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Impact of green transition on sustainable development in Saudi Universities - Applied Study College of Business Administration - Northern Borders University

1.Introduction

Sustainable development has emerged as a critical concept and framework for addressing the complex challenges faced by societies worldwide. To secure the welfare of current and future generations, it includes the integration of environmental conservation, social fairness, and economic development. As civilizations struggle with concerns like climate change, resource depletion, social inequality, and environmental degradation, sustainable development has acquired a lot of traction recently. The Sustainable Development Goals (SDGs) of the United Nations offer a global road map for attaining sustainable development by 2030. These goals encompass a wide range of interrelated objectives; including poverty eradication, clean energy, sustainable cities, and responsible consumption (Wei, 2023). Those objectives concern with the environment awareness besides developing a green environment

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within workforce that encourages green values, practices, and initiatives (Anwar, 2020).

Environmental responsibility is a concept that is growing crucial for all businesses, whether they are public or private (Qin, 2023). This applies to this research, as the university sector is either governmental or private; Universities have many practices related to the sustainable environment that distinguish them from other institutions; Universities, like other institutions, are moving towards implementing these green practices, which we can call the green transition (Leal Filho, 2023).

Putting these practices in the consideration, affirm would help in reducing pollution emissions by reducing lesser energy consumption at whole or by promoting green energy consumption practices and maintaining the sustainability as the case of the Northern Border University in Saudi Arabia. With risk of pollution and environmental damage that may harm employees, students, faculty members, therefore these practices are highly required to sustain a green environment. Hence, the statement of the problem for this study can be formulated in a form of a question, what is the impact of green transition practices on the sustainable development in NBU?

The present study aims to examine the impact of green transition practices on sustainable development by addressing different components of these practices at NBU; in this paper, the author argues that the shift towards green practices opens up new horizons for universities and can become one of the main drivers of the shift towards a sustainable environment (Carayannis 2022). Especially in light of the orientations of Saudi universities towards a focus on sustainable development and the inclusion of university courses related to this, such as Green Human Resource Management, this is in addition to awareness campaigns for conserving natural resources. Moreover, the trends related to sustainable development have been incorporated into the strategic priorities of scientific research in various colleges within the university.

The study focuses on the practices and their impact on sustainable development at NBU. Hence, the study is significant from different sides, including that there is no study that has so far explored the impact of green practices on sustainable development at NBU according to the best of the author's knowledge. Additionally, the study provides empirical evidence from Saudi Arabia on the green practices and sustainability framework and theoretical model in this study. Finally, the study supports decision makers and academicians with relevant data on green practices in Saudi universities. By application to the Northern

Border University and this study will focus on the faculty members' point of view. What distinguishes this study is that highlights the importance of green transition practices at universities seeking to adopt those practices to promote sustainability; the paper proposes a set of recommendations for universities aiming at developing new forms and channels of distribution of education, research and innovation. In order to identify the extent to which the university has reached and what it should do to increase the green transformation process through green practices, as well as to give university decision-makers the opportunity to make decisions related to a sustainable environment based on the information drawn from the questionnaire and the research hypotheses in this study.

2. Literature review

Global awareness of sustainability and the need for a safe environment free from pollution, carbon emissions, and gas emissions has grown. Effective organizations are concerned about environmental issues because they have an impact on performance and productivity. In addition, a lack of effective green manufacturing practices results in pollution, which in turn creates environmental risks. (Ahmad, 2015). All communities throughout the world work to address the serious issues of environmental sustainability and climate change, the idea of green transition techniques has grown in popularity in recent years. The term "green transition" refers to the methodical, transformational processes intended to move economies and society toward low-carbon, sustainable practices (Lis, 2023).

Green transition practices include a wide range of programs and tactics designed to lower greenhouse gas emissions, support renewable energy, improve resource efficiency, and promote sustainable patterns of consumption and production. In order to achieve long-term environmental sustainability, these methods acknowledge the necessity of fundamental changes in society behavior, technical systems, and economic structures.

The practices of the green transformation differ depending on the activity of this organization. For instance, the methods used by industrial organizations to protect the environment and their orientation towards sustainability are different from those used by organizations that offer educational services (Suchek, 2021). The researcher attempted to discover the elements and strategies of transition to sustainability relevant to universities, and came up with a number of practices related to campus operations such as energy

efficiency, water management, and transportation. This methodology has been used in many studies (Lozano, 2015) (Klein-Banai, 2013), (Jabbour, 2013).

These practices, through the hypotheses that will be discussed in the hypotheses phase of the study, the researcher will seek to develop a proposed vision for these practices of this transition through the hypotheses that will be mentioned in the hypotheses part.

This means that organizations, including universities, strive to improve sustainable performance while minimizing the negative impacts of their operations on the environment. The activities of these organizations lead to pollution, which in turn produces environmental hazards (Ahmad, 2015). Academics are presently studying the role of universities in assisting in the construction of a more sustainable society more and more due to their effect on the economy, society, and environment (Marques et al., 2019). However, the literature too far has concentrated on particular facets of sustainability in the higher education sector, ignoring the incorporation of environmental concerns in all major facets of university activity (Fissi, 2021). Based on previous studies that targeted practices related to sustainable development in universities and higher education institutions (Leal Filho W. W., 2019), (Fissi, 2021). This study will take into account these practices through the questionnaire for faculty members at NBU.

3.Environmental Sustainability

The World Commission on Environment and Development's 'Our Common Future' study from 1987 defines sustainability. It has subsequently gained widespread usage in a variety of organizational contexts with administrative, development, and leadership implications. Environmental sustainability may be defined as a balance in which people are permitted to achieve their present requirements via the use of natural resources without compromising the capacity of future generations to achieve their full demands. Environmental sustainability is a proactive and thoughtful interaction with the environment with the goal of protecting natural resources by decreasing pollution and other harmful effects that might degrade environmental quality (Liu H. A., 2022).

4. Sustainable Development (SD)

Sustainability is important because it deals with protecting the environment in all of its forms, including social, which emphasizes the rights of future

generations in social well-being and enhances living conditions in the present and future, economic, which deals with resource exploitation and eradicating poverty, and environmental, which deals with the preservation, upkeep, and development of all living things (Flint, 2013). Environmental performance is seen as the preservation of natural resources and preventing environmental damage (Anwar, 2020). Because organizations are the ones that contribute most to environmental problems, achieving sustainability is crucial to meeting current demands and addressing concerns. Additionally, green activities such as reducing waste, resource waste, energy use, carbon dioxide emissions, and producing green-related goods, are strongly tied to environmental sustainability (Tehrany, 2015).

The primary challenges of environmental deterioration, global warming, and climate change have caused confusion over how to achieve sustainable development that is both balanced and effective. As a result, efforts to protect the environment and resources must be coordinated. The discourse on Sustainable Development (SD) has emerged as a pivotal domain within the sphere of higher education management, research. Emphasis has been placed on the significant role of higher education institutions in fostering sustainable development, as underscored by numerous prominent international declarations and initiatives, dating back to the Stockholm Declaration of 1972 (Abubakar, 2020). The Sustainable Development objectives (2015–2030) were established by the UNGA in 2015 and the UN General Assembly detailed how the objectives are combined to promote sustainable development on a global scale (Mio, 2020). 45.5% of Saudi universities have SD included in their campus development plans or strategic plans, despite the lack of evidence of specialized campus sustainability plans at these institutions. Reports and assessments on sustainability are typically deficient. A strong institutional foundation is essential for integrating SD in higher education (Abubakar, 2020).

5. Green transition practices

Campus operations related to green and sustainable development encompass various practices aimed at reducing environmental impact, promoting sustainability, and fostering a greener campus environment. Through previous studies, this study will be based on monitoring the practices of sustainable development in Saudi universities, by applying it to the NBU, and each set of similar practices will be compiled in one dimension, which will constitute the

sub-research hypothesis that emanates from the main hypothesis, which is the green transition in Saudi universities as follows:

1. Waste Management: (WM)

Recently, researchers have shown an increased interest in waste management at universities (Abad-Segura, 2020)(Ayilara, 2020)(Shooshtarian, 2022). Despite this, very few studies have investigated the impact of waste management on sustainable development in Saudi universities (Anwar, 2020). Identifying and implementing effective approaches to handle waste efficiently within the campus environment (Sharma, 2020) to give a thorough grasp of waste management activities, such as recycling schemes, composting facilities, waste reduction, and reuse techniques. The evaluation also emphasizes the difficulties and results of university waste management initiatives.

Universities have put in place recycling initiatives to prevent trash from going to landfills and to encourage recycling among students (Amaral, 2020). The process of greening universities involves more than just reducing paper consumption. The main role of the environmental management system in the university should be to focus on the indirect environmental aspects, for example, to introduce environmental and sustainability issues into academic courses and scientific research of faculty members and students (Sammalisto, 2008).

Universities use a variety of tactics to reduce waste production; the first step is to implement a waste management plan at the University, taking in consideration the composition, the amount and the distribution of the waste generated in its campus (Gallardo, 2016). By implementing this plan, the campus community hopes to reduce waste at its source. Resource conservation and waste reduction can both benefit from the adoption of waste reuse strategies, such as the establishment of reuse centers (Acerbi, 2020). Universities with efficient waste management strategies have shown notable increases in waste reduction and diversion rates, however, with the increase in digital technology, paper usage is expected to reduce, and hence, minimal paper waste is likely to be achieved (Owojori, 2020). During the implementation of that plan, the university is seeking to implement sustainable waste management techniques in universities with the aim of improving community awareness and behavior modification while reducing the environmental impact of garbage (Debrah, 2021).

2. Energy Efficiency :(EE)

In recent years, there has been an increasing interest in energy efficiency, due to its impact on sustainable development (Singh, 2023). And also for being, the energy efficiency has become a central issue in many countries and institutions around the world (Rasoulinezhad, 2022), also to due to benefits resulted from

energy savings, besides its role in mitigating climate change and reducing greenhouse, gas emissions (Zhao, 2022). And in this context, universities, whether private or governmental, energy is an important means of providing a suitable work environment in terms of lighting, air conditioning and computers in general. In universities, the educational process depends on energy, especially the smart board and Internet connections. The educational process often stops in the absence of energy. In this article, the author will discuss the means used to improve the efficiency of using energy (Khaleel, 2023). For example, the universities can apply what is appropriate from power-saving mechanisms due to the benefits resulted from energy savings (Khuc, 2023). Universities, as centers of education and research, have the opportunity to choose the appropriate strategy (i.e., manual controls, predefined schedules, etc...) based on their energy savings (Tekler, 2022). Universities can build energy management systems, to optimize energy consumption (D'Souza et al., 2020). These systems include of energy-saving HVAC units, sophisticated lighting controls, and occupancy sensors (Patel et al., 2021). Universities can pinpoint areas of energy inefficiency and adopt focused energy-saving initiatives by conducting real-time monitoring and data analysis. Universities have focused on adopting energy-efficient technology, such as LED lighting, smart thermostats, and effective heating, ventilation, and air conditioning (HVAC) systems. These technologies not only help to save money and produce healthier interior environments, but they also help to cut energy usage. As a result of these actions, greenhouse gas emissions will be significantly reduced and the environment will be sustained (Şahin, 2021). By using these strategies, institutions may reduce their carbon footprint and lessen the effects of their activities on the environment. Questions related to energy efficiency in the university under study were included in order to identify the extent of energy efficiency in NBU.

3. Renewable Energy: (RE)

Sustainable development is the primary and nominal goal of the whole world, countries and regional and international institutions, and no one loses sight of the fact that energy is the main engine and the active element of all growth and development, as it is the basic element for all sectors of the economy, that most of the energy used in the whole world is traditional and unsustainable energy. In addition, it pollutes the environment and causes harmful emissions, and what increases the importance of research in finding alternatives to traditional energy is that some studies indicate that the amount of oil and natural gas consumption will continue to grow at a faster rate. By 2026 (Guo, 2023), since

sustainable development is primarily based on protecting the environment, ensuring optimal use and fair distribution of resources between the current generation and subsequent generations, such traditional energy does not allow for sustainable development. Therefore, it shows us the importance of focusing on finding alternatives to traditional energy. In this regard, countries must change the prevailing energy policy and work on actual diversification in order to preserve the environment and the right of future generations of energy, whether traditional or renewable (Rabbi, 2022).

Therefore, many countries have begun to take great strides towards the establishment and development of renewable energy sources, especially solar and wind energy, and the Kingdom of Saudi Arabia has vast desert areas in addition to a high temperature atmosphere, which enables it to exploit these natural characteristics of the Kingdom in finding alternatives to generate energy, whether solar energy or from wind that include the installation of wind turbines, give institutions access to sustainable power. NBU as one of the universities in the Kingdom of Saudi Arabia can adopt these methods of energy generation as well as being an educational and research institution that can adopt research and educational directions in the courses that are taught in the various colleges of the university, especially engineering. Furthermore, renewable energy installations provide beneficial educational possibilities by acting as real-world for learning environments where students may practice using renewable energy technology. In order to prepare them for future professions in the renewable energy industry, students can acquire hands-on experience in planning, implementing, and running renewable energy systems. With the aim of achieving a balance in using traditional energy, also find clean energy and to preserve the rights of future generations (AlKassem, 2022).

4. Water preservation: (WP)

Water is essential to the existence of a vast array of living things, including plants, animals, and humans. There are growing worries about a water shortage as a result of an increase in water use caused by an increase in human population (Rathi, 2021) (Phasinam, 2022). In order for humans to survive on earth, water is a necessity. Due to an increase in water demand brought on by an increase in human population, there are growing concerns about a water scarcity. Water conservation is a crucial component of university campuses' sustainable operations. Universities may significantly reduce water use, protect local water supplies, and save money by installing water-efficient fixtures and irrigation systems. Collaboration and cooperation between several sectors, including governments, communities, industries, and academia, are essential

for effective water management. Universities as an academic institution whose role is not limited to teaching courses that include how to conserve water as one of the important aspects of sustainable development, but extends its role to the application of sustainable practices to conserve water in addition to its research role in devising new means to conserve water, such as the use of artificial intelligence in the departments of the Faculty of Engineering at the university. The advancement of water conservation techniques at universities is largely dependent on overcoming behavioral barriers and putting appropriate water management plans into sustainable practice (Nova, 2023) (Baskaran, 2022).

Universities have many Strategies for Water Conservation, Water-efficient Fixtures. For example, universities can implement water-efficient fixtures such as low-flow faucets, to reduce water consumption (Jawaid, 2023). Also, universities can apply Water-efficient Irrigation Systems strategy for efficient irrigation systems, including drip irrigation and smart irrigation controllers (Hakimovich, 2023). Universities have developed measures to cut down on water usage in outdoor gardening and other areas. These systems monitor soil moisture levels and weather conditions, optimizing irrigation schedules and minimizing water use. Water conservation practices at universities contribute to the preservation of local water resources and ecosystems (Nova, 2023). Universities may reduce the stress on freshwater resources and preserve a healthy water balance by lowering their water use. Also, planning for effective water management is essential for universities. To identify improvement areas and implement specific water conservation techniques, it is essential to develop comprehensive water management plans, carry out routine water audits, and monitor water usage patterns. Universities can cut water utility expenses and divert resources to other important areas by reducing water consumption (Hakimovich, 2023). Water-saving techniques also extend the life of infrastructure and lower maintenance expenses. A crucial step in attaining long-term water conservation objectives is involving the campus community. Particularly if long-term water conservation goals are to be achieved. This requires universities to work on changing behaviors and promoting water-saving habits among students, faculty, and staff are essential for successful water conservation efforts. Universities can implement educational campaigns, workshops, and incentives to raise awareness and encourage sustainable water practices (López-Ruiz, 2023).

5. Education and Awareness: (EA)

Education and awareness initiatives are essential components of sustainability efforts at universities (Faura-Martínez, 2022). Universities can apply many strategies to raise awareness and educate students, faculty, and staff about

sustainable practices (Adnyana, 2022). Where, universities can integrate sustainability principles into their curricula by offering sustainability-focused courses across various disciplines. These courses provide students with the knowledge and skills necessary to understand and address sustainability challenges. Universities can also organize workshops and training programs to educate faculty, staff, and students about sustainable practices (Alm, 2022). These interactive sessions enhance participants' understanding of sustainability issues and provide practical tools for implementing sustainable solutions as well as Universities can host sustainability-focused events and conferences to create platforms for knowledge sharing and collaboration. Or encouraging sustainability clubs and initiatives fosters a culture of sustainability (Li, 2022).

This requires the university to make efforts to raise education and awareness programs to influence behavioral change and promote sustainable actions. It also requires the university to make efforts to create a culture of sustainability requires the integration of education and awareness initiatives into the institutional fabric of universities (Badea, 2020). Universities need to prioritize sustainability in their strategic plans, policies, and practices, ensuring long-term commitment. As well as the universities should evaluate. The universities should evaluate the effectiveness of education and awareness programs are crucial for continuous improvement (Mokski, 2023). Universities should employ evaluation methods to measure the impact of initiatives, identify areas for improvement, and share best practices (Ali, 2022).

6. Sustainable Transportation: (ST)

Reducing greenhouse gas emissions and promoting environmentally friendly behaviors in universities has become a possible goal with the use of sustainable transportation. There are many strategies, to mitigate the environmental impact, of campus commuting (Ribeiro, 2022). That universities can follow, such as, Alternative Transportation Options, where universities apply biking infrastructure, walking paths, carpooling programs, and the promotion of public transportation (Alberti, 2023). These strategies encourage students, faculty, and staff to choose sustainable modes of transportation, reducing reliance on single-occupancy vehicles. Universities can also apply the use of electric and hybrid vehicles on campus are another significant strategy for sustainable transportation at universities (Ribeiro, 2022).

There is no doubt that the university achieves many benefits from good practices in the field of sustainable transportation (Cirrincione, 2022). Such as Health and Well-being resulted from promoting active transportation modes such as biking and walking improves the physical and mental well-being of

the campus community (Anderson, 2022). It should be noted that the university provides buses for workers and also students, but there is no reliance on bicycles due to the long distance between the university and residential areas.

Hypotheses of the study

To fulfill the main purpose, of this study at NBU the following hypotheses are formulated:

H1: There is a significant effect of green transition practices on sustainable development at NBU.

This hypothesis is divided into six sub-hypotheses based on of the green transition practices and as follows:

H1-A: Education and Awareness (EA) is one of the green transition practices that have an impact on the sustainable development at NBU.

H1-B: Energy Efficiency (EE) is one of the green transition practices that have an impact on the sustainable development at NBU.

H1-C: Renewable Energy (RE) is one of the green transition practices that have an impact on the sustainable development at NBU.

H1-D: Sustainable Transportation: (ST) is one of the green transition practices that have an impact on the sustainable development at NBU.

H1-E: Waste Management: (WM) is one of the green transition practices that have an impact on the sustainable development at NBU.

H1-F: Water preservation: (WP) is one of the green transition practices that have an impact on the sustainable development at NBU.

6. Research Methodology

The study uses exploratory, descriptive, and explanatory methodologies to explore the basic knowledge about green transition practices, and sustainable development background related to the problem and variables of this study. This study used the quantitative technique, questionnaire, to collect data about the influence of green transition practices and sustainable development in Saudi Arabia (Northern Border University), where measures were adapted from an extensive review of relevant literature. Finally, Partial Least Squares tool (PLS-SEM) was used to analyses the data resulted from the questionnaires.

7. Research Population and Sample

According to (Hair, Black, Babin, & Anderson, 2010), choosing the appropriate sample size requires careful evaluation of the nature of the data analyses to be

performed. There is direction in this study's usage of PLS-SEM, notably from a procedural and empirical standpoint. PLS-SEM is acknowledged as a limited information estimate technique procedurally because it is thought to be able to handle lesser sample sizes (Marcoulides& Saunders, 2006). In some instances, the population itself—the study's population—might be countable limited, according to (Rigdon, 2016). Because of this, the population's characteristics, not the sample's size, will support the decision to use PLS path modeling. Whether PLS-SEM achieves better than other approaches in the analysis of data from finite populations is a little-explored research area.

In the case of this study, the researcher depends on the method of (Hair, 2014, p. 21) for its easiness application, and it takes consideration the minimum sample size requirements necessary to identify minimum R2 values of 0.10, 0.25, 0.50 and 0.75 for variables in the Structural Model for significance levels of 1%, 5%, and 10%. This method is based on the frequently used Statistical Power level of 80% and the level of complexity of the PLS path model. The study questionnaire targeted faculty members at northern border university, college of business administration. It measured the relationship between six independent variables, green transition practices (Waste Management, Energy Efficiency, Renewable Energy, water preservation and Education and Awareness, Sustainable Transportation) and one dependent variable, sustainable development. There is a maximum of six arrows pointing at a single variable, to realize a Statistical Power of 80% for R2 values of at least 0.25 (with a 5%Probability of Error), the sample size of at least 75 would be required.

8. Data collection

A survey comprising of a structured questionnaire was utilized for data collection as it is the optimum method available to investigate the perceptions of faculty members at the College of Business Administration, Northern Border University. The college contains 91 members of different nationalities. The questionnaire was launched on the first of June 2023 for two months. To assess validity of content, the items of questionnaire were reviewed by experts and pre-test was conducted. Their suggestions have been taken in consideration to modify the items. All constructs were measured using multi-item, 5-point Likert-type scales anchored from '1'= strongly disagree to '5'= strongly agree.

9. Data analysis and Findings

Initially, the Descriptive Statistics were performed in order to expose the main feature of the data in this study. At that point, the data was explored for missing values, Outliers, Normality Distribution, and Data Errors. It is obvious from this analysis that the distribution of data might be non-normal, but there no missing or Duplicate Cases were found, and also, there is no sharp deviations between mean and trimmed mean for all variables in this study. In this study, all questionnaires were distributed handle and electronically. Moreover, respondents were shortly informed about the objectives of the study by holding many seminars for them. According to (Field, 2009), the researcher did not assume a big effect of Outliers in advance.

Otherwise, PLS-SEM is robust for Non-normal Distributions, so the researchers did not make any attempt to transform data to meet the Normality assumption. On another hand, the researcher runs the bootstrapping technique at Smart PLS, by generating 5000 samples to approximate the Normality of data. This procedure will be illustrated in detail in the next section to meet the requirement of assessing the Structural Model at PLS-SEM (Hair J. J., Hult, Ringle, &Sarstedt, 2014).

Following the guidelines of (Hair, Black, Babin, & Anderson, 2010), the initially proposed model was evaluated through Measurement and Structural Model Analysis.

Assessment of the Measurement Model

Indicates to the systematic approach to validating the measurement model by evaluating its Reliability and Validity as follows.

10. Evaluating the Reliability of Measurement Model

This study conducted three iterations to assess the Reliability of Measurement Model to achieve satisfactory measurement values for Cronbachalpha's, Composite Reliability, and AVE. PLS Algorithm should be performed again by discarding weak indicators PE12, PE13, RE17, RE19, SC29, SC30, SD31, SD33, and SD34 to reach to 0.707 thresholds of Factor Loading as shown in table 1, and figure 1.

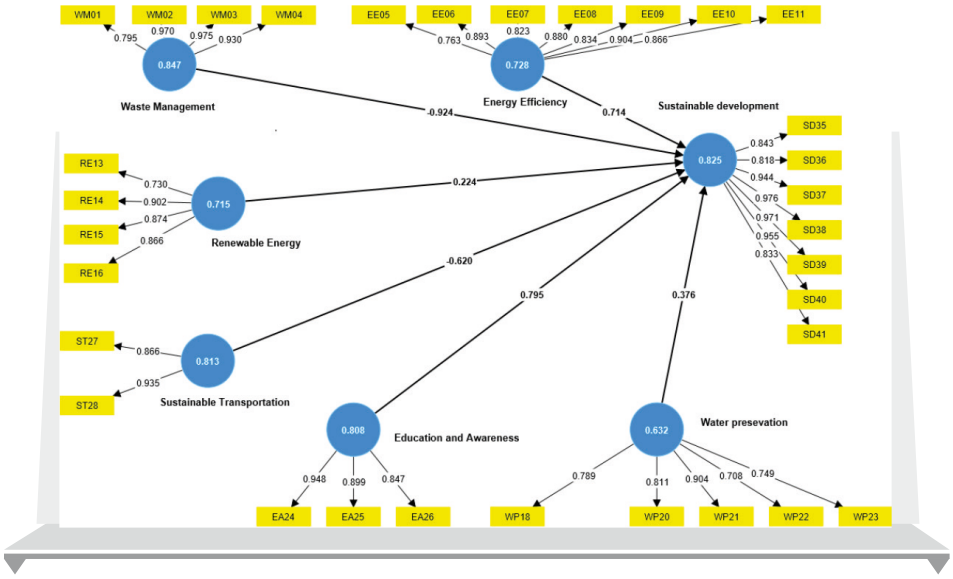

Figure 1. The Measurement Model

Source: outputs of Smart PLS 4.0

Table 1. Validity and reliability of measurement model

Var.	Ind.	Loadings	Cron-bach's alpha	Composite Reliability (rho-c)	(AVE)
Education and Awareness	EA24	0.948	0.880	0.926	0.808
	EA25	0.899			
	EA26	0.847			
Energy Efficiency	EE05	0.763	0.945	0.949	0.728
	EE06	0.893			
	EE07	0.823			
	EE08	0.880			
	EE09	0.834			
	EE10	0.904			
	EE11	0.866			

	RE13	0.730			
	RE14	0.902			
	RE15	0.874			
Renewable Energy	RE16	0.866	0.871	0.909	0.715
	ST27	0.866			
Sustainable Transportation	ST28	0.935	0.776	0.896	0.813
	WM01	0.795			
	WM02	0.970			
	WM03	0.975			
Waste Management	WM04	0.930	0.953	0.957	0.847
	WP18	0.789			
	WP20	0.811			
	WP21	0.904			
	WP22	0.708			
Water preservation	WP23	0.749	0.862	0.895	0.632
	SD35	0.843			
	SD36	0.818			
	SD37	0.944			
	SD38	0.976			
	SD39	0.971			
	SD40	0.955			
Sustainable development	SD41	0.833	0.963	0.970	0.825

Source: outputs of Smart PLS 4.0

The data of table 1, and figure 1 show that all AVE values of the variables and indicators are exceeded the required value of 0.5, all variables have the Composite Reliability values, and Cronbach's Alpha above 0.7, and indicator

loadings are above 0.895 thresholds. Subsequently, the Indicator Reliability, Composite Reliability, and Convergent Validity of the Measurement Model are approved. Once the iteration process completed, the final Measurement Model should be checked for Discriminant Validity based on Fornell-Larcker Criterion, and Cross Loading values generated from the Third Iteration.

11. Evaluating the Validity of Measurement Model

The Discriminant Validity means that the indicators forming up a variable should be distinguished from indicators of another variable. According to (Hair J. J., Hult, Ringle, &Sarstedt, 2014), it is calculated by using Fornell-Larcker Criterion which is based on the square root of AVE should be much larger than the correlations of the variable to all the other variables.

Table 2. Test result of Fornell-Larcker Criterion

	AE	EE	RE	ST	SD	WM	WP
AE	0.899						
EE	0.535	0.853					
RE	0.824	0.545	0.846				
ST	0.697	0.300	0.705	0.901			
SD	0.817	0.465	0.822	0.439	0.908		
WM	0.391	0.913	0.331	0.044	0.264	0.920	
WP	0.659	0.617	0.785	0.461	0.795	0.473	0.795

Source: outputs of Smart PLS 4.0

Table 2 shows the correlations among variables and the square root of AVE value for each variable on the diagonal and BLUE cells. The square root of the AVE value for each variable is greater than the correlation between a selected variable and all others. Accordingly, the Discriminant Validity of the Measurement Model is confirmed.

12. Assessment of the Structural Model

The Structural Model applies structural theory by specifying which variables are related to each other and the nature of the relationship. These relationships can be expressed as regression coefficients. The results of this model fit allow us to contrast theory against reality in terms of the data collected from the target population. For testing the structural theory, structural parameter estimates should be statistically significant in the predicted direction. The next stages of validating the Structural Model were performed in the following order (Hair, Black, Babin, & Anderson, 2010):

13. Assessing the significance and relevance of the model relationships

The Path Coefficients test was conducted to test the hypothesized relationships. As suggested by (Kwong & Wong, 2013), and (Hair J. J., Hult, Ringle, &Sarstedt, 2014), in this study, the Bootstrapping generated 5000 samples and these samples are used to compute t-values at significance level= 5% with test type two-tailed. In table 3 and figure 2 below, the Path Coefficients, as well as their respective t-values, are provided.

Table 3. Hypothesis Testing

Path	Hypothesis	Direct Effect				
		Confidence Interval 95% 2.5%	97.5%	t	P Value	Hypothesis Supported
EA→SD	H_{1-A}	0.527	1.256	4.744	0.000	Supported
EE→SD	H_{1-B}	0.400	0.933	4.398	0.000	Supported
RE→SD	H_{1-C}	-0.050	0.402	1.963	0.050	Not Supported
ST→SD	H_{1-D}	-0.814	-0.403	5.020	0.000	Supported
WM→SD	H_{1-E}	-1.177	-0.708	4.813	0.000	Supported
WP→SD	H_{1-F}	0.153	0.514	4.489	0.000	Supported

Source: outputs of Smart PLS 4.0

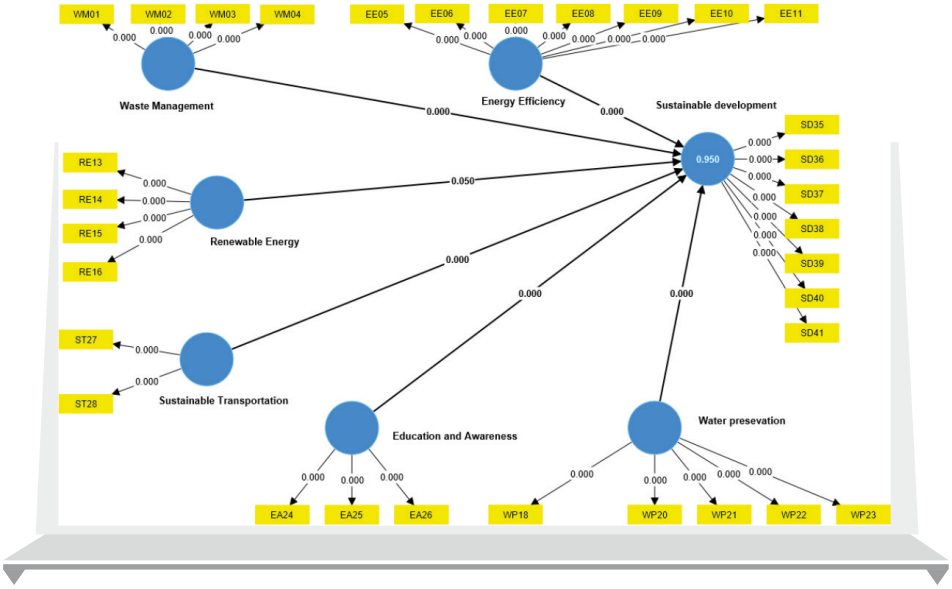

Figure 2. PLS Bootstrapping (t-values) for the study model

Source: outputs of Smart PLS 4.0

As shown in table 3, and figure 2, all Path Coefficients of the sample of this study are significant except path of H1-C; the Bootstrapping results confirmed that all Path Coefficients are significant; the t-statistics for each path are larger than 1.96 at 5% significance level.

As presented in table 3 and fig. 2, a positive relationship among Sustainable development and green transition practices with five of its components is concluded. In H1-A, results revealed that the proposed relationship between Sustainable development and sub-hypotheses of green transition practices (Education and Awareness). H1-A was supported (t-Statistics = 4.744, p=0.000) because t-statistic is greater than 1.96 and P-Value is less than 0.05. Furthermore, we observed highly significant relationship between Sustainable development and sub-hypotheses of green transition practices (Energy Efficiency). H1-B was supported (t-Statistics = 4.398, p=0.000) because t-statistic is greater than 1.96 and P-Value is less than 0.05. Moreover, when testing Hypothesis H1-C, this study found there is no significant association between Sustainable development and Renewable Energy (t-Statistics = 1.963, p = 0.050) because

t-statistic is equal to 1.963. It indicates that Renewable Energy does not have significant association with Sustainable development. Therefore, hypothesis H1-C is not supported. In the case of this hypothesis for renewable energy at NBU As a result extracted from Smart-PLS, the P value, which is equal to 0.05, means that the observed data will be obtained only 5% of the time if the null hypothesis is correct. A P value of 0.05, P value less than or equal to 0.05 have the same meaning according to (Andrade, 2019), while (Goodman S. , 2008) argues that, the probability of a rejection being true or false clearly depends on more than just the P value. Using the Dictionary Bayesian, it also depends on our prior certainty (or strength of external evidence), which is quantified as the "prior probability" of the hypothesis. The researcher agrees with (Goodman S. , 2008) opinion because evidence on renewable energy, such as solar energy and wind energy at the university of NBU, is not available. This may be due to the fact that the Kingdom of Saudi Arabia relies primarily on petroleum, as KSA is considered the second-largest producer of total petroleum liquids production in the world, according to the latest statistics for the year 2022 (investopedia, 2023). There is a significant relationship between Sustainable development and sub-hypotheses of green transition practices (Sustainable Transportation) H1-D was supported (t-Statistics 5.020, p=0.000) because t-statistic is greater than 1.96 and P-Value is less than 0.05. Furthermore, we observed a highly significant relationship between Sustainable development and sub-hypotheses of green transition practices (Waste Management) H1-E was supported (t-Statistics = 4.813, p=0.000) because t-statistic is greater than 1.96 and P-Value is less than 0.05. Moreover, we observed a significant relationship between Sustainable development and sub-hypotheses of green transition practices (Water preservation) H1-F was supported (t-Statistics = 4.489, p=0.000) because t-statistic is greater than 1.96 and P-Value is less than 0.05.

13.1..Coefficient of Determination R2

The Coefficient of Determination or R2 provides an indication of the predictive accuracy of the model. It is calculated as the squared correlation between a specific endogenous variable's actual and predicted values (Hair J. J., Hult, Ringle, &Sarstedt, 2014). The outputs of Smart PLS indicated that R2 of study model equal 0.950, it is obvious that study model is capable of explaining the variance at independent variable hence; it has a high predictive accuracy.

13.2. Effect Size F2

In examining the strength and impact of exogenous latent variable on endogenous latent variable, the effect size (f2) can be implemented. Based on the value obtained for effect size, values higher than 0.02, 0.15 and 0.35 would represent small, medium and large effect sizes respectively (Garson 2016). The following table show Effect size F2 of each dependent variable on independent variable:

Table 4. Effect Size F2

Dependent variable → Independent variable	Sustainable Development
EA→SD	3.186
EE→SD	0.866
RE→SD	0.174
ST→SD	2.573
WM→SD	1.651
WP→SD	0.921

Source: outputs of Smart PLS 4.0

With this, Education and Awareness, Sustainable Transportation, Waste Management have a large effect size on Sustainable Development (f2=3.186, 2.573, 1.65) respectively. The Education and Awareness gave the largest effect size with a value of (f2=3.186). On the other hand, the Sustainable Transportation has a medium effect size on Sustainable Development (f2=2.573).

13.3. Goodness of Fit (GOF)

It measures the extent to which the standard and structural model of the study can be relied upon, and can be calculated mathematically by combining both according to the following equation:

$$GOF = \sqrt{R^2 \times AVE} = \sqrt{0.950 \times 0.825} = 0.885$$

By applying the equation, we find that the Goodness of Fit (GOF) of the study model reached 0.885, which is higher than the required minimum,

which is 0.404, which is a high value indicating that the model is suitable for the study.

14. Conclusion

Environmental concerns such as thermal emissions and large temperature changes force universities to develop environmentally friendly green policies. Practices must be consistent with approved policies to ensure effective and sustainable implementation of those policies. Although the adoption of green transformation practices within universities is still in its early stages. Studies indicate the need to integrate sustainable technologies into all aspects of university operations in a comprehensive manner. This study addressed how NBU can transform into a green institution through some green practices, which this study addressed in order to transform towards a green university. The results of this study will help universities reduce environmental pollution to create a safer and cleaner planet through practices related to the transition towards the green model of universities. Five of the six hypotheses indicated a significant association with sustainable development; but the relationship between renewable energy and sustainable developments has been minimal. There has been significant engagement with sustainable development for education and awareness, waste management, energy efficiency and water conservation, and sustainable transportation

A limitation of the study is the generalized finding, because the university was this study conducted was just one of several institutions in KSA. Future research, however, can use the NBU's green practice's dimensions to apply a general framework for a green and sustainable university to other green universities or academic institutions. Finally, it would be helpful to replicate this research to track NBU's development towards a green university in order to better comprehend institutional practices in transitioning towards a sustainable or green university model. Additionally, the study relied on faculty members' perceptions, that may be affected by subjectivity and bias, thus examining the green transition practices on sustainable development in NBU accurately is challenging.

15. Recommendation

The author recommends further highlighting the green transformation practices of the NBU, and complementing perceptions of green environmental

practices. As for education and awareness about sustainable development in higher education institutions, it is considered responsible for providing the next generation of sustainability leaders with basic knowledge and skills, and trying to work proactively to achieve the Sustainable Development Goals (SDGs) through some conceptual and practical tools to consider strategically how to integrate the concept Sustainability in policies, approaches and practices in line with the Sustainable Development Goals and the global agenda for sustainable development (Franco, 2019). As for energy efficiency, universities have a role in this regard. The first is an institution that provides its educational services through a group of buildings. It requires applying different methods to save energy and use it efficiently. In addition, universities and research centers must come together to educate society on some aspects of energy efficiency so that efficiency becomes a mandatory requirement for any project (Cristino, 2021). As for renewable energy, universities need to play a major role in promoting solar energy as a practical form of renewable energy, especially in the Kingdom of Saudi Arabia, where the sun is available most times of the year. In this context, universities, as state institutions, may need significant investments in this regard (Vaka, 2020). As for sustainable transportation, public transportation is seen as a major driving factor in achieving a more sustainable city. In addition, mobility management is a type of soft measure adopted by the public transport authority to make the existing infrastructure more efficient and effective. It also creates and maintains dialogue with companies, universities and citizens on how to choose travel modes to meet daily needs and what can be done to make travel behavior more sustainable (Bibri, 2020). Last but not least, universities must pay attention to the results of opinion polls and take the results of scientific research on an ongoing basis with the aim of achieving sustainable development at the level of universities in Arab countries to keep pace with global trends in this regard. The NBU also needs to participate in multiple projects funded by higher education in Saudi Arabia. In this article, universities are invited to seize the opportunities coming from green and digital transformations and create a thriving and innovative ecosystem that integrates and uses physical and virtual spaces to meet societal needs. Universities can establish committees to oversee sustainability initiatives and ensure that sustainability is integrated into all aspects of campus operations. These committees can include students, faculty, and staff and can provide a forum to discuss and implement sustainability-related initiatives.

16. Future research

While it is clear that the practices addressed in this research have an impact on sustainability, there is still a need to delve deeper into the comprehensive nature of this impact. This includes exploring the scale of the impact, its longevity, and the complex relationship between the costs associated with implementing such practices and the resulting benefits to the environment or future generations. Therefore, future research endeavors should aim to elucidate these nuanced dimensions to provide a more comprehensive understanding of the interplay between green initiatives and sustainable outcomes within higher education institutions.

Abstract

Purpose - This article aims to study the impact of green transformation practices in Saudi universities on sustainable development. Some practices derived from previous studies as well as the Millennium Sustainable Development Goals were highlighted. The importance of studying these practices that related to sustainable development in universities is due to three reasons, the first of which is preserving the environment surrounding the university and its impact on sustainability, and the second is that the university offers in its curricula many courses on sustainable development and research programs. Use resources in a way that respects the rights of present and future generations.

Design/methodology/approach – The study used descriptive methodology to get more information about the green transition practices, and sustainable development that are closely linked to the problem and variables of the study. This study used quantitative technique, to collect data about the impact of green transition practices on sustainable development in Saudi universities, where Measures were adapted from an extensive review of relevant literature. A questionnaire survey with valid responses from 92 faculty members, at the College of Business Administration, Northern Border University. In 2023, the PLS-SEM method was used to analyze the data.

Findings –The results of this study revealed a positive relationship between five green transition practices and Sustainable development.

Originality/value – The study of impact of green transition practices on sustainable was considered as the first study to be conducted at Northern border university (NBU). Moreover, the findings of the study will support sustainability and green practices in NBU

Keywords: *green transition practices in universities, sustainability, Sustainable development.*

JEL Codes: Q01, H83.

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