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# The Impact of Green Technology Adoption and Dynamic Capabilities on Green Competitive Advantage and Sustainable Development: Moderating Role of Organizational Commitment

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**ABSTRACT**

Sustainable development (SD) is the foremost requirement for the environmental sustainability and this aspect needs the attention of recent studies and policymakers. Hence, the present study examines the impact of green technology adoption (GTA), green dynamic capabilities (GDC) on the green competitive advantage (GCA) and SD of manufacturing companies in China. The study also investigates the mediating role of GCA among GTA, dynamic capabilities and SD and also checks the moderating role of organizational commitment among GCA and SD. The study gets the primary data from the employees of manufacturing companies in China using survey questionnaires. The study also used the smart-PLS to check the nexus among the variables. The outcomes indicated that the GTA and dynamic capabilities has a positive association with GCA and SD. The outcomes also exposed that the GCA significantly mediates and organizational commitment significantly moderates among variables. The study provides the guidelines to the policymakers in making the policies related to enhance the SD using GTA and dynamic capabilities.



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## 1. Introduction

A number of issues that may affect our future. One of them is the lack of SD which may be caused due to environmental degradation. Therefore, the secret to a better future with less waste creation is SD. The three main sectors of SD are the environmental, social and economic. There are a few ways to control SD like the use of resources to aid in mitigating carbon emissions and, the adoption of green concepts. Environmentalists prevail has a prominent impact on the economy and the companies that serve that sector. Development that satisfies current demands without abusing or overusing natural resources in order to protect them for future generations is SD (Chien et al., 2022; Kasztelan, 2017). Three goals characterize SD: first, economic, which tries to achieve balanced growth; second, environmental, which protects the ecosystem; and third, society, which ensures that all people have equitable access to resources (Baloch et al., 2021; Dogaru, 2022). The concept of SD emerged in response to the ever-changing and expanding environmental problems that our world is currently confronting (Abbas & Sağsan, 2019; Lotfi et al., 2018). There are numerous ideas created for the achievement of SD and the most suitable is the

green concept. The green concept is all about the utilization of resources that support the environment.

China is attracting the world for its business and supporting its economy. Such an increase in business is causing an increase in industrialization at a rapid pace. This industrialization is causing environmental degradation (Yurui et al., 2021). China's extreme environmental deterioration, along with its enormous population and unheard-of rapid economic expansion, pose serious obstacles to SD. Significant economic progress has been accomplished since 1978, but new difficulties are now arising (Chien et al., 2021; Hanif et al., 2022; Wang et al., 2023). Serious environmental contamination and scarce, strategically preserved resources are two of them. In the near future, China's existing economic model will put more strain on the country's ability to preserve its environment and supply of resources. Environmental issues are becoming a major element influencing social stability and national security (Adebayo & Ullah, 2023). China has experienced several issues related to industrialization that have plagued several industrialized nations in the past. A high prevalence of illnesses has been caused by air quality and noise pollution, which are also key causes of water contamination in numerous major rivers (Hussain et al., 2021; Luo et al., 2023). Development and the environment are increasingly at odds with one another. Future growth is likely hampered by a number of serious issues, including a relative lack of resources, a delicate ecological system, and inadequate environmental carrying capacity (Farooq, Gillani, et al., 2023; Liu et al., 2022). Recent years have seen significant environmental consequences as a result of enormous efforts on conservation and cleanup challenges. The amount of carbon emissions is rising quickly. In order to achieve SD the country has adopted the green concept by converting its technology to green technology to support the environment, safeguard the natural resources, and be cost-effective and by creating GDC in its people (Shafiq & Zafar, 2023; Yang et al., 2024; Ye et al., 2021).

The present study has addressed the following gaps that exist in the literature investigation of the model consisting of the factors i.e., SD, GTA, and GDC with the moderating effect of organizational commitment and the mediating effect of GCA particularly in China. Further, 1) Shahzad et al. (2022) and Fu et al. (2018), explored the nexus between GTA and SD. However, the present study added factors like GDC. Furthermore, also tested the mediating effect of GCA, 2) Nath and Siepong (2022) and Li and Lin (2024), explored the nexus between GDC and SD. However, the present study added factors like GTA. Furthermore, also tested the mediating effect of GCA, 3) Ibrahim and Mahmood (2016) and Anwar et al. (2018), explored the mediating effect of GCA in multiple relationships, hence, the same is also employed here in the relationship amid GTA, GDC, and SD, 4) Srivalli and Kanta (2016) and Schmidt and Diestel (2012), explored the moderating effect of organizational commitment in multiple relationships, hence, the same is also employed here in the relationship amid GCA and SD. Likewise, the other studies the significance of the present study is 1) it highlights the need as well as the importance of green concept for the achievement of SD, 2) the study also resulted in the addition of the literature on the concept of green concept for achievement of SD, 3) the study also helpful the professionals associated with the concept of SD to have more understanding and application of the concept.

## 2. Literature Review

The world is getting advanced with the passage of time as everything is getting advanced as a result of the technological revolution. This advancement is bringing ease into every aspect of our lives (Farooq, Subhani, et al., 2023; Mohsin et al., 2021; Nawab et al., 2021). It’s a matter of hours to travel from one country to another as compared to the past. On the other side, the issues are also getting advanced like diseases, and environmental problems. This is creating problems to attain the SD (Al-Emran & Griffy-Brown, 2023; Shah et al., 2021). Resultantly, the world is moving towards a green concept i.e., green technology being one of the most suitable and secure ways for SD as proposed by literature (Li et al., 2022; Nazir et al., 2023). In this context, Shahzad et al. (2022),

explored whether there is any sort of association between GTA and SD. The study used the data of 516 respondents as a sample. The study analyzed the collected data using SEM. The results proposed that the significant nexus between GTA and SD. Further, to provide a safe future for our generation the world should adopt green technology. The adoption would result in 1) safeguarding the environment, 2) saving natural resources, 3) cost-effectiveness, and 4) mitigation of carbon emissions. Moreover, a comprehensive literature review was conducted by Fu et al. (2018) on the concept of factors affecting SD. The study consulted 964 articles regarding SD. Out of which 34 were selected for review. The study concluded there are numerous factors that affect SD. Further, SD is a continuous process. The world should continue to hustle free efforts recommended till the achievement. The study also recommended that the world should adopt sustainable technology to safeguard the future. Additionally, Khurshid et al. (2024), checked whether innovation, institutions, and sustainability are drivers of GTA as well as SD. The study used the data of 20 years as a sample. The sampling data covers the tenure from 2001 to 2021. The study analyzed the collected data by employing the Granger Causality analysis approach. The results proposed that the significant nexus between GTA and SD. Further, it will also result in a) providing ease in the SD process, b) safeguarding the world by saving natural resources, c) easy adoption, and 4) the need for time. Thus, based on above studies the hypotheses are development below:

**H1:** Green technology adoption is significantly associated with sustainable development.

Whether it's a developed or developing economy, the achievement of SD is one of its prime aims. In this achievement, the green concept is playing a vital role (Castiaux, 2012). The world is evolving throughout time as a result of the technological revolution, which has made everything more advanced. Our lives are becoming easier in every way because of this innovation. Compared to earlier times, traveling from one country to another just takes a few hours. On the other hand, concerns like illnesses and environmental difficulties are also becoming more complex (Farooq et al., 2024). This is making it more difficult to achieve SD. Although the concept of green technology introduced as well as practiced in advanced economies still there are numerous issues that need to be addressed to withdraw maximum benefits from the adoption of the green concept. Since it is not at its peak, therefore, there is a scarcity of GDC which are key to the achievement of SD (Mazon et al., 2023). In this context, the association between green marketing capabilities and SD was explored by Nath and Siepong (2022). The study analyzed the collected data by employing the linear regression analysis approach. The study concluded that GDC significantly affect SD. Further, the GDC are important for SD. The countries should focus on a system for proper learning of GDC with the view to a) achievement of SD, and b) to get skilled the manpower for future. The study strongly recommended that developing economies prepare a GDC manpower for a bright future. Moreover, Li and Lin (2024), checked the role of GDC towards the achievement of GDC. The study used the data of 10 years as a sample. The sampling data covers the tenure from 2010 to 2020. The study analyzed the collected data by employing the SEM analysis approach. The results proposed that GDC play a vital role in the achievement of SD. Additionally, Arshad et al. (2023), explored whether there is any sort of association between sustainable i.e., GDC and SD. The study analyzed the collected data by employing the SMART PLS analysis approach. The results concluded the significant nexus between GTA and SD. Thus, based on above studies the hypotheses are development below:

**H2:** Green dynamic capabilities are significantly associated with sustainable development.

The decision regarding adopting any concept completely depends on any government or the firm. Likewise, if the government is committed to adopting any concept then will ensure its best efforts to get it formalized (Carvalho et al., 2019). Similar is the case with the firm. If a firm plans to achieve SD by achieving a competitive advantage i.e., green then will provide the best environment and culture to fulfill its commitment (Goh & Marimuthu, 2016). Thus, the organizational commitment results as a moderator in this regard. The study by, Srivalli and Kanta (2016), used organizational commitment as

moderator with the concept of teaching effectiveness. The study analyzed the collected data by employing the ML regression analysis approach. The results proposed that organizational commitment acts significant moderator of teaching effectiveness. Similarly, Schmidt and Diestel (2012), explored the moderating role of organizational commitment in the nexus between self-control demands and job strains. The study analyzed the collected data by employing the SPSS analysis approach. The results proposed the significant nexus between self-control demands and job strains. Further, institutional support acts as a significant moderator. Thus, based on above studies the hypotheses are development below:

**H3:** Organizational commitment significantly moderates the nexus between GCA and sustainable development.

Firms across the globe adopt different ways to achieve their targets i.e., creative marketing, customer targeting, innovation, high-standard products, etc. according to the market needs (Astuti & Datrini, 2021). One of the reliable ways to secure success in any competition is the competitive advantage (Lin & Chen, 2017). Similar is the case with GCA. In the case the gravity of sustainability is not enhanced despite being adoption of green technology the firms prefer the GCA as it mediates positively towards SD. In this context, Ibrahim and Mahmood (2016), explored whether the competitive advantage i.e., green mediates in the nexus between entrepreneurial intentions and SME performance. The study analyzed the collected data by employing the PLSS analysis approach. The outcomes proposed the significant nexus between entrepreneurial intentions and SME performance. Further, this nexus is mediated by GCA. Moreover, Anwar et al. (2018), explored whether the competitive advantage mediates in the nexus between intellectual capital, entrepreneurial strategy, and new venture performance. The study analyzed the collected data by employing the linear regression analysis approach. The outcomes proposed the significant nexus between intellectual capital, entrepreneurial strategy, and new venture performance. Further, this nexus is mediated by GCA. Thus, based on above studies the hypotheses are development below:

**H4:** Green competitive advantage significantly mediates in between green technology adoption and sustainable development.

Usually, GDC play a vital role in SD achievement. However a number of times the required level of development not achieved despite being employing the best dynamic capabilities (Setyaningrum et al., 2023). Different firms adopt different ways and one of them is the intervention of competitive advantage concept. The green concept plays a vital role in SD (Zameer et al., 2020). In the context of mediation, Novitasari and Agustia (2023), explored whether the GCA mediates in the nexus between green innovation and firm performance. The sample tenure covers from 2010 to 2018. The study analyzed the collected data by employing the regression analysis approach. The outcomes proposed the significant nexus between green innovation and firm performance. Further, this nexus is mediated by GCA. Moreover, Rua et al. (2018) explored the SMEs' key performance along with the mediating effect of GCA. The study analyzed the collected data by employing the SMART PLS analysis approach. The outcomes proposed that GCA mediates with SMEs' key performance. Thus, based on above studies the hypotheses are development below:

**H5:** Green competitive advantage significantly mediates in between green technology adoption and SD.

## 3. Research Methodology

The study examines the impact of GTA, dynamic capabilities on the GCA and SD and also investigates the mediating role of GCA among GTA, GDC and SD and also checks the moderating role of organizational commitment among GCA and SD of manufacturing companies in China. The study gets the primary data from the employees of manufacturing companies in China using survey questionnaires. The items are used to measure the variables such as GTA has seven items taken from Song et al. (2020), GDC has four items

taken from Singh et al. (2022), GCA has four items extracted from Fatoki (2021), organizational commitment has eight items adopted from Abdirahman (2018) and SD has five items extracted from Severino-González et al. (2022). These items are given in Table 1.

**Table 1**
***Measurement of Variables***

| Items | Statements | Sources |
|---|---|---|
| **Green Technology Adoption** | | |
| GTA1 | The firm select the materials that produce the minimum amount of pollution. | (Song et al., 2020) |
| GTA2 | The firm select the materials that consume the minimum amount of energy. | |
| GTA3 | The firm uses the lack of materials in quantity to produce the product. | |
| GTA4 | The firm deliberates whether the product is easy to recycle and decompose. | |
| GTA5 | The firm process efficiently decreases the emissions or waste. | |
| GTA6 | The process of recycles waste and emissions are used. | |
| GTA7 | The firm process decreases the consumption of water, electricity and coal. | |
| **Green Dynamic Capabilities** | | |
| GDC1 | GDC helps to understand the needs of customers | (Singh et al., 2022) |
| GDC2 | GDC helps to communicate effectively among the departments. | |
| GDC3 | GDC helps to equilibrium work and family life of their employees | |
| GDC4 | GDC helps to harmonize with the community to fulfill mutual needs. | |
| **Green Competitive Advantage** | | |
| GCA1 | Our firm has competitive advantage of low cost. | (Fatoki, 2021) |
| GCA2 | The firm produce quality green products that is better than our competitors. | |
| GCA3 | Our company is more proficient of investing in environmental development. | |
| GCA4 | Our firm is more proficient of environmental management compared to competitors. | |
| **Organizational Commitment** | | |
| OC1 | I feel strong sense of loyalty toward organization. | (Abdirahman, 2018) |
| OC2 | I am devoted to my organization. | |
| OC3 | I am proud to tell others I work at my organization. | |
| OC4 | I would be happy to work till retirement. | |
| OC5 | I feel organizational problems are my problems. | |
| OC6 | I care the destiny of my organization. | |
| OC7 | Working for organization is considered as the deal of personal meaning for me. | |
| OC8 | I am providing great effort to help this organization be successful. | |
| **Sustainable Development** | | |
| SD1 | Education about environment is important. | (Severino-González et al., 2022) |
| SD2 | The environmental care is involved in the curricular formation. | |
| SD3 | The precise use of gas, water and energy is promoted. | |
| SD4 | Containers are available to separate garbage according to material type. | |
| SD5 | Awareness of environmental problems is created. | |

The employees of the manufacturing companies are chosen as the respondents. In addition, the study also used simple random sampling to choose the respondent. Moreover, the study also selects the mail and personal visit method to distribute the surveys. The 505 surveys were distributed and received only 290 valid responses. These responses have approximately 57.43 percent response rate. In addition, the study also used the smart-PLS to check the nexus among the variables. It is an effective tool that deals with primary data and provides best results using large data sets (Hair Jr et al., 2020). Finally, the study has two predictors named green technology adoption (GTA) and green dynamic capabilities (GDC), while the study also used one mediating variable named green competitive advantage (GCA), one moderating variable named organizational commitment (OC) and one predictive variable named sustainable development (SD). Figure 1 shows these variables in framework.

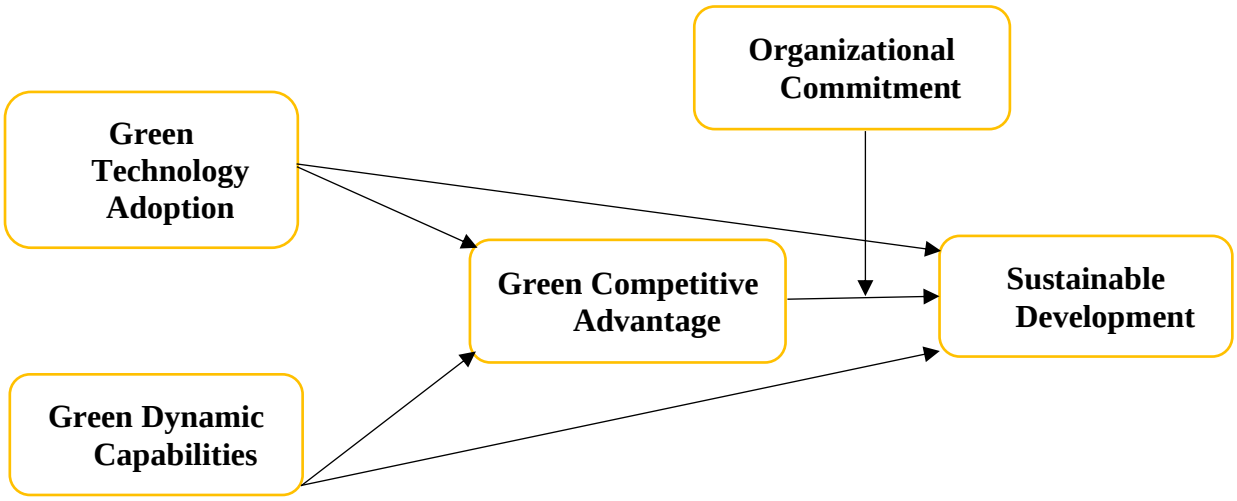


**Figure 1: Theoretical Model**

## 4. Research Findings

The convergent validity has been examined that shows the correlation among items. It is checked using factor loadings and average variance extracted (AVE) and both the tests shows values larger than 0.50. In addition, it is also checked using Alpha and composite reliability (CR) and both the tests shows values larger than 0.70. These values show a high correlation between items. These results are given in Table 2.

The study also checks the correlation among variables called discriminant validity. It is checked using Heterotrait Monotrait (HTMT) ratio and the results show that the values are not larger than 0.85. These values show a low correlation between variables. These results are given in Table 3. The outcomes indicated that the GTA and dynamic capabilities has a positive association with GCA and SD and accept H1 and H2. The outcomes also exposed that the GCA significantly mediates among GTA, dynamic capabilities and SD and accept H4 and H5. Finally, the organizational commitment significantly moderates among GCA and SD and accept H3. Table 4 shows these results.

**Table 2**
***Convergent Validity***

| Constructs | Items | Loadings | Alpha | CR | AVE |
|---|---|---|---|---|---|
| Green Competitive Advantage | GCA1 | 0.988 | 0.975 | 0.982 | 0.930 |
| | GCA2 | 0.977 | | | |
| | GCA3 | 0.985 | | | |
| | GCA4 | 0.906 | | | |
| Green Dynamic Capabilities | GDC1 | 0.917 | 0.919 | 0.942 | 0.804 |
| | GDC2 | 0.882 | | | |
| | GDC3 | 0.877 | | | |

| | | | | | |
|---|---|---|---|---|---|
| | GDC4 | 0.910 | | | |
| Green Technology Adoption | GTA1 | 0.783 | 0.886 | 0.906 | 0.581 |
| | GTA2 | 0.805 | | | |
| | GTA3 | 0.749 | | | |
| | GTA4 | 0.810 | | | |
| | GTA5 | 0.734 | | | |
| | GTA6 | 0.794 | | | |
| | GTA7 | 0.650 | | | |
| Organizational Commitment | OC1 | 0.838 | 0.941 | 0.951 | 0.709 |
| | OC2 | 0.860 | | | |
| | OC3 | 0.850 | | | |
| | OC4 | 0.808 | | | |
| | OC5 | 0.867 | | | |
| | OC6 | 0.866 | | | |
| | OC7 | 0.852 | | | |
| | OC8 | 0.795 | | | |
| Sustainable Development | SD1 | 0.641 | 0.825 | 0.878 | 0.592 |
| | SD2 | 0.852 | | | |
| | SD3 | 0.715 | | | |
| | SD4 | 0.793 | | | |
| | SD5 | 0.828 | | | |

**Table 3**
***Discriminant Validity***

| | GCA | GDC | GTA | OC | SD |
|---|---|---|---|---|---|
| GCA | | | | | |
| GDC | 0.484 | | | | |
| GTA | 0.106 | 0.064 | | | |
| OC | 0.445 | 0.442 | 0.117 | | |
| SD | 0.486 | 0.529 | 0.147 | 0.446 | |

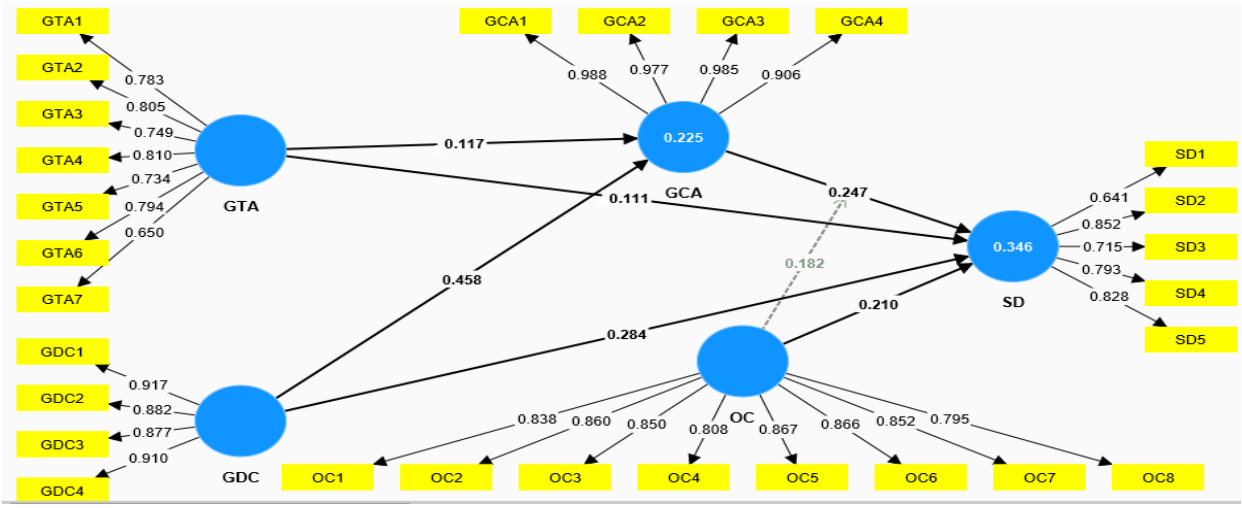


**Figure 2: Measurement Assessment Model**

**Table 4**
***Path Analysis***

| Relationships | Beta | Standard deviation | T statistics | P values |
|---|---|---|---|---|
| GCA -> SD | 0.247 | 0.072 | 3.447 | 0.001 |
| GDC -> GCA | 0.458 | 0.051 | 8.955 | 0.000 |
| GDC -> SD | 0.284 | 0.063 | 4.521 | 0.000 |
| GTA -> GCA | 0.117 | 0.055 | 2.117 | 0.035 |
| GTA -> SD | 0.111 | 0.053 | 2.092 | 0.037 |
| OC -> SD | 0.210 | 0.063 | 3.315 | 0.001 |
| OC x GCA -> SD | 0.182 | 0.058 | 3.106 | 0.002 |

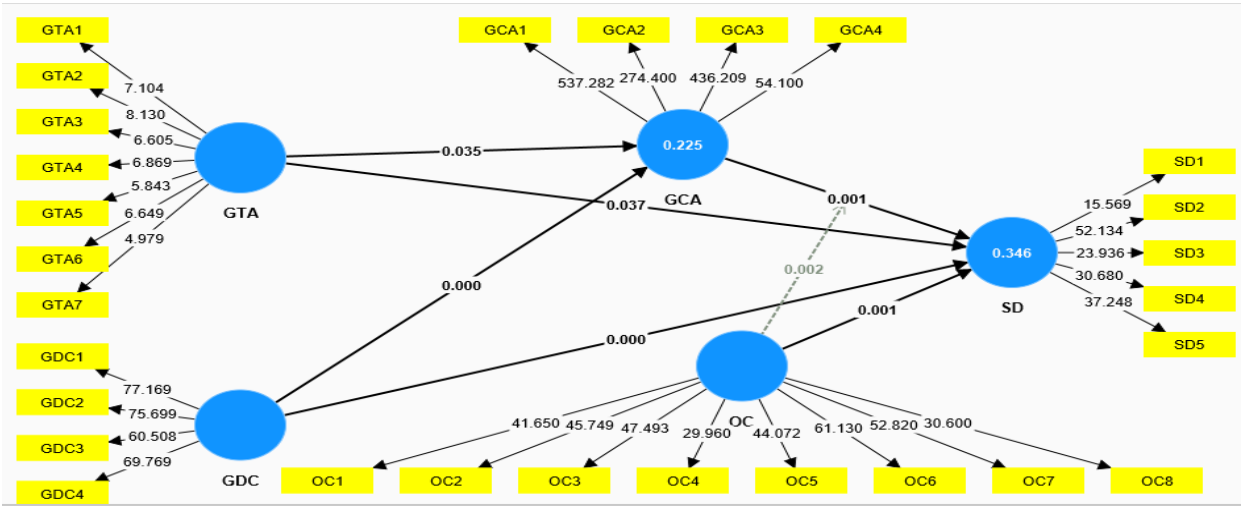


**Figure 3: Structural Assessment Model**

## 5. Discussions

The study gives a detailed analysis on how GTA and dynamic capabilities help to achieve competitive advantage and sustainability especially in China. Given China's rank as one of the largest economies, and the nation's contribution to many environmental problems, this paper aims to present the country's experience in the integration of innovative green technologies as well as the encouragement of sustainable business. It engages the function of the green technology and the dynamic capabilities to advance the competitive superiority of Chinese firm as well as the SD (Qiu et al., 2020). The adoption of green technology in China according to Wang et al. (2021) is the integration of new technologies that are designed to help China manage the effects of environmental pollution and Climate Change by reducing its rate, damage, and impact. This is more so prevailing in a country like China due to increasing industrialization that has increased pollution levels. Thus, the use of green technologies helps Chinese firms to decrease the effect of their activity on the environment, obey the requirements of the legislation that becomes stricter each day, and satisfy the new needs of consumers (Martinsons et al., 1997). Observing the antecedent literature the study argues that it is possible to accrue a competitive advantage by proactively taking to green technology as this enables firms to operate efficiently hence minimize costs by using resources optimally.

Furthermore, organizations that adopt the green technology portfolio can improve the firm's image and customers' loyalty which are two valuable factors within the changing consumer environment. The GCA mediates the GDC and SD relationships, the Teece and Pisano (2003) define as a firm's ability to integrate, build, and reconfigure the internal and external competencies to respond to the environment moving at a higher speed. The paper reveals that innovation, organizational learning, and strategic flexibility constitute the dynamic capabilities that help firms to enact green technologies as well as adjust to environmental dynamism. Specifically in the context of China, Li and Liu (2014) points that when the market and government policies are fluctuating and thus not very stable, firms that possess more dynamic capabilities are more capable to responding to these changes. They are able to predict over economic, legal, social, and political changes necessary to effectively implement sustainable changes, constantly implement better changes to the company's take on sustainability, and modify their approach over time in order to keep them in a position of dominance in the industry. For instance, those firms that are in a position to respond positively to changes in the business environment such as new environmental laws or consumers' changing needs for environmentally friendly products are likely to perform better than competitors who cannot respond to these changes effectively.

In this paper the analysis also includes the topic of GCA with reference to Chinese business. As mentioned above, GCA is the accrual of value to the firm from its green undertakings that set it apart from rivals. They include reduction in cost through increased

efficiency, better image, increased customer loyalty, and the possibility to penetrate new market that supports sustainability (Leonidou et al., 2013). According to Zhang and Wen (2008), China has in recent years, been encouraging SD through certain policies and incentives and therefore; firms that position themselves strategically based on these national priorities stand to benefit. It hypothesizes that firms which have implemented green technologies and exploited their dynamic capabilities not only receive increased, competitive advantages but also work towards the attainment of global SD goals, in terms of decreasing the firms' ecological impacts and enhancing social welfare.

Substantial to the research is the moderating effect of organizational commitment. Specifically, organizational commitment focuses on the extent to which an individual identifies with and is committed to the organization (Mowday et al., 1979). Thus, the research indicates that enhanced organizational commitment can promote the efficiency of green technology and dynamic capabilities. Previous studies like Nazir et al. (2016) and Kim et al. (2018) finds that Loyalty to the organization and collectivism, which are the interdependent culture dimensions, are significantly prevalent in China, and thereby HOC influences the organizational commitment most in this context. Thus, green human capital increases organizational commitments of actors to support and be involved in green practices, encourage sustainability, and undertake activities towards developing GCA and sustainable advancement. The study emphasizes that for the enhancement of the positive impacts of the GTA and dynamic capabilities, organizational commitment improves sustainability culture and innovation.

## 6. Implications

The impacts of this study are evident for the Chinese policymakers, entrepreneurs, and academics. In this way, these insights may be utilized by the policymakers to develop regulations and incentives that will promote the adoption of green technology as well as enhance the dynamic capabilities in firms that are involved in technology development. Managers are encouraged to pursue the green technologies and secure organizational commitment as a way of improving its competitive advantage and SD. Coming from this study, other researchers can advance the research on the relationship between green measures and organizational climate in various settings. The study guides the regulator in making the policies related to enhance the SD using GTA and GDC.

## 6.1 Limitations

However, the study has the following limitations which are worth acknowledging. One limitation is the definition and measurement of green technology and dynamic capabilities. This may vary from one study to another which may influence the consistency of the results. Another weakness is that the study is based on the attitudes of the respondents hence limiting their specific city and the validity of the outcomes. They are confined to selected industries or areas in China thereby restricting the extent of external validity of the findings to other industries or other area in China. Further, because the field of green technology is fluid and regulation is ever changing the issues may become less significant as newer and improved technologies, and or regulation develops over time. Last, the research may not consider all the interactions between organizational culture, outside entities, and other factors in relation to the green initiatives' success.

**Authors Contribution**
Tabish Nawab: study design & concept, data collection, data analysis, write-up
Ahsan Shafiq: critical revision, data interpretation, drafting

**Conflict of Interests/Disclosures**
The authors declared no potential conflicts of interest w.r.t the research, authorship and/or publication of this article.

## References


Abbas, J., & Sağsan, M. (2019). Impact of knowledge management practices on green innovation and corporate sustainable development: A structural analysis. *Journal of cleaner production*, *229*, 611-620. https://doi.org/10.1016/j.jclepro.2019.05.024

Abdirahman, H. I. H. (2018). Impact of work-life balance, job satisfaction and organizational commitment on employee performance. In: Universiti Utara Malaysia.

Adebayo, T. S., & Ullah, S. (2023). Formulating sustainable development policies for China within the framework of socioeconomic conditions and government stability. *Environmental Pollution*, *328*, 121-135. https://doi.org/10.1016/j.envpol.2023.121673

Al-Emran, M., & Griffy-Brown, C. (2023). The role of technology adoption in sustainable development: Overview, opportunities, challenges, and future research agendas. *Technology in Society*, *73*, 102240. https://doi.org/10.1016/j.techsoc.2023.102240

Anwar, M., Khan, S. Z., & Khan, N. U. (2018). Intellectual capital, entrepreneurial strategy and new ventures performance: Mediating role of competitive advantage. *Business and Economic Review*, *10*(1), 63-93. https://dx.doi.org/10.22547/BER/10.1.3

Arshad, M., Yu, C. K., Qadir, A., & Rafique, M. (2023). The influence of climate change, green innovation, and aspects of green dynamic capabilities as an approach to achieving sustainable development. *Environmental Science and Pollution Research*, *30*(27), 71340-71359. https://doi.org/10.1007/s11356-023-27343-0

Astuti, P., & Datrini, L. (2021). Green competitive advantage: Examining the role of environmental consciousness and green intellectual capital. *Management Science Letters*, *11*(4), 1141-1152. https://doi.org/10.5267/j.msl.2020.11.025

Baloch, Z. A., Tan, Q., Kamran, H. W., Nawaz, M. A., Albashar, G., & Hameed, J. (2021). A multi-perspective assessment approach of renewable energy production: policy perspective analysis. *Environment, Development and Sustainability*, *24*, 2164–2192. https://doi.org/10.1007/s10668-021-01524-8

Carvalho, F., Domingues, P., & Sampaio, P. (2019). Communication of commitment towards sustainable development of certified Portuguese organisations: Quality, environment and occupational health and safety. *International Journal of Quality & Reliability Management*, *36*(4), 458-484. https://doi.org/10.1108/IJQRM-04-2018-0099

Castiaux, A. (2012). Developing dynamic capabilities to meet sustainable development challenges. *International Journal of Innovation Management*, *16*(06), 124-131. https://doi.org/10.1142/S1363919612400130

Chien, F., Hsu, C.-C., Zhang, Y., Vu, H. M., & Nawaz, M. A. (2022). Unlocking the role of energy poverty and its impacts on financial growth of household: is there any economic concern. *Environmental Science and Pollution Research*, *29*(9), 13431-13444. https://doi.org/10.1007/s11356-021-16649-6

Chien, F., Sadiq, M., Nawaz, M. A., Hussain, M. S., Tran, T. D., & Le Thanh, T. (2021). A step toward reducing air pollution in top Asian economies: The role of green energy, eco-innovation, and environmental taxes. *Journal of environmental management*, *297*, 113420. https://doi.org/10.1016/j.jenvman.2021.113420

Dogaru, L. (2022, 2021). Green economy and green growth—Opportunities for sustainable development.

Farooq, U., Gillani, S., Subhani, B. H., & Shafiq, M. N. (2023). Economic policy uncertainty and environmental degradation: the moderating role of political stability. *Environmental Science and Pollution Research*, *30*(7), 18785-18797. https://doi.org/10.1007/s11356-022-23479-7

Farooq, U., Shafiq, M. N., Subhani, B. H., & Gillani, S. (2024). Climate policy uncertainty and regional innovation performance: New empirical evidence from the United States. *Managerial and Decision Economics*, *45*(3), 1497-1510. https://doi.org/10.1002/mde.4088

Farooq, U., Subhani, B. H., Shafiq, M. N., & Gillani, S. (2023). Assessing the environmental impacts of environmental tax rate and corporate statutory tax rate: Empirical evidence from industry-intensive economies. *Energy Reports*, *9*, 6241-6250. https://doi.org/10.1016/j.egyr.2023.05.254

Fatoki, O. (2021). Environmental orientation and green competitive advantage of hospitality firms in South Africa: Mediating effect of green innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(4), 223-233. https://doi.org/10.3390/joitmc7040223

Fu, Y., Kok, R. A. W., Dankbaar, B., Ligthart, P. E. M., & van Riel, A. C. R. (2018). Factors affecting sustainable process technology adoption: A systematic literature review. *Journal of cleaner production*, *205*, 226-251. https://doi.org/10.1016/j.jclepro.2018.08.268

Goh, C. Y., & Marimuthu, M. (2016). The path towards healthcare sustainability: the role of organisational commitment. *Procedia-Social and Behavioral Sciences*, *224*, 587-592. https://doi.org/10.1016/j.sbspro.2016.05.445

Hair Jr, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, *109*, 101-110. https://doi.org/10.1016/j.jbusres.2019.11.069

Hanif, S., Nawaz, A., Hussain, A., & Bhatti, M. A. (2022). Linking non renewable energy, renewable energy, globalization and CO2 emission under EKC hypothesis: evidence from ASEAN-6 countries through advance panel estimation. *Pakistan Journal of Humanities and Social Sciences*, *10*(1), 391–402. https://doi.org/10.52131/pjhss.2022.1001.0204

Hussain, M. S., Nawaz, M. A., Ahmad, T. I., & Bhatti, M. A. (2021). Environmental Governance and Green Energy: An Administrative Toolkit to Reduce Environmental Degradation. *iRASD Journal of Management*, *3*(3), 329-338. https://doi.org/10.52131/jom.2021.0303.0049

Ibrahim, N. M. N., & Mahmood, R. (2016). Mediating role of competitive advantage on the relationship between entrepreneurial orientation and the performance of small and medium enterprises. *International business management*, *10*(12), 2444-2452.

Kasztelan, A. (2017). Green growth, green economy and sustainable development: terminological and relational discourse. *Prague Economic Papers*, *26*(4), 487-499.

Khurshid, A., Huang, Y., Khan, K., & Cifuentes-Faura, J. (2024). Innovation, institutions, and sustainability: Evaluating drivers of household green technology adoption and environmental sustainability of Africa. *Gondwana Research*, *132*, 88-102. https://doi.org/10.1016/j.gr.2024.03.012

Kim, M., Choi, L., Borchgrevink, C. P., Knutson, B., & Cha, J. (2018). Effects of Gen Y hotel employee's voice and team-member exchange on satisfaction and affective commitment between the US and China. *International Journal of Contemporary Hospitality Management*, *30*(5), 2230-2248. https://doi.org/10.1108/IJCHM-12-2016-0653

Leonidou, L. C., Leonidou, C. N., Fotiadis, T. A., & Zeriti, A. (2013). Resources and capabilities as drivers of hotel environmental marketing strategy: Implications for competitive advantage and performance. *Tourism management*, *35*, 94-110. https://doi.org/10.1016/j.tourman.2012.06.003

Li, D.-y., & Liu, J. (2014). Dynamic capabilities, environmental dynamism, and competitive advantage: Evidence from China. *Journal of Business Research*, *67*(1), 2793-2799. https://doi.org/10.1016/j.jbusres.2012.08.007

Li, L., & Lin, J. (2024). Digital transformation for the sustainable development of firms: The role of green capability and green culture. *Sustainable Development*, *32*(3), 1861-1875. https://doi.org/10.1002/sd.2756

Li, X., Wu, T., Zhang, H., & Yang, D. (2022). Digital technology adoption and sustainable development performance of strategic emerging industries: the mediating role of digital technology capability and the moderating role of digital strategy. *Journal of Organizational and End User Computing (JOEUC)*, *34*(8), 1-18.

Lin, Y.-H., & Chen, Y.-S. (2017). Determinants of green competitive advantage: the roles of green knowledge sharing, green dynamic capabilities, and green service innovation. *Quality & Quantity*, *51*, 1663-1685. https://doi.org/10.1007/s11135-016-0358-6

Liu, Z., Lan, J., Chien, F., Sadiq, M., & Nawaz, M. A. (2022). Role of tourism development in environmental degradation: A step towards emission reduction. *Journal of environmental management*, *303*, 114-128. https://doi.org/10.1016/j.jenvman.2021.114078

Lotfi, M., Yousefi, A., & Jafari, S. (2018). The effect of emerging green market on green entrepreneurship and sustainable development in knowledge-based companies. *Sustainability*, *10*(7), 23-31. https://doi.org/10.3390/su10072308

Luo, S., Yimamu, N., Li, Y., Wu, H., Irfan, M., & Hao, Y. (2023). Digitalization and sustainable development: How could digital economy development improve green innovation in China? *Business Strategy and the Environment*, *32*(4), 1847-1871. https://doi.org/10.1002/bse.3223

Martinsons, M. G., So, S. K., Tin, C., & Wong, D. (1997). Hong Kong and China: emerging markets for environmental products and technologies. *Long Range Planning*, *30*(2), 277-156. https://doi.org/10.1016/S0024-6301(96)00119-7

Mazon, G., Soares, T. C., Birch, R. S., Schneider, J., & Andrade Guerra, J. B. S. O. d. A. (2023). Green absorptive capacity, green dynamic capabilities and green service innovation: a study in Brazilian universities. *International Journal of Sustainability in Higher Education*, *24*(4), 859-876. https://doi.org/10.1108/IJSHE-10-2021-0454

Mohsin, M., Kamran, H. W., Nawaz, M. A., Hussain, M. S., & Dahri, A. S. (2021). Assessing the impact of transition from nonrenewable to renewable energy consumption on economic growth-environmental nexus from developing Asian economies. *Journal of environmental management*, *284*, 111999. https://doi.org/10.1016/j.jenvman.2021.111999

Mowday, R. T., Steers, R. M., & Porter, L. W. (1979). The measurement of organizational commitment. *Journal of vocational behavior*, *14*(2), 224-247. https://doi.org/10.1016/0001-8791(79)90072-1

Nath, P., & Siepong, A. (2022). Green marketing capability: A configuration approach towards sustainable development. *Journal of cleaner production*, *354*, 13-24. https://doi.org/10.1016/j.jclepro.2022.131727

Nawab, T., Bhatti, M. A., & Nawaz, M. A. (2021). Does Technological Innovation Advance Environmental Sustainability in ASEAN Countries? *Pakistan Journal of Humanities and Social Sciences*, *9*(3), 425–434. https://doi.org/10.52131/pjhss.2021.0903.0148

Nazir, R., Gillani, S., & Shafiq, M. N. (2023). Realizing direct and indirect impact of environmental regulations on pollution: A path analysis approach to explore the mediating role of green innovation in G7 economies. *Environmental Science and Pollution Research*, *30*(15), 44795-44818. https://doi.org/10.1007/s11356-023-25399-6

Nazir, S., Shafi, A., Qun, W., Nazir, N., & Tran, Q. D. (2016). Influence of organizational rewards on organizational commitment and turnover intentions. *Employee Relations*, *38*(4), 596-619. https://doi.org/10.1108/ER-12-2014-0150

Novitasari, M., & Agustia, D. (2023). Competitive advantage as a mediating effect in the impact of green innovation and firm performance. *Business: Theory and Practice*, *24*(1), 216-226. https://doi.org/10.3846/btp.2023.15865

Qiu, L., Jie, X., Wang, Y., & Zhao, M. (2020). Green product innovation, green dynamic capability, and competitive advantage: Evidence from Chinese manufacturing enterprises. *Corporate Social Responsibility and Environmental Management*, *27*(1), 146-165. https://doi.org/10.1002/csr.1780

Rua, O., França, A., & Fernández Ortiz, R. (2018). Key drivers of SMEs export performance: the mediating effect of competitive advantage. *Journal of Knowledge Management*, *22*(2), 257-279. https://doi.org/10.1108/JKM-07-2017-0267

Schmidt, K. H., & Diestel, S. (2012). The relation of self-control demands to job strain: The moderating role of organisational commitment. *Applied Psychology*, *61*(3), 479-497. https://doi.org/10.1111/j.1464-0597.2011.00479.x

Setyaningrum, R. P., Kholid, M. N., & Susilo, P. (2023). Sustainable SMEs performance and green competitive advantage: The role of green creativity, business independence and green IT empowerment. *Sustainability*, *15*(15), 120-131. https://doi.org/10.3390/su151512096

Severino-González, P., Gallardo-Vázquez, D., Ortuya-Poblete, C., Romero-Argueta, J., Tunjo-Buitrago, E., Arenas-Torres, F., & Sarmiento-Peralta, G. (2022). Social Responsibility: Sustainable Development Goals and COVID-19—Perception Scale of

Students from Higher Education Institutions. *International Journal of Environmental Research and Public Health*, *19*(9), 1-15. https://doi.org/10.3390/ijerph19095323

Shafiq, M. N., & Zafar, M. A. (2023). Unraveling the Dynamics of BRICS: A Comprehensive Analysis of CO2 Emissions, Energy Consumption, and Technological Innovation. *iRASD Journal of Energy & Environment*, *4*(2), 91-100. https://doi.org/10.52131/jee.2023.0402.0038

Shah, A. A., Hussain, M. S., Nawaz, M. A., & Iqbal, M. (2021). Nexus of renewable energy consumption, economic growth, population growth, FDI, and environmental degradation in south asian countries: New evidence from Driscoll-Kraay standard error approach. *iRASD Journal of Economics*, *3*(2), 200-211. https://doi.org/10.52131/joe.2021.0302.0037

Shahzad, M., Qu, Y., Rehman, S. U., & Zafar, A. U. (2022). Adoption of green innovation technology to accelerate sustainable development among manufacturing industry. *Journal of Innovation & Knowledge*, *7*(4), 1002-1016. https://doi.org/10.1016/j.jik.2022.100231

Singh, S. K., Del Giudice, M., Chiappetta Jabbour, C. J., Latan, H., & Sohal, A. S. (2022). Stakeholder pressure, green innovation, and performance in small and medium-sized enterprises: The role of green dynamic capabilities. *Business Strategy and the Environment*, *31*(1), 500-514. https://doi.org/10.1002/bse.2906

Song, M., Yang, M. X., Zeng, K. J., & Feng, W. (2020). Green knowledge sharing, stakeholder pressure, absorptive capacity, and green innovation: Evidence from Chinese manufacturing firms. *Business Strategy and the Environment*, *29*(3), 1517-1531. https://doi.org/10.1002/bse.2450

Srivalli, P., & Kanta, K. N. M. (2016). Teaching effectiveness: A study on moderation effect of organisational support and organisational commitment. *Journal of Organisation & Human Behaviour*, *5*(1), 65-74. https://doi.org/10.21863/johb/2016.5.1.023

Teece, D., & Pisano, G. (2003). *The dynamic capabilities of firms*. Springer. https://doi.org/10.1007/978-3-540-24748-7_10

Wang, F., Gillani, S., Nazir, R., & Razzaq, A. (2023). Environmental regulations, fiscal decentralization, and health outcomes. *Energy & Environment*, 1-27. https://doi.org/10.1177/0958305X231164680

Wang, K.-H., Umar, M., Akram, R., & Caglar, E. (2021). Is technological innovation making world" Greener"? An evidence from changing growth story of China. *Technological Forecasting and Social Change*, *165*, 120-516. https://doi.org/10.1016/j.techfore.2020.120516

Yang, X., Shafiq, M. N., Nazir, R., & Gillani, S. (2024). Unleashing the influence mechanism of technology innovation and human development for ecological sustainability in emerging countries. *Emerging Markets Finance and Trade*, 1-24. https://doi.org/10.1080/1540496X.2024.2308180

Ye, L., Peng, X., Aniche, L. Q., Scholten, P. H. T., & Ensenado, E. M. (2021). Urban renewal as policy innovation in China: From growth stimulation to sustainable development. *Public Administration and Development*, *41*(1), 23-33. https://doi.org/10.1002/pad.1903

Yurui, L., Xuanchang, Z., Zhi, C., Zhengjia, L., Zhi, L., & Yansui, L. (2021). Towards the progress of ecological restoration and economic development in China's Loess Plateau and strategy for more sustainable development. *Science of the Total Environment*, *756*, 143676. https://doi.org/10.1016/j.scitotenv.2020.143676

Zameer, H., Wang, Y., & Yasmeen, H. (2020). Reinforcing green competitive advantage through green production, creativity and green brand image: Implications for cleaner production in China. *Journal of cleaner production*, *247*, 119119. https://doi.org/10.1016/j.jclepro.2019.119119

Zhang, K.-m., & Wen, Z.-g. (2008). Review and challenges of policies of environmental protection and sustainable development in China. *Journal of environmental management*, *88*(4), 1249-1261. https://doi.org/10.1016/j.jenvman.2007.06.019