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# Artificial Intelligence, Environmental sustainability, Eco-Friendly products, Islamic Values and Green Purchase Intention

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**Abstract**

This research aims to establish an understanding of how artificial intelligence and Islamic values impact green purchase intentions among the consumers of Pakistan. Therefore, the study employs a quantitative and qualitative research design to establish a complex relationship between these variables. The information on Islamic values is gathered from Hadith, as well as Quran verses quantitative data on global CO2 emissions, green purchase intentions, and AI application is obtained from the World Development Indicators and prior literature. For the analysis of religious endorsed texts regarding the environment, this study uses the content analysis method, and for putting Pakistan's environmental problems in the perspective of other South Asian countries the researcher uses the comparative analysis method. To test the hypotheses proposed, an analysis of the arithmetic characteristics and a correlation and regression analysis were performed on the use of the tools in question using SPSS. The conclusions drawn from the study are that there is a strong and significant link between AI and green purchase intentions; moreover, Islamic values, as the selected moderating variable, have a positive effect on the subject relationship. The social implication of the findings reveals that AI technologies and Islamic ethical attributes should both be applied to enhance the call for environmentally responsible consumerism. In this context, the recommendations for improving green products' recognition, investing in AI technologies, and engaging Islamic rules on environmental consciousness in educational processes are stated. For future work, several research implications are suggested to expand the understanding of how AI can facilitate green consumerism in the context of Pakistan's cultural and religious values. This research benefits the fields of environmental sustainability and consumer behavior by revealing that the use of AI and a focus on culture can influence consumers' decisions to purchase environmentally friendly products.

**Keywords:** Artificial Intelligence, Environmental Sustainability, Eco-friendly Products,

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Islamic Values and Green Purchase Intentions

## 1 Introduction

The enhancement of human development is more influenced by the environment within which people exist and can be hampered by adverse changes in the same environment upon receipt of certain stimuli (Ukaogo et al., 2020). Some of these activities include demography, logging, urbanization, development, industrialization, and changing trends in human life which have made society ask whether the existence of human beings is having an impact on the conditions required in the world (Khan et al., 2020). In recent years, the issue of natural contamination especially air and water has been brought to realization. Thus, natural contamination is rather a worldwide problem than an individual one for a specific state (Morin-Crini, et al., 2022). To solve such problems, governments focus on the legislation of actions and operations of organizations and individuals to minimize environmental pollution, besides the adoption of enhanced sustainable practices.

For any nation to fully harness the value propositions of the AI revolution, the AI industry needs to be steered and expanded towards areas that affect change within the environment of such nations (Perifanis & Kitsios, 2023). Given the advances in AI by the leading economies, the rest of the world needs to ensure that AI is an important pillar in environmental conservation. The recent innovations in AI are eye-openers for policymakers as the climate of the world is becoming more challenging. Sustainability is now a chance of this epoch. AI and other concepts of the Fourth Industrial Revolution (IR (IV)) are new approaches, which can help redefine measures containing the advancement of environmental sustainability (Nabi & Zohora, 2022).

Traditionally, the role of technologies has been comparatively insignificant in strategies of planning, predicting, monitoring, and regulating the ecosystems at the micro- and macro-level, as well as during different time intervals (Ally & Perris, 2022). The environmental protection policy in the first instance depends on the quality of accessible data on the environment as well as the utilization of modern tools such as AI, Deep Learning, and Data analysis which can be applied to make the right decisions at the right time (Chen et al., 2023). This mix of independent permutations can allow AI to move from being just mere experiments to reality. In this paper, AI is defined as an approach towards environmental sustainability.

Some of the human activities have proven to be dire to the environment. Some of them are resource utilization, pollution, direct felling of trees, emission of carbon, and depletion of the ozone layer (Chisom et al., 2024). The global concern for the above detrimental changes has been evident in studies assessing people's knowledge and perception about the environment, the significance of saving the earth, and the impact of environmentally friendly products (EFP) purchasing (Malik & Singhal, 2017). Different research works show that people increasingly recognize themselves as a negative factor for nature.

Although the theory also deplores the impact of environmental concerns, values, beliefs, and attitudes toward GPs; it is evident that very few GPs have been successful (Kim-Choi, 2006). GPs are generally described as non-hazardous, eco-friendly, bare necessities of life in minimal packaging using recycled paper (Mostafa, 2006). Their GM is referred to as EFP. These are defined as respectively: attitudes toward GP, referring to one's general liking for GP; and tendency to buy GP, referring to the probability of one to purchase GP.

From the study by Song et al. (2020), we understand that though survey data mainly point to population approval of environmental conservation, it is still unclear what they are prepared to do (or spend) for environment enhancement. This brings complications in predicting when the GP will be used as it is evident that such consumers are not always continent in their practices. Indeed, the interconnection of the values presented as pro-environmental beliefs and attitudes for future

behaviors is still the topic of investigation. It is also postulated that while many developing countries are still in the red zone, many of them are at the entrance to green awakening (Mostafa, 2006).

Moreover, the revisionist GDP involving Latin America is affected by this factor equally religious, particularly Islamic. If the Islamic approach is to give an impetus to GPI, it is worth noting that the basic doctrines of Islam are devoted to environmental protection. Firstly, Islam being a way of life gives solutions that are efficient, totalizing, and systemic to counter the contemporary degenerative environmental problem (Chisom et al., 2024). Thus, this study calls for the attention of scholars to religious values as predisposing factors that affect GPI among Muslim consumers.

### 1.1 Research Objectives

The objectives of this study are:

- To examine the effects of AI on GPI in Pakistan.
- To examine the cross-sectional moderating role of Islamic values on the established AI –GPI relationship.
- To investigate environmental problems with purchasing behaviors and offer suggestions of how the principles of AI and Islamic teachings can be applied to positively affect the environment.
- To help fill the existing literature gap in analyzing the relevance of Islamic values on the integration of artificial intelligence with environmental sustainability.

## 2 Literature Review

Sustainability has been an issue of debate for the last few decades though; more specifically, for the last five decades, sustainability refers to human sustainability (Lipschutz, 2009). The official definition of sustainability by the UN states that "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Therefore, there are three major goals of sustainability: social, economic, and environmental (Goni et al., 2015).

Risk assessment and means of exposure are the two principal facets where the impacts of environments are mostly measured and implied on both human beings and ecosystems (Cardona et al., 2012). The other aspect of risk assessment and risk exposure is environmental justice, which is admissible in American policy as a concern on behalf of the vulnerable, discriminated, and people with low standard incomes in susceptible communities (Aven, 2016). There is a need for Legislation to assess the environmental impacts and if legislation is enforced, then Policies have to be analyzed through the cost-benefit analysis. The first practices in sustainability, including the principles of rational choice with cost-benefit evaluation, environmental justice, and risk and exposure reflection, are considered the signs of the current set of practices of sustainability (Howes et al., 2017).

Environmental sustainability is mainly observed as the responsibility of preserving the environment for future generations (Ziaul & Shuwei, 2023). Environmental sustainability can only be controlled by environmental management and this can only be done if all the harms resulting from human activities are alleviated (Qayyum et al., 2024). Chemicals include; organic compounds, sulfur oxides, nitrogen oxides, pollutants, Acid rain, and Ozone layer depletion. In the same way, oceans, freshwater resources, and utilization of land also come under the detrimental practices of human beings, which question human existence. Environmental sustainably has been one of the most discussed topics all over the world in the last few decades (Turnbull et al., 2021).

Thus, the advantages and disadvantages of the ICT for environment have been discussed and it is

also noted that the disposal, use, and production facilities of ICT have negative impacts on the environment (Gonel & Akinci, 2018). Indirectly, ICT has impacted the environment negatively since the use of electricity has risen with the use of ICT. This mainly involved the creation of procedures and devices, as well as the operation of data centers and server ensembles. Research shows that ICT currently contributes about two percent to total greenhouse gas emissions (Shaaban-Nejad & Shirazi, 2022). Still, ICT plays a double-edged role as emissions can be decreased when industrial processes, electrical grids, transportation systems, and smarter cities are to be built. According to these statistics, the interaction of ICT to CO2 emission will reach 2. 8 percent in 2020 but at the same time, the role of ICT in decreasing CO2 emission will be 15 percent. ICT, if well applied for dematerialization, grids, buildings, logistical means, and motor systems, will indicate a highly positive impact on the sustainable environment (Higón et al., 2017).

The kind, development, and consequences of the AI have been analyzed by the researchers since the 1950s (Rawas, 2024). AI is the collection of processes and tools that are symbolic and statistical in nature to display some of the features of intelligence to solve several tasks that are primarily analytical (Tredinnick, 2017). For the last seven decades, AI has continued to be an area of interest when it comes to computing research. For instance, in 1950, a research-oriented project was formulated by McCarthy to synthesize knowledge of AI, AI conceptions, and AI abstractions for solving human problems. Researchers have differentiated four major kinds of AI depending on their capabilities – ASI (Artificial Super Intelligence), AGI (Artificial General Intelligence), and ANI (Artificial Narrow Intelligence) (Kelly et al., 2023).

ANI is the state in which machines are taught for a specific use and can only decide in that given path; some of the familiar instances are passenger planes, and Google search (Thangavel et al., 2024). True Synthetic Intelligence or AGI can learn, reason abstractly, understand space, solve problems, and plan; an example is self-driving cars. If machines are capable of performing social skills, general knowledge, and scientific intelligence far much better than human beings, then it is called ASI. Intelligence is also divided into four types: emotional, people-oriented, logical, and technical (Huang & Rust, 2018).

AI and thus, its levels involve numerous processes, namely; making decisions under conditions of uncertainty and conflict, reasoning, and language comprehension (Nordström, 2021). Though some of these activities have been established to have negative repercussions, contradicting findings show that certain activities can also have positive consequences as posed by other scholars. There is a claim that through AI, poverty and diseases will be eradicated while the natural environment will be conserved; however, it may go beyond ethical standards and in the process of doing so, annihilate human minds (Bankins & Formosa, 2023). Thus, the need arises to define the societal impact implications of AI and possible advantages and disadvantages.

Pollution management, waste management, and prediction are areas where AI can be highly useful and other prediction areas can also safeguard human beings from disgraceful natural disasters such as extreme weather conditions and even earthquakes (Fang et al., 2023). For example, in a study conducted on the effectiveness of wasting management, it was ascertained that fuzzy inference could be of great use. Like, pollution, AI-related pollution can also be controlled as the hazardous effects of AI on the environment can be measured by the Environmental Vulnerability Index (EVI). AI can also aid in increasing the level of biodiversity by analyzing information from images of animals (Norouzzadeh et al., 2018).

Another area that can be also regulated with the help of AI to control the emission of greenhouse gases is the use of self-driven cars will also help in regulating greenhouse gases in that to some extent greenhouse gases can be even minimized by twenty percent by using eco-driving self-driven cars (Greenblatt & Saxena, 2015). Traffic jams can also be a strain on the AI as it can suggest realistic fast and other routes that would take in semi-urban and urban areas hence conserving fuel

(Igliński and Babiak, 2017).

According to current trends in Islamic economics, there are arguments that environmental problems have always been answered by Islamic legislation for years because the main focus is always on the welfare of mankind (Ab Rahman et al., 2018). As for the rights upheld by the Quran, the Book of Islam grants the right to protect the money, offspring, mind, honor, and religion, but no one can obtain these rights through Bismah and Rahmah with wisdom and justice. Sustainable development is hence an inherent component of Islamic law and culture (Koehrsen, 2021). Hence, it can be concluded that the religion of Islam promotes environmental sustainability and cleanness in the Muslim community.

The service and goods consumption for the last decade has been boosted due to industrialization and this has had disastrous impacts on the environment (Usman & Balsalobre-Lorente, 2022). Many developed countries have realized the negative side effects of this issue and have adopted policies to check it. Thus, the concept of sustainable development arises from this concern, to call for sustainable business mindsets. Eco-buying and eco-creativity are promoted under sustainable development campaigns (Kumar, 2020). Eco-innovation refers to the integration of sustainable improvements in all aspects of the creation of services and goods. Likewise, if a customer incorporates the aspect of environmental effects in their usage or purchase of a certain product, it is referred to as Green Consumption (Pichlak & Szromek, 2021).

Consumers who do not follow certain strategies of shopping can have poor impacts on the environment. Statistics have shown that forty percent of environmental calamities are a result of materials bought in households (Wang & Zhao, 2023). Thus, if consumers get accustomed to buying green products, they will be contributing to the management of environmental degradation. This paper aims to establish that the higher the awareness level concerns environmental conservation, the higher the probability of people using ecological products. Nevertheless, consumers' awareness of green products and their actual purchases remains limited and are estimated to account for only 1 – 3% of the market (Sukresna & Mikina, 2024). Accordingly, it can be stated that there is considerably less part played by consumer purchase decisions on environmental impacts because these are often hidden during shopping (Sreen et al., 2020).

There is a contradiction between the amounts of green products bought by customers and the favorable perception that customers have of green products. Costa et al. (2020) observed that although customer attitude towards green products is positively high at sixty-seven percent, the actual buying behavior is a mere four percent. Likewise, in the case of the UK, thirty percent of customers display environmental consciousness; however, only four percent put this consciousness into action through green product purchasing, which shows a contradiction between customers' beliefs and behaviors (Joshi et al., 2021).

## 3 Theoretical Framework and Hypotheses

### 3.1 Theoretical Framework

This study examines the role of AI and Islamic values in influencing GP) among consumers by integrating two well-established models: the Technology Acceptance Model (TAM) (Musa et al., 2024) and the Theory of Planned Behavior (TPB), which can be used appropriately. From these models, a theoretical framework can be provided on how AI and Islamic values affect consumers' decisions toward environmentally sustainable products.

Davis developed the Technology Acceptance Model (TAM) in 1989 for which he stated that perceived usefulness (PU) and perceived ease of use (PEOU) were the two central factors that influenced a person's decision to accept technology (Al-Adwan et al., 2023). Perceived usefulness is the measure of the extent to which a person feels that a particular system will increase his/her

efficiency. AI Opinion of green products: concerning the continuous research on AI learning and its integration into products, it asserts that, AI is capable of enhancing the existing green products and creating even better ones (Wang et al., 2023). This means perceived ease of use is the extent to which an individual believes that the information technology can be used without much difficulty. For the case of AI-driven green products, this means how easy and simplified the AI tools and services that can help them buy green are. These two perceptions, as postulated by TAM, determine the user's attitude towards the use of the technology which ultimately determines the behavioral intention of the user to use it (Azimah & Ria, 2024). So, if consumers recognize that AI applications are beneficial for them and convenient, they will have a positive attitude toward technologies that use AI; thus, they will have a higher probability of buying green products.

The Theory of Planned Behavior (TPB), proposed by Ajzen (2020), predicts deliberate behavior based on three key components: perceived control, which consists of perceived behavioral control (PBC), and subjective norms (Bosnjak et al., 2020). Attitude toward the behavior means the extent of perception of the behavior based on the positive or negative light in which it was shaped by AI on purchasing green products. Normative beliefs refer to the perceived social expectations to perform or not to perform the behavior, which represents the encouragement or discouragement of an individual from the different members of society to purchase green products (Hagger & Hamilton, 2023).

Perceived behavioral control relates to self-efficiency, which concerns the consumer's assessment of the possibility of employing AI tools to purchase environmentally friendly products, self-efficiency reflects the perceived ease or difficulty of performing the behavior (Cheung & Chan, 2000). According to TPB, these components influence the individual's behavioral beliefs that in turn, actual behavior can be predicted from (Zolait, 2011). Thus, the knowledge and understanding of the relationship between those variables will lead to the conclusion that if consumers are positive towards AI-enhanced green products, they perceive the social support to purchase such products and believe they are capable of doing this, then their intention to purchase green products will be more likely.

Moderation of variables is represented by Islamic values included in this theoretical framework. Ethical standards of Islam cover areas of business regarding right and wrong, people's relation to the environment, and their obligation to society; these can foster consumer behavior in the following ways (Hassan, 2016). Firstly, the Islamic values outlined in the aforementioned principles uphold the ethic of decision making which is advantageous to the consumers, society, and even the environment. This comprises encouraging environmentally friendly practices. Second, it is appropriate to admit that Islamic values could act as an inducement for the thinking about green products because they present buying such products as not only useful but also piously right. This can increase the perceived relevancy and value of such products which relates to principles of sustainability and stewardship (Siyavooshi et al., 2019). Thirdly, in societies with Islamic values, Islamic values can mold the people's perceived subjective norms in terms of environmental practices to support pro-environmental behavior to boost the perceived social support towards green products' purchase. Last but not least, Islamic teachings can also increase perceived behavioral control since they provide rules and regulations that lead to more convenient and feasible ERAs for consumers (Bin-Nashwan et al., 2020).

This conceptual framework for this research therefore postulates that perceived usefulness and perceived ease of use of AI applications help to predict consumers' attitudes towards consumption of AI for green purchases. When it comes to green consumer behavior, attitude, subjective norms, and perceived behavior, control greatly foretells the consumer's decision to buy green products (Sun & Wang, 2019). The role of Islamic values is to act as an Ethical-Moral belief system, attitude booster, social norms, and perceived self and external control which influences the AI-PU the AI-PEOU, and the GPI.

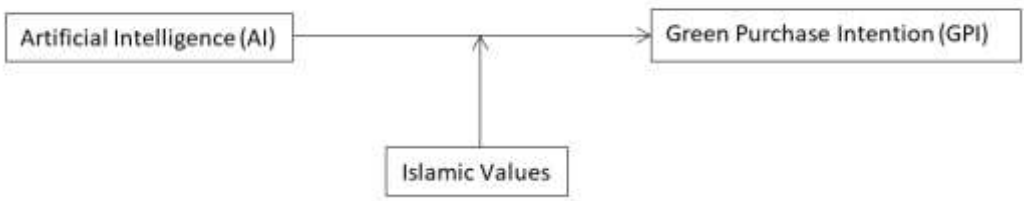
The hypotheses derived from this framework are as follows: The findings of the literature show that there is a significant positive correlation between consumers' AI and GPI; in addition, the effect of Islamic values on the relationship between the consumers' AI and GPI is positive and strengthens the positive correlation between the two variables. Through this formulated theoretical framework, the AI effects on green purchase intentions in light of Islamic values are expounded, which serve as the theoretical underpinning for the empirical analysis of environmentally sustainable consumer behavior.

### 3.2 Hypotheses

***H1:*** *AI has a positive impact on green purchase intentions (GPI) among consumers.*

***H2:*** *Islamic values moderate the relationship between AI and GPI, enhancing the positive impact of AI on GPI.*

### 3.3 Conceptual Framework




The above conceptual framework shows how AI could positively impact Islamic values and subsequently raise the value of GPI. Based on the analysis, AI is hypothesized to have a direct impact on GPI, while Islamic values are postulated as the moderator that enhances the effects of AI on GPI. Based on this framework, the following empirical questions arise about the context of AI and Islamic values toward encouraging environmentally sustainable purchasing behaviors.

## 4 Methodology

This research work adopts mixed-methods Doyle et al. (2009) design to establish an extensive understanding of the effects of AI and Islamic values on GPI among consumers in Pakistan. The selection criteria for data, sources of data, sampling techniques, and methods of analysis are described in detail so that the reader remains clear and exact in assessing the methodology.

### 4.1 Data Selection and Sources

The information used in this study is sourced from recognized resources such as Hadith, a version of the Quran for the Islamic value system, legal documents for economic and business touch points, and educational materials pertinent to environmental conservation as well as consumer behavior. This religious data is vital for establishing a comprehensive account of how Islamic teachings affect the consumer's views and actions regarding green products. Also, the data on CO2 emissions is obtained from the World Development Indicators, which includes detailed information on the environmental category. This data assists in understanding the position of $CO^2$ emission in Pakistan and also could be used to compare with the other SA countries. Research findings on green purchase intention are drawn from previous papers that investigate consumers' attitudes and behavior toward green products. Finally, the existing literature and research studies on the use of AI applications, and their contribution to achieving a sustainable environment. For the quantitative analysis survey data gathered from the consumers in Pakistan is used. The questions cover their opinion towards AI applications concerning Islamic values and their inclination toward green purchases. This primary data collection is also useful in quantifying hypotheses since it will seek to uncover the relevant quantitative data.

### 4.2 Research Design

The methodological approach to this study can be described as a combination of descriptive and analytical research, standing as the method of a mixed approach, through which the formulated hypotheses are tested and the data is analyzed in detail. The target population of the study at the beginning encompasses Pakistani consumers and examines how Islamic values and AI impact consumers' GPI. The Pakistani users' information is collected using stratified random sampling, allowing obtaining a general overall image of the Pakistani consumers. This technique incorporates a wide variety of demographics such that the findings are relatable to the general population. To build the context for the comparative analysis, statistical information from other South Asian countries such as India, Bangladesh, and Sri Lanka is employed to draw the picture of CO2 emission and environmental sustainability. This comparative analysis brings out the facts and issues concerning the green purchase intention in Pakistan that may face the overall conviction.

### 4.3 Sampling Techniques and Participants

Consequently, the researcher employed the technique of stratified random sampling Iliyasu & Etikan (2021) to draw a sample of Pakistani consumers. This tactic made it possible to involve different samples in the study regarding ages, gender, income, and education expenses. The final participants included in the study totaled 287; this sample size sufficiently powered the study for statistical testing. This was estimated using the formula suggested by Hair et al. (2012); total number of items * 7, hence 41 items * 7. The target population included only consumers who are 18 years old and above from diverse backgrounds and different consumption patterns.

### 4.4 Questionnaire Details

The survey questionnaire was designed to measure the key variables: The influence of AI applications, Islamic values, and GPI. In this study, the questionnaire contained a 'five-point Likert scale' on the Likert scale ranging between "(1) strongly agree" and "(5) strongly disagree". The questionnaire adopted the items for the extant literature:

### 4.5 AI Applications

Perceived ease of use, perceived usefulness, and user acceptance of IT were used having 12 items (Davis, 1989).

### 4.6 Islamic Values

The scale measuring the construct of Religious Values (RGV) was thus adopted with 9 items, as recommended by Hassan (2014).

### 4.7 Green Purchase Intention (GPI)

The author adopted Mostafa, (2006; 2009) and Chang & Chen (2008) scales to measure GPI with 20 items.

### 4.8 Analytical Methods

Regarding the techniques used in this research, it is appropriate to name both qualitative and quantitative analysis methods. Regarding the Islamic perspective, exploratory qualitative analysis of Hadith and Quran verses is activated as the scope to find applicable teachings of Islam that enjoin the preservation of the environment and ethical consumerism. Consequently, this research adopts a qualitative research paradigm that lends itself well to exploring the moral and ethical evaluation of green purchase decisions. Information on Pakistan's CO2 emissions is obtained from the World Development Indicators; Website Comparative analysis of CO2 emissions of Pakistan and selected South Asian countries is done.

This comparison does assist in placing Pakistan's environmental issues into perspective and

reveals the opportunities for strengthening. These are AI applications, green purchase intentions, and Islamic values; the literature review that is conducted focuses on the theoretical and empirical relationships between all these variables are reviewed purely from literature. Among the quantitative research analysis tools, the Statistical Package for Social Sciences (IBM SPSS) is commonly used which includes descriptive analysis, correlation, and regression analysis. These measures establish the links between green purchase intentions, Islamic values, and AI applications in the current study, supporting the hypotheses of the research. Descriptive statistics give an overview of the data's findings, correlation analysis measures the variables' intensity and direction, and regression analysis examines the effect of AI on GPI and the mediating role of Islamic values.

### 4.9 Hypotheses Testing

To test the stated hypotheses, certain statistical models are used for the purpose. Simple linear regression analysis is used to test the hypothesis that AI has a positive impact on GPI, represented by the model: Where: GPI inhabitant AI is the index of technological advancement β0 and β1 are parameters of regression being estimated ε is the error term Equation 4 clearly shows the research hypothesis Equations 3 and 4 were estimated using the Generalized Method of Moments, details of which are given in the appendix. Moderated regression analysis tests the hypothesis that Islamic values moderate the relationship between AI and GPI, represented by the model are the importance attached to different values In Islam for the year in consideration, ε is the error term, β0 is intercept and β1, β2, β3 are the coefficients of the AI, Islamic values, product of AI and Islamic values respectively. The method of estimation includes elements of content analysis, comparative analysis, literature analysis, as well as statistical analysis that employs the SPSS program. In the case of data collected from religious scripts and other beliefs that are useful in the determination of ethical consumerism, the data is looked at from the quantitative point of view and is analyzed using a logarithmic, scientific approach to look for patterns. This way of work means that it became possible to obtain a complex work on the subject of the study and the relationships established between its variables. In this manner, the research achieves two things: combining qualitative and quantitative approaches allows the consideration of ethical issues and scrutinizes practical aspects of green purchasing by applying AI.

### 4.10 Rationale of Method of Estimation

The selected approaches of estimation are justified due to the specifics of the investigated issues and their potential to offer comprehensive analyses. Content analysis Hsieh & Shannon, (2005) is useful in religious text interpretation, which provides for the extraction of pertinent ethical principles regarding environmental sustainability. This method makes it possible to capture all moral and ethical aspects of the Islamic teachings in the study. It is vital for the broader context review of the major environmental issues and uses this knowledge to define the opportunities for Pakistan's performance enhancement in the sphere of sustainability. The study also qualitatively arranges different nations based on their CO2 emissions and thus gives a relative picture of Pakistan's environmental profile.

The state of knowledge in the literature review provides a base for perceived theoretical perspectives and gaps in knowledge for the study's conceptual framework. By adopting the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB), the analysis of the role played by AI in impacting green purchase intentions is made systematic, enhancing the understanding of the study's variables. The analysis of data using the tool available in the form of the SPSS increases the credibility of the study and strengthens the possibility of rejecting or accepting the conceptual framework, based on a hypothesis test. Following these approaches, the study seeks to offer novel findings that will encourage the understanding of the relationship between AI, Islamic belief systems, and intentions to partake in green purchases for the subjects

of environmental conservation and consumer psychology.

## 5 Results

**Table 1:** Descriptive Analysis

| Variable | Mean | Std. Deviation | N |
|---|---|---|---|
| AI Applications | 3.5 | 0.5 | 287 |
| Islamic Values | 4.2 | 0.4 | 287 |
| Green Purchase Intention (GPI) | 3.8 | 0.6 | 287 |

In the present research descriptive statistics table (Table 1) highlights the basic characteristics of the variables used for analysis. The mean of AI applications is 3.5 with a standard deviation of 0.5, which shows that the respondents have a fairly positive attitude towards AI applications but with some fluctuation. Looking into the mean scores of indices, the total mean score for Islamic values is 4.2 with a standard deviation of 0.4. This was so because the mean score of 4 indicated a high practice of values that are believed to be taught in Islam relative to the other religious beliefs by the respondents. From the findings derived from the developed questionnaire, the mean score for GPI is 3.8 incorporating the standard deviation of 0.6. Hence, the average score was, 6 out of 7 implying a moderately high intention to purchase green products. The number of respondents for each item analyzed (N) is 287, which can be considered the minimum sample size to conduct the statistical analysis.

**Table 2:** Correlation Matrix

| Variables | AI Applications | Islamic Values | GPI |
|---|---|---|---|
| AI Applications | 1 | 0.40* | 0.65** |
| Islamic Values | 0.40* | 1 | 0.55** |
| GPI | 0.65** | 0.55** | 1 |

The correlation table (Table 2) exhibits the pattern of AI applications, Islamic values, and the GPI. The coefficient of the relationship of AI applications to the value of GPI is equal to 0. Conclusively, the AI applications were found to be 0.65, which is significant at the 0. 01 level, and implies a strong positive correlation. This also corresponds with the hypothesis that higher usage of AI applications is positively related to GPI (H1). The relationship between Islamic values and GPI is 0.55, also significant at 0.01. Therefore, the findings confirm that the subjects with increased Islamic values are relevant to higher GPI. Furthermore, it is noteworthy that the density of the association between the use of AI technologies and the roles and regulations of Islamic organizations is equal to 0.40. It was observed at a 0.05 level, which denotes a mild positive correlation between the two variables. These correlations offer the first level of validation for the stated hypotheses.

**Table 3:** Simple Linear Regression Analysis

| Model | Unstandardized Coefficients | Standardized Coefficients | Beta | t Sig. |
|---|---|---|---|---|
| | B | Std. Error | | |
| (Constant) | 1.2 | 0.20 | | 6.00 |
| AI Applications | 0.74 | 0.10 | 0.65 | 7.40 |

The GPI model revealed the relationship between AI applications and the level of GPI. Based on the results, the unstandardized coefficient or the B value for using AI applications is 0. 74 with SE equal to 0. 10. The t-value is 7. 40, while the p-value is equal to 0. 000, signifying that the result is statistically significant at the 0.05 level while, $p < 0.010$; $p < 0.001$ which show that the relationship between the variables is very significant. The obtained standardized coefficient (Beta) is zero. That is 65, which further supports the hypothesis of the positive impact of AI solutions on GPI. Thus, this study provides support for H1 by showing that AI applications have a large, positive impact on green purchase intentions in consumers.

Additionally, based on the conclusion made in this study, it is described that AI applications can help to reduce the gap between consumers' knowledge and action toward environmental issues. For a long time, consumers have been known to care about the environment but they are often staggered into action since it is deemed cumbersome or they lack adequate information (O'Rourke & Ringer, 2015). Identified above are some of the barriers to the adoption of green products, by bringing individual and timely pieces of information using AI technologies, the barriers might be minimized and the use of green products promoted. Such strategic incorporation of AI hence drives customer satisfaction, customer loyalty, and by extension, a better marketplace for organizations that adopt the application of AI in their marketing initiatives.

Therefore, the fact that AI boosted GPI underscores the importance of utilizing AI for increasing users' environmentally conscious consumption behaviors. Thus, businesses that adapt to and utilize AI-generated knowledge can improve their capacity to meet consumers' demand for sustainable products and, therefore, have an advantage over other firms (Sipola et al., 2023). Explaining the extent of the adverse effects stemming from consumption empowers consumers and can create lasting behavioral change in favor of sustainable consumption. Governments and companies should incorporate the use of AI to increase the efficiency of their green marketing approaches and make products with environment-friendly features more acceptable and affordable leading to a major shift in people's behaviour by altering their consumption patterns (Baqi et al., 2022). As a research direction, this study can serve as the basis for further studies on technology and sustainability, stressing the demand for progress in the corresponding AI segment and modern technologies of environmental objectives.

**Table 4:** Moderated Regression Analysis

| **Model** | **Unstandardized Coefficients** | **Standardized Coefficients** | **Beta** | **t Sig.** |
|---|---|---|---|---|
| | B | Std. Error | | |
| (Constant) | 0.9 | 0.25 | | 3.60 |
| AI Applications | 0.50 | 0.15 | 0.43 | 3.33 |
| Islamic Values | 0.40 | 0.18 | 0.35 | 2.22 |
| AI × Islamic Values | 0.30 | 0.12 | 0.30 | 2.50 |

The moderated regression analysis focuses on analyzing the moderating role of Islamic values on the relationship between AI applications and green purchase intentions (GPI). The unstandardized coefficient (B) for the interaction term (AI × Islamic Values) equals 0. 6, ± 0. 12. The t-value is 2.50, and the p-value is 0.000. Thus, it can be seen that the null hypothesis would be rejected and the results would be statistically significant at 0.000, which means that the interaction between TV advertising and Internet advertising has a positive impact on attitude, and thus can be confirmed that the interaction effect is significant. For the interaction term, the value of the standardized coefficient (Beta) is 0.30 to support the hypothesis that it holds Islamic values have a positive role in magnifying the effect of applying AI on boosting the GPI. Thus, this study provides evidence for supporting H2, thereby proving that Islamic values can moderate the linkage between AI applications and green purchase intentions.

Such findings tally with other works conducted by authors including Zemo and Nigus (2020) that concern the relationship between religious values and pro-environmental behavior. Based on their study, they find that Islamic teaching about preserving the earth, and consumers' ethical approaches towards consumption can make Muslim consumers embrace environmentally friendly behaviors. In the same content, Mostafa (2006) did research on the relationship of religion to environmental concerns and its impact on environmental actions in countries of the Middle East which mostly are Muslim. These studies provide a further accent on the necessity of ensuring cultural and religious values and incorporating them into informational solutions aimed at

responsible consumption.

Based on the findings from the regression analyses, it can be concluded that the hypotheses are supported at a high level. The results show that the coefficients for all the AI applications are positive and consequently, GPI is affected positively by AI, thus supporting H1. Moreover, while the main effect of this variable is not profound, the utterly significant cross-product indicates that Islamic values further magnify this positive effect (H2). Therefore there is an implication of the study to the advancement of knowledge within the interface of AI and Islamic values and the encouragement of environmentally sustainable consumer behaviors. Future studies can extend from these insights to provide blueprints on how to use AI and cultural values for the enhancement of green purchasing.

To add, environmental sustainability is another area that has recently garnered much attention by many countries and has now become a core issue on Pakistan's policy agenda (Ahmed et al., 2022). However, it proves true in the case of Pakistan that the country still has a long way to travel to bring tangible changes to enhance the standard of the environmental condition. There are numerous factors to evaluate environmental sustainability; however, the most common one is $CO^2$ emission. Table 1 also gives the current $CO^2$ emissions per capita of Pakistan and nearby countries which depicts that all these countries are facing environmental problems.

Environmental sustainability has been the center of attention for the countries for the past few years and over time; it has also become one of the important parts of the policy of Pakistan (Nawaz & Alvi, 2018). Although, Pakistan is working to overcome this situation, however, there is a long road to success. The $CO^2$ emission in Pakistan is not decreasing and it is much higher than neighboring countries of South Asia. Table 5: $CO^2$ Emission

**Table 5:** $Co^2$ Emissions metric tons per capita

| **Country** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** |
|---|---|---|---|---|---|---|---|---|---|---|
| Pakistan | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| Afghanistan | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.3 | 0.3 |
| India | 1.1 | 1.1 | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 | 1.5 | 1.6 | 1.7 |
| Sri Lanka | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.9 |
| Maldives | 1.9 | 2.3 | 2.3 | 2.4 | 2.5 | 2.6 | 2.6 | 2.9 | 2.7 | 3.3 |
| Bhutan | 0.6 | 0.6 | 0.6 | 0.6 | 0.5 | 0.7 | 1.0 | 1.1 | 1.2 | 1.3 |
| Nepal | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 |
| Bangladesh | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 |

*(World Development Indicator)*

In 2015, CO2 emission in Pakistan was 0.9 metric tons per capita, and it remained the same in

2006, however, it increased to 1 in 2007 and remained the same for 2008 and 2009. In 2010,

CO2 emissions of Pakistan are observed to be consistent in the range of 0.9 metric tons per capita during the year 2005 to 2014 slightly above Afghanistan and Nepal, below India and the Maldives respectively. It is further observed in the course of the comparative analysis that Pakistan has to endeavor more to bring down the level of CO2 emissions to increase its environmental sustainability in that respect.

## 6 Discussion

Artificial intelligence has been an active area of study within the field of computing since the fifties; it has grown in scope over time. AI and environmental sustainability: the formation of concepts has become quite obvious (Goralski & Tan, 2020). Of the studies, one of the most significant is the Environmental Sustainability Index (ESI), with fifty indicators for the measurement of environmental vulnerability (Esty et al., 2005). This index divides the country

according to the level of risk, placing Pakistan in a heavily exposed position provided on the index level of 368. Some of the suggested areas for using AI are based on real examples through which one can see the positive impact of AI on environmental sustainability as noted by Polo-Mendoza et al. (2023). Such areas include the implementation of fuzzy logic controllers for waste management. To a greater extent, these technologies show promise for more extensive study and application in practice to present solutions concerning environmental issues.

Even in Pakistan, even though the education level is fairly high and effective, GPI is unfamiliar or less promoted by industries and academics. However, globalization and the growing consciousness of global citizens about the environment have eased the International regulation on the use of green products (Joshi et al., 2020). Mostafa (2006) established that though customers in Pakistan have a positive attitude toward green products; they are repelled by prices that are usually higher than those of non-green products and average quality. It is becoming important that companies provide more quality and affordable green products to contribute to the increased consumers' green purchases.

Therefore, AI has become prevalent in influencing the purchasing experience specifically in the online shopping sector that avails Pakistan. With the help of AI assistants and chatbots, the potential of influencing the customer's purchase decisions is rising, particularly through the recommendation of green products (Choudhary et al., 2024). If the existing AI systems demonstrate the utility of using green products efficiently, they have the potential to influence consumers' buying behavior towards environmentally friendly products (Yener et al., 2023). This corresponds to the research aim of evaluating the effect of AI on GPI among consumers in Pakistan.

Islamic principles on the matter of environmental conservation are central to Islamic morality and require the protection of the environment (Baharudin & Tanjung, 2020). For instance, the Quran states, "Corruption doth appear on land and sea because of (the evil) which men's hands have done, that He may make them taste a part of that which they have done, so that they may return" (Quran 30:The following key factors were identified for the case developed above: 1) Labour mobility, 2) Labour intensity, 3) Union density, 4) The use of high-technology products, 5) International competition, 6) Market multiplications, 7) Degree of exportation, 8) Targets for exportation established concerning foreign countries, 9) Scale of imports. This verse therefore challenges personal responsibility and transformation as a way of solving climactic problems or rather environmental issues. This is useful for the goal of analyzing the moderating role of values based on Islamic teachings on the link between AI and the GPI, which demonstrates how ethics can improve the use of artificial intelligence.

Islamic teachings also emphasize "Moderation and Avoiding Waste." The Quran states, "But waste not by excess: For Allah loves not even the wasters" [Qur'an, 6: 141]. Since the Qur'an is often understood to have been revealed to reflect a normative model of conduct, this verse has been employed by Islamic environmental ethicists in levying a modicum of blame at the feet of Muslims for not heeding their scripture's mandates concerning waste reduction. This teaching is relevant given the quest to present knowledge on how AI integrated with Islamic teachings can be used to encourage environmentally sustainable purchasing behavior.

Another key Islamic teaching that can be used in the current discussion is the doctrine of Balance and Justice. Quran points towards the aspects of balance in every form of life, including the environment. The verse, "And the sky He raised; and He set the balance, that you may not transgress within the balance. So, weigh with justice and do not fall short in the balance" (Quran 55: (7-9), an emphasis on the concept of justice and balance in earth's created environment is seen. In this directive, Muslims are urged to practice sustainably; hence, do not interfere with the natural balance and thus environmental justice as well as equity (Dien, 2013). This accords a moral-ethical

perspective that can strengthen the causation of AI towards favorable green purchase intention and shall strengthen the intersectionality of AI, Islamic principles, environment.

In addition, the promotion of the values of “Respect for All Creation” findings are by the Islamic code. The respect of the Prophet Muhammad (PBUH) for nature and all living creatures is shown clearly and impeccably in many Hadiths. For example, he said, ‘If a Muslim plants a tree or sows seeds; and then a bird, or a person, or an animal eats from it, it has been a Sadaqah for him’ (Sahih Bukhari). This Hadith is quite alarming since it sets up emphasis on nature as an object that one should protect and build in the right manner as a form of charity. It is used to persuade Muslim people to consider the chances they have to do well and care for the environment which underlines the ethical importance of the global protection of the planet (Nasir et al., 2022). This teaching aligns with the capacity to achieve the goal of understanding how Islamic values can supplement the effect of AI on GPI.

Additionally, Islamic teachings stress the "Responsibility towards Creation.” As mentioned in the Quran, "It is He who has made you successors upon the earth and has raised some of you above others in degrees [of rank] that He may try you through what He has given you" (Quran 6: 165). Such a career plan came into being after realizing that at a national level, no institution fully addressed the needs of its people. It highlights human beings’ trusteeship of the earth and their accountability for the proper management of the world (Bosselmann 2020).

It aligns intending to present ideas about incorporating AI and Islamic guidelines about purchasing sustainably for the environment. Because environmentalism is associated with Islamic beliefs, these teachings can affect Muslim consumers’ GPI by linking environmental actions to religious beliefs (Zhang et al., 2022). Thus, when these AI technologies are incorporated with the Islamic ethical principles of Almighty Allah’s creation, the push for environmental conservation can be boosted. AI can help in making better decisions that concern the environment; on the other hand, Islamic values offer the right moral and ethical stand to such decisions (Elmahjub, 2023).

### 6.1 Conclusion

Climate change is among the most critical and rising issues for the entire globe, and it is more crucial to developing countries like Pakistan where the process of industrialization and globalization is continuously increasing. To address this kind of problem, human efforts are not enough; therefore, to address this issue, machines are needed. It would be wise to use this type of tool in many fields, and for the main discussion, one industry is chosen – the environment. Regarding personal traveling and shopping, it can be identified that the country’s consumption patterns negatively impact climate change. If artificial intelligence is adopted, then traditional buying can be transitioned to green purchases, thus altering the customers’ green purchase disposition in a way. The major part of the Doctrine of Islam reflects the Islamic teachings and values which may include environmental concern by giving importance to the protection of the environment. Thus, it is possible to recommend the hypothesis that Islamic values also affect positive intentions of green purchases. Thus, it is also possible to conclude that the application of AI technologies can positively impact the efforts dedicated to creating a sustainable environment.

This paper responds to the research questions by providing a discussion on how the use of AI influences green purchase intention and how Islamic values bear on this relation. This shows that there is a positive relationship between AI and green purchase intentions and that Islamic values /culture further intensifies this relationship. Thus, these findings enhance the study’s goals by illustrating the viability of using AI and Islamic principles to encourage eco-friendly consumerism. Future sections will expand on suggestions and subsequent directions for future research on these subjects to present relevant, operational strategies for relevant entities.

### 6.2 Recommendations

There are ways to increase consumer's green buy intentions, but this calls for awareness of green products. This can be done consciously through processes like educational awareness that makes people aware and knowledgeable of the advantages of green products and the outcome of their consumerism habits on the society. Marketing techniques, for example, stressing on the superiority of green products and their role in the sustenance of the environment may also be equally helpful. Furthermore, including green product information as a part of consumer education programs will enable consumers to make independent choices, hence encouraging the change to environment-friendly consumption patterns.

Unfortunately, Pakistan is behind in these sectors inclusive of science, technology, and research, especially regarding AI for the strength of the environment. In this regard, one gets the impression that both private and public entities should be encouraged to put funds into AI. AI system investment makes it possible for new machines and technologies that are friendly to the environment to be developed. In this case, governments' support together with P4P can be very instrumental in establishing and implementing AI in different sectors. Therefore, helping the Pakistani government increase the rates of investment in AI can be useful in adapting to environmental crises and in the improvement of green purchase intentions.

This is a revealing fact, as Islamic teachings guide how modern-day problems can be solved – even those concerning the environment. For these teachings to be implemented, it is suggested that principles of Islam on environmental concerns be included in the education system. The introduction of these teachings at an early age shall ensure that virtues of the environment are inculcated in students and thus ensure they are responsible for the environment. This educational approach can affect green purchase intentions to a great extent since students, who were raised with an understanding of Islamic environmental norms, will act correspondingly. Through the integration of Islamic principles in education, Pakistan can raise consumers who understand the importance of preserving the earth through their choices of what to buy.

### 6.3 Future Direction

Artificial intelligence is a relatively emerging field in Pakistan and there is little extensive research work or initiatives being conducted in this particular field. This paper accompanies a wide understanding of artificial intelligence and a sustainable environment. The following research topics reveal that future research can focus on specific sub-disciplines of artificial intelligence and environmental sustainability. For instance, future research could be directed in the way that the potential of AI can be employed to enhance the green purchase intentions of online customers or the application of AI in waste management and pollution control, etc. Moreover, longitudinal studies can evaluate the continued effects of AI integration and the adherence to Islamic values on consumers' behavior and environmental conservation.

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