

Ajina, Ahmad S.; Islam, Dewan Md Zahurul; Zamil, Ahmad M. A.; Khan, Kaleemullah

Article

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Understanding green IT adoption: TAM and dual-lens of innovation resistance

Ahmad S. Ajina^a, Dewan Md Zahurul Islam^b, Ahmad M. A. Zamil^a and Kaleemullah Khan^c 

^aDepartment of Marketing, College of Business Administration, Prince Sattam bin Abdulaziz University, Al-Kharj, Saudi Arabia; ^bOperations and Supply Chain Management, Northumbria University, Newcastle upon Tyne, UK; ^cDepartment of Business Administration, Kardan University, Kabul, Afghanistan

ABSTRACT

The escalating environmental impact of IT products in Gulf Cooperation Council (GCC) countries, particularly Saudi Arabia, has prompted the exploration of specific green IT adoption practices, such as the use of energy-efficient computers, renewable energy-powered devices, and electronics with sustainability certifications. However, existing theoretical models often overlook aspects of long-term usage and resistance to technology adoption. To bridge this gap, this study integrates the widely recognized Technology Acceptance Model (TAM) and Innovation Resistance Theory (IRT) to understand the drivers and barriers affecting consumers' intention to adopt green IT products. Cross-sectional data were collected from 237 consumers using an online survey. Variance-based structural equation modeling (SEM), specifically partial least squares (PLS)-SEM analysis, was employed. The results underscore the importance of perceived ease of use and usefulness as key drivers of adoption intention. Simultaneously, active innovation resistance, encompassing usage, value, and risk factors, and passive innovation resistance, linked to image and traditions, emerged as significant barriers. Increased passive barriers underlined the necessity for particular approaches to overcome them. Using acceptance and resistance theories, this research has improved our knowledge of IT adoption dynamics. This study helps practitioners promote green IT adoption by emphasising user-friendly design and passive resistance. We discuss the study's limitations and advise additional research.

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SUBJECTS

Management of IT;
Environmental Psychology;
Environmental Issues

1. Introduction

Environmental protection is growing more important to individuals and businesses worldwide (Paço et al., 2022). This awareness is due to water and air pollution, ozone layer degradation, improper waste management, and reckless use of non-renewable resources, which harm human and environmental health (Islam et al., 2021). Researchers and industry professionals are particularly interested in environmentally responsible buying strategies (Ramón & Lull, 2019).

Increased environmental awareness has changed product demand and customer preferences (Kulshreshtha et al., 2019). Information technology (IT) has reformed human-nature interaction. Because of its complicated relationship with the environment, IT plays both a positive and negative role in sustainable development. This includes both first-order consequences, such as e-waste generation, and second-order consequences, like increased energy consumption (Ali et al., 2021; Gholami et al., 2013).

The advent of Information and Communication Technology (ICT) ushered in a digital revolution of unprecedented global magnitude. Currently, an astonishing 3.6 billion people, representing nearly half of the world's population, have embraced the Internet. Notably, mobile technology is a key driver in this transformation, with astounding 7.7 billion mobile-cellular subscriptions and 4.2 billion active mobile broadband subscriptions worldwide. More remarkably, over 80% of the global population benefits from

mobile broadband signals (Balde et al., 2017; E-Waste, 2023). This digital era has seamlessly integrated itself into households, with 54% enjoying Internet access and 48% owning computers. However, this surge in digital technology has led to a significant e-waste problem. The annual production of 300 million computers and 1 billion cell phones is projected to grow by 8% annually. In the U.S. alone, discarded cell phones contain approximately \$60 million worth of precious metals each year (Balde et al., 2017; E-Waste, 2023).

The issue of e-waste is further exacerbated by trends such as the electrification of non-electrical equipment, increased ownership of multiple devices, the expansion of cloud computing services and data centers, and shorter replacement cycles for electronic devices. ICT equipment contributes a substantial 10.5 million tons of e-waste annually (Balde et al., 2017; E-Waste, 2023).

Beyond the e-waste crisis, IT's first-order negative impacts include the generation of electronic waste during the production, use, and disposal of devices. Second-order negative impacts include IT's effect on energy consumption in both industries and households, straining the environment. Global energy demand surged by 2.1% in 2017, with forecasts indicating a 25% growth by 2040, necessitating an annual investment of over \$2 trillion for energy supply. However, green IT offers a promising solution to mitigate these impacts by promoting the environmentally conscious design, manufacturing, usage, and disposal of IT products (Melville, 2010).

Green IT is gaining traction as organizations recognize its effectiveness in minimizing environmental impact (Ainin et al., 2016). In the same vein, Ali et al. (2019) delved into the several ways in which green IT might benefit developing nations' economy, communities, and the environment. However, company viewpoints have dominated research on green IT adoption, which has ignored this interest (Yoon, 2018). Moreover, user attitudes and behaviours have been largely disregarded in green IT research (Yoon, 2018). Likewise, the majority of research has utilised frameworks like the Technology acceptability Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) to find out what factors impact the acceptability of eco-friendly IT solutions (Ali et al., 2021; Dezdar, 2017; Yoon, 2018). Hence, Khanra et al. (2021) claims that these models ignore potential barriers to technology adoption in favour of analysing what makes it easier to adopt.

Moreover, the TAM and the IRT, two models of resistance and acceptance, are required to bridge this gap. A single model can now account for both acceptance and resistance due to this integration (Lian & Yen, 2014; Sivathanu, 2019). Another factor that makes IT adoption more challenging is the fact that humans have their own set of motives, goals, and constraints. According to Lian & Yen (2014) and Sivathanu (2019) these models can help academics better understand trends in green IT adoption.

Tansuhaj et al. (1991) opined that users' reluctance also affects public opinion and the rate of technological adoption. There are two types of resistance to innovation. The first is active resistance, which comes from wanting to hold on to long-held beliefs and ideas. The second is passive resistance, which comes from not wanting to think about other perspectives (Heidenreich & Handrich, 2015). In the same vein, Ajina et al. (2023a) and Kaur et al. (2020) use an active/passive classification system for resistance. Value, risk and usage and barriers are indicators of active resistance, whereas challenges to image and tradition are elements of passive resistance. ...Furthermore, Talwar et al. (2020) demonstrated that it is essential to understand numerous kinds of resistance factors to effectively accept technology. Although studies on resistance in many situations, adoption motivators still fail to explain why certain customers are resistive to new goods and services (Claudy et al., 2015). Hence, understanding green IT consumer behaviour from the perspectives of active and passive resistance is important.

Saudi Arabia and other GCC nations, particularly, Saudi Arabia is expected to see a large rise in population by 2030, which would most likely lead to an increase in e-waste creation. In light of this, it is essential to identify the factors driving and inhibiting the adoption of green IT in Saudi Arabia. What factors (acceptance and resistance) have the greatest influence on the green IT adoption in Saudi Arabia? With this research, this research aims to determine what elements encouraging and hindering green IT adoption by focusing on particular socioeconomic and cultural aspects of the studied context. Using the TAM and IRT, we intend to provide the notions on how to encourage environmentally responsible IT practices.

The unique cultural and socioeconomic features of Saudi Arabia provide a suitable setting for this study. Results will be useful for developing plans to reduce the ecological footprint of IT devices and

improve e-waste management procedures in Saudi Arabia and the wider GCC area. This research helps promote greener IT practices on a local and international scale, which in turn advances sustainable technology practices.

2. Theoretical background and hypothesis development

2.1. Green information technology

Green IT primarily relies on ICT because Green IT refers to the way of developing, assembling, using and eventually disposing of environmentally friendly information technology (Ali et al., 2021). Moreover, Green IT saves energy and reduces the environmental impact while promoting both sustainability and responsible decision-making (Bhat et al., 2024; Melville, 2010). Further, (Dezdar, 2017) clarifies that IT can achieve environmental sustainability through four following cycles; Green Use which involves efficiency in energy use. Next is Green Disposal this cycle emphasizes more on recycling of e-waste. Third is the greening design inscribed into product development and lastly, green manufacturing which deals with ways like sustainable enterprise practices to make industries responsible for carrying it out These cycles was opined by Ali et al., (2019) as increasing the potential for environmental sustainability within the IT sector and digital enterprises.

2.2. Electronic waste (E-waste)

E-waste (discarded IT equipment) is a major ecological problem due to its distinct chemical and physical traits (Madkhali et al., 2023). In addition, Madkhali et al. (2023) stated that it consists of precious metals like gold and copper, along with toxic substances such as flame retardants, mercury arsenic and lead. To effectively reduce pollutants and address health problems, it is crucial to use the utmost caution while recycling and processing waste materials (Almulhim, 2022).

In the same vein, e-waste is rising due to new IT devices with shorter lifespans, increasing urbanisation, higher living standards, faster growth, and a larger population (Ali et al., 2021). E-waste production reached a record 53.6 million metric tonnes in 2021, an upsurge with 2.5 million tonnes annually (Madkhali et al., 2023). Since 2014, e-waste has increased by over 20%, requiring rapid care (Ismail & Hanafiah, 2020). However, green IT practises reduce e-waste by improving energy efficiency, upgradability, modular design, product longevity, circular economic mindset, e-waste disposal and sustainable production. Likewise, implementing these ideas into IT initiatives may help prevent e-waste and promote a greener future.

2.3. Theoretical background

In this study, we examine Saudi citizens' attitudes and intentions regarding the adoption of green IT products. We seek to gain a comprehensive and profound understanding by employing two well-established frameworks, namely Mindsponge Theory, TAM and IRT. The mindsponge theory assumes that mind is an information collection-cum-processor that can update conditional on the environmental conditions and psychological states. TAM aids in identifying crucial factors that shape individuals' willingness to embrace environmentally friendly technologies. Simultaneously, IRT allows us to delve into specific concerns and obstacles related to green IT products in Saudi Arabia. The research aims to provide profound insights into the factors influencing green IT adoption while highlighting potential barriers. Ultimately, the goal is to contribute to a more sustainable digital future by promoting eco-friendly technologies among the Saudi citizens.

2.4. Conceptualization of the mindsponge theory

Vuong and Napier (2015) introduced the notion of 'mindsponge', conceptualized as 'the mind's capacity to assimilate new values that align with its core principles while expelling incongruent ones. Nguyen et al. (2021) proposed that the mindsponge concept can elucidate complex psychological and

behavioral phenomena, offering a dynamic, multiplex framework. It is commonly depicted through a pie-shaped conceptual diagram symbolizing the interaction between the mind and its environment (see [Figure 1](#)). The diagram comprises five primary elements: '(1) mindset, (2) comfort zone, (3) multi-filtering system, (4) cultural and ideological context (or environment), and (5) cultural values (or information)'.

The outermost section in the figure (yellow-colored) represents the cultural and ideological context (or general environment) in which the individual resides. The innermost section of the figure (red-colored) symbolizes the mindset or core values of the individual. The mindset encompasses cultural values and other highly esteemed beliefs known as core values. These core values act as standards for assessing the suitability of newly acquired information or values influencing individual attitudes, perceptions, and behavioral responses. The central blue segment between the outermost layer and the nucleus represents the comfort zone, also called the buffer zone. It comprises values in the mind that are not considered core values. The comfort zone serves two primary functions. Firstly, it acts as a filter through which values must pass before entering the mindset, thereby shielding the mindset from sudden environmental changes such as cultural shocks. Secondly, within the comfort zone, the multi-filtering system is activated to assess the validity and useability of newly introduced values. While the filtering process may occur at any point within the mind, the white layers between the blue/red and yellow/blue sections symbolize visual filtering indicators or evaluation, facilitating interpretation. The filtering or evaluation process deepens as values move closer to the mindset (Vuong et al., 2022). Further, Vuong et al. (2022) demonstrated that the multi-filtering system performs two fundamental functions: integrating and differentiating information. When environmental information aligns with core values (or mindset), it undergoes synthesis and integration into the mind. If new information diverges from existing values, it undergoes differentiation to evaluate the costs and benefits of considering or refusing it or replacing current values with different ones.

The multi-filtering system is influenced by the 3D (triple-discipline) filter, including the concept of inductive attitude and trust evaluators (Vuong & Napier, 2014). The 3D filter entails well-ordered procedures that assess, link, compare, and visualize emerging and established values to generate practical and readily applicable understandings to approve or reject the novel values (Vuong et al., 2022). Emerging values denote novel information assimilated from the environment, whereas established values represent knowledge already saved in memory as trusted information. Vuong and Napier (2015) proposed that trust evaluation operates across four levels: (1) Assessment of personal attributes and characteristics, (2)

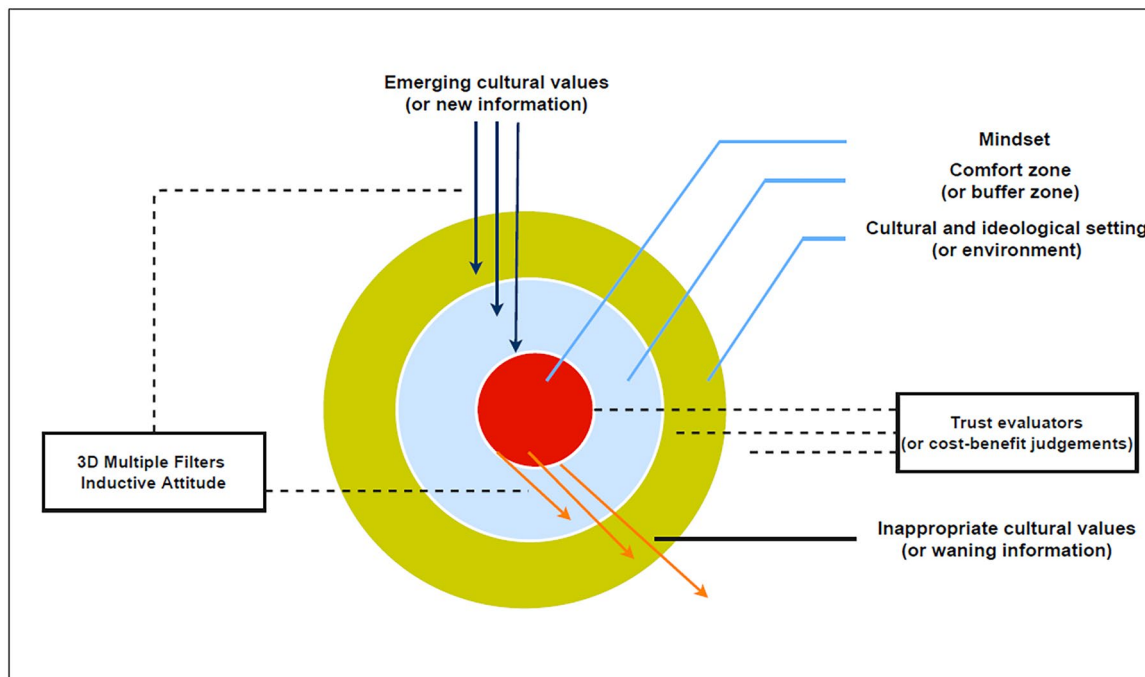


Figure 1. Mindsponge Thoery adopted from Nguyen et al. (2022).

consideration of anticipated short and long-term costs and benefits, (3) evaluation of a value's compatibility with the present mindset, (4) appropriateness of predominant values at a philosophical level.

For information to be absorbed, it must meet two criteria: availability, meaning it exists objectively in the environment, and accessibility, indicating the mind's openness to accessing it. The mind's ability to access information depends on its objective availability and the individual's perceivable range. Nguyen et al. (2022) defined perceivable range as the physical environment in which individuals can perceive stimuli using their sense organs. Due to human limitations in mental and physical capacity, individuals cannot process and admit all information within this range.

The inclusion and exclusion of information and values are symbolized by arrows entering and exiting. Arrows directed towards the nucleus represent emerging values and information, while those pointing outward represent diminishing information, no longer aligning with core values. The continuous inflow and outflow represent ongoing processes integral to the updating feature of the mindsponge mechanism. The updating feature assists in distinguishing between the 3D filter and trust evaluator, initially seeming analogous due to their association with subjective cost-benefit assessment. Expanding on this, when assessing the cost-benefit of new values via trust evaluators, analogous current values previously admitted, evaluated, and validated using an inductive process. Novel values aligned with trusted ones are granted a 'priority pass,' necessitating less stringent evaluation for inclusion into the mindset. In contrast, those conflicting with trusted values are given priority for rejection. Conversely, if emerging values lack analogous counterparts among previously evaluated and validated values, they must undergo careful evaluation by the 3D filter as usual. Despite its complexity and dynamism, the mindsponge mechanism can be condensed into five main rules (Vuong et al., 2022).

1. Information within the subjective realm of the mind must be present for processing.
2. The processing mechanism of information within the mind, involving absorption and expulsion processes, relies on trust evaluation and subjective cost-benefit analysis to optimize perceived benefits and minimize perceived costs.
3. The multi-filtering process is influenced by the value system defined by the mindset, which comprises core values.
4. The results of subconscious and conscious mental processes, such as thoughts, behaviors, and emotions, are predominantly shaped by the values within the mind, particularly the main values in the mindset.
5. For information to be absorbed into the subjective realm of the mind, it must first exist in the objective environment and be within the individual's perceivable range. These five principles are visually depicted on a logical diagram to enhance understanding and practical application.

2.5. Technology acceptance model (TAM)

The Technology Acceptance Model (TAM) is a theory that explains how people adopt new technologies (Davis, 1985). Davis (Davis, 1985) built on the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). The TAM posits that individuals' intention to adopt technology is influenced by their attitudes, which in turn are shaped by two main factors: perceived usefulness (PU) and perceived ease of use (PEOU).

Perceived Usefulness: This refers to the degree to which a person believes that using a particular technology will enhance their job performance or overall experience (Davis, 1989). It essentially encapsulates how individuals assess the value and benefits that technology brings to their lives. Positive attitudes towards technology adoption typically arise when individuals perceive significant advantages and benefits of using technology. In contrast, negative attitudes may develop when individuals see limited or no advantages in adopting technology. The evaluation of PU is a critical factor that influences an individual's decision to embrace or resist a new technology. PU has particular significance in the context of green IT. People take green IT solutions seriously because they see the potential for increased workplace efficiency and a better job experience. If they believe green IT can save energy, reduce environmental impact, and promote sustainable living, they're more likely to adopt it. Green IT's focus on environmental, social, and personal benefits makes it appealing. When these solutions address environmental challenges and climate change, they align with people's values and sense of responsibility. Seeing

the tangible improvements in their lives and work environments encourages adoption. Demonstrating the benefits of green IT is key to promoting its use in both personal and professional settings (Ali et al., 2020, 2021; Zahid et al., 2022).

Perceived Ease of Use: The word 'PEOU' relates to how easy technology is to learn and use (Davis, 1989). It shows how people feel about technology's ease or difficulty. How easy people perceive technology is affects their attitude and desire to use it. PEOU is important to green IT. This depends on eco-friendly technology being easy to adopt. User-friendly, clear, and easy-to-use green IT solutions are more likely to be adopted and used in daily operations. Users are more likely to adopt green IT solutions that are simple and integrated into daily life. If these technologies are easy to use, individuals will like them. Users may oppose green IT if they think it's too complicated or time-consuming. Businesses must make green IT solutions easy to use to increase adoption. Making the experience smooth, providing user-friendly interfaces, and making training resources accessible are all part of this. Researchers believe simplifying and making green IT more accessible will make the future more sustainable (Ali et al., 2020, 2021; Zahid et al., 2022). According to the TAM, a new technology's simplicity of use and practicality determine its acceptance. This paradigm helps explain technology adoption incentives. Studies have shown that TAM drives consumers to take eco-friendly behaviours (Ali et al., 2020, 2021; Lazim & Ismail, 2021; Muñoz-Leiva et al., 2017; Yoon, 2018). The TAM framework helps investigate green IT adoption motivations.

2.6. Innovation resistance theory (IRT)

Product innovation is essential for companies that drive earnings and growth although it involves significant research and development (R&D) costs (Zsifkovits & Günther, 2015). However, high investment in R&D does not always result in high returns. The success rate for new products is often relatively low at approximately 10% (Sun et al., 2022). Failing to innovate can adversely affect a company, potentially compromising its competitiveness (Zsifkovits & Günther, 2015). To thrive, companies must strongly emphasize consumer resistance to innovation (Khanra et al., 2021).

IRT provides a theoretical foundation for understanding customer resistance, as it elucidates the behavioral patterns of resistance exhibited by users (Ram & Sheth, 1989). This resistance-oriented behavior is influenced by the fear of changes to the status quo and deviations from existing belief systems, which significantly impacts the success or failure of innovations (Tansuhaj et al., 1991). Innovations succeed or fail due to customer (Ram & Sheth, 1989). In addition, Khanra et al. (2021) imply that users may resist innovations that modify their lifestyles and habits. Prior study report that user resistance is subdivided into active and passive resistance (Heidenreich & Handrich, 2015). However, the IRT framework is often used as a theoretical foundation due to its reputation for predicting pro-environmental conduct and high explanatory power (Ajina et al., 2023a; Chen et al., 2022; Sadiq et al., 2021; Talwar et al., 2020). Hence, we offer the IRT as a theoretical framework for investigating why customers adopt green IT.

2.6.1. Active resistance

When users consider the existing information but still opt not to use innovation, they engage in active resistance (Heidenreich & Handrich, 2015). One form of active resistance is postponement, in which the individual decides to hold off on adoption until a better opportunity comes along (Tansuhaj et al., 1991). In addition, functional barriers hinder the utilisation and acceptance of innovations since they conflict with people's habits and beliefs. However, usage, value, and risk barriers are functional barriers that impact active resistance (Kaur et al., 2020).

Usage barrier – when new products upset work habits or clash with users' prior experiences, attitudes, and acceptance standards, usability barriers prevent widespread adoption. If new technology interrupts their routines, customers may be hesitant to accept it. Consumers usually base new technology evaluations on what they know. Resistance may arise when new technology violates traditional habits and beliefs. Disruptions to work traditions might also hinder usage. New technology is more likely to be adopted when it can be readily integrated into daily life without major changes. Users may be reluctant to accept innovations that disturb their habits (Gupta & Arora, 2017; Kaur et al., 2020; Talwar et al., 2020).

Value barrier – Customers assess the new product's worth against their alternatives. Innovation is unlikely to be accepted unless it greatly improves their life. Users compare an invention's value to current choices. They resist change unless innovation is highly valued. If they think the pros don't exceed the downsides or think the current options are preferable, people may resist (Gupta & Arora, 2017; Kaur et al., 2020; Talwar et al., 2020).

Risk barrier – Individuals may be unwilling to accept new breakthroughs because they don't understand the technology, making it hard to assess risks and advantages. Technology unfamiliarity can cause anxiety and nervousness. The unfamiliarity about innovation's features, advantages, and downsides may deter people from embracing it. If they can't assess the advantages and downsides, customers may be unwilling to adopt an invention. Hence, failure to anticipate negative outcomes may cause hesitation and resistance (Gupta & Arora, 2017; Kaur et al., 2020; Talwar et al., 2020).

2.6.2. *Passive resistance*

A less visible form of resistance, passive resistance, is characterised by a lack of interest or awareness. When individuals are unaware of the invention or have never heard of it, we say that they are unaware of it. On the other hand, when people are interested in the technology but not the product, we say that they are disinterested (Heidenreich & Handrich, 2015). However, two types of psychological barriers might influence passive resistance: traditional and image-based (Kaur et al., 2020).

Image barrier – Users can dismiss new technologies if they oppose the country, brand, or enterprise that produced them. Image barriers are among the most innovative psychological challenges. Buyers expect the idea to fail due to its history, brand, industry, or other problems. Users may form opinions on innovations based on their places of origin. Some may be suspicious of immoral nations' new ideas. Brand reputation is equally crucial for the idea's creator. Consumers may avoid a firm with poor products or business operations. Innovation-driven industries are occasionally criticized. Polluting corporations' eco-friendly products and services may be opposed by consumers. The innovation's downsides may severely affect people's emotions. If an invention harms them, people will resist it (Gupta & Arora, 2017; Kaur et al., 2020; Talwar et al., 2020).

Tradition barrier – When consumers try to apply new ideas that go against their cultural norms, they meet the tradition barrier. Resistance increases with conflict intensity. Novel ideas that disregard cultural norms and behaviors encounter this traditional barrier. The degree to which new ideas challenge conventions determines change resistance. Each culture has its own customs and beliefs. Resistance is unavoidable when novel concepts upset standards. If modifying the service conflicts with their cultural values, people may resist. Innovations that disagree with religious or societal convictions may also face resistance. Novel ideas are always met with resistance when people act on their deepest beliefs. However, many people and societies value tradition. If changes threaten or eliminate long-standing habits or involve the loss of significant cultural items, people may reject them (Gupta & Arora, 2017; Kaur et al., 2020; Talwar et al., 2020). However, innovators and enterprises must understand consumer resistance types to overcome obstacles and enhance innovation adoption. Hence, overcoming functional and psychological barriers might help innovators get user acceptance and positive feedback.

2.7. *Conceptual model*

The conceptual model integrates the Mindsponge Theory, TAM, and IRT to elucidate the factors influencing green IT adoption intention. At its core, the model acknowledges the Mindsponge Theory's depiction of the mind's assimilating capacity for new values within a cultural and ideological context. Within this context, TAM provides insight into how PU and PEOU influence attitudes toward technology adoption, aligning with the Mindsponge's emphasis on the evaluation of newly introduced values. Moreover, IRT contributes by explaining active and passive resistance barriers that hinder innovation adoption, reflecting the Mindsponge's filtration process. Active resistance, shaped by functional barriers like usage, value, and risk, reflects the Mindsponge's assessment of congruence with core values, while passive resistance, influenced by psychological barriers of tradition and image, reflects the Mindsponge's evaluation of value compatibility with existing beliefs. Hence, by connecting these theories, the model underscores how

individuals' green IT adoption intentions are shaped by the interplay of their core values, perceptions of technology usefulness and ease of use, and resistance to innovation, ultimately offering a comprehensive framework for understanding and addressing barriers to green IT adoption. (see Figure 2)

2.8. Hypothesis development

The subsequent sections of this research explore the hypotheses concerning the factors that motivate and hinder Saudi citizens' adoption of green IT.

2.8.1. Drivers

2.8.1.1. PU and intention. Over time, a significant body of research has explored and understood the acceptance of new technologies using the TAM model. Prior researchers have adopted this well-established framework to explain and predict how individuals embrace and adopt emerging technological innovations. However, PU is about how much people believe a system will improve their performance (Davis, 1989). When considering green IT, people look at how it will enhance their tasks and outcomes. Research shows PU is a key factor in deciding whether to adopt green IT (Ali et al., 2021), with significant impacts on behavioral intentions (Kamal et al., 2020). In addition, PU positively impacts intentions to embrace new technologies, particularly green IT (Ali et al., 2020). On a similar note, Rafique et al. (2020) found that PU significantly predicts users' intentions. Likewise, Paganin et al. (2022) demonstrated that PU influences intentions to embrace mobile apps in a good way. Moreover, Ali et al. (2021) found a statistically significant correlation between PU and intention to utilize environmentally friendly IT products. Hence, this proves that PU is an important factor in determining whether or not individuals would embrace green IT solutions. Hence, researchers proposed that:

H1: PU is positively related to BI toward green IT adoption.

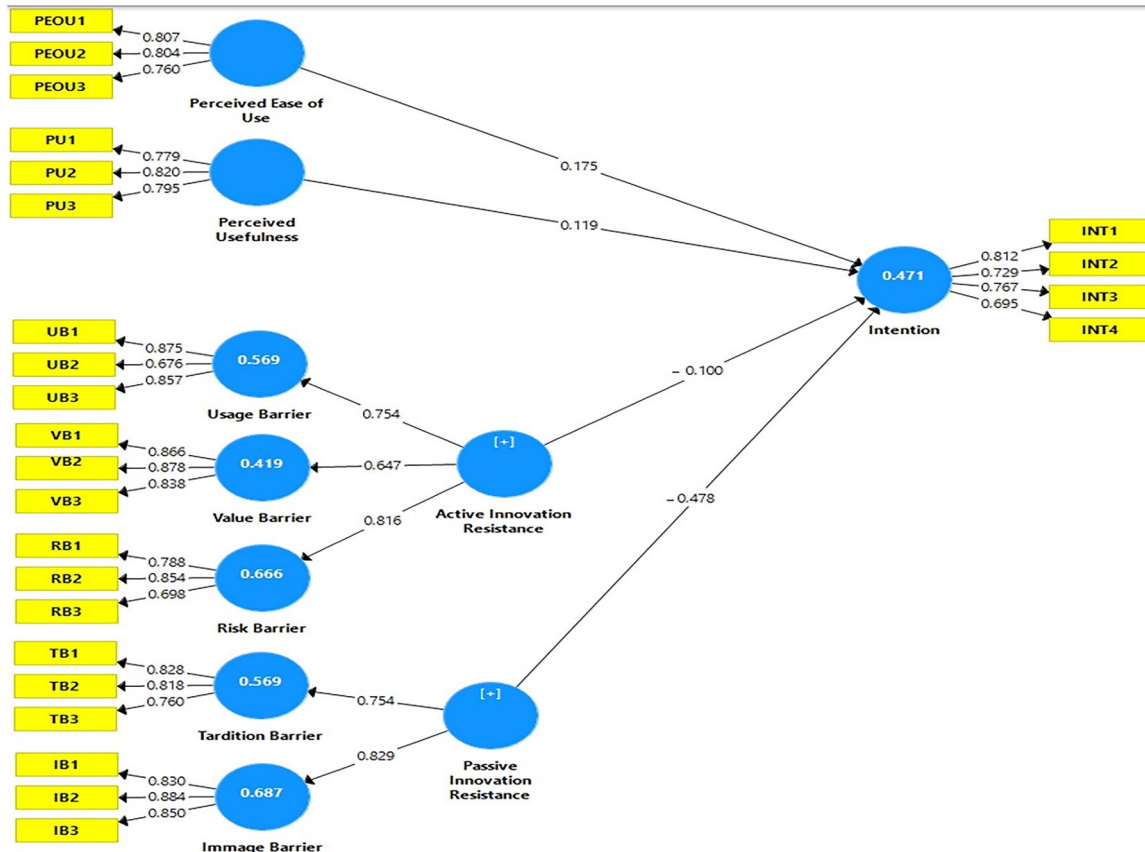


Figure 2. Measurement model.

2.8.1.2. PEOU and intention. PEOU pertains to an individual's perception that utilizing a new application or technology would be straightforward and manageable (Davis, 1989). From a consumer behavior perspective, technology that is easier to use and more user-friendly is perceived as more advantageous. However, PEOU plays a pivotal role in the acceptance of green technology, serving as a crucial determinant (Ali et al., 2021). Researchers identified PEOU as the most effective and suitable determinant of green IT adoption (Ali et al., 2020). In addition, PEOU influence usage intention (Kamal et al., 2020). In the similar vein, Rafique et al. (2020) highlighted that PEOU emerged as direct and significant predictors of intention to use green technology. Moreover, Alsyouf et al. (2023) and Paganin et al. (2022) revealed that PEOU strongly affects mobile app usage. A prominent study indicated that PEOU greatly affects customers' intention to use green IT products (Ali et al., 2021). PEOU has been shown to predict green IT acceptance in many situations. Thus, the following hypotheses were proposed to examine how PEOU affects Saudi behavioral intentions regarding green IT.

H2: PEOU is positively related to BI toward green IT adoption.

2.8.2. Barriers

In light of innovation resistance theory, customer resistance can be classified into active and passive resistance (Heidenreich & Handrich, 2015). Active resistance is caused by innovations' unique properties and can be investigated using IRT functional barriers (Yu & Chantatub, 2015). Disagreements over their usage, value, and associated risks lead to functional barriers, which slow down the adoption and use of new ideas (Yu & Chantatub, 2015). According to Kaur et al. (2020), users actively reject innovation when there is a mismatch between innovative concepts or technology and their usual habits and beliefs. Because of this mismatch, functional obstacles are created. As a result, the behavior of active resistance is significantly influenced by these functional barriers, which include value, use, and risk (Kaur et al., 2020).

Moreover, the complexity and ease of use of an innovation have a direct correlation with its usage barrier in the field of IT (Davis, 1989; Laukkanen et al., 2008). This obstacle consists of the user's expectations regarding the ease or difficulty of learning and utilizing new technologies and integrating them into current procedures. More people will accept and use green IT solutions if they are simple, straightforward, and compatible with people's current routines. An important element that hinders the successful application of green technology, is the failure to identify and overcome the usage barrier (Cruz et al., 2010). Therefore, when users perceive new IT as being too complicated, they are more likely to avoid using it (Joseph, 2010). Consequently, people are hesitant to use green IT due to the usage barrier.

Likewise, The value barrier makes innovation adoption harder when it doesn't provide customers more value than existing options (Kaur et al., 2020). In addition, Cruz et al. (2010) found that customers are less inclined to accept new technology without a clear benefit. If individuals think a new habit would make their lives worse, they're less inclined to initiate it. The value barrier is expected to reduce green IT adoption.

Furthermore, innovation usually carries with it a proportionate number of uncertainties and potential hazards. Consumers evaluate the risks and uncertainties of new inventions before adopting them (Sadiq et al., 2021). When people fear change will harm them, innovation adoption may slow (Ram & Sheth, 1989). People may be hesitant to adopt green IT due to the perceived risk. People may avoid using green IT products in their daily life if they fear the hazards (Sadiq et al., 2021). People are less likely to utilize green IT due to risk. Risk barriers matter more in green IT. Green IT solutions aim to reduce environmental impact and promote sustainability. However, people may realize these technologies' risks. Businesses and entrepreneurs must identify the risk barrier and develop a solution in order to successfully implement green IT solutions.

H3. The active innovation resistance is negatively related to BI toward green IT adoption.

Passive resistance arises due to conflicts with existing beliefs and is linked to the psychological barriers proposed by the IRT (Yu & Chantatub, 2015). These barriers include traditions and images (Kaur et al., 2020). Individuals exhibiting passive resistance may be hesitant to adopt innovation as it contradicts their established traditions and concerns about their image or reputation. Furthermore, individuals who are more accustomed to traditional physical technologies may encounter a higher traditional barrier (Sadiq et al., 2021). The traditional barrier represents a psychological obstacle to innovation

adoption, particularly when individuals have a strong attachment to, and comfort with, traditional technologies and practices. People who are deeply attached to and comfortable with conventional or traditional technologies may resist adopting green IT. In addition, people have created routines, preferences, and habits for this well-known technology. One noticeable effect is a decline in interest in green IT. Even if they are more efficient or environmentally friendly, people with strong feelings about their current technology may be reluctant to switch (Sadiq et al., 2021). However, it is crucial to overcome this obstacle using education, user-centred design, and emphasizing the importance of green IT to encourage the use of environmentally friendly technologies and attain sustainability objectives. Furthermore, the image barrier refers to a psychological obstacle that users may encounter when contemplating the adoption of green IT. This obstacle might develop due to a multitude of variables, encompassing the challenge of watching the operational mechanisms or distinctive features of environmentally-friendly advancements (Lian & Yen, 2014). Compared to conventional technologies, green IT solutions may have subtle benefits. Users may find it difficult to properly understand the functioning of these technologies and their potential advantages. Similarly, users may base their opinions of green IT solutions on a restricted amount of knowledge, gossip, or stereotypes (Ram & Sheth, 1989). The public domain encompasses both reliable and problematic content, which has the potential to shape these perceptions. Adverse media coverage can potentially diminish the reputation of green IT. Nevertheless, adverse media portrayal or the propagation of conspiracy theories regarding environmentally friendly technologies might induce anxiety in individuals. This may encompass negative opinions of the country of origin, brand, or industry linked to green IT advancements (Lian & Yen, 2014). Due to negative perceptions or ambiguities regarding green IT solutions, the image barrier may cause hesitancy and resistance to adopting green technologies.

H4. The passive resistance is negatively related to BI toward green IT adoption.

3. Methods

3.1. Study location

Dammam City, Saudi Arabia's capital of the Eastern Province and a major administrative centre for the Saudi oil sector, is the subject of this research (Almulhim & Abubakar, 2021). There has been a dramatic increase in the population of Dammam, which has led to a corresponding rise in the demand for and production of electronic trash. However, the rate of zone recycling remains inadequate, ranging from 10.5% to 15.5% (Labib et al., 2021). Drawing upon the aforementioned information, the objective of this study is to discern the challenges engendered by electronic waste and propose remedies for its administration. This study takes into account Dammam's rapid urbanisation and economic growth in order to solve environmental problems and promote sustainable regional waste management strategies.

3.2. Data collection methodology

A survey via the Internet was conducted to study the many constructs relevant to our research. Previous research has extensively employed online surveys due to its numerous benefits, including value for money, fast response time, and broad geographical reach. Email and well-known social media platforms such as Facebook and WhatsApp were among the digital approaches utilised to send the survey link to potential respondents.

3.3. Sampling technique

Participants were chosen using purposive sampling, a non-probability sampling method. This method was chosen due to the uncertain population size and practical difficulties connected with gathering responses from the whole sample frame. Purposive sampling allowed us to carefully select participants based on specific criteria, thus enhancing the suitability of our data for theoretical generalization.

3.4. Sample size

Hair et al. (2011) suggested a guideline for determining sample size, advising a minimum ratio of five observations per item. With a questionnaire comprising 25 items, this guideline suggests a minimum sample size of 250 for the current research. Churchill and Iacobucci (2006) recommended a sample size ranging from 200 to 500 respondents for consumer studies. Similarly, Nulty (2008) suggested that an optimal response rate for research questionnaires in consumer studies falls between 40% and 60%. To ensure an adequate sample size and maintain statistical shared 800 questionnaire links based on Nulty (2008) recommendations.

3.5. Measurement scales and screening question

Researcher has adapted the constructs' items from previous studies. PEOU, PU and Intentions from (Ali et al., 2021). Items for active innovation resistance (usage, value and risk barrier) and passive innovation resistance (traditional and image barrier) from the research of Sivathanu (2019). The detailed items of constructs are presented in [Appendix A](#). We used a 7-point Likert scale to measure all items, ranging from 1 (strongly disagree) to 7 (strongly agree). Our target demographics consisted of individuals perceived as digital natives, as they were likely to possess significant experience with technology usage. To ensure the eligibility of the respondents and confirm their familiarity with green IT products, we included a screening question in the survey. This screening question asked respondents whether they had ever used or considered eco-friendly or green IT products, such as energy-efficient computers, renewable energy-powered devices, or electronics with sustainability certifications. This screening question was instrumental in identifying respondents with prior experience in or knowledge of green IT products.

3.6. Survey administration

The survey was administered online between April 2023 and May 2023. Respondents were allotted one week to complete the questionnaire, and a soft reminder was sent to those who did not respond after three days. The data collection was conducted by the research team, consisting of three trained research assistants who monitored the survey distribution and reminders. To achieve our target sample size, we distributed 800 questionnaire links via email, Facebook, and WhatsApp. This strategy yielded 487 responses, with a response rate of 60.87%. We set a cut-off point by including only those respondents who confirmed through the screening question that they had used or considered using green IT products. Data analysis proceeded with 434 responses (54.25% response) after thorough filtering and cleaning. Filtering involved removing incomplete responses and those failing to pass the screening question. [Table 1](#) exhibits the demographic information provided by respondents.

3.7. Data quality validation

To ensure the quality and reliability of the data, we performed several validation steps. The survey instrument was pre-tested with a small sample of 30 participants to refine the questions and improve clarity. Additionally, research assistants were trained to ensure consistency in administering the survey and managing data collection. This training helped minimize potential biases and errors during the data collection process. Structural Equation Modeling (SEM) was used for data analysis to test the relationships between constructs and ensure robust results.

3.8. Ethics approval

All procedures involving human participants in this study adhered to the ethical standards of Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia, as recommended by their Institutional Ethics Committee. These standards align with the principles outlined in the 1964 Helsinki Declaration and its subsequent amendments.

Table 1. Respondents' demographic profile.

Respondent Profile	Frequency 434	Percentage%
Gender		
Female	186	42.86
Male	248	57.14
Age (in years)		
Below 25	109	25.12
26–35	163	37.56
35–45	127	29.26
Above 45	35	8.06
Education		
Intermediate	8	1.84
Secondary	27	6.22
University and above	399	91.94
Monthly family Income (Ryals)		
≤3500	205	47.24
3501–6500	147	33.87
6501–8500	52	11.98
>8500	30	6.91

3.9. Informed consent

Informed consent was obtained from all participants before their involvement in the study. Participants were provided with a written consent form detailing the purpose of the research, procedures involved, potential risks and benefits, confidentiality measures, and their rights as participants. This consent was obtained in written form as the study employed an online survey distributed to participants via email and social media platforms. Participants were ensured that their participation was voluntary, and they were free to withdraw from the study at any time without consequence.

4. Data analysis and results

This study used PLS-SEM because it is reliable and robust when evaluating both simple and complex interconnections among variables at the same time (Ali et al., 2020; Hair et al., 2016). Particularly, it also works fine with tiny samples and non-normal data. Moreover, PLS-SEM is a two-stage procedure that involves examining both the measurement and structural models (Ajina et al., 2023b; Ali et al., 2022).

4.1. Common method bias (CMB)

Cross-sectional surveys were employed to collect data, and researchers were aware of CMB bias. Harman's single-factor test assessed these problems (Podsakoff et al., 2003). According to Harman (1976), CMB becomes problematic when one variable explains more than 50% of the variation. Since just a single variable accounted for little under fifty percent of the total variation, we may conclude that CMV bias was not present.

4.2. Measurement model assessment

The process of assessing validity and reliability is an essential part of the measurement model that contributes to the attain accuracy (Ali et al., 2021). In particular, composite reliability (CR) is the prevailing method used to assess reliability of constructs. As findings confirmed that every construct had CR values more than 0.7, demonstrating its reliability (Hair et al., 2016). After that, the constructs' validity was determined using convergent and discriminant validity. Likewise, factor loadings and average variance extracted (AVE) were used to verify the convergent validity. However, the results confirm that each item's factor loadings are above the permitted range of 0.4 to 0.7, and the AVE values for each construct are greater than the acceptable threshold of 0.5 (Hair et al., 2016), implying that convergent validity has proved (see Table 2 and Figure 2).

Furthermore, we employed heterotrait-monotrait (HTMT) ratios to ensure the discriminant validity of the constructs. Henseler et al. (2014) suggested that the HTMT values must be below 0.9. As presented

in Table 3, the results confirmed that discriminant validity was not a concern in this study. Next, multicollinearity was tested using the variance inflation factor (VIF). The results showed that VIF values were less than 3.3 (Kock, 2015), indicating that multicollinearity was not a problem.

4.3. Structured model assessment

After analyzing the measurement model, the goodness of fit of the study's theoretical model was analyzed. The standardized root mean square residual (SRMR) and normed fit index (NFI) were used to determine the goodness of fit of the overall model. As the SRMR value (i.e. 0.064) is below 0.08 as Hu and Bentler [48] suggested and NFI value (i.e. 0.94) is above the suggested value of 0.9 (Bentler & Bonett, 1980), which shows that the model has good fitness.

Structural model analysis was used to test the significance of the proposed hypothesized relationships between the constructs. The significance of the hypotheses was determined using a bootstrapping approach (5000 resamples), path coefficient (β), t-value (>1.64), and significance value ($p < 0.05$) (Ali, Mishra, et al., 2021). As presented in Table 4, the results confirm that all the hypotheses are accepted. This indicates that PEOU ($\beta = 0.175$, $t = 4.480 > 1.64$, $p < 0.05$), PU ($\beta = 0.119$, $t = 3.096 > 1.64$, $p < 0.05$), active innovation resistance ($\beta = -0.100$, $t = 2.381 > 1.64$, $p < 0.05$), and passive innovation resistance ($\beta = -0.478$,

Table 2. Factor loading, reliability analysis and convergent validity.

First order	Second order	Items	Loadings	CR	AVE
Perceived ease of use		PEOU1	0.807	0.833	0.625
		PEOU2	0.804		
		PEOU3	0.760		
Perceived usefulness		PU1	0.779	0.840	0.637
		PU2	0.820		
		PU3	0.795		
Value barrier		VB1	0.866	0.896	0.741
		VB2	0.878		
		VB3	0.838		
Risk barrier		RB1	0.788	0.825	0.612
		RB2	0.854		
		RB3	0.698		
Usage barrier		UB1	0.875	0.848	0.652
		UB2	0.676		
		UB3	0.857		
	Active Innovation Resistance	UB	0.754	0.785	0.551
		VB	0.647z		
		RB	0.816		
Image barrier		IB1	0.830	0.891	0.731
		IB2	0.884		
		IB3	0.850		
Tradition barrier		TB1	0.828	0.844	0.644
		TB2	0.818		
		TB3	0.760		
	Passive Innovation Resistance	IB	0.829	0.771	0.628
		TB	0.754		
Intention		INT1	0.812	0.838	0.565
		INT2	0.729		
		INT3	0.767		
		INT4	0.695		

Table 3. Discriminant validity-HTMT.

	Image barrier	Intention	Perceived ease of use	Perceived usefulness	Risk barrier	Tradition barrier	Usage barrier	Value barrier
Image barrier								
Intention	0.410							
Perceived ease of use	0.487	0.557						
Perceived usefulness	0.314	0.602	0.442					
Risk barrier	0.372	0.673	0.359	0.518				
Tradition barrier	0.366	0.478	0.586	0.423	0.535			
Usage barrier	0.525	0.889	0.548	0.594	0.593	0.431		
Value barrier	0.054	0.288	0.095	0.398	0.470	0.130	0.285	

$t=12.464 > 1.64$, $p < 0.05$) have significant and positive associations with intentions towards green IT. Furthermore, the coefficient of determination (R^2) of intention towards green IT adoption is 0.471, revealing that a 47.1% change in intention is due to PEOU, PU, active innovation resistance, and passive innovation resistance. The R^2 value reveals that the research model has substantial explanatory power, as suggested by Cohen (Cohen, 1988). Subsequently, the Q^2 score was determined to ensure the predictive relevance. As presented in Table 4, the results show that the Q^2 score is 0.260, which is greater than 0, proving that the research model has predictive value (Hair et al., 2016). Subsequently, f^2 was used to determine the significance of the effect size. As proposed by Cohen (Cohen, 1988), the results demonstrate that the f^2 values lie between small and medium effect sizes (see Table 4).

5. Discussion and implications

This study aims to examine the influence of factors including PEOU, PU (drivers), active innovation resistance (i.e. usage barrier, value barrier, and risk barrier), and passive innovation resistance (image barrier and traditional barrier) on users' intentions towards green IT adoption from the perspective of Saudi Arabia. Based on the Technology Acceptance Model (TAM) (Davis, 1989) and the Innovation Resistance Theory (IRT) (Ram & Sheth, 1989), the results demonstrate that all predictive variables (both drivers and barriers) significantly influence users' intentions towards green IT adoption.

As expected, PEOU has a significant and positive influence on users' intentions, which motivates them to adopt green IT innovation. These findings are consistent with those of previous studies (Kamal et al., 2020; Paganin et al., 2022; Rafique et al., 2020), demonstrating that if users consider environmentally friendly IT solutions as simple and easy to use, they are more likely to adopt them. The fact users choose technology with a low learning curve and minimal effort for successful use drives green IT adoption's perceived simplicity (Ali et al., 2021; Davis, 1989; Kamal et al., 2020; Paganin et al., 2022). Nevertheless, within the realms of business and management, these results suggest that organizations that invest in user-friendly green IT products are more likely to experience increased rates of adoption and improved incorporation of sustainable technologies into their operations. This, in turn, has the potential to enhance their competitiveness and sustainability endeavours within the green IT market. A similar pattern emerges with PU, which has a significant positive effect on consumers' inclinations to embrace green IT. In agreement with other studies, the results show that PU is a strong factor affecting people's intentions to use (Kamal et al., 2020; Paganin et al., 2022; Rafique et al., 2020). One reason people want to utilise these technologies is because they claim to have benefits like reducing energy use and protecting the environment. Innovations that support consumers' environmental principles and provide real benefits—in terms of resource conservation and environmental well-being—are becoming more popular, which is in line with the larger social trend towards sustainability and eco-conscious decision-making (Ali et al., 2021; Davis, 1989; Kamal et al., 2020; Paganin et al., 2022). In addition, these results have important implications for management and business, suggesting that organizations that highlight the hands-on advantages of green IT products will attract more customers, help them achieve their sustainability objectives, and maybe even gain an advantage in the green IT industry.

Furthermore, these findings hold significant relevance in Saudi Arabia, particularly given the nation's commitment to sustainability outlined in the Vision 2030 initiative. Saudi Arabia faces distinct environmental challenges, including water scarcity and rising energy consumption. Green IT solutions are being implemented to help achieve sanctuary goal set by the country. In Saudi Arabia, utmost priority is given to economic considerations such as resource efficiency and cost reduction—for this reason these insights are critical. Saudi organizations may drive users to use green IT through informing user views and exploiting sustainability trends. In addition, it is making the technology advancements by helping the country to be eco-friendly at par with that it saves a lot of cost which spends on different activity for purposely harming environments (AlArabiya News, 2022).

Table 4. Structural model results.

	Beta value	t Value	p Value	Supported	R^2	Q^2	f^2
Perceived Ease of Use → Intention	0.175	4.480	0.000	Yes	0.471	0.260	0.042
Perceived Usefulness → Intention	0.119	3.096	0.001	Yes			0.019
Active Innovation Resistance → Intention	-0.100	2.381	0.009	Yes			0.012
Passive Innovation Resistance → Intention	-0.478	12.464	0.000	Yes			0.290

The study found that active innovation resistance (use, value, and risk barriers) significantly and negatively affects users' intentions, preventing green IT adoption. This is in agreement with various studies that observed the same effect (Gupta & Arora, 2017; Kaur et al., 2020; Laukkanen et al., 2008; Sadiq et al., 2021). This indicates a range of factors that can be targeted to overcome several adoption hurdles and the need for more user-centric policies including effecting changes in consumption behaviours, market perceptions of value and risk adversity in business and management settings. In short, organizations may increase their adoption rates by developing user-friendly interfaces, communicating the benefits of green IT solutions and mitigating perceived risks through training. Therefore, these projects play a pivotal role for companies aiming to capitalize on the green tech industry and uphold their sustainability goals. In the same vein, passive innovation resistance (image barrier and tradition barrier) significantly and negatively affects the users' intentions towards green IT adoption. These findings are concurrent to prior research (Gupta & Arora, 2017; Kaur et al., 2020; Laukkanen et al., 2008; Sadiq et al., 2021), which have clarified that environmental advantages of new technology get overshadowed by cultural inertia root from extreme adherence towards traditions and customs. Customers feel skeptical and reluctant to adopt modern green IT solutions. To motivate business users to reduce this reluctance and embrace green IT security needs simplification and the potential benefits have to be defined. These findings are crucial to stimulate market uptake and develop sustainable business models for green IT firms, and imply the necessity of specific promotions, consumer outreach campaigns, product modifications etc. in the area of green IT sector.

5.1. Theoretical implications

This study makes a significant theoretical contribution to the literature on green IT adoption that focuses specifically on an individual perspective, while also addressing multiple limitations of prior research. Although several studies have delineated the significance of green IT adoption at an organizational level, little attention has been paid to a single user as new information system users' beliefs and behaviors related to using 'green' technologies. This paper fills this gap by exploring an under investigated issue from a micro level and it is the first main contribution. The second main contribution of this study is to integrate the Innovation Resistance Theory (IRT) with traditional Technology Acceptance Model (TAM). This integration overcomes the challenges of examining classification based on just adoption to neglect long term usage behaviours and resistance factors which could help or hinder the process of green IT adoption. By expanding TAM to IRT, this research provides a richer analytical perspective to unravel the complexity of sustainable IT adoption and thereby represents an important step forward in this area. Third, the examination of active and passive resistance for innovation is an unprecedented perspective in this research. Although the innovation resistance has been examined in prior literature, few studies have focused on differentiating between active and passive forms of resistance. By investigating these two dimensions of resistance, our study contributes to a deeper understanding of the factors that impede or hinder the adoption of green IT, thus enhancing the overall richness of research on innovation resistance.

Finally, the study's consideration of non-Western contexts, specifically in the case of Saudi Arabia and other developing countries, offers valuable insights with significant implications. Given that most prior research on green IT adoption is based in Western contexts, it has been assumed that the general awareness of e-waste and related environmental concerns may be higher in these regions. However, our study recognizes the unique challenges and limited public knowledge of e-waste in non-Western contexts. This aspect of the research contributes to the broader discourse on cross-cultural differences in technology adoption and can assist legislators and government organizations in these regions in promoting awareness and sustainable practices regarding e-waste, thus forming the fourth substantial contribution.

5.2. Practical implications

5.2.1. Practical implications for managers

Managers serve as key change agents to foster the adoption of green IT within their organizations. To effectively facilitate this transition, they should prioritize a multifaceted approach. Managers first need to care about the ease of use, PU and green IT products/solutions. This includes adopting user-friendly tech

and training users properly through clear, hands-on education and continued support. Therefore, employees are confident enough to take these solutions into consideration while performing their tasks every day. This is where those concerns over complexity and potential barriers to entry need to be addressed. Managers should also be concerned with the immediate rewards related to green IT. It contains evidence of how the adoption of green IT policies can bring considerable energy savings and other eco benefits too. It can be very compelling to show directly the contribution of these activities, quantifiably laid out, in how what you are doing is contributing not just to environmental concerns, but also positively impacting on earnings. This should emphasise to the users that Green IT practices are not just a trend, but an investment in the future of their business.

In addition, managers should also note that the non-technical barriers to adopting green IT include related image and tradition issues. There may be a natural tendency for some employees to be sceptical because they are worried about the possible negative impact on their organization's image if they opt-in environmentally friendly technology. The way managers can overcome these reservations is to communicate success stories and case studies of leading organizations that have successfully adopted green IT illustrating the outcomes achieved. Adopting green IT also shows the organization's values and commitment towards sustainability hence, it a good image for an organization. In particular, the role of education and myth-busting is also very important. Managers also have to engage their employees in talking about how green IT is going to help them and debunking the misconceptions the myth around it. Organizations rely on transparency to quell any fears or doubts associated with potential ambiguity of how traditional processes are translated from IT retrospective solutions into green IT solutions. Motivation for green IT initiatives can be greatly encouraged through rewards and recognition programs as well. Managers can use positive reinforcement strategies, to reward and recognise the contributions of individuals (and teams) to greening their bit of IT, assisting in the development of autonomy and mastery and giving employees a sense of ownership and pride. Moreover, mechanisms must be established for ongoing feedback and adaptation for these strategies to be successful and instill a culture of continuous improvement in organizations. Allowing employees to contribute in green IT initiatives by providing inputs, suggestions and raising concerns will help to improve the strategy with alignment of organization needs and workforce preference. Finally, while the managers should lead for instance. By practising and advocating green IT initiatives, an enterprise can signal proof of a strong seriousness towards sustainability as well harnessing technology for the good—setting an aspirational model of behaviour that employees are likely to emulate.

5.2.2. Implications for policy makers

Policymakers are capable of exerting influence over to help promote the use of green IT must be far more comprehensive than merely throwing money at it. One of the significant ways embracing green IT can be made cost-effective is by offering financial incentives like tax benefits, grants, and subsidies which will reduce the economic cost for adopting green IT practices for providing a lot more people in organizations from females to lower alongside business persons. Second, universally accepted green IT standards and certifications have to be developed. The standards make it easier for companies to identify sustainable products and services, and consumers can have a level playing field when making eco-conscious purchase. Engaging with market towards developing robust standards that are up to date given the changing advancements in technology. The third largest issue to be aware of is e-waste that has become a global problem. There is thus a need for the policymakers to devise strategies and programmes, functional in varied dimensions of e-waste management. This involves setting up easily accessible collection points for used electronics, availing responsible disposal options and making recycling the most comfortable economic decision. Proper e-waste management, can substantially reduce the environmental impacts of discarded electronics.

The fourth critical area is to incorporate green IT requirements into public procurement processes, which can be a very strong tool in initiating change. In order by government agencies and institutions to prioritize eco-friendly products and services when sourcing, they create demands for these products. This generates a demand for manufacturers to adopt sustainability options in order to fulfill their markets. Fifth, Investment in R&D is also a primary importance to promote innovation and maintain the adoption of green IT solution. To this end, resources should be made available by policymakers to

incentivize R&D of green IT. This includes providing grants for R&D projects, creating technology incubators, and fostering university-industry collaboration. As such, policymakers could help push innovation to a next generation of green IT solutions being as not only green as cutting-edge two. Last but not least: raising public awareness and educational campaigns are necessary to change mindsets and behaviors. Policymakers might invest resources in these campaigns to educate both individuals and organizations in the benefits of moving towards green IT adoption. These campaigns serve to debunk myths, advance best practices, and increase awareness of green IT solutions—resulting in a culture that is environmentally conscious.

5.3. Limitations and future research directions

Despite its significant implications for both practitioners and academics, this study has certain limitations and suggests promising avenues for future research. First, the generalizability of our results may be limited. This study treated all green IT products as a broad category in assessing consumers' intentions towards them. Future research should examine consumers' intentions regarding specific types of green IT products, such as mobile phones, laptops, or printers. Second, this study focuses on consumers' intentions. However, while intention is a crucial determinant of actual behavior, a gap remains acknowledged by many researchers regarding intention and real-world behavior. Therefore, it is essential for future researchers to investigate consumers' actual behavior concerning the adoption of green IT products.

Furthermore, a substantial body of research has highlighted the significant role of age in shaping consumer behavior. Studies have shown that individuals of different age groups, such as 'Generation Z' (16–24 years), 'Generation Y' (25–34 years), and 'Generation X' (35–55 years) exhibit distinct responses in their consumption patterns. This suggests that diverse age cohorts may have varying priorities and experiences concerning green behavior. Consequently, there is a need for green marketing researchers to address this gap by examining different generational cohorts (e.g. Generation X, Y, and Z) as potential moderating variables. This approach aims to explore whether there are discernible differences in green behavior across these generational groups.

5.4. Conclusion

In this study, an attempt has been made to investigate the imperative area of green IT adoption in the context of Gulf Cooperation Council (GCC) countries, specifically, Saudi Arabia. The pressing environmental problems of IT products in graduated and professional suitability in this area have further fascinating examination of superior IT acceptance. Besides, existing literature have predominantly focused on first adoption intentions, positive affiliation in favour of green IT acceptance, yet this study incorporates all key elements from post-adoption to determinants advocating more of a comprehensive approach on long-term use resistances which may impede technology adoption. In an attempt to expand green IT product adoption research, this study merged the Technology Acceptance Model (TAM) and Innovation Resistance Theory (IRT) in an effort to offer a holistic view of all the dimensions that influence the consumers in adopting green IT products. However, the results offer several important implications. Results indicate that PEOU and PU are two key factors in predicting adoption intention, emphasizing the importance of ease of use and perceived benefits from green IT solutions in practice. The severe barriers to adopting this system included active innovation resistance (usage, value and risk barrier) and passive innovation resistance (image and tradition barrier) in the current stage. The dominant impact of passive barriers was of significant importance, indicating the important requirement for specific tactics to address these entrenched attitudes and beliefs. Besides, this research improves the current theoretical knowledge of green IT adoption providing a complete understanding of its adoption drivers and barriers. Thus, this paper offers a more detailed insight into the green IT consumer behavior that is not captured on or other usage frequencies between early adoption and continuation of use. The practical implication of these findings is likely highest for industry practitioners. They reminded the rest of us how green IT products and services must be high-tech, but also accessible by people, user-friendly, and, by the way, useful in real life. We illustrate that strategies that minimise passive innovation resistance, by addressing image and incongruence concerns, are critical to successful uptake.

Author contributions

'Conceptualization and Supervision: Dr Kaleemullah Khan; formal analysis and writing original draft: Ahmad S. Ajina; review and editing: Dewan Md Zahurul Islam; Writing-Critical revision and editing of article; Ahmad M. A. Zamil and Dewan Md Zahurul Islam. All authors participated equally and approved the final version of the manuscript.'

Disclosure statement

No potential conflict of interest was reported by the author(s).

About the authors

Dr. Ahmad S. Ajina is a distinguished scholar and accomplished academic in the field of marketing. With a PhD from the prestigious University of Hull, UK, he has made significant contributions to research in areas such as corporate social responsibility, green marketing, digital marketing, and social media. Dr. Ajina's work is highly regarded for its relevance and impact, addressing critical issues in today's business environment. His publications in reputable journals reflect his dedication to advancing knowledge and providing innovative solutions, positioning him as a thought leader in marketing and sustainability practices. His role as Associate Professor and Advisor for Investment Affairs at Prince Sattam bin Abdul Aziz University further highlights his leadership and commitment to fostering academic excellence and research-driven strategies within the academic and business communities.

Dr. Dewan Md Zahurul Islam is a Senior Lecturer in Newcastle Business School at Northumbria University. He achieved Ph.D. from the University of Plymouth, UK in April 2005 in Operations, Logistics, and Supply Chain Management. He is an active researcher in multi-disciplinary fields including Logistics 4.0, development of multi-modal freight transport systems, sustainable and efficient freight transport systems, sustainable and efficient port operations, efficient and effective logistic service operations, sustainable urban logistics, sustainable warehouse operations, and efficient, effective and resilient supply chain management.

Dr. Ahmad M. A. Zamil is a Professor in Marketing, College of Business Administration, Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia. He has over two and half decades of teaching. He has published a number of papers in reputed national and international journals. He has also authored several books on various topics in marketing. His research fields include Marketing management, E-Marketing, E-Retailer, Wom Marketing, Consumer Behavior.

Dr. Kaleemullah Khan earned his PhD from the School of Management at University Sains Malaysia, specializing in Organizational Behavior and Development. He currently serves as an Assistant Professor in the Department of Business Administration at Kardan University in Kabul, Afghanistan. Dr. Khan's expertise in Organizational Behavior and Development has significantly contributed to his field, and his role at Kardan University reflects his commitment to advancing education and research in this crucial area of business studies.

Data availability statement

'The data that support the findings of this study are available from the author Ahmad S. Ajina upon reasonable request.'

ORCID

Kaleemullah Khan  <http://orcid.org/0000-0003-0687-0958>

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Appendix A. Instrumentation or measures of constructs.

Perceived Ease of Use

PE1. Using green IT devices would be more economical.

PE2. Using green IT devices would be efficient.

PE3. I find green IT devices useful for improving my work.

(Ali, Javed, et al., 2021)

Perceived Usefulness

PF1. Learning to operate green IT devices would be easy for me.

PF2. I would find it easy to use green IT devices to do my work.

PF3. It would be easy for me to become skillful at using green IT devices.

(Sivathanu, 2019)

Active Innovation Resistance

Value Barrier

VB1: The use of green IT devices is uneconomical

VB2: I feel that green IT devices do not offer any advantage for routine activities compared with traditional IT devices.

VB3: I feel that the use of green IT devices is unable to improve my capability to manage my work independently.

Risk Barrier

RB1. When I use green IT devices, I am worried about the accuracy of the input information which might result in mistakes.

RB2. While using green IT devices, I am anxious about unexpected loss of my task.

RB3. A technical glitch can disrupt my work even after using green IT devices.

Usage Barrier

UB1: I feel that green IT devices are not simple for use

UB 2: I feel that the use of green IT devices is not user friendly

UB3: I feel that use of green IT devices is not convenient

Passive Innovation Resistance

Image Barrier

IB1: I do not have very positive image of green IT devices.

IB2: In my opinion, green IT devices is often too complex to use.

IB3: I feel that green IT devices are hard to use.

Tradition Barrier

TB1. I am more comfortable with traditional IT devices than adopting green IT devices.

TB2. The adoption of green IT devices seems complex to me.

TB2: I find it difficult to obtain information about the usage and benefits of green IT devices.

Intention

INT1. I will consider adopting green IT devices.

INT2. I plan to switch to other brands/versions of green IT devices that are more energy efficient.

INT3. I intend to buy green IT devices.

INT4. I will buy green IT devices in my next purchase.

(Ali, Javed, et al., 2021)