three key types: process, product, and organizational innovation (Chen et al., 2006). When integrated into corporate strategies, these forms of innovation can enhance competitiveness and improve both environmental and organizational performance (Cheng et al., 2014). Green Process Innovation (GPR) improves production through technologies that minimize negative environmental impacts throughout the product life cycle (Tang et al., 2018). GPR helps companies reclaim waste, reduce harmful emissions, and improve production efficiency by eliminating resource loss (Jakobsen & Clausen, 2016).

Green Product Innovation (GPI), on the other hand, focuses on designing and developing products using non-toxic and renewable materials (Ashraf et al., 2023; Zhang et al., 2019). By aligning product design with sustainability, GPI allows firms to access green markets and achieve competitive advantages (Karabulut & Hatipoğlu, 2020). Green Organizational Innovation (GOI) refers to eco-friendly operational and administrative practices that aim to reduce costs, enhance business performance, and improve employee satisfaction (Hizarci-Payne et al., 2021; Barin Cruz et al., 2006). While process innovation is largely technology-driven, GOI emphasizes structures, people, and culture to reduce environmental impact through green knowledge and practices.

2.3 Green Innovation Drivers

Several internal and external factors influence GI implementation. This study focuses on four primary drivers: environmental regulation (ER), environmental collaboration (COL), firm resources and dynamic capabilities (FR), and market demand (MD). Each of these drivers affects the adoption of green products, processes, and organizational innovations within firms (Singh et al., 2016).

Environmental Regulation (ER) plays a critical role in shaping firm behavior and achieving policy goals (Zhang & Song, 2021). Regulatory tools can be either market-based incentives or command-andcontrol mechanisms. The Porter Hypothesis posits that well-designed regulation can stimulate innovation and enhance economic and environmental performance (Porter & van der Linde, 1995). However, some argue that regulatory compliance may divert resources from innovation investments. Still, evidence suggests a positive correlation between environmental regulations and GI (Luo et al., 2021).

Environmental Collaboration (COL) involves working with stakeholders to reduce environmental impacts throughout the supply chain (Vachon & Klassen, 2008). Strong external networks increase the likelihood of adopting GI practices (Cai & Zhou, 2014). Partnerships with universities and research institutions help firms overcome technological challenges, gain legitimacy, and strengthen green innovation capabilities (Díaz-García et al., 2015). Collaborative R&D with competitors can reduce risk and accelerate the innovation timeline (Vasuvanich et al., 2020).

Firm Resources and Dynamic Capabilities (FR) are also crucial. According to the Resource-Based View (RBV), firms gain a sustainable advantage by leveraging unique, hard-to-replicate resources (Barney, 1991). RBV includes static resources and dynamic capabilities—the latter emphasizing adaptation in fastchanging environments (Schulze, 1994). Firms must evolve continuously to stay competitive (Teece et al., 1997). Dynamic capabilities enable proactive responses to environmental regulation through innovative solutions, fostering resilience and long-term success (Ramanathan et al., 2017). However, there remains a gap in understanding how firms sustain competitive advantage through these capabilities in dynamic markets (Teece, 2007; Tariq et al., 2017).

Market Demand (MD) is a major external driver of GI. Environmentally conscious consumers pressure firms to reduce energy use and toxic inputs (Horbach et al., 2012). As consumer preference shifts toward organic and energy-efficient products, firms must adapt their innovation strategies (Tang et al., 2018; Rana & Paul, 2017). Market demand has been found to influence process innovation more strongly than product innovation (El-Kassar & Singh, 2019). Nonetheless, responding to every market signal can sometimes reduce innovation effectiveness (Eggers et al., 2020).

2.4 Firm Performance

Firm performance is often measured through financial indicators but increasingly includes environmental outcomes as well (Wang et al., 2021). Profitability, market value, growth, customer satisfaction, and operational efficiency are key dimensions (Tarigan et al., 2021). Companies that integrate

sustainability into their operations may achieve competitive advantages and build stronger reputations (Nguyen et al., 2021; Khairani et al., 2022).

2.5 Business opportunities (BO, i.e., the opportunity to reduce costs and increase revenues)

Business opportunities refer to firms' potential to increase revenues and reduce costs through green innovation. This includes responding to sustainable procurement policies and accessing environmentally conscious markets (Kunzik, 2003). Firms can cut manufacturing costs by enhancing energy efficiency and reducing raw material use (Torugsa et al., 2012; Hermundsdottir & Aspelund, 2022). BOs may also emerge through first-mover advantages, stakeholder over-performance, or differentiation strategies (Liao, 2016; Buysse & Verbeke, 2003). According to inside-out strategy, firms can develop strategic resources through early investments in green technology (Hojnik et al., 2017).

2.6 Managerial Environmental Concern (MEC)

Managerial Environmental Concern (MEC) reflects the level of awareness and action by executives toward environmental issues (Xue et al., 2019). Firms with high MEC are more likely to adopt ecoinnovative practices (Song et al., 2021; Mo et al., 2022). MEC can also moderate the impact of GI on firm performance, particularly when firms face high implementation costs (Tang et al., 2018). While MEC may not directly influence product innovation, it can enhance the relationship between process innovation and firm outcomes. However, further research is needed to clarify MEC's full moderating role.

3. Underpinning Theory

This section outlines the theoretical foundations relevant to understanding how green innovation (GI) influences firm performance, particularly through business opportunities (BO) and managerial environmental concern (MEC). Theories considered include the Porter Hypothesis, Ecological Modernization Theory (EMT), the Natural Resource-Based View (NRBV), Stakeholder Theory, and Institutional Theory. These theories help explain how market demand, collaboration, firm resources and capabilities, and regulatory pressures drive green innovation in the agri-food sector.

3.1 Porter Hypothesis

The Porter Hypothesis argues that well-designed environmental regulations can stimulate innovation and enhance firm competitiveness (Porter, 1991; Porter & van der Linde, 1995). Rather than merely imposing compliance costs, regulation may prompt innovative practices that increase productivity and create added value. This leads to "win-win" outcomes where pollution reduction and competitive gains occur simultaneously. Torugsa et al. (2012) and Bos-Brouwers (2010) suggest that such innovation can yield cost savings (e.g., reduced energy and water use) and reputation benefits (e.g., brand loyalty and improved customer satisfaction).

3.2 Natural Resource-Based View (NRBV) and Resource-Based View (RBV)

The RBV posits that firms gain competitive advantage through the possession of unique, valuable, and hard-to-imitate resources (Barney, 1991). In the GI context, this includes leveraging green technologies, specialized knowledge, and intangible assets to enhance both environmental and financial outcomes (Cheng et al., 2014).

However, RBV has been criticized for insufficient attention to adaptability. The dynamic capabilities approach, introduced by Teece (2007), addresses this gap by focusing on how firms renew and transform capabilities in response to environmental changes. NRBV extends RBV by incorporating ecological

considerations. It argues that firms achieve long-term competitiveness by integrating environmental capabilities into their strategies (Hart, 1995). Resources must not only be rare and inimitable but also aligned with sustainability objectives. NRBV thus underpins ecological modernization by linking green innovation with the development of valuable organizational competencies (Li, 2021).

3.3 Ecological Modernization Theory (EMT)

EMT contends that environmental protection and economic growth are compatible and mutually reinforcing. Technological, organizational, and social innovations can reduce ecological harm while improving productivity and competitiveness (Murphy & Gouldson, 1998). At the firm level, EMT frames environmental management as a strategic tool and an opportunity rather than a constraint (Revell & Blackburn, 2007). By embedding clean technologies and aligning them with organizational change, firms can overcome barriers to green innovation and gain strategic benefits (Murphy & Gouldson, 2000).

3.4 Stakeholder Theory

Stakeholder Theory emphasizes the importance of addressing the expectations and influence of both primary and secondary stakeholders in pursuing green innovation. Hamilton (1995) notes that environmental negligence poses reputational and financial risks to shareholders. Reinhardt (1999) adds that firms with poor environmental images may face difficulties attracting environmentally conscious talent. As such, stakeholder engagement is essential for fostering legitimacy, trust, and long-term performance (Berrone et al., 2013).

3.5 Institutional theory

Institutional Theory explains how external pressures - such as regulations, norms, and industry expectations - influence organizational behaviour. Firms often adopt green innovation practices in response to institutional pressures aimed at conformity and legitimacy (Abernethy & Stoelwinder, 1995; Cai & Li, 2018). These pressures shape how and when organizations embrace green products and processes. As noted by Tariq et al. (2017), institutional theory is increasingly used to examine how regulatory, normative, and mimetic forces influence green innovation adoption.

4. Proposed Framework

As mentioned in the literature, the structure of green innovation is mainly derived from concepts originating from the fields of environmental economics, innovation economics, and management. To fill the gap concerning the relationship between green innovation and firm performance, this study proposes a conceptual framework that incorporates MEC and BO. This study entails a number of important theories, such as the Porter Hypothesis, Institutional theory, Stakeholder theory, NRBV, RBV, and Ecological Modernization Theory (EMT). The framework looks at four drivers of green innovation: market demand, environmental collaboration, firm resources and capabilities, and regulation; it also explores three dimensions of green innovation, which are green product, process, and organizational innovation. which in turn positively influences both Environmental Performance (FEP) and Financial Performance (FFP). Business opportunities mediate the link between green innovation and firm performance, while Managerial Environmental Concern (MEC) moderates this impact. Additionally, firm-level controls such as firm size and age, and respondent-level controls such as respondent's position, are incorporated to account for variability in green innovation adoption. Hence, a conceptual framework is derived (as shown in Fig.1), and 31 propositions are formulated based on the above assertions. (As shown in Table 1).

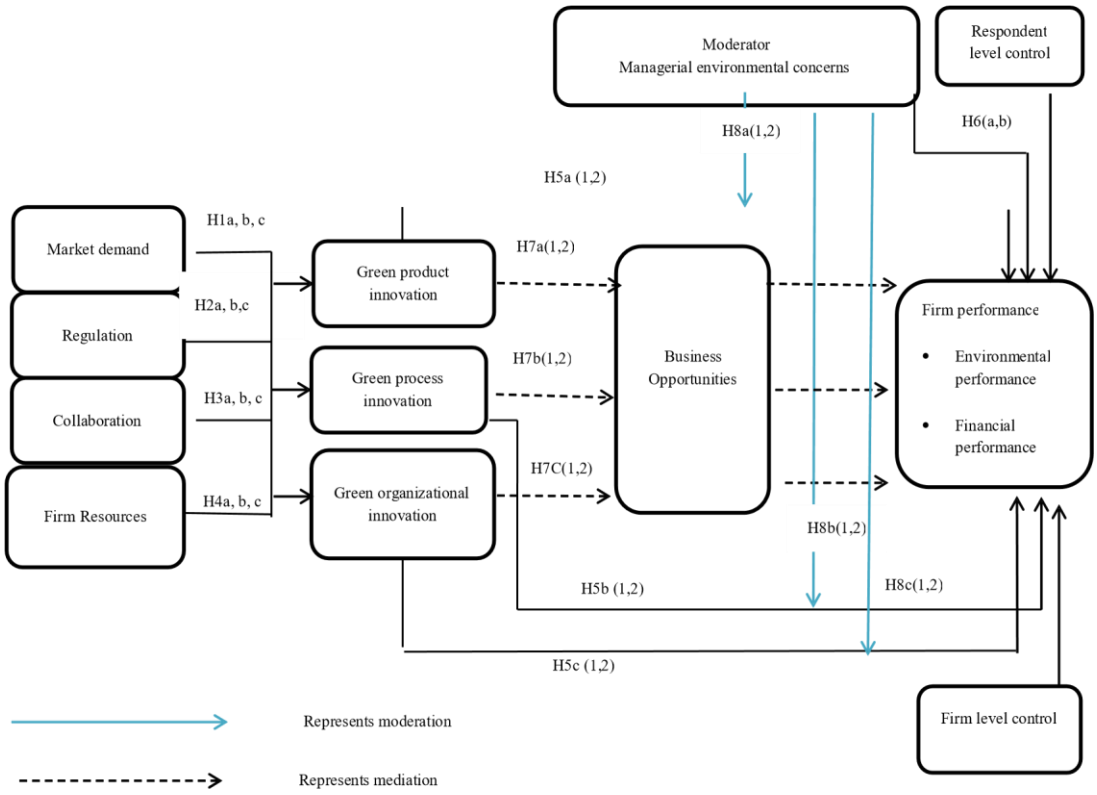

Figure 1. Conceptual framework

Table 1. Table of Hypotheses

Hypothesis 1:	Market Demand (MD) is positively associated with green Technology innovations (GI)
H1a:	MD relates positively with GPI
H1b:	MD relates positively with GPRI
H1c:	MD relates positively with GOI
Hypothesis *2:*	Regulations (ER) positively affect green technology innovation (GI)
H2a:	ER positively affects GPI
H2b:	ER positively affects GPRI
H2c:	ER positively affects GOI
Hypothesis *3:*	Collaboration (COL) is positively associated with green technology innovations (GI)
H3a:	COL relates positively with GPI
H3b:	COL relates positively with GPRI
H3C:	COL relates positively with GOI
Hypothesis 4:	Firm resources have a positive association with green technology innovations (GI)

H4a:	FR relates positively with GPI
H4b:	FR relates positively with GPRI
H4C:	FR relates positively with GOI
Hypothesis 5:	Green technology innovations have a positive impact on firm performance
H5a1:	GPI positively impacts FEP
H5a2:	GPI positively impacts FFP
H5b1:	GPRI positively impacts FEP
H5b2:	GPRI positively impacts FFP
H5C1:	GOI positively impacts FEP
H5C2:	GOI positively impacts FFP
Hypothesis 6:	Managerial environmental concern (MEC) has a positive impact on firm performance.
H6a:	MEC positively impacts FEP H6b: MEC positively impacts FFP
Mediation effects:	
Hypothesis 7:	Business Opportunities (BO) mediate the Green Innovation-firm performance relationship
H7a1:	BO mediates the GPI-FEP relationship
H7a2:	BO mediates the GPI-FFP relationship
H7b1:	BO mediates the GPRI-FEP relationship
H7b2:	BO mediates the GPRI-FFP relationship
H7C1:	BO mediates the GOI-FEP relationship
H7C2:	BO mediates the GOI-FFP relationship
Moderation effects:	
H8:	Managerial environmental concern (MEC) positively moderates the green innovation-firm performance relationship.
H8a1:	H8a1: MEC positively moderates the GPI-FEP relationship.
H8a2:	H8a2: MEC positively moderates the GPI-FFP relationship.
H8b1:	H8b1: MEC positively moderates the GPRI-FEP relationship.
H8b2:	H8b2: MEC positively moderates the GPRI-FFP relationship.
H8c1:	H8c1: MEC positively moderates the GOI-FEP relationship.
H8c2:	H8c2: MEC positively moderates the GOI-FFP relationship.

Source: Developed by the Author

5. Discusssion

This conceptual paper presents a comprehensive model illustrating the relationships between green innovation dimensions, key drivers, and the roles of business opportunities (BO) and managerial environmental concern (MEC). The findings will open the black box of how MEC and BO, shape the coupling between green innovation and financial and environmental firm performance. Moreover, they offer valuable guidance for agri-food leaders by identifying factors that drive green innovation and encouraging the adoption of strategies to enhance performance. Furthermore, the findings challenge misconceptions about green innovation negatively affecting performance and underscore the importance of adopting green practices to enhance financial and environmental performance. These insights are vital for

strategic planning, particularly in addressing managerial environmental concerns and leveraging business opportunities.

6. Conclusion

This conceptual study set out to explore how integrating a green innovation (GI) framework can foster business opportunities (BO) and enhance firm performance in the Jordanian agri-food industry. It also examines the roles of market demand, environmental collaboration, regulation, and firm capabilities as drivers of GI and its performance outcomes. Additionally, the study investigates how managerial environmental concern (MEC) moderates the relationship between GI and firm performance. To fulfil these objectives, a comprehensive conceptual framework was developed, integrating three dimensions of green innovation (product, process, and organizational), four key drivers, and two outcome areas: environmental and financial performance. The framework also incorporates business opportunities (BO) as a mediating variable and MEC as a moderator, highlighting their essential roles in shaping green innovation effectiveness in resource-constrained, low-tech sectors like agri-food.

This study contributes to the literature by advancing an integrative model that reflects the contextual realities of Jordan's agri-food sector and conceptualizes the strategic importance of green innovation. It underscores that GI initiatives, when aligned with firm capabilities and external pressures, can yield positive environmental and financial performance outcomes. Moreover, it demonstrates the need to account for BO as a critical mechanism through which GI affects performance, and MEC as a condition that can strengthen or weaken this effect. Practically, the findings suggest that policymakers and managers should actively promote environmental collaboration, invest in internal capabilities, and foster managerial concern for sustainability to maximize the gains from GI. Future empirical research is encouraged to validate this framework and examine its applicability across different developing economies.

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Ethics approval

This study followed the ethical standards of the UITM Research Ethics Committee and the 1964 Helsinki Declaration. The study was approved under reference number REC/05/2024(PG/MR/157).

Conflict of Interest

This paper has no conflicts of interest.

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