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Do knowledge sharing and big data analytics capabilities matter for green absorptive capacity and green entrepreneurship orientation? Implications for green innovation

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Abstract

Purpose – This study is the first to examine how big data analytics (BDA) capabilities affect green absorptive capacity (GAC) and green entrepreneurship orientation (GEO). It uses the dynamic capability view, BDA and knowledge-sharing literature. There is a lack of studies addressing the BDA–GAC and BDA–GEO relationships and their potential impact on green innovation. Continuing the ongoing research discussion, a few studies examined the vital implications of knowledge sharing (KS) on GAC, GEO and green innovation.

Design/methodology/approach – The study used a cross-sectional and stratified random sampling technique to collect data through self-administered surveys among Chinese manufacturing firm employees. The study applied SmartPLS to analyze the obtained data.

Findings – The findings revealed that BDA capabilities positively influence GAC and GEO. In addition, GEO and KS positively impact green innovation. The KS recorded a positive impact on GAC and GEO. Furthermore, GAC and GEO recorded a partial mediating effect.

Practical implications – The study acknowledges that GAC is the backbone of a firm green entrepreneurial orientation, which needs to be aligned with BDA capabilities to anticipate future green business trends. GAC's help drives GEO's green business agenda. KS plays a strategic role in developing GAC, fostering GEO and improving green innovation.

Originality/value – The study highlights the necessity of aligning BDA capabilities to fit firms' GEO green business agendas. This study focuses on the role of BDA capabilities in developing firms' green dynamics capabilities (e.g. GAC), which helps GEO drive superior green business growth. KS develops GAC and boosts GEO to enhance green innovation.

Keywords Green innovation, Green entrepreneurship orientation, Big data analytics capabilities, Knowledge sharing, Green absorptive capacity, Dynamic capability view

Paper type Research paper

1. Introduction

Firms acknowledged the vital impact of data and the necessity of creating valuable knowledge to maintain green competitive advantage and develop green innovation capabilities (Waqas *et al.*, 2021). Increased massive data storage and information use requires firms to develop big data analytics capabilities (Khan *et al.*, 2022). It helps firms to create, develop and share distinguished knowledge. BDA capabilities support firms in developing business models, introducing new products, forecasting customer behavior, reconfiguring business processes, reducing energy consumption, and responding to market needs (Dahiya *et al.*, 2022; Khan *et al.*, 2022). Drawing upon the dynamic capability theory (DCT), this study advocates that BDA capabilities are viewed as an essential distinguished capability that fosters and reconfigures business processes and enhances innovation

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capabilities to boost entrepreneurial goals (Mikalef *et al.*, 2019). Several studies have found that BDA capabilities offer strategic, operational and managerial benefits. It includes improving business performance (Rialti *et al.*, 2019b), introducing new green products (Waqas and Tan, 2023), developing green innovation (Waqas *et al.*, 2021), creating valuable knowledge (Ferraris *et al.*, 2019), reconfigure dynamic capabilities (Mikalef *et al.*, 2019) and drive high entrepreneurial outcomes (Ciampi *et al.*, 2021). In conclusion, researchers have assumed that BDA capabilities function as reconfiguration capabilities to enhance existing dynamic capabilities (Bahrami and Shokouhyar, 2022; Mikalef *et al.*, 2019; Teece *et al.*, 1997).

On the other hand, based on the DCT lens, green absorptive capacity (GAC) is seen as "the ability to acquire, assimilate, transform, and exploit environmental knowledge" (Chen *et al.*, 2014). It is the firms' capacity to create green knowledge, disseminate it, and convert the obtained knowledge to knowledge applications (Makhloufi *et al.*, 2023a). This study advocates that firms seeking to achieve competitive advantage should develop and reconfigure their dynamic capabilities to fit and maintain them in the dynamic business environment (Teece, 2016; Teece *et al.*, 1997). Absorptive capacity is the backbone of a firm's dynamic capabilities (Cohen and Levinthal, 1990; Zahra and George, 2002). Given increasing green concerns, GAC's core focus is to create and leverage developed knowledge with existing ones to help drive high responsiveness by neutralizing external threats and forecasting future opportunities (Zhang *et al.*, 2020). This occurs through combining the obtained external knowledge with internal ones, boosting innovation performance (Pacheco *et al.*, 2018). Thus, it supports entrepreneurs' green business agenda. Following the DCT lens, this study suggests that GAC is an essential dynamic capability that supports an entrepreneur's green mindset with valuable knowledge and insights regarding potential green opportunities and anticipating threats (Wang *et al.*, 2022). Thus, it promotes entrepreneurs' proactive green decision-making by providing necessary information to introduce new products and reducing risk-taking (Mo *et al.*, 2022). It is the reason why GAC should be aligned with the GEO agenda. This research is among the pioneers' studies predicting and testing the relevancy of the DCT assumptions about the need to develop and reconfigure dynamic capabilities to boost entrepreneurial goals (Teece *et al.*, 1997).

Applying the DCT, green entrepreneurship orientation refers to a firm's green proactive strategy to balance green business growth and reduce environmental impacts (Makhloufi *et al.*, 2023c). GEO means that firms should prioritize environmental concerns in light of increasing green business goals (Wang *et al.*, 2023). The study assumes that with massive data analyzed, GEO would effectively address green issues, develop profitable green business models, and anticipate customer behavior and market demands (Ciampi *et al.*, 2021; Ciasullo *et al.*, 2022; Lozada *et al.*, 2023; Waqas *et al.*, 2021). Entrepreneurs' green mindset needs solid and effective BDA platforms to generate green insights and valuable knowledge to forecast future business trends, draw business plans, problem-solve, respond to customer needs and boost entrepreneurial goals (Waqas and Tan, 2023; Yu *et al.*, 2022). In contrast, DCT suggests that green absorptive capacity is the central pillar of the GEO business agenda; in turn, it fosters an entrepreneur's green strategy, assists in anticipating market reaction, provides a holistic picture of risk-taking, innovates new business processes and introduces new products (Wang *et al.*, 2022; Zhang *et al.*, 2023). Studies suggest that entrepreneurial firms highly depend on their absorptive capacity to drive superior business performance (Engelen *et al.*, 2014; Sciascia *et al.*, 2014). In this study's context, GAC facilitates entrepreneurs' green business agendas by supplying valuable green knowledge for commercialized ends. In response to the DCT, this study suggests that having unique dynamic capabilities like GAC and BDA would help people become successful entrepreneurs (Ciampi *et al.*, 2021; Lozada *et al.*, 2023; Waqas *et al.*, 2021). Thus, the primary goal of GEO is to balance green business growth with environmental impacts. Researcher Wang *et al.* (2022) acknowledge green innovation as a vital tool that promotes GEO promises. Green innovation

is the firm capacity to deploy green technologies and green business processes to create eco-friendly products, reduce CO2 emissions, decrease energy consumption and promote a green brand reputation (Soomro *et al.*, 2023).

Based on the underpinning theory, green innovation is a firm dynamic capability that should be continuously reconfigured and developed (Dangelico *et al.*, 2017; Yu *et al.*, 2022). Thus responding to the increased customer environmental concerns and institutional and ecological pressures (Shehzad *et al.*, 2023). Based on the DCT approach, green innovation requires firms to search for and deploy valuable capabilities to improve green processes, develop eco-friendly products, use clean energies, and, in turn, create green competitive advantages and enhance ecosystem performance (Chen *et al.*, 2023; Dangelico *et al.*, 2017; Yu *et al.*, 2022). There is a strong justification from the dynamic capability literature supporting the notion that green innovation is a firm's capacity to respond to and neutralize green concerns to maintain survival in highly dynamic environmental issues (Arranz *et al.*, 2020; Ferreira *et al.*, 2020; Yousaf, 2021). Continuing the ongoing debates, this study links green innovation literature and the DCT lens.

Applying BDA capabilities literature to advance green practices supports firms' flexibility and entrepreneurial business agility (Mikalef *et al.*, 2019). GEO's primary purpose is to deliver eco-products and promote eco-business processes, which may be associated with the high cost and uncertainty of business failure (Demirel *et al.*, 2019). Therefore, BDA capabilities enable GEO through accurate information, decision-making choices, profitable green business models, and entrepreneurial activities with less cost, thus driving eco-business growth while addressing environmental concerns (El-Kassar and Singh, 2019; Waqas *et al.*, 2021). Meanwhile, GAC purposely seeks to convert the developed knowledge from external and internal sources to knowledge application (Pacheco *et al.*, 2018). It significantly fosters GEO achievements by supporting and leveraging green practices to polish the impacts of environmental activities (Zhang *et al.*, 2020). GAC drives green value-added by strengthening entrepreneurial green businesses (Makhloufi *et al.*, 2021). It helps GEO innovativeness, proactiveness and risk-taking by understanding customer needs, reconfiguring business processes, enhancing green products, developing new ones, and anticipating future opportunities (Rodrigo-Alarcón *et al.*, 2020). The DCT asserted that BDA capabilities and GAC develop firms' dynamic capabilities by empowering existing knowledge to support managerial-operational skills, routines, know-how, new product development, processes and individual practices (Mikalef *et al.*, 2019; Wang *et al.*, 2023). This, in turn, leads to promoting eco-friendly products and processes, increasing resource efficiencies, and enhancing the firm's image and brand reputation (Lozada *et al.*, 2023). For the first time, if any, the study proposes and empirically tests the relationship between BDA capabilities, GAC and GEO. It is thus extending the body of green entrepreneurship, BDA capabilities and the dynamic capability theory.

Talented employees possessing years of experience, high learning skills, know-how and the accumulation of knowledge can help firms and individuals create and establish distinguished knowledge (Hanifah *et al.*, 2021). Scholars of the DCT assert that the knowledge-creation process, after years of experience, is one of the key dynamic capabilities that offer strategic value-added (Islam *et al.*, 2022). Scholars of the DCT asserted that knowledge is the most strategic weapon to promote entrepreneurial orientation (Pittino *et al.*, 2018). The KS capacity of an entrepreneur develops a firm's dynamic abilities (Li *et al.*, 2020). Studies such as (Carmeli *et al.*, 2013; Kang and Lee, 2017) argue that KS empowers employees' dynamic capability to foster product development, enabling an entrepreneur to absorb and predict business opportunities. Researchers Rafique *et al.* (2018) observed that knowledge management is insufficient unless firms recognize knowledge sharing as a dynamic capability that fosters green entrepreneurial activities. Hanifah *et al.* (2022) confirm that KS supports entrepreneurial innovativeness. This implies that an entrepreneur's capacity to

deliver eco-friendly products, level up green processes, and proactively be green is needed and stimulated by KS to do so (Hanifah *et al.*, 2022). Given the vital role of KS on green innovation (Lin and Chen, 2017) and KS on entrepreneurial orientation (Hanifah *et al.*, 2022). It is crucial to predict the potential impact of KS on GEO and green innovation, especially in the dynamic capability literature, which is still scarce in evidence examining the impact of KS on green innovation and GEO. In this way, the study would add to the DCT by going into more detail about the important part that KS plays as a green dynamic capability that helps achieve GEO.

This research proposes the dynamic capability theory as a theoretical foundation to examine the BDA capabilities, GAC and GEO relationships to boost green innovation outcomes. Literature shows that the DCT is mainly applied to explain the potential relationship between BDA capabilities, GAC, GEO and green innovation (Ferraris *et al.*, 2019; Mikalef *et al.*, 2019; Mikalef *et al.*, 2021). However, these variables were often studied in isolation, leading to intense debates regarding the nature of their relationships and the resulting outcomes. In addition, the DCT overcomes the limitations observed in resource-based and knowledge-based theories in explaining the strategic value of BDA capabilities to enhance the firm's dynamic capabilities. The resource-based view regards the generated data (information) as valuable but does not emphasize its potential value for business processes. At the same time, the knowledge-based view does not fully address the strategic choices enabled by BDA capabilities to foster problem-solving options. Specifically, the DCT viewed BDA capabilities as a resource for value-creation and its potential benefits. The DCT also helps to examine how firms reconfigure big data assets and processes on the one hand and understand how to extract knowledge and disseminate it to employ it efficiently within a business operation. To conclude, the DCT considers BDA a dynamic capability that allows firms to distinctively possess unique capabilities to create strategic insights (Mikalef *et al.*, 2021). This study, therefore, overcomes the deficiencies of resource-based and knowledge-based theories and extends the body of dynamic capability theory.

To conclude, because of the massive amount of data stored and analyzed and applying underpinning theory, this study examines the relationship between BDA capabilities and GEO. It also seeks to confirm the role of BDA capabilities in supporting GEO through generating new insights, creating innovative business models, strategic decision-making and forecasting future business trends. This study believes that GEO would strategically benefit from the valuable knowledge created by BDA capabilities. Furthermore, green absorptive capacity has a considerable impact on facilitating entrepreneurs' green business goals. Thus, we seek to test the relationship. Moreover, the study, for the first time, if any, addresses the contribution of knowledge sharing among employees and its relation to GEO's green business agenda. It is unclear and lacks evidence discussing KS's role in reducing entrepreneurs' green environmental concerns. Dynamic capability literature is still scarce in terms of evidence examining the impact of KS on green innovation. Several questions should be answered to extend the dynamic capability body of knowledge: (1) Does BDA capabilities boost GAC to drive entrepreneurial green business growth? (2) To what extent do BDA capabilities facilitate the GEO business agenda? (3) Does knowledge sharing help entrepreneurs overcome green issues? (4) Does extensive knowledge sharing among employees benefit green absorptive capacity? (5) Why has accumulated knowledge sharing over the years been a matter for firms to develop green innovation? Answering these questions extends the dynamic capability of the body of knowledge and enriches existing literature about the relationships among the constructs of the study. The paper begins with an introduction to the study's core focus, followed by the development of theoretical assumptions and hypotheses. Then, address the methodological approach and data analysis. Lastly, it ends with a discussion of the study's contribution and future research direction.

2. Theoretical assumption

2.1 Dynamic capability theory as the foundation lens of the study

According to scholars of ***Dynamic Capability Theory*** (Teece, 2016, 2018; Teece *et al.*, 1997; Zahra and George, 2002; Zahra *et al.*, 2006), firms should reconfigure and develop valuable resources into dynamic capabilities responding to highly changing environment and thus, achieving a competitive advantage. DCT acknowledges that absorptive capacity is the main backbone of the firm's dynamic capabilities (Teece, 2016; Zahra *et al.*, 2009; Zahra *et al.*, 2006). In the light of increasing green concerns, GAC refers to firms capability to track, assimilate and convert green knowledge creation into knowledge applications (Wang *et al.*, 2022; Zhang *et al.*, 2023). While GEO aims to boost green business growth by detecting and neutralizing environmental risks, enhancing firms' process and product innovativeness and supporting proactive strategies (Wang *et al.*, 2023; Zahra *et al.*, 2009). In the context of the study and considering green issues that firms seek to overcome, this study stands on the notion that the DCT advocates that green absorptive capacity can facilitate GEO's green business agenda (Zhang *et al.*, 2023). This implies that GAC supports entrepreneurial firms by introducing and converting new ideas into new products, developing green practices and know-how, tracking green opportunities and advancing green processes to reduce energy consumption, in turn, leads to green competitive advantage (Makhloufi *et al.*, 2023a; Wang *et al.*, 2022).

Due to the increased volume of data created and tracked by firms. It is vital to note that firms must develop existing IT resources that can foster the process of information systems (Steininger *et al.*, 2022). BDA capability is one of the main tools that help a firm to deal with massive data and know-how, generate new insights, forecast future green-business trends and solve green business problems (Mikalef *et al.*, 2019; Waqas *et al.*, 2021). This implies that GAC tracking, assimilating and leveraging green knowledge into existing firms' green datasets is in need and developed by DBA capabilities (Khan *et al.*, 2022; Lozada *et al.*, 2023). Hence, the success of GAC in converting knowledge creation into knowledge applications used for commercialized ends relies on the existing link with BDA capabilities (Khan *et al.*, 2022; Lozada *et al.*, 2023). From the DCT lens, knowledge resource accumulation is static and should be converted into a dynamic capability (Teece *et al.*, 1997). GAC, therefore, develops knowledge creation by integrating it with existing resources to generate new insights, develop green processes, innovate new ways of reducing energy consumption and enhance the firm's brand reputation (Zahra *et al.*, 2006, 2009; Zahra and George, 2002). Moreover, examining how BDA capabilities can level up green absorptive capacity to match GEO's green business agenda is crucial. Bridging this impressive gap and extending the body of DCT and green absorptive capacity literature, this study is an attempt to confirm the need for BDA capabilities as an IT enabler of firms dynamic capabilities as suggested by (Steininger *et al.*, 2022).

In addition, this study assumes that employees' knowledge sharing created throughout the years, know-how, training, learning, interpersonal skills and knowledge would strongly affect the GAC. Studies have argued that KS supports firms' absorptive capacity (Kang and Lee, 2017; Rafique *et al.*, 2018). Balle *et al.* (2020) argued that understanding which construct can be antecedents and outcomes of the KS-absorptive capacity relationship is still undeveloped. In light of green concerns, Song *et al.* (2020) stated that GAC mediates the relationship between knowledge sharing and green innovation. Another study by Kang and Lee (2017) revealed that KS affects innovation behavior through the existence of absorptive capacity; however, due to the importance of KS on firms' innovation outcomes, products, processes, R&D and managerial capabilities (Islam *et al.*, 2022; Kang and Lee, 2017; Lin and Chen, 2017; Pittino *et al.*, 2018; Rafique *et al.*, 2018). Drawing upon the DCT, examining the KS-GAC and KS-GEO relationships still ambiguous and overcoming the significance contribution of employees KS is of utmost crucial. In addition, it is not clear whether green concerns are prioritized by employees KS or not which raise another critical question of the

usefulness of KS for firms GAC and GEO. The study assume that KS could be beneficial to boost GAC and facilitate GEO eco-business agenda.

3. Hypotheses development

3.1 Big data analytic capabilities, green absorptive capacity and GEO

This study introduces the dynamic capability theory as an appropriate theoretical umbrella to examine the role of BDA capabilities in developing firms' green absorptive capacity to boost GEO goals. Prior studies used the DCT to explain the relationships between BDAC, GAC, GEO and green innovation separately (Ferraris *et al.*, 2019; Mikalef *et al.*, 2019, 2021). The essential task of BDA capabilities is to assemble, combine and leverage existing resources, and primarily to generate results of big data analytics to foster the decision-making process, introduce new products, develop business models and forecast business trends (Lozada *et al.*, 2023). BDA capabilities support firms to decrease operational risks and improve real-time production processes (El-Kassar and Singh, 2019). Advanced BDA tools will allow firms to anticipate customer behavior, innovate new products and develop green processes (Al-Khatib, 2022).

On the other hand, green absorptive capacity is acknowledged by the DCT lens as a distinguished green dynamic capability achieving entrepreneurial goals and environmental performance (Meirun *et al.*, 2020a). GAC's core objective is to develop leverage and convert green knowledge creation to applications (Makhloufi *et al.*, 2023a). The converted knowledge covers essential activities, namely upgrading green processes, introducing eco-friendly products, customer responsiveness, tracking market demands and predicting future business trends (Makhloufi *et al.*, 2021). Furthermore, GAC helps to reduce waste hazardous and CO2 emissions, greening technology, and enhance resource efficiencies (Zhang *et al.*, 2020). Based on the DCT, it recognized GAC as the backbone of GEO seeking superior green innovation performance (Islam *et al.*, 2022). In contrast, BDA's fundamental goal is to facilitate firms' data analytics to drive valuable insights, ideas and green knowledge regarding business operations to boost entrepreneurial performance and neutralize environmental threats in high uncertainty (Waqas *et al.*, 2021). Specifically, it is theoretically needed to address the relationship between BDA capabilities and GAC because it empowers entrepreneurial environmental knowledge. BDA can improve and extend the scope of GAC to address entrepreneurs' eco-business agenda. BDA is the primary tool and resource for analyzing the obtained data, generating valuable decisions, estimating future trends, and creating new ideas and insights (Li *et al.*, 2022). GAC can benefit from BDA development by converting the acquired knowledge and ideas into knowledge applications (Khan *et al.*, 2022). It is expected that GAC will increase firms' GEO achievements. Few studies treat the direct and indirect BDAC-GAC relationship (Khan *et al.*, 2022; Lozada *et al.*, 2023). However, understanding the outcomes generated from this integration would be significant, especially for entrepreneurs with green-oriented behavior. To conclude, BDA is the fundamental source of knowledge and ideas that GAC uses to advance the firm's green dynamic capabilities. Therefore, this study addresses the BDA capabilities-GAC relationship to bridge the dynamic capability literature gap.

BDA capabilities analyze massive amounts of data, create in-depth insight and know-how, predict future trends, increase organizational responsiveness and enhance decision-making effectiveness (Aljumah *et al.*, 2022). BDA enables firms to obtain green knowledge by tracking sources of information (data) and establishing their corporate knowledge catalog (Khan *et al.*, 2022). Cao *et al.* (2015) advocate that BDA is a vital IT resource to improve firms' agility to create, disseminate and store developed knowledge from diverse sources (Steininger *et al.*, 2022). The primary reason for developing BDA tools is to let an organization sense and deal with unexpected future business changes. Ferraris *et al.* (2019) stated that BDA enhances

decision-making and creates innovative ideas, know-how and learning skills. It overcomes GEO's primary goals. Hence, the success of entrepreneurs' green business agenda highly relies on BDA capabilities (Ciampi *et al.*, 2021). Drawing upon the dynamic capability perspective and giving entrepreneurs green concerns, analyzing the massive amount of data help to advance green process, improve green products, develop green business models, anticipate future green issues and neutralize environmental impacts is an essential goal of firms GEO (Ciampi *et al.*, 2021; Lozada *et al.*, 2019; Waqas *et al.*, 2021). Leveraging large-scale data covering green issues, it support in determining customer green awareness, green purchasing behavior, identifying the perceived value of eco-friendly products, in turn, enhance green business growth (Ma *et al.*, 2022). Feng and Guo (2018) suggest that business analytics increase business agility to absorb business changes and promote eco-friendly products and processes, while Niebel *et al.* (2019) advise firms to use BDA tools for deploying green business strategies. Steininger *et al.* (2022) argued that IT-enabled dynamic capabilities foster firms to reconfigure and develop existing capabilities to maintain business survival and alive in highly business uncertainty. Which in turn, it cross the dynamic capability scholars view (Teece *et al.*, 1997; Zahra *et al.*, 2006). Applying the DCT and BDA literature, this study aims to bridge theoretical gap and test the hypothesized path between BDA capabilities and GEO for the first time.

The dynamic capability community scholars see green innovation as a unique and vital strategic solution for greening business operations and creating competitive advantages (Chen *et al.*, 2023; Dangelico *et al.*, 2017). This, in turn, supports entrepreneurs to reduce environmental impacts and increase green business performance (Qiu *et al.*, 2020). Green innovation focuses on developing green products, reducing energy consumption, decreasing hazardous waste, and promoting entrepreneurs' brand reputation (Soomro *et al.*, 2023). BDA capabilities offer distinguished knowledge, in-depth insights and know-how to reconfigure and develop green innovation capabilities (Lozada *et al.*, 2019). Which, in turn, assists in overcoming entrepreneur-green concerns. This implies that BDA capabilities key role is to provide a holistic picture of developing green innovation practices and their consequences. Entrepreneurial green-oriented firms, Yu *et al.* (2022) suggest reinforcing green innovation capabilities through deploying green dynamic capabilities. The study found that BDA capabilities strengthen the relationship between green dynamic capabilities and green innovation (Yu *et al.*, 2022). This means that BDA capabilities can reconfigure and develop existing capabilities, as suggested by the DCT scholars (Steininger *et al.*, 2022). Dynamic capability literature is still at the very early stage of discussing the potential impact of BDA on GEO and green innovation relationships, signifying that several theoretical gaps should be examined. Thus, this study aims to test the interlink between BDA and GI in entrepreneurial green orientation firms. Hence, the study hypothesizes.

H1. Big data analytics capabilities positively influence green absorptive capacity.

H2. Big data analytics capabilities positively influence green entrepreneurship orientation.

H2a. GEO positively mediates the relationship between BDA capabilities and GI.

3.2 Green absorptive capacity, knowledge sharing and GEO

Entrepreneurs' green orientation behavior primarily aims to track and maximize profitable green business opportunities and neutralize environmental impacts (Makhloufi *et al.*, 2021). GEO is the process of greening business operations, using green technology, reducing energy consumption, minimizing waste and delivering green value to customers. On the other hand, GAC helps entrepreneurs apply green knowledge and identify essential core competencies that should go green for exploitation (Aboelmaged and Hashem, 2019). Zahra *et al.* (2009)

asserted that absorptive capacity is the backbone of entrepreneur success. It is a crucial dynamic capability that reconfigures and develops over time, boosting entrepreneurial goals (Zahra and George, 2002). Firms with sufficient GAC convert knowledge creation to applications used for commercialized entrepreneurial purposes (Makhloufi *et al.*, 2022; Wang *et al.*, 2023). In addition, it helps firms GEO to explore market opportunities, access information and forecast customer behavior and future business trends (Mahmood and Mubarik, 2020). Absorptive capacity enables entrepreneur alertness to track opportunities, especially during product development phases (Patel, 2019). Hence, using the DCT, this study examines the role of GAC on entrepreneurs' green orientation.

The DCV lens advocates that GAC is the leading firm's green dynamic capability to overcome entrepreneurs' green concerns and neutralize environmental threats (Ferreira *et al.*, 2020; Yousaf, 2021; Zahra *et al.*, 2006). BDA capabilities offer valuable information, analyses business trends, anticipate customer behavior, develop business models, introduce new products and support managers' decision-making (Ciampi *et al.*, 2021; Khan *et al.*, 2022; Lozada *et al.*, 2023). A study by Waqas *et al.* (2021) found that big data analytics support firms in improving environmental performance through analyzing and incorporating green knowledge into green strategies. In contrast, Singh and El-Kassar (2019) suggest that big data analytics foster the sustainability of dynamic capabilities. Another study by Mikalef *et al.* (2019) asserted that BDA develops innovation capabilities. Al-Khatib (2022) empirically found that BDA positively influences radical and incremental green innovation, achieving a competitive advantage. A study by Ciampi *et al.* (2021) indicates that BDA positively impacts business model innovation. Drawing upon the DCT, BDA overcomes prominent entrepreneurs' green concerns, directly or indirectly questioning whether BDA and GEO were a relationship. The literature stated that absorptive capacity mediates the relationship between BDA capabilities and strategic business value (Persaud and Zare, 2023). Arshad *et al.* (2022) found that BDA capabilities positively impact absorptive capacity and mediate the relationship between BDA and organizational sustainable development. Understanding whether BDA capabilities enhance entrepreneurs' eco-business agenda and goals is crucial, especially in the existence of GAC. This study seeks to test the mediating role of GAC on the BDA-GEO relationship.

Green absorptive capacity converted knowledge sharing to knowledge applications (Kang and Lee, 2017; Pacheco *et al.*, 2018). Knowledge applications are applied for commercialized purposes (Zahra *et al.*, 2009). Song *et al.* (2020) found that green knowledge sharing positively correlates with absorptive capacity, and this last mediates the KS–green innovation relationship. Kang and Lee (2017) indicate that KS impacts innovation behavior indirectly through realized absorptive capacity, whereas potential absorptive capacity is positively associated with KS. Rafique *et al.* (2018) stated that KS has a positive impact on absorptive capacity. Another study by Ali *et al.* (2019) suggests that KS practices positively influence cost reduction, organizational growth and intangible benefits. Lin and Chen (2017) discovered that green knowledge sharing enhances green dynamic capacities, develops green innovation, and creates green competitive advantages. Nguyen *et al.* (2023) asserted that green knowledge sharing moderates the relationship between green entrepreneurship and environmental sustainability. KS created over years of experiences, learning, profound training and observation, acknowledged as a distinctive dynamic capability that cannot be imitated (Teece *et al.*, 1997; Zahra *et al.*, 2006). This drives superior innovation capabilities and entrepreneurial goals. KS boosts absorptive capacity. GAC enhances entrepreneurs' business goals. Signifying that GAC might mediate the KS-GEO relationship. Deploying the DCT approach, this study believes KS could support entrepreneurs' green activities by converting shared knowledge to environmental ends. Thus, the following hypotheses were developed:

H3. GAC positively influences green entrepreneurship orientation.

H3a. GAC positively mediates the relationship between BDA capabilities and GEO.

H3b. GAC positively mediates the relationship between KS and GEO.

3.3 Green entrepreneurship orientation and green innovation

According to the DCT, entrepreneurs with a green mindset view green innovation as central to corporate environmental entrepreneurship (Makhloufi *et al.*, 2023a). Eco-friendly entrepreneurs usually prioritize environmental impacts as the top concern of green strategies (Shehzad *et al.*, 2023). Hence, green innovation is one of the major strategic solutions to reduce environmental impacts and promote green entrepreneurs' brand reputation (Hillestad *et al.*, 2010). GI overcome environmental issues by greening business processes to increase resources efficiencies and decrease energy consumption (Sun *et al.*, 2019), leveraging clean technologies to minimize CO2 emissions (Meirun *et al.*, 2020b), introduces eco-friendly products (Dangelico *et al.*, 2017), boost green entrepreneurial goals (Wang *et al.*, 2022) and drive corporate social responsibility (Kraus *et al.*, 2020). Based on the dynamic capability perspective, firms should acknowledge green innovation as a dynamic capability that should be continuously developed and reconfigured according to the existing environmental challenges (Chen *et al.*, 2023). Thus, it needs to identify core competencies that should go green and create green competitive advantages (Qu *et al.*, 2022). Hence, firms' GEOs must search, identify, and develop core competencies that bolster green innovation capabilities to generate entrepreneurial goals. This study has seen GI as the major source of GEO success.

Using the DCT lens, green absorptive capacity reconfigures green innovation capabilities to match green entrepreneurs' business agenda (Zhang *et al.*, 2023). It integrates new green knowledge, know-how and green insights into green strategies to reduce environmental impacts (Mo *et al.*, 2022). In addition, the core focus of GAC is to offer solutions for solving firms' green problems by deploying newly developed knowledge across business units, enhancing employees' green practices, supporting green products development and increasing the efficiency of green decision-making (Makhloufi *et al.*, 2023a; Pacheco *et al.*, 2018; Wang *et al.*, 2023; Zhang *et al.*, 2020). Drawing upon the DCT approach, GAC is recognized as the backbone of entrepreneurial green-oriented firms and stands on developing green innovation capabilities (Arranz *et al.*, 2020; Yousaf, 2021; Zahra *et al.*, 2006). This implies that GEO's success relies on developing green innovation capabilities (Makhloufi *et al.*, 2023c). Green innovation and dynamic capabilities are the core goals of green absorptive capacity. Hence, GEO must achieve a close interaction between GAC and the green innovation business agenda to boost entrepreneurial objectives. On the other hand, entrepreneurs are advised to identify the innovation capabilities of core business units that need to be developed and reconfigured through leveraging GAC (Aboelmaged and Hashem, 2019). Knowledge sharing is considered a valuable and distinguished capability due to its complexity and unclear knowledge-creation process (Teece *et al.*, 1997).

Scholars of dynamic capability advocate that distinguished capabilities are essential for entrepreneurial aims and superior innovation performance (Teece, 2018; Zahra *et al.*, 2006). Knowledge sharing obtained over years of experience, training and observation is crucial for entrepreneurial green strategies (Nguyen *et al.*, 2023). It supports entrepreneurs' green behavior by offering new insights, developing green business models, tracking customer behavior and understanding future business trends (Hanifah *et al.*, 2022; Islam *et al.*, 2022; Kang and Lee, 2017; Song *et al.*, 2020). GEO's top responsibility should be valuable KS that develops and upgrades green innovation practices. It helps entrepreneurs' innovativeness capacities and proactiveness behavior and neutralizes environmental risks (Nguyen *et al.*, 2023; Pittino *et al.*, 2018). Dynamic capability literature suggests that KS is associated with green innovation and GEO. How GEO uses KS to strengthen green innovation capabilities to boost entrepreneurial goals is vital. Hence, this study hypothesizes the following.

H4. Green entrepreneurship orientation positively influences green innovation.

H4a. GEO positively mediates the relationship between GAC and green innovation.

H4b. GEO positively mediates the relationship between KS and green innovation.

3.4 Knowledge sharing, GAC, GEO and green innovation

Knowledge sharing is strongly associated with the GAC concept. Well-talented employees significantly create and develop organizational knowledge capabilities (Hanifah *et al.*, 2021). Absorptive capacity converted and transferred KS to commercialized ends (Balle *et al.*, 2020). Which in turn facilitates entrepreneurial activities (Pittino *et al.*, 2018). Green absorptive capacity focusing on green issues and neutralizing environmental impacts requires employees' experiences and observation. This supports developing knowledge capabilities and reconfiguring business processes. In turn, it drives superior green innovation capabilities. The knowledge-creation process after long experiences is seen as one of the strategic dynamic capabilities that offer strategic value-added (Islam *et al.*, 2022). Thus, the knowledge acquired improved business processes, product development, and managerial and individual cognitive skills (Islam and Asad, 2021). The DCT argued that knowledge is the most strategic weapon to promote entrepreneurial orientation (Pittino *et al.*, 2018). The knowledge creation process helps firms' responsiveness and flexibility and predicts future trends (Hanifah *et al.*, 2021). However, the knowledge created and developed can be worthless unless shared across organizational hierarchy and among individuals (Balle *et al.*, 2020). It is important to note that knowledge sharing affects firms' dynamic capabilities, resulting in reconfiguring the entire business operations (Kang and Lee, 2017). The KS capacity of an entrepreneur develops a firm's dynamic abilities (Li *et al.*, 2020). Studies such as (Carmeli *et al.*, 2013; Kang and Lee, 2017) argued that KS empowers employees' dynamic capability to foster product development, enabling an entrepreneur to absorb and predict business changes and search for opportunities.

Researchers Rafique *et al.* (2018) advocate that knowledge management is insufficient unless firms recognize KS as a dynamic capability that fosters entrepreneurial activities. In addition, Hanifah *et al.* (2022) claimed that KS is an essential resource that helps firms' entrepreneurial orientation and intellectual capital to advance green innovation performance. Thus, understanding how KS is incorporated into the GEO green business agenda is paramount. Studies such as (Ali *et al.*, 2018; Balle *et al.*, 2020; Islam *et al.*, 2022; Rafique *et al.*, 2018) stated that KS develops firms' dynamic capabilities and reconfigure business process to upgrade core competencies. Hanifah *et al.* (2022) confirm that KS supports entrepreneurial innovativeness. This implies that an entrepreneur's capacity to deliver eco-friendly products, level up green processes, and proactively be green behavior is needed and stimulated by KS to do so (Hanifah *et al.*, 2022). Few studies, if any, have examined the KS-GAC, KS-GEO and KS-GI relationships. However, understanding how KS reconfigured GAC, boosted green entrepreneurial goals and strengthened green innovation performance is still unclear, especially in the light of the DCT. Thus, this study combines four research streams and aims to advance the body of dynamic capability, knowledge management, entrepreneurship and innovation literature. Hence, the following hypotheses should be tested:

H5. Knowledge sharing positively influences GAC.

H6. KS positively influences GEO.

H7. KS positively influences green innovation.

Applying underpinning theory, this study aims to address the effect of BDA capabilities on GAC and GEO. Based on the literature by Garmaki *et al.* (2023), Ardito *et al.* (2019) and

Tchuente and El Haddadi (2023), this research is among fewer studies that introduce to test the BDAC-GAC and BDAC-GEO relationships, which it question whether BDA could develop GAC to the level of GEO green business agenda. However, how BDA capabilities boost the GEO eco-business agenda is still ambiguous, and the relationship between BDA and GAC is unclear. Based on the existing studies using the DCT as a theoretical framework, a lack of studies has been conducted to understand how dynamic capabilities are developed and combined (Steininger *et al.*, 2022). In addition, from the existing literature, few studies have examined the knowledge sharing-GEO and KS-GAC relationships. It implies that understanding how employee knowledge is shared and converted impacts the GEO green business agenda, which still needs serious attention. Entrepreneurs seeking to exploit green business opportunities should combine the shared knowledge developed by talented employees and top-management practices to reconfigure green business processes and products. This research proposed an evolutionary theoretical model by which BDAC levels GAC to fit GEO and advance green innovation capabilities. It is a new dynamic model that emphasizes the role of BDA capabilities and KS in developing entrepreneurs' green dynamics capabilities. The study combines four research streams namely dynamic capability literature, BDA, KS and green innovation to introduce the problem of the study. The theoretical framework is presented in Figure 1.

4. Methodology

4.1 Sample frame and data collection

After conducting face and content validity based on deep learning and consultation with past studies, the study adopted accurate and meaningful items relevant to each dimension and latent variable. The questionnaire was provided in dual versions (English and Chinese language). The study sample size was determined based on Morgan (1970), and following the recommendation of Israel (1992) to avoid low response rate and missing values (incomplete surveys), this study distributed 450 questionnaires. From September 2022 to January 2023, 282 questionnaires were returned. Excluding incomplete surveys, the final dataset is 268 responses, which is enough for mediation studies and as suggested by (Fritz and MacKinnon, 2007).

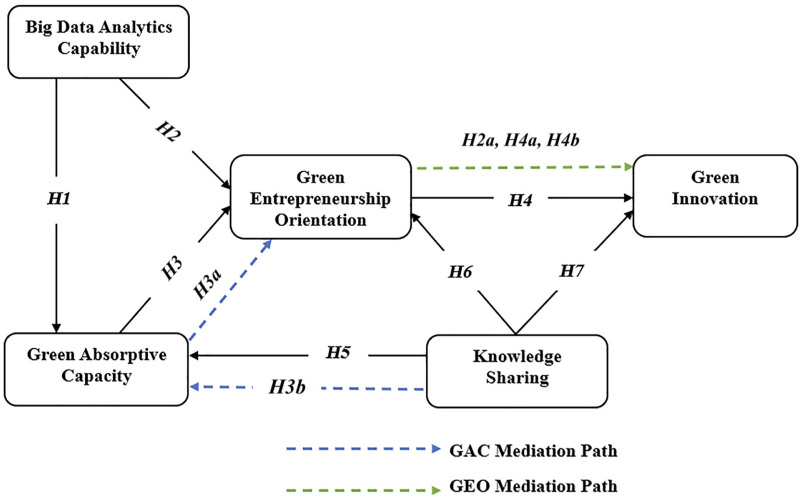


Figure 1.
Theoretical model

Source(s): Figure created by author

4.2 Measurement of variables

The content and face validity revealed that internal consistency and composite reliability ranged between 0.834 and 0.957, indicating a high-reliable coefficient. Based on past studies that examined and measured BDAC, the study applied six items used by (Al-Khatib, 2022) to predict the impact of BDAC on both GAC and GEO. The study stands on and used five items by (Chen *et al.*, 2014; Lichtenthaler, 2009) to measure GAC, which consists of (1) the organizational structure of the company has the ability to understand, analyze, and interpret information from external environmental knowledge; (2) the company can communicate environmental knowledge across its units; (3) the company has the ability to combine existing environmental knowledge with the newly acquired and assimilated environmental knowledge; (4) the company has the ability to recognize, value, and acquire external environmental knowledge that is critical to its operations; and (5) the company has the ability to successfully commercialize new external environmental knowledge. To measure green entrepreneurship orientation, the study applied five items used by (Makhloufi *et al.*, 2021). Knowledge sharing is measured using five items adopted from (Li *et al.*, 2020). Green innovation is defined by proposing two dimensions, radical green innovation and green incremental innovation, each measured by six items adopted (Al-Khatib, 2022). The study applied a 7-point Likert scale ranging from 1 = (strongly disagree) to 7= (strongly agree).

5. Data analysis

Several bibliometric analysis studies stated that most empirical studies used smart PLS as a preferable tool to estimate and examine the measurement and structural models. Smart PLS is preferred because the sample size is relatively small and can handle complicated models (mediation and moderation models) (Henseler *et al.*, 2015). Maximize the predictive precision of predictor variables, and lastly, when the sample data was not normal distribution (Chin, 1998). Examining whether the study is free of non-response bias is an important and common practice. Hence, we applied an independent samples *t*-test to determine whether the study contained non-response bias. Results showed that Levene's test for equality of variance was higher than 0.05 for all variables. Thus fulfilling the significance level requirement based on (Pallant, 2011) and signifying that this study is free of non-response bias. Researchers Kraus *et al.* (2020) argued that collecting data from a single source to measure endogenous and exogenous constructs might lead to the possibility of common method bias. Hence, this study seriously addressed and avoided this vital issue as it will influence the prediction impact on the relationship between independent and dependent constructs. Therefore, CMB is tested using a full collinearity test, as recommended by (Kock and Lynn, 2012). The full collinearity test is estimated by observing values of variance inflation factors (VIFs) yielded for all latent constructs in the research model. The values of VIF greater than 3.3 are proposed as an indication that a model might be contaminated by CMB (Kock, 2015). The sorted VIF values are all below 3.3. Hence, this model is free of CMB.

5.1 Validity and reliability assessment

Due to the significant benefits gained from SmartPLS to generate accurate results and strictly predict the relationships between variables. The study, therefore, chose to apply PLS-SEM to measure both convergent and discriminant validity. Scholars suggest measuring convergent validity. Testing the indicator's outer loading, composite reliability, and average variance extracted (AVE) is advised. As shown in Figure 2, item loadings of all constructs ranged between 0.553 and 0.916 (Hair *et al.*, 2014). At the same time, recorded results stated that the composite reliability of all variables was higher than 0.70 (Chin,

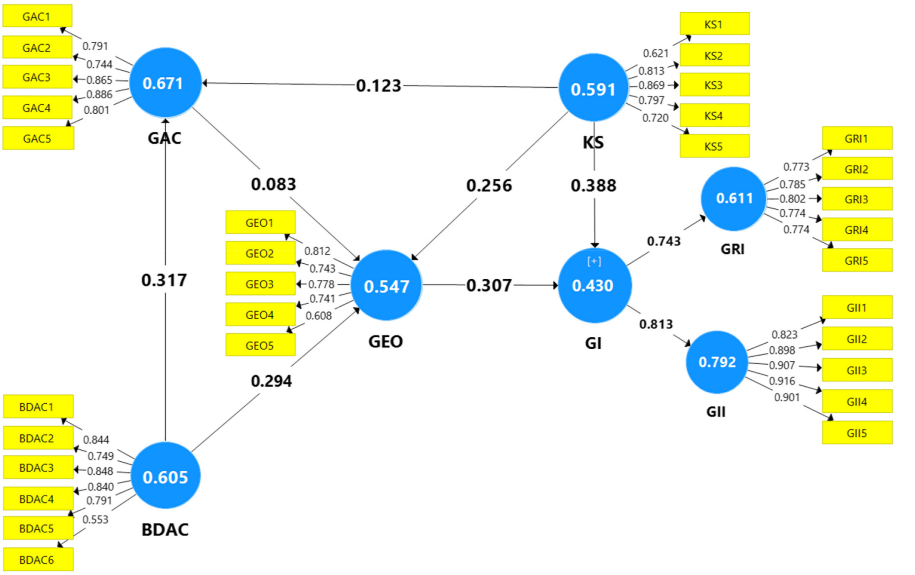


Figure 2.
Measurement model

Source(s): Figure created by author

1998). The AVE values of all constructs were more significant than 0.50, as suggested by (Hair *et al.*, 2017) for both first and second-order constructs.

Discriminant validity is another critical test that must be performed to validate and ensure the adequacy of the measurement tool and is free of outliers and errors before actual analysis (structural model estimation). Scholars Hair *et al.* (2021) suggest the cross-loading test, the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio test. This study tested the Fornell and Larcker criterion to address the comparison of correlation between predictor factors with the square root of the AVE of the factors itself. Table 1 shows that the bolded values on the diagonals were more significant than those in their respective row and columns, signifying that the measures applied in this research are discriminant. Furthermore, results showed that the outer loading is higher than the cross-loading of all factors, suggesting that the cross-loading test was achieved. Moreover, the last test is the HTMT ratio to determine if the model is well-addressed. Table 1 revealed that the values are less than 0.85, inferring that the study fulfilled the criterion value $HTMT_{0.85}$ (Kline *et al.*, 2012). Hence, the study confirmed discriminant validity (Henseler *et al.*, 2015).

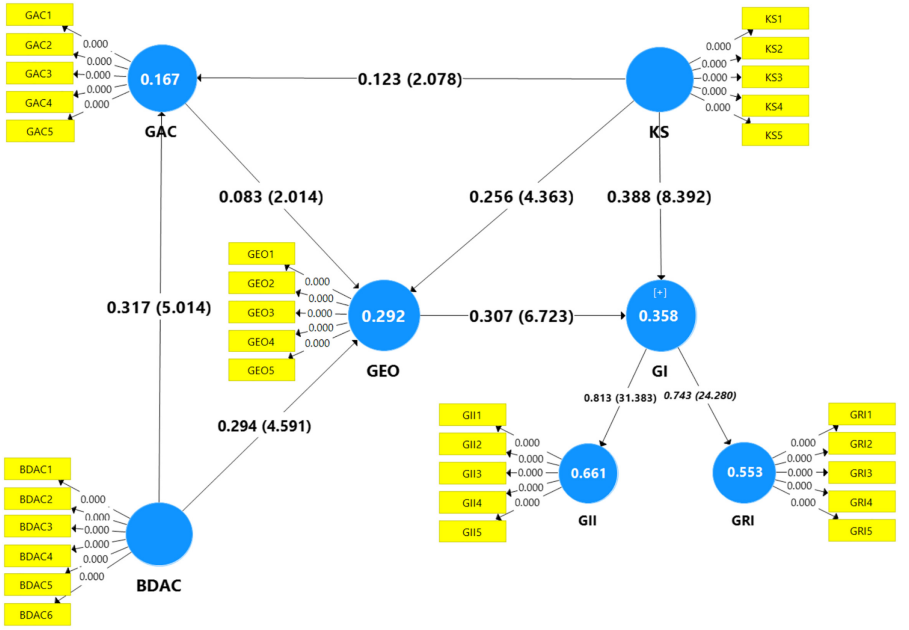
5.2 Structural model

Figure 3 and Table 2 revealed that BDAC recorded a positive and significant relationship with both GAC ($\boldsymbol{\beta_1} = 0.317$, $t = 5.084$, $p < 0.000$) and GEO ($\boldsymbol{\beta_2} = 0.294$, $t = 4.591$, $p < 0.000$), signifying that H1 and H2 are accepted. Next, the GAC generated a positive and significant effect on GEO ($\boldsymbol{\beta_3} = 0.083$, $t = 2.014$, $p < 0.022$), suggesting that hypothesis H3 is supported. In addition, GEO positively and significantly impacts GI ($\boldsymbol{\beta_4} = 0.307$, $t = 6.723$, $p < 0.000$), denoting that H4 is retained. Furthermore, while KS has recorded a positive impact on GAC ($\boldsymbol{\beta_5} = 0.123$, $t = 2.078$, $p < 0.019$), which indicates that H5 is supported, the sorted results revealed that KS has a positive impact on both GEO ($\boldsymbol{\beta_6} = 0.256$, $t = 4.363$, $p < 0.000$) and GI ($\boldsymbol{\beta_7} = 0.388$, $t = 8.392$, $p < 0.000$), thus, accepting H6 and H7.

	BDAC	GAC	GEO	GI	GII	GRI	KS
BDAC	*0.778*						
GAC	0.398	*0.819*					
GEO	0.497	0.286	*0.74*				
GI	0.586	0.103	0.492	*0.655*			
GII	0.398	0.455	0.266	0.413	*0.89*		
GRI	0.523	0.258	0.518	0.543	0.215	*0.782*	
KS	0.66	0.332	0.478	0.334	0.262	0.593	*0.769*
HTMT ration							
BDAC							
GAC	0.446						
GEO	0.552	0.311					
GI	0.683	0.69	0.583				
GII	0.444	0.72	0.3	0.609			
GRI	0.609	0.291	0.615	0.58	0.236		
KS	0.763	0.341	0.533	0.603	0.258	0.699	

Source(s): Table created by the author

Table 1.
Farnell and locker criterion and HTMT ratio test



Source(s): Figure created by author

Figure 3.
Structural model results

5.3 The effect size

The effect size (f^2) of predictor factors on a specific criterion one details to what extent these factors are correlated and influence the dependent constructs simultaneously, explaining the research model strength (Hair *et al.*, 2014). Predictors recording an f^2 value of 0.02 are seen as a small effect, while a value of 0.15 is considered moderate, and a value of 0.35 is recognized as a large effect size (Cohen, 1988). As tabulated in Table 2, BDAC recorded a small effect size on

GAC and GEO. In contrast, KS possesses a moderate effect size on GEO and a small effect size on GAC and GEO. Whereas GAC recorded a small effect size on GEO, this last has a negligible effect size on GI.

5.4 Testing the mediation effect

Table 3 shows that BDAC positively influences GEO, and this last positively influences GI; hence, as expected, GEO positively and statistically mediates the relationship between BDAC and GI (**β2a** = 0.09, $t = 3.498$, $p < 0.000$), which means that H2a is accepted. To determine the mediation type, the study applied Preacher and Hayes' approach (Preacher and Hayes, 2004, 2008). Results in Table 3 indicated that the indirect effect (BDAC → GEO → GI) had a $\boldsymbol{\beta}$ value of 0.09 and a $\boldsymbol{t}$ value of 3.489. Following Hair *et al.* (2013), the variance accounted for (VAF) was calculated to determine the indirect effect size with the total effect. Thus, the VAF = direct effect/total effect had a value of 0.09/0.294 = 0.3061, which indicated that 30.61% of the BDAC effect on GI was explained via the existence of the mediation effect of GEO. Since the VAF is greater than 20% but less than 80%, GEO partially mediated this relationship; thus, H2a is supported. Applying the same procedure of mediation calculation and as shown in Table 3, all mediation hypotheses were recorded with a partial mediation impact, supporting all proposed hypotheses.

Following Cohen (1988), $\boldsymbol{R^2}$ values ranged between 0.02 and 0.13, seen as small, whereas values ranging from 0.13 to 0.26 were considered moderate, while values above 0.26 were acknowledged as substantial. As presented in Table 2 and Figure 3, the $\boldsymbol{R^2}$ value of GAC was moderate, while GEO and green innovation were substantial. Thus, the variance explained by the predictor constructs on GEO and green innovation was relevant. It is crucial to determine the predictive relevance of the research model. Using Smart PLS and through blindfolding procedures suggested by (Geisser, 1975), the study estimates the model's predictive relevance. $\boldsymbol{Q^2}$ recorded a value higher than zero or close to 1, which suggests that the model is relevant, recognizing the strength of interrelationships (Chin, 1998). Cohen *et al.* (2013)

Table 2. Structural model results

Hypothesis	B	*t* value	*p* value	5.00%	95.00%	F^2	R^2	Decision
H1. BDAC → GAC	0.317	5.014	0	0.212	0.419	0.068	0.167	Accepted
H2. BDAC → GEO	0.294	4.591	0	0.187	0.396	0.065		Accepted
H3. GAC → GEO	0.083	2.014	0.022	0.018	0.154	0.072	0.292	Accepted
H4. GEO → GI	0.307	6.723	0	0.23	0.379	0.113		Accepted
H5. KS → GAC	0.123	2.078	0.019	0.024	0.217	0.016		Accepted
H6. KS → GEO	0.256	4.363	0	0.15	0.354	0.052		Accepted
H7. KS → GI	0.388	8.392	0	0.306	0.463	0.18	0.358	Accepted

Source(s): Table created by the author

Table 3. Variance accounted for (VAF) of the mediating variables

Hypothesis	B	*t* value	*p* value	5.00%	95.00%	VAF %	Decision
H2a. BDAC → GEO → GI	0.09	3.498	0	0.053	0.135	30.61	Partial
H3a. BDAC → GAC → GEO	0.126	1.862	0.032	0.006	0.051	39.74	Partial
H3b. KS → GAC → GEO	0.061	1.283	0.1	0	0.026	49.59	Partial
H4a. GAC → GEO → GI	0.026	1.806	0.036	0.005	0.051	31.32	Partial
H4b. KS → GEO → GI	0.079	3.717	0	0.043	0.117	30.85	Partial

Source(s): Table created by the author

suggest that Q^2 values greater than 0.02, 0.15 and 0.35 are considered small, moderate and sizeable predictive relevance. Sorted results revealed that Q^2 values of GAC, GEO and green innovation are 0.106, 0.13 and 0.163, indicating that GAC and GEO constructs recorded a small Q^2 while GI has a moderate Q^2 value, respectively.

6. Discussion

Drawing upon the dynamic capability theory, this study aims to examine for the first time the vital impact of BDA capabilities on firms' green absorptive capacity and GEO to boost green innovation. Due to the massive amount of data stored and utilized and because of the increasing green concerns and ecological and institutional pressures, GEO needs sufficient BDA capabilities. BDA capabilities is the source of creating distinguished knowledge, developing valuable insights, offering solutions for business problems and forecasting future business trends. It supports GEO's green business agenda to develop green business models, introduce new products, enhance innovativeness capacities, improve business performance, neutralize threats, and exploit green opportunities. On the other hand, BDA capabilities support knowledge absorptive capacity to convert it to commercialized knowledge. In turn, it empowers entrepreneurs with a green business agenda. Based on the DCT lens, we can argue that BDA capability is the backbone of firms GAC and GEO. Hence, green innovation can be developed and achieve high performance. This study confirms the strategic role of developing BDA platforms as a dynamic capability that could reconfigure and develop existing capabilities to maintain competitive advantages and survive in a highly dynamic environment.

Based on the existing literature, Garmaki *et al.* (2023), Tchuente and El Haddadi (2023), Inamdar *et al.* (2021), Rialti *et al.* (2019a) and Ardito *et al.* (2019), this research is among the pioneer studies that were developing new hypotheses and empirically testing the relationships between BDAC-GAC and BADC-GEO to level up green innovation. It is also important to note that this study answers questions raised by a study by Steininger *et al.* (2022) about the necessary to acquire well-developed IT capabilities to reconfigure existing dynamic capabilities, thus fulfilling the DCT promise (Teece *et al.*, 1997; Zahra *et al.*, 2006). Having sufficient BDA capabilities reconfigure the system of business operations, increases the effectiveness of strategic decision-making, and introduces innovative solutions for problem-solving and forecasting future market and customer behaviors. In addition, the contribution of knowledge sharing to the GEO eco-business agenda and how the shared knowledge among well-experienced employees would strengthen the GAC-GEO and GEO-green innovation relationships are unknown. Moreover, the study answered the necessity of integrating employees' KS to develop firms' dynamic capabilities to encounter existing business challenges. Hence, this study confirms that the accumulated knowledge over the years should be of interest to enhance firms' green dynamic capabilities such as GAC (Zahra and George, 2002; Zahra *et al.*, 2006). In turn, it generates green knowledge that reconfigures and increases the effectiveness of business systems. This study advances the knowledge of dynamic capability theory, big data analytics, and knowledge management literature. Most past studies addresses the effect of BDA on different measures of financial performance, competitive advantages, co-innovation and supply chain (Garmaki *et al.*, 2023). Given the importance of current digital businesses and despite the high uncertainty, BDA capabilities significantly became the backbone of entrepreneurs eco-business success. To conclude, applying underpinning theory, this study advocate that BDA and GAC are the key sources of GEO success to foster green business innovation.

The study revealed that BDA capabilities positively and significantly impacted GAC and GEO, indicating that H1 and H2 are supported. This means firms with well-developed BDA platforms would reconfigure and develop green absorptive capacity (Khan *et al.*, 2022). This

implies that GAC could create, assimilate, leverage and convert the developed green knowledge to commercialized ends (Zahra *et al.*, 2009). Hence, GAC's core focus is introducing new insights, exploiting existing green capabilities to foster entrepreneurs exploring green opportunities and boosting entrepreneurial goals (Zahra *et al.*, 2006). Referring to the DC theory, BDA is viewed as the source of developing firms' dynamic capabilities. A study by Steininger *et al.* (2022) emphasizes the importance of firms' IT-enabled dynamic capabilities to reconfigure and create valuable knowledge. BDA capabilities strongly affect developing firms' knowledge management (Ferraris *et al.*, 2019). In the era of digital businesses, entrepreneurs' green behavior needs distinguished green knowledge to neutralize environmental pressures and increase business profit (Waqas and Tan, 2023). Hence, BDA capabilities offer GEO green business insights and know-how, help develop profitable green business models, and anticipate future business trends (Waqas *et al.*, 2021). As a result, this study confirms BDA's role in promoting GEO goals. Furthermore, the study found that GEO partially mediates the BDA-green innovation relationship, revealing that 30.61% of the BDAC effect on GI was explained via the existence of the mediation effect of GEO**,** inferring that H2a is accepted. Based on the DC theory, GEO benefits from BDA that offers strong support to enhance green innovation by developing new green products and green business models; and reconfiguring green processes to reduce energy consumption and improve ecosystem (Makhloufi *et al.*, 2023b; Persaud and Zare, 2023).

Furthermore, the study finds that GAC positively influences GEO, denoting that H3 is accepted. Theoretical support exists for green absorptive capacity's role in enhancing firms' green orientation (Zhang *et al.*, 2023). GAC is seen as the backbone of GEO business goals (Makhloufi *et al.*, 2023a; Zahra *et al.*, 2006). Importantly, GAC partially mediates the BDA-GEO and KS-GEO relationships, signifying that H3a and H3b are accepted. GAC's primary goal is to convert environmental knowledge into a commercialized end which creates entrepreneurial profits (Wang *et al.*, 2023). While BDA capabilities provide valuable knowledge, know-how and in-depth insights (Singh and El-Kassar, 2019), GAC leverage and convert knowledge to knowledge applications (Makhloufi *et al.*, 2023c). Knowledge applications promote GEO's business agenda, respond to customer needs, forecast future business trends, and develop new green products. It implies that entrepreneurs prioritizing green concerns rely on GAC to offer green knowledge (Zhang *et al.*, 2023). The combination of BDA and GAC develops this last.

Additionally, GAC partially mediates the relationship between knowledge sharing and GEO. Employees' accumulated knowledge over the years has played a significant role in developing and reconfiguring green knowledge absorptive capacity (Song *et al.*, 2020; Zhang *et al.*, 2020). Long years of experience, training and deep learning help employees obtain valuable knowledge and skills to understand business processes, anticipate future trends, respond to customers and assist entrepreneurs with green business plans (Kang and Lee, 2017). Applying the DC theory, employee knowledge sharing is seen as a dynamic capability that reconfigures the entire business process, enhances green innovation, develops green business models, and boosts business-problem solutions (Lin and Chen, 2017; Song *et al.*, 2020). This means that the knowledge shared among employees across business units would be beneficial for GAC to transfer and convert accumulated knowledge into commercialized ends (Balle *et al.*, 2020; Rafique *et al.*, 2018).

The findings indicate that GEO positively impacts green innovation, inferring that H4 is accepted. The study is in line with past studies (Shehzad *et al.*, 2023; Wang *et al.*, 2023). From the DC theory, the entrepreneur green mindset's primary objective is to introduce eco-friendly products, greening processes and reducing energy consumption should rely on green innovation (Makhloufi *et al.*, 2023a; Wang *et al.*, 2022). Green innovation is the central pillar of GEO's success. Thus, entrepreneurs usually spend great efforts to develop green innovation practices (Wang *et al.*, 2023). The study also found that GEO mediates the GAC-GI and KS-GI

relationships, implying that H4a and H4b are accepted. GAC is the backbone of firms' knowledge creation, and the key objective is to create, convert and leverage developed green knowledge (Pacheco *et al.*, 2018). Green knowledge is applied to reconfigure green innovation capabilities (Song *et al.*, 2020). It implies that reconfiguring and developing existing green innovation capabilities leads to new eco-friendly products, advancing green processes, reducing energy consumption and exploring green opportunities (Zhang *et al.*, 2023). In turn, it boosts entrepreneurial green business goals. In contrast, GEO mediates the KS-GI relationship, inferring that knowledge sharing strongly impacts green innovation capabilities (Song *et al.*, 2020). It indicates that firms incorporating and valuing employees with long years of experience, training and in-depth learning could be the major asset to develop and reconfigure existing capabilities to create green competitive advantages and drive high entrepreneurial green competencies (Lin and Chen, 2017). According to the dynamic capability theory, employees sharing accumulative knowledge seen as distinguished capabilities that competitors cannot duplicate due to the complexity of creation and development (Teece *et al.*, 1997; Zahra and George, 2002). It develops green innovation capabilities to the level of the GEO business agenda.

Last, the sorted results confirmed the positive impact of knowledge sharing on GAC, GEO and green innovation, suggesting that H5, H6 and H7 are accepted. Employee knowledge sharing is vital for developing firms' dynamic capabilities (Rafique *et al.*, 2018). Firms' absorptive capacity benefits and transfers employees' KS into knowledge applications, generating new insights and know-how, improving products, and developing business models (Balle *et al.*, 2020). Given increasing green concerns, examining the relationship between employees' knowledge sharing and GAC's response to entrepreneurs' green business agenda is essential. This study bridges the gap and offers strong evidence for DCT and absorptive capacity literature. In addition, KS positively influences GEO, meaning that employees accumulating distinguished knowledge obtained over years of experience understand entrepreneurial firms' business agenda and are aware of environmental impacts. Thus, sharing employees' environmental knowledge is crucial for entrepreneurs' green strategies. The DCT perspective advocates that GEO's primary purpose is to balance the environmental system and green business goals. Employees KS are aware of environmental responsibility, which boosts corporate environmental entrepreneurship (Makhloufi *et al.*, 2023c).

Additionally, the study confirms a positive relationship between KS and green innovation, denoting that employees' experiences and in-depth knowledge can develop green innovation capabilities to overcome firms' concerns. There was a lack of studies that emphasized the contribution of individual KS to enhance innovation capabilities (Song *et al.*, 2020). To conclude, this study addresses significant gaps identified and discussed throughout this paper using the dynamic capability theory as a theoretical umbrella.

7. Study implications

7.1 Theoretical implications

Drawing upon the dynamic capability theory and according to the ongoing research discussions. This study is among the pioneers of research addressing the importance of BDA capabilities to enhance and level up firms' green absorptive capacity to the level of green entrepreneurship orientation. Eminent scholars of the dynamic capability perspective Teece (2016) and Zahra *et al.* (2006) advocate that successful entrepreneurial firms should rely on converting, reconfiguring and developing existing dynamic capabilities to absorb and neutralize external threats, boosting entrepreneurial achievements. This study argues that firms possessing well-developed BDA platforms could contribute to developing dynamic capabilities. Entrepreneurs with a green mindset seek to advance green businesses to create

green profits while reducing the minimum environmental impact. BDA capabilities help GEO by forecasting green business trends and customer concerns, developing innovative ways to reduce energy consumption and introducing new green products.

Conversely, GAC is the firms process of creating knowledge, integrating it with existing knowledge, and converting it to knowledge applications. The developed knowledge applications is applied for commercialized ends. According to the DCT perspective, it is the reason firms develop dynamic capabilities to adapt to all kinds of business environments (Teece, 2016; Zahra *et al.*, 2006). As a result, the study supports the notion that dynamic capabilities such as green absorptive and BDA capabilities are the backbone of successful firms' GEO.

In addition, understanding how knowledge sharing is associated with green absorptive capacity, supporting entrepreneurs with green mindsets, and enhancing green innovation is still ambiguous. To the best of our knowledge, a lack of studies, if any, have addressed the KS-GAC, KS-GEO and KS–green innovation relationships. Applying the dynamic capability theory, this study questions and discusses whether knowledge sharing among employees throughout organizational structure could impact firms that are entrepreneurially green-oriented, level up green innovation, develop dynamic capabilities and contribute to entrepreneurial achievements. Existing studies have examined the role of KS from different organizational, behavioral and institutional perspectives. However, standing on the DCT lens, it is still unclear and controversial how employees KS can promote entrepreneurs' green behavior to address the green business agenda. Hence, this study seeded the knowledge management and entrepreneurship literature by providing necessary evidence of the KS-GEO relationship, and future studies are recommended to examine the relationship in another context.

Another significant theoretical contribution from this study is the impact of KS on green innovation. According to Grant's knowledge-based theory, firms should obtain the necessary knowledge to survive in a dynamic environment. The obtained knowledge reduces costs, increases innovation and creativity, drives efficiencies, and anticipates future business changes. However, this last theory suggests that firms must acquire knowledge to survive in the dynamic environment. The theory does not answer whether the obtained knowledge can reconfigure and develop existing dynamic capabilities to drive green innovation. Hence, applying the DCT lens, this study covers the knowledge-based theory's deficiencies and extends its scope. Employees who acquire long experience, know-how, training, deep learning, and high interpersonal skills play strategic roles in developing firms' green innovation. Based on the dynamic capability theory, employees KS can reconfigure existing green dynamic capabilities by reducing energy use, improving the workplace environment, enhancing green practices, innovating new ways to increase resource efficiencies, and introducing new green products.

Last but not least, this study confirms the impact of KS on green absorptive capacity. According to the DCT, developing dynamic capabilities is necessary to maintain survival and growth. Sharing accumulated knowledge over the years significantly impacts organizational capabilities. Employees' KS is one of the primary sources of knowledge absorptive capacity. Firms GAC focusing on improving green practices, helping entrepreneurs' green business agenda and introducing new green products need valuable accumulated knowledge over the years. Knowledge created from profound experiences and learning leads to developing existing capabilities.

To conclude, this study applies the DCT to examine how firms' green dynamic capabilities are developed and reconfigured. This study focuses on the interrelationship between BDA capabilities, green absorptive capacity, green entrepreneurship orientation and knowledge sharing. Furthermore, using the DCT approach, this paper covers the theoretical limitation of resource-based and knowledge-based theories in examining the role of BDA capabilities and

knowledge sharing in developing organizational capabilities. The resource-based view seen information as valuable. However, it does not emphasize their potential value in business processes. In contrast, the knowledge-based view does not fully address the strategic choices enabled by BDA capabilities and KS to foster problem-solving options. Specifically, the DCT advocates BDA capabilities as a resource of value creation and a dynamic capability that drives distinctive capabilities to create strategic insights (Mikalef *et al.*, 2021).

7.2 Managerial implications

Firms with well-developed BDA platforms can help develop and reconfigure existing dynamic capabilities. It leads to boosting green business performance and developing innovative green practices. An entrepreneur prioritizing green concerns relies on green insights generated by BDA capabilities. Managers should exploit benefits created from BDA capabilities to forecast future green business trends, anticipate customer green concerns, respond to market demands and develop suitable plans to neutralize future threats and explore opportunities. BDA capabilities support entrepreneurs with valuable insights to strategize decisions regarding the future of business. In addition, BDA capability is the key source for firms to develop existing dynamic capabilities and generate new ones. This study confirms the role of BDA in enhancing the impact of GAC and GEO.

Furthermore, green absorptive capacity is the backbone of knowledge creation and dissemination, which managers need in all business operations. GAC's prominent role is converting knowledge creation to knowledge applications used for commercialized ends. Moreover, this study addresses one of the missing practical gaps where prior studies do not examine the contribution of knowledge sharing to the development of dynamic capabilities such as GAC and GEO. Hence, this study confirms the role of employees KS in supporting entrepreneurs' green business agenda, the development of GAC and green innovation. The study validates that accumulated knowledge over the years would be beneficial to improve green practices and promote entrepreneurial achievements.

8. Future research direction

This study advises future researchers to address the effect of knowledge sharing and BDA capabilities on the multidimensionality of green entrepreneurial orientation and green absorptive capacity. It also recommends examining the relationship between BDA capabilities, GAC, GEO and green innovation. Other factors may improve and increase GAC's level to boost GEO's business agenda. In addition, KS plays an essential role in accompanying an entrepreneur's green journey. Hence, it is suggested that there were other potential constructs concerning the effect of GEO on green innovation. Subsequent studies should focus on multidimensions of BDA to drive green practices, enhance employees' creativity, advance green processes and promote green business growth. Furthermore, literature concerning the relationship between KS-GEO, KS-GAC and KS–green innovation is still scarce. It is vital to enrich existing literature by emphasizing the role of knowledge sharing in developing dynamic capabilities. Based on the DCT, several theoretical gaps still exist and are underdeveloped regarding how dynamic capabilities are developed and configured. For the first time, this research examined the role of KS in developing firms' dynamic capabilities to drive green entrepreneurial growth.

This paper focuses on manufacturing firms that possess unlimited resources. While SMEs seen as the backbone of economies, creating jobs and characterized by intensive innovation. Examining the progress and contribution of BDA capabilities on green innovation is advised. Due to the intensity of innovation capabilities among SMEs, understanding the role of employees KS in developing green innovation and driving high entrepreneurial outcomes is

crucial. Additionally, a longitudinal study is recommended to address the progress of BDA and green innovation over the years. The study is limited to a single country and context; thus, covering other countries and contexts is highly suggested.

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