Insights from behavioural economics to enhance the environmental dimension of sustainable development

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Abstract

Individuals everywhere and every day take decisions and make choices that affect the environment either positively or negatively. By understanding and analysing the determinants and incentives of humans' decision-making process, behavioural economics helps change behaviours toward more sustainable practices using efficient and well- designed policies. Using a survey targeting 4000 households' participants from 11 Egyptian governorates in 2019, the paper explores attitudes' determinants and behaviour's motivations concerning environmental concerns, which- in turn- help policymakers to design effective policies considering households' attitudes. Using a structural equation model, the paper examines the critical links among attitudes, values, and behaviours related to sustainability. It provides empirical evidence from a data set collected from the surveyed sample. The paper also indicates how insights and tools from behavioural economics could help understand attitudes, values, and behaviours. The current study builds on contemporary literature and develops last research to explore how behaviour economics helps policymakers design cost-effective policies to change behaviours toward sustainable environmental practices. The results indicated that behavioural economics has a minimal role in designing sustainable development policies and environmental interventions in Egypt- as a developing country- and showed that there is an overall willingness to change the way of thinking toward more environmentally friendly choices, specifically if policy interventions derive the behaviours in that direction. Finally, many essential recommendations and policy implications were concluded to develop public policies according to environmental sustainability considerations.

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1. Introduction

Our daily behaviours and choices have significant effects on the environment. Behaviour economics provides insights into why people make certain environmental choices. This is important because households' awareness and attitudes towards environmental issues have significant impacts on the effectiveness of the environmental policy. In the neoclassical economic theory, humans are assumed to be entirely rational as they maximise their utility, given that they have full rationality and consistent preferences. In contrast, behavioural economists argue that neoclassical assumptions are unrealistic and inaccurate in explaining how people think, arrange their preferences, and make choices [1]. Empirical

evidence indicates that individuals systematically underestimate the future impacts of environmental risks such as climate change, biodiversity loss, or ecological damage.

Moreover, they discount the near term at higher rates than they do for the distant future, which results in too little concern about current stocks of natural resources and ecosystem services [2]. In that context, behavioural economists discover how humans think and how public policies should be designed to affect behaviours and maximise policies' outcomes. Concerning environmental collaboration, behavioural economics has explored how governments' rules and interventions affect or are affected by people's attitudes and decisions. Human behaviour is much more complicated than what the neoclassical models suggest. Recent research on psychology and behavioural insights has proved that humans often suffer from different types of mental bias when making choices or making decisions, which make their choices deviate from what is expected by the neoclassical economic models [3-4]. Incorporating psychological and behavioural factors in understanding the decision-making process helps predict human economic behaviour as behavioural economics provides various assumptions on human behaviour centred around bounded rationality, the importance of social preferences, and inconsistent and context-dependent preferences [5-9].

Moreover, using behavioural economics insights to achieve environmental sustainability can help eliminate what is called the "intention- action gap" as a reference to the difference between people's intentions and their actual actions. Contemporary empirical studies show that rational choice might be a poor guide for environmental concerns [10]. At the same time, behavioural economics helps in improving benefit-cost analysis through methodological adjustments to nonmarket valuation techniques and developing policy mechanisms to influence environmental behaviour [11-12].

For developing countries, some evidence indicated that traditional public policies are less efficient in addressing environmental challenges. Traditional interventions' outcomes are weak in most countries that demonstrate the vital role of behavioural-based policy interventions in marinating ecological sustainability [13].

Using a qualitative analysis approach based on reviewing the relevant literature and countries' experiences and analysing the designed survey, this paper explores the role of behavioural economics in changing humans' attitudes and behaviours toward more sustainable practices. It also provides empirical evidence on the importance of behavioural insights to increase the efficiency of environmental policy. Finally, many policy implications are concluded.

2. Materials and Methods

As structural equation modelling (SEM) is a popular analytic technique in the social sciences, it was employed in the current study to analyse the structural relationship between the measured variables and latent constructs. For that purpose, the statistical software package of linear structural relations "LISREL-Version 10" was applied. Data collected from a cross-section of age groups, gender, income levels, locations and attitudes showed the various perspectives and behaviours towards the environmental considerations. Households' participants from 11 governorates in Egypt were asked about their attitudes, intentions, and practices related to ecological components. Analysing the responses have critical implications for the success of environmental- targeting policies. Due to the "intention- action" gap, policymakers must help people behave according to their good intentions by employing behavioural insights to make the targeted behaviours are the defaults and easy for people to apply. Analysing the responses on the survey statements show minor variations between participants from different governorates due to lifestyles' differences between urban and rural governorates. Still, the reactions help in exploring the principal environmental attitudes in society. For Instance, about 84% of responders are willing to modify their lifestyle toward sustainable environmental practices but to make actions match

intentions, designed policies must include information, awareness, incentives, and interventions that help people change their lifestyles. The survey was designed to focus on five components of environmental sustainability: energy-saving- water use- transportation choices-food production and consumption- waste management. In that text, the survey explores four main questions:

How do environmental attitudes affect energy saving, water use, transport choices, organic food production and consumption, and waste management?
Who has the willingness to pay extra payments to live in a green environment?
What are the key factors that determine sustainability practices?
What are the most effective policies for achieving environmental sustainability?

Participants' responds showed little variations due to the nature of governorate's region (urban/ rural), gender (male/ female), age (young/old), and level of education (high/ intermediate). Responses were mainly affected by price factors and psychological factors. The online questionnaire participants from 11 governorates included 20 questions related to the mentioned components of the environment as participants were asked to agree, disagree, or be natural about the following statements:
Future generations should consider environmental problems
I am willing to change my practices toward a green environment if others did
I believe that the announced environmental impacts are often overestimated
Technological progress will address most of the environmental issues
The government must design policies to resolve ecological problems without charging me extra payments.
Promoting economic growth requires protecting the environment
I am willing to modify my lifestyle toward sustainable environmental practices
I think I should not pay extra for green energy
I do not trust extra cost will affect the energy mix
I would pay extra for green environmental practices if I had more money
I believe that there are enough renewables in the energy mix
I doubt the environmental benefits
The issue of renewable energy is out of my interest.
I think it is good to collect rainwater and recycle wastewater
To save water, I will invest in water-efficient equipment
To save water, I usually plug the sink when washing the dishes by hand, turn off the water while brushing my teeth and take showers instead of baths.
Improved public transport is an essential mean to reduce car use
More and safer cycling paths would give me an incentive to use public transports
There is a need for fewer parking spaces to replace private cars with public transport
The increasing cost of car use would decrease it.
The calculated percentages of agreement on every statement are shown in table 1:

Table 1: The percentages of agreement on the survey statements in each governorate

Statement No.	Governorate											Mean (%)
	Cairo	Alex.	Giza	Tanta	Bnha	Matruh	Aswan	Sohag	Suez	Hurghada	Sinai	
1	9%	8%	7%	8%	5%	8%	22%	33%	9%	8%	10%	11.5
2	78%	87%	65%	547%	68%	55%	75%	62%	77%	48%	82%	67.8
3	3%	5%	4%	7%	2%	8%	30%	38%	6%	2%	10%	10.5
4	38%	37%	39%	33%	21%	44%	43%	56%	42%	27%	28%	37.1
5	36%	62%	58%	75%	64%	50%	59%	92%	76%	50%	58%	61.8
6	60%	64%	78%	60%	63%	60%	60%	57%	68%	75%	57%	58.4
7	91%	92%	84%	86%	82%	89%	93%	81%	91%	92%	90%	88.3
8	36%	65%	60%	78%	66%	55%	62%	96%	81%	53%	62%	65.1
9	33%	68%	56%	76%	64%	58%	68%	92%	83%	55%	59%	65.5
10	45%	33%	24%	32%	19%	23%	19%	22%	36%	54%	44%	31.9
11	3%	6%	4%	7%	1%	2%	5%	7%	3%	6%	1%	4.1
12	4%	2%	1%	6%	3%	3%	7%	9%	6%	2%	1%	3.8
13	1%	3%	1%	2%	2%	5%	12%	24%	7%	3%	8%	6.2
14	63%	43%	32%	21%	41%	12%	34%	4%	22%	26%	17%	29.1
15	88%	91%	78%	77%	81%	83%	61%	56%	89%	92%	77%	79.4
16	12%	22%	10%	32%	41%	23%	11%	14%	10%	17%	15%	18.9
17	91%	89%	93%	93%	95%	96%	87%	84%	88%	87%	88%	90.1
18	91%	88%	92%	93%	95%	97%	89%	87%	91%	84%	88%	90.1
19	91%	88%	91%	91%	92%	94%	88%	83%	89%	84%	87%	96,5
20	44%	35%	42%	38%	33%	23%	36%	22%	19%	34%	13%	30.8

According to the percentages in table 1, it would be indicated that 88,3% of the respondents have the willingness to modify their lifestyles toward sustainable environmental practices (statement 7). Still, there is a notable gap between their intentions and their actual actions (intention- action gab) as only 18.9% of them use resources rationally (statement 16) and 67.8% of participants would change their practices toward green environment only if others did (statement 2). Figure 1 shows this "Intention- Action" gab for the surveyed households' participants in the selected Egyptian governorates and the average percentage for all governorates.

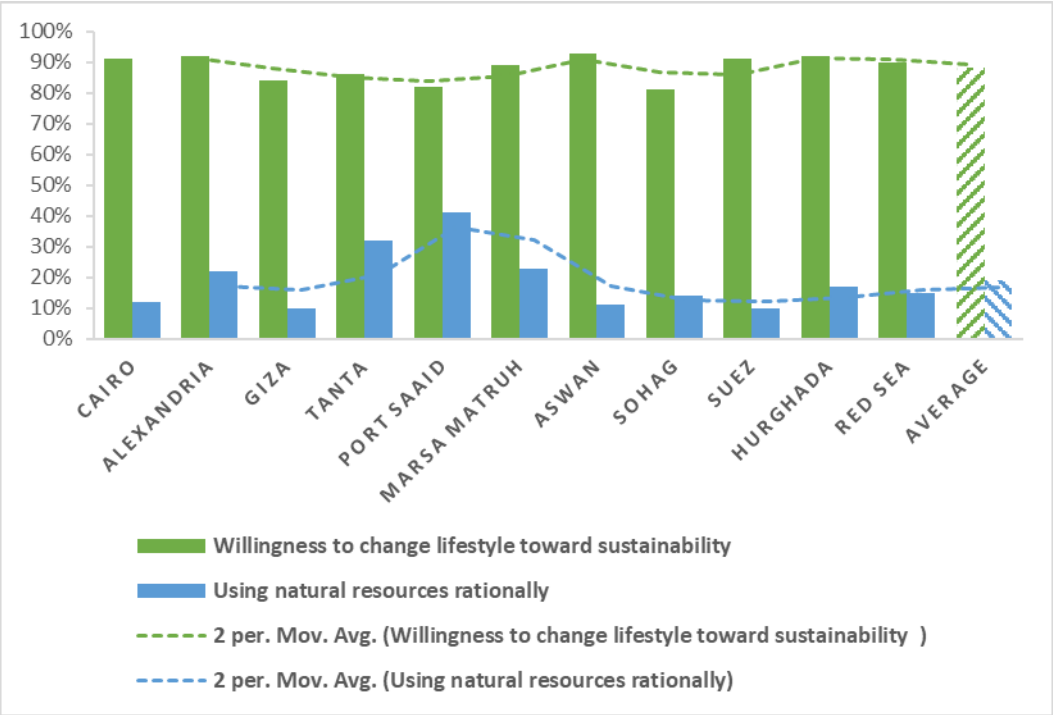

Figure 1: The "Intention- Action" gab in Egyptian governorates

According to behaviour insights, the willingness to do something when others did (statement 2) is called "The impact of social norms", as individuals are strongly influenced by what others do. When talking about environmental awareness, respondents showed some disparities between governorates and respondents with different education levels in the same governorate (statements 1,3,6 and 12). Factors related to prices and cost considerations have significant impacts on respondents' attitudes. They have strong disagreement toward any extra payments in addressing environmental issues (statements 5, 8,9, and 10), specifically in "Sohag", one of the poorest governorates in Egypt. A high percentage of surveyed households decided to use public transports depending on non-environmental concerns, which play only a minor role in their decisions related to that issue (statements 17- 20). Figure 2 indicates the notable variances in participants' willingness to pay extra payments to move toward more sustainable practices related to energy use.

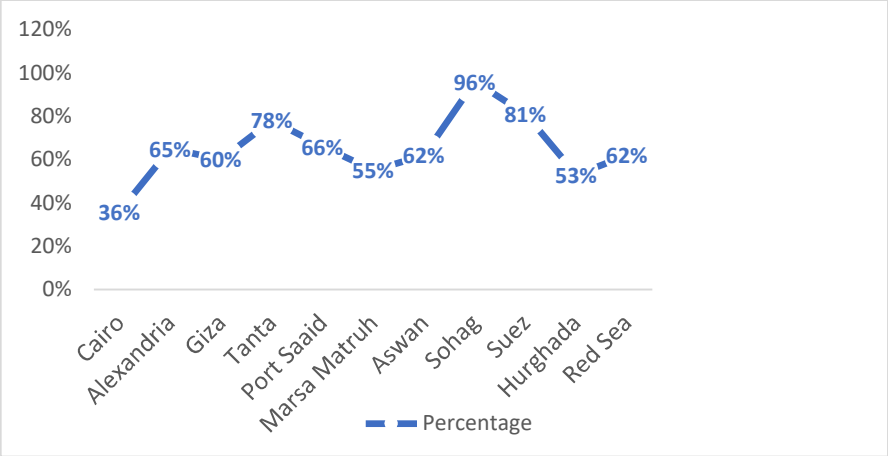

Figure 2: Variances in participants' willingness to pay more for getting green energy

Regarding that educated youth has a vital role in influencing attitudes and behaviours in the society, they must be at the centre of any changing process and the leaders in moving toward sustainability. The survey included a specified section targeting university students from the selected governorates to explore the link between values, attitudes, and youth's green practices. Data collected from different public universities in Egypt provided empirical evidence related to sustainable behaviours and its impacts on policy design in developing countries. They are using a structural equation model, that section of the survey aimed at exploring the relationship between values, attitudes, and practices in the context of environmental concerns. Out of the 4000 surveyed household participants, there were 479 students (about 12% out of the total respondents) are distributed to Egyptian universities as follow: 107 students in Cairo university (22%), 88 students in Alexandria University (18%), 118 in Tanta University (25%), 96 students in Suez (20%), and 70 students (about 15%) are distributed between eight other universities. Regarding the participants' gender distribution, 284 students are females (59%), and 195 (41%) are males. The sample's distribution is shown in figure 3.

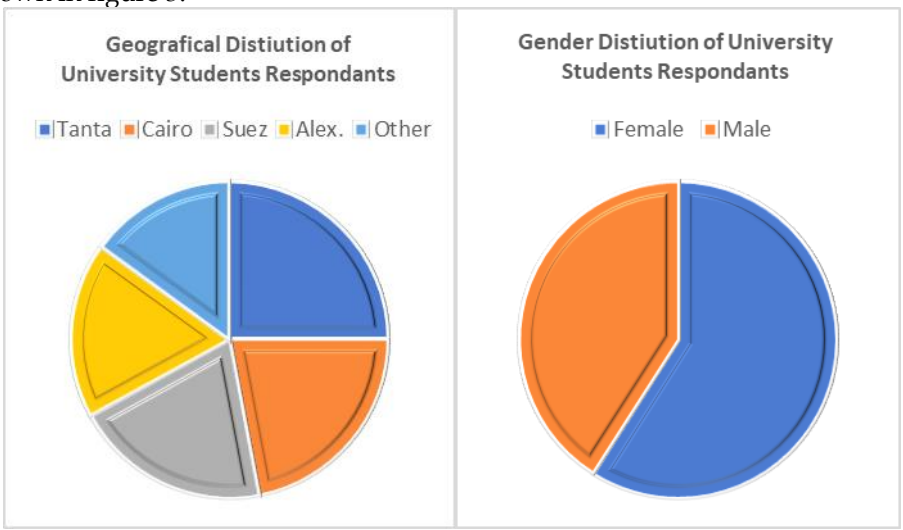

Figure 3: Distribution of University Students Respondents

The structural equation modelling examines the causal relationship between the main variables of the analyses, either directly or indirectly measured variables. Our three Indirectly measured variables (unobserved variables)- values, attitudes, and green behaviours- were measured by the responses on the survey statements (observed variables), which were calculated as follow: responses related to attitudes toward sustainability and environmental values were measured using 5-point Likert type (strongly disagree = 1, disagree = 2, undecided = 3, agree = 4, strongly agree = 5). Behaviours relating to sustainability were measured on a rating scale (always, sometimes, rarely, never). The direction and strength of the relationships between the selected variables were analysed using path coefficients and t-tests to identify the significance of the calculated coefficients. In that section, the participants were asked to respond to the following statements:

In my daily life, I use renewable resources (as electricity and water) rationally.
Using less water to bathe or brush my teeth is hard for me to do.
I turn the lights off when I do not need them anymore.
When I go shopping, products are contained in recyclable packages.
I deal with companies that consider environmental concerns in their activities.
To eliminate environmental risks, I walk or move by cycle instead of cars.
I prefer eating home food instead of fast foods.
I try to pick up recycled glass bottles, aluminium cans and paper.
I am interested in reading books and articles related to environmental topics.
I advise others to think green and protect the surrounding environment.

The participants' responses indicated that attitudes are significant determinants of university students' behaviour toward sustainability. It also revealed that gender is an essential factor affecting sustainability-related attributes. It has shown that female students are more willing to think sustainably and engage in green environmental practices. Those results support the evidence that was concentrating on more sustainable attitudes and practices in the higher education sector is necessary to build sustainable societies [14-15]. To examine the hypothetical model explaining the causal relationships between the variable related to environmental sustainability for Egyptian university students, suppose that the values of the coefficient (α) refer to the strength and direction of the relationships between the model's endogenous variables (values, attitudes, behaviour, and outdoor activities) and the exogenous variables (gender and tendency to follow media). Suppose also that the coefficient (β) values refer to the strength and direction of the relations among the endogenous variables. The resulting values are shown in table 2.

Table 2: Path coefficients and t-tests for the hypothetical model

Variables	**B**	**α**	**t**
Activities & Attitudes	0.81	-	3.94
Values & Activities	0.39	-	5.45
Behaviours & Attitudes	0.62	-	5.99
Behaviours & Activities	0.27	-	4.92
Behaviours & Values	0.13	-	2.13
Media & Attitudes	-	0.10	2.34
Media & Activities	-	0.24	5.22
Media & Behaviour	-	0.16	4.44
Gender & Attitudes	-	-0.62	-6.17
Gender & Activities	-	0.73	4.11
Gender & Values	-	0.63	-7.31

The data analysis indicated that gender had a significant direct effect on sustainability's attitudes (α = 0.62) and environmental values (α = 0.63) favouring females. In contrast, the effect of gender on participants' outdoor activities was significant in favour of males (α = 0.73). It was indicated also that media had a positive direct effect on participants' activities (α = 0.24), attitudes (α = 0.10), and behaviours (α = 0.16). The results indicated that attitudes toward sustainability had a positive direct effect (β = 0.62) on behaviours regarding the interrelationships among endogenous variables. It was also shown a positive direct effect of environmental values on behaviours related to sustainability (β = 0.13). In brief, sustainability attitudes and values toward the environment had a significant and positive relationship with Egyptian university students' behaviours related to sustainability. Although the gender factor was insignificant in affecting environmental sustainability concerns for household respondents in Egypt, it emerged as a strong variable affecting the university students' behaviour toward sustainability.

3. Results

3.1 Behavioural Economics Insights and Environmental Sustainability

Behavioural economics explores core patterns of real humans' behaviour. It indicates that individuals seek to earn, avoid losses, concentrate on changes, overweigh small opportunities, think in discrete mental accounts, value the present highly, care about others. Financial incentives can negatively impact their good intentions. Moreover, they are influenced by social and cultural norms and the default choices [16-17]. Regarding environmental concerns, behavioural economics play a key role as it helps in eliminating disappointments, reducing environmental risk, easing environmental conflict, maintaining environmental management, supercharge environmental incentives, better measure environmental values, and create more prosperity in a world of environmental scarcity [18-19]. Insights from behavioural economics are more than helpful in environmental policy design. It analyses the determinants of people's choices which are the outcome of a complex set of motivations and have significant environmental implications as environment-related decisions are affected by various financial, psychological, and social factors [20]. The question now is: How to benefit from behavioural economics' insights to maintain targeted environmental sustainability?

The answer to that question begins with understanding the dynamic relationship between values and behaviours. In that context, the results of the current study support many of contemporary research's results: ***First,*** the households survey supports last evidence [21] that good values toward the environment have a positive impact on individuals' engagements in sustainable practices as people make their life choices according to their attitudes, beliefs, and values. ***Second,*** the responses to the survey's statements showed that attitudes are not direct interpreters of behaviours but affect behavioural intentions and -indirectly- explain the vast differences in actual behaviours, which have a notable matching with the theory of "Planned Behaviour" [22]. ***Third,*** regarding the role of media and gender in driving the changes in attitudes, values, and behaviours toward sustainable lifestyles, the results indicated the significance of that role for university students only, which differs from other research's results [23]. ***Fourth,*** concerning the relationships between attitudes and values as significant interpreters of behaviours, the current study results indicated that university students' attitudes toward sustainability had not a direct but indirect impact on their values toward the environment. It was concluded that these students' values toward the environment could be predicted by their attitudes toward sustainability not directly but mediated by other factors such as their tendency to engage in outdoor activities. That result was discussed in detail in previous literature [24].

3.2 Main Factors Affecting Environmental Sustainability

Analysing surveyed household respondents indicated two main factors affecting individuals' attitudes toward environmental concerns and then modifying their behaviours and practices toward or against sustainability. Economic factors, including prices and costs of sustainable environmental practices and nonmonetary factors in the form of environmental awareness and psychological factors, motivate humans' attitudes and behaviours and- in turn- encourage or discourage social responsibilities about environmental issues. The participants' responses showed the importance of factors in individuals' decisions related to environmental concerns. Still, psychological and social factors have a more significant impact on attitudes and behaviours within the university society. Moreover, it was indicated that enhancing knowledge would directly lead to an increase of awareness or attitudes, which would result in more sustainable environmental behaviours. Gender has been considered in several research studies as a critical determinant of sustainable behaviour as it was stated that women have more willingness to change their lifestyles toward sustainability and show more significant concern toward problems associated with it than do men regardless of the culture, age, or educational status [25]. The pricing factors indicated that the price of energy-efficient equipment is a crucial factor influencing respondents' purchases in all Egyptian governorates. Still, one of the main motivations for those who have not the willingness to pay anything for switching to renewable energy seems to be the lack of confidence that power could be entirely produced from renewable sources.

Also, households that are individually metered and whose bill depends on actual water consumption are significantly more likely to save water and buy water-efficient equipment. Moreover, respondents concerned about the environment and environmental support organisations are more likely to purchase water-efficient devices. Concerning transportations, environmental attitudes play a vital role in households' transportation choices as it was shown that respondents with more significant concern for environmental issues are more likely to use public transport and have a higher willingness to pay for more sustainable practices. Still, prices and improved public transport represent the primary motivations for using cars less. When considering waste management, respondents living in rural governorates (more impoverished areas) produce about 26% less waste than those in urban governorates (areas with relatively high income). The most surprising result is that more than 30% of the respondents (including university students) do not know the available collection services for recyclables in their area. Those results refer again to the importance of social and psychological determinants on the process of moving toward sustainability.

3.3 Employing Behavioural Insights to Enhance Sustainability, Policy Implications

Most developing countries face significant challenges in achieving sustainable development goods. Those challenges are related to the limited outcomes of public policies. Regarding environmental policies, there are two main types of challenges facing policymaking: ***First:*** Scarcity of resources, specifically renewable energy and water. ***Second***: Social constraints related to the lack of information, weak awareness, and the absence of social responsibility due to irrational behaviours toward the environment. In that context, public policy has a vital role to play regarding the environmental dimension of sustainable development, mainly through integrating psychological and social insights from behavioural economics into the policy design process to affect the environmental values and attitudes positively and, in turn, move the general behaviours toward targeted, sustainable practices. Employing behavioural economics' tools in the policymaking process make policies more costly by predicting the impacts of traditional incentive-based policies and offering a structure for identifying aspects of standard policies that could be improved.

Moreover, behavioural economics provides new tools and mechanisms of interventions based on psychology, which economists have not traditionally considered and might complement traditional environmental policy instruments [26]. Behavioural economics has also created new policy tools that help move towards more socially desirable behaviour through psychology-based interventions, which are proven to be more attractive and less costly compared to policies based on traditional interventions such as taxation, subsidies, and financial incentives [27]. Several recent policy implementations built on behavioural economics support the results of the current study about the role of behavioural economics in increasing public policies' efficiency in different countries [28- 31].

Regarding environmental policies, behavioural economics provides helpful insights for designing the corrective fiscal measures that aim to protect the environment and use the natural resources rationally and effectively. For Instance, behavioural-based research suggests that making corrective taxes more complicated prevents most people with bounded rationality from engaging in harmful taxable activities by making compliance costs of such taxes high [32]. Moreover, behavioural insights deal with social preferences related to individuals' interests in social values such as justice, cooperation with others, and adherence to social norms motivate them to act in a manner that respects others by considering the social benefits and costs associated with their decisions which due to discouraging practices with negative impacts and increase those with positive ones. Hence, individual choices would be more consistent with the socially optimum findings, and the need to use corrective taxes and subsidies to promote environmental protection will be reduced [33]. The success and efficiency of behaviours- based policies depends on their ability to provide sufficient and powerful incentives for individuals and institutions to make more environmentally sustainable decisions. So, it is urgent to develop policies based on realistic representations of the mechanisms driving individual and collective decision-making [34]. Policymakers must have sufficient awareness of behavioural insights to identify the different behavioural patterns and explore the behavioural biases due to the targeted environmental issue. Besides, policy designers must well understand the mental mechanisms of individual decision-making to help design, implement, and evaluate policies to deal with environmentally harmful behaviours. Then, various behavioural insights can be employed to identify the suitable policy interventions and assess their outcomes which should be empirically evaluated.

4. Discussion

Following qualitative and quantitative analysis approaches, this paper explores the linkages between behavioural economics, public policy, and the environmental dimension of sustainable development with more focus on Egypt as a middle eastern developing country. Using a household survey that includes a specified section for university students, the data analyses indicated the limited outcomes of the traditional environmental policy due to the gap between the actual ecological behaviours and the supposed behaviours. Like most developing countries, Egypt faces massive environmental challenges such as resources scarcity, environmental pollution, air quality decline, and climate change. Moreover, the high rates of population growth and the unsustainable production and consumption patterns have increased pressures on the use of natural resources [35]. The analysis showed that the Egyptian government needs to consider utilising insights from behavioural economics to formulate better and more effective public policies and specifically environmental policies. Price and non-price policies are necessary for helping people move toward more environment-friendly attitudes, which have a significant influence on their behaviours. According to OECD, effective policies targeting environmental sustainability in the household sector must focus on promoting energy efficiency, increasing use of renewable energy at home, influencing households' water-saving behaviour and adoption of water-efficient devices, understanding how to reduce CO2 emissions from transport, especially private cars, increasing consumption of organic

and humanely produced food and reducing household waste [36]. For implementing those targets efficiently, behavioural insights could be helpful. Policymakers must improve their understanding of behavioural insights and how to employ them in environmental policy design. They have also to indicate the main determinants of environmental attitudes and practices to create more effective incentive mechanisms and increase the general environmental well-being by designing environmental policy differently. Recent research [37] has assessed a wide variety of instruments used by governments to influence environmental behaviour, including economic devices (such as waste charges, grants for insulation), direct regulation (such as water use restrictions, technical standards of appliances), labelling and information campaigns (such as eco-labels), as well as the provision of environment-related public services (recycling schemes, public transport).

The success of these instruments depends on the attitudes and knowledge of individual consumers and households. Understanding how these interact with exposure to different policies can produce beneficial behavioural changes. The current study had proved those results as the data analyses found that households vary in their exposure to the different types of policies across the governorates, between men and women, and according to age and income level. Moreover, the minimal willingness of the surveyed households' participants to pay voluntary extra payments to move toward green practice may indicate that obligatory charges are more effective in changing behaviours. In consistence with previous applied research [38], this study concluded that increasing and improving environmental awareness is a must for enhancing sustainability as individuals who believe in the value of nature and the consequences of environmental pollution and national resources scarcity have more willingness to change their lifestyle to more sustainable aspects and also have higher tendency to support sustainability by advising others to have the targeted attitudes and taking the necessary actions.

Additionally, as it was also pointed out by recent works of literature [39], the results of the current study have indicated that individuals who care about the quality of the environment and are more interested in sustainable lifestyle- like university students are more likely to engage into green outdoor activities and influence behaviours of others regarding the economic, social, and environmental aspects of sustainable development. On the other hand, the current study concluded that values play a vital role in determining attitudes toward sustainability, which matches past research [40]. Other variables' impacts on sustainability were examined in our studies, such as gender and tendency to influence media and gender, specifically between university students.

The participants' responses concerning their behaviours toward sustainable life showed that social media and females influence most university students to support sustainability aspects more than male students. Those results match other studies which examined the same variables in other countries [41- 43]. In those studies, gender has emerged as a substantial variable affecting university students' behaviour toward sustainability as it had a significant direct relationship with university students' attitudes and values toward environmental sustainability and -in turn- had an indirect impact on ecological behaviours. Other research also supports this point of view [44] as it was proven that female students have more significant concern toward the risk-related sustainability issues with more favourable support for the value of nature within itself than do male students, which might be attributed to the fact that the concern felt by females for a character is based on the conscious of taking care of health and personal well-being [45- 46].

The findings of the current study concerning the behaviour of household sector and university students toward sustainability provide important implications for the sustainability aspects and provide voluble policy recommendations that can contribute efficiently to the policy designing process as follow:

In many developing countries, people have insufficient information about sustainable development goals, government's plans and strategies, and the instruments employed to achieve economic, social, and

environmental targets. Regarding the critical interrelationship between the environment and human behaviour, increasing and improving environmental awareness became necessary.

To change the general behaviour to more sustainable aspects, both price incentives (such as subsidies, taxes, grants, and waste charges) and non-price incentives (such as awareness campaigns) should be used along with providing the needed information related to the targeted actions people can do and efficient devices they can use to consume natural resources rationally.

The analyses of participants' responses indicated the importance of improving public transport access and developing infrastructure for alternative types of transport to encourage greener purchases and reduce car use.

To facilitate implementing the environmental targets, governments must provide appropriate waste collection systems and encourage retailers to use less packaging and households to purchase products with less packaging and increase the availability of drop-off centres and door-to-door collection of recyclables.

There is a piece of evidence that providing sufficient information on natural resources' use in the household sector affect consumption choices of such resources. Furthermore, the way of delivering information affects consumers' decisions. In that context, well-designed information campaigns and education programs should target increasing the general awareness about the communication between environmental goodness and economic outcomes of policies. For Instance, all citizens must be aware of the economic development of any new environmental taxes and subsidies. So, individuals' knowledge, values, and skills should be developed through educational institutions and social media channels to help them efficiently engage in green activities that will improve the quality of life for both current and future generations [47]. Considering the results of our recent study, higher education institutions have a particular social responsibility to change their communities and their societies towards sustainability.

It had proven that behaviour-based interventions are more efficient than the traditional ones, which are based on the unrealistic neoclassical economic theory, which assumes that individuals have full rationality. They take decisions and make choices with consistent preferences to maximise their utility. Behaviour-based interventions are more realistic with different assumptions on human behaviour: bounded rationality, the importance of social preferences, and inconsistent and context-dependent preferences [48-49]. To succeed in deriving behaviours toward sustainability, public policies must consider that individuals are caring not only about the outcomes they achieve when taking a decision but also about what the others obtain. They are usually influenced by other factors like self-image, social status, and social norms [50].

Behavioural incentives must be identified related to the behavioural economics assumption that individuals evaluate the future changes over time. They may set plans and then find it difficult to commit to them due to "present bias". This concept implies that individuals tend to prefer immediate benefits if they will be achieved soon but will also be glad to delay those benefits that would be completed later. Another behavioural relevant concept is the "projection bias", according to which individuals take future-related decisions based on their current preferences assuming that they will remain unchanged. So, individuals tend to prefer taking the decisions that have direct benefits in the short term even if they result in more costs in the future [51- 52]

Concerning the targets of environment protection and sustainable use of natural resources, public policy can effectively affect the consumption and production patterns using the environmental taxes and subsidies as corrective actions to manage the externalities associated with the various production and consumption activities and-in turn- enhance the socially optimum and most efficient allocation of resources [53].

Finally, behavioural insights can be used to increase the effectiveness of existing policy tools and create new ones to achieve more environmentally sustainable behaviours. Those new tools should not be considered alternatives but complement the old ones considering that the new environmental policy interventions are less costly than the traditional interventions, either direct pricing or regulation.

5. Conclusions, Limitation of the Study, and Future Research Direction

Using qualitative and quantitative data analyses, this study concluded that insights from behavioural economics can be utilised to design effective public policies that promote environmental sustainability. To succeed in deriving the general behaviour and the individuals' daily practices in the society towards sustainable lifestyle, specifically in environmental domains, the study had explored various policy implications. It indicated key policy recommendations related to the mechanisms of employing behavioural economics to design more effective behaviour- based policy interventions. The current study has some limitations to consider in the context of the generalizability of the results. First, this study is limited to Egypt as a middle eastern developing country.

Additionally, data was collected from the household sector in selected Egyptian governorates, focusing on public universities' students. So, the results of the current study may be associated with the social structure of the region and the survey participants' cultural characteristics. More research is needed to examine the validity of those results in different geographical areas and participants from different cultures. Future research should examine the role of other variables such as income, and political orientations on sustainability and evaluate the effects driven by behavioural interventions, and how they may interact with more traditional policy instruments. Further empirical and experimental research is also required to assess the effectiveness of behavioural-based interventions and evaluate cost-effectiveness of those interventions.

6. References

Riel, Arno. Behavioural and Experimental Economics Can Inform Public Policy: Some Thoughts. Centre for Economic Studies and Institute for Economic Research (CESifo). 2009. Working Paper No. 2902.4. Available online:
https://www.researchgate.net/publication/46464031

Organisation for Economic Co-operation and Development (OECD). Environmental Incentives. 2012. Environment Working Paper No. 49. 21.
https://dx.doi.org/10.1787/5k8zwbhqs1xn-en

Camerer, C. Behavioral Economics: Reunifying Psychology and Economics. Proceedings of the National Academy of Sciences of the United States of America (PNAS). 1999 .96 (19) 10575-10577.
https://doi.org/10.1073/pnas.96.19.10575

Solek, A. Behavioral Economics Approaches to Public Policy. Journal of International Studies. 2014. Vol. 7. No. 2. 33-45.

Cong W.J., Kling, J., and Mullainathan, S. Behavioral Economics and Tax Policy; Tax Policy and the Economic Recovery. National Tax Journal. 2009. Vol. 62, No. 3. 375-386.

Leicester, A., Levell, P., and Rasul, I. Tax and Benefit Policy: Insights from Behavioral Economics. Institute for Fiscal Studies (IFS), Commentary C125, London, UK. 2012. Available online:
http://www.ifs.og.uk. https://doi.org/10.1920/co.ifs.2012.0124

Galizzi, M.M. Behavioral Aspects of Policy Formulation: Experiments, Behavioral Insights, Nudges. In: Howlett, Michael, Mukherjee, Ishani, and Fraser, Simon, (eds.), Handbook of Policy Formulation. Handbooks of Research on Public Policy. Edward Elgar Publishing, Cheltenham, UK. 2017. ISBN 9781784719319.

[4] (p. 41).

Carlsson, F., and Johansson-Stenman, O. Behavioral Economics and Environmental Policy. The Annual Review of Resource Economics. 2012. Vol. 4. 75-99.

Tversky, A. and D. Kahneman. Rational Choice and the Framing of Decisions: D. Kahneman and A. Tversky. eds. Cambridge University Press. Cambridge. 2012. 209-223.

Shogren, J.F., Taylor, L.O., On Behavioral-Environmental Economics. Review of Environmental Economics and Policy. 2008. 2(1), 26-44.

Brown, Alexander L., and Kim, Hwagyun. Do Individuals Have Preferences Used in Macro-Finance Models? An Experimental Investigation. Management Science, Mays Business School Research. 2012. Paper No. 2304667.

Israa A. El Husseiny. Enhancing the Role of Fiscal Policy in Achieving the Sustainable Development Goals (SDGs): Insights from Behavioral Economics with a Special Reference to Egypt. European Journal of Economics, Finance and Administrative Sciences. 2020. Issue 106. 25-29.

Fien, J. Advancing sustainability in higher education. International Journal of Sustainability in Higher Education. 2002. 3(3). 243-253.

Boyle, C., Considerations on educating engineers in sustainability. International Journal of Sustainability in Higher Education. 2004. 5(2). 147-155.

Metcalfe, Robert & Dolan, Paul. Behavioral Economics and its Implications for Transport. Journal of Transport Geography, Elsevier. 2012. Vol. 24(C). 503-511. doi: 10.1016/j.jtrangeo.2012.01.019

[16] (p 505).

Shogren, J. F., G. M. Parkhurst, and P. Banerjee. Two Cheers and a Qualm for Behavioral Environmental Economics. Environmental and Resource Economics. 2010. 46. 235-247.

{18} (p 239).

OECD Environment Directorate. Behavioral Economics and Environmental Policy Design. Empirical Policy Analysis Unit. Environment and Economy Integration Division. 2012.4.

{9} (p 85).

Ajzen, I. and Fishbein, M. Understanding Attitudes and Predicting Social Behavior, Prentice-Hall, Englewood Cliffs, NJ. Prentice-Hall. 1980.

Kates W. Robert, Thomas M. Parris & Anthony A. Leiserowitz. What is Sustainable Development: Goals. Indicators, Values, and Practice. Published Online 2 August 2012. Vo. 47. Issue 3. 2005. pp 8-21.

https://doi.org/10.1080/00139157.2005.10524444

Miettinen OS, Miettinen KS. A commentary on Murray et al. 'No exit? Intellectual integrity under the regime of "evidence" and "best practices"'. J Eval Clin Pract. Journal of Evaluation in Clinical Practice. 2007. 13(4):517-521. doi: 10.1111/j.1365-2753.2007.00877

Tikka, P.M., Kuitunen, M.T. and Tynys, S.M. Effects of Educational Background on Students' Attitudes, Activity Levels, and Knowledge Concerning the Environment. The Journal of Environmental Education. 2000. 31, 12-19. http://dx.doi.org/10.1080/00958960009598640

Organisation for Economic Co-operation and Development (OECD). Working Party on Integrating Environmental and Economic Policies. An Inventory of Examples in Behavioral Economics which are Relevant for Environmental Policy Design, Paris, 19-20 November 2012.

B. Douglas Bernheim and Dmitry Taubinsky. Behavioral Public Economics. 2018. NBER Working Paper No. 24828.

https://www.nber.org/papers/w24828. doi: 10.3386/w24828

Lunn, P., Regulatory Policy and Behavioral Economics. OECD Publishing. Paris 2014.

https://doi.org/10.1787/9789264207851-en

James AC, James G, Cowdrey FA, Soler A, Choke A. Cognitive behavioral therapy for anxiety disorders in children and adolescents. Cochrane Database of Systematic Reviews. 2015. Issue 2. No. CD004690.

doi: 10.1002/14651858.CD004690

Bennhold, Cornelius & Medsker, Larry. New Approach to Analyzing Physics Problems: A Taxonomy of Introductory Physics Problems. Physical Review Special Topics. Physics Education Research. 2013. 9.

doi: 10.1103/PhysRevSTPER.9.010103

Leonard, T.C. Richard H. Thaler, Cass R. Sunstein, Nudge: Improving Decisions about Health, Wealth, and Happiness. Const Polit Econ. 2008. 19, 356–360. https://doi.org/10.1007/s10602-008-9056-2

James, S. and Edwards, A. The Importance of Behavioral Economics in Tax Research and Tax Reform: The Issues of Tax Compliance and Tax Simplification. Discussion Papers in Management. 2007. Paper No. 07/14. ISSN 1472-293.

Leicester, A., Levell, P., and Rasul, I. Tax and Benefit Policy: Insights from Behavioral Economics. Institute for Fiscal Studies (IFS). Commentary C 125. London. 2012. https://www.ifs.org.uk/comms/comm125.pdf DOI: 10.1920/co.ifs.2012.0124

OECD. How Can Behavioral Insights Help Tackle Environmental Problems? in Tackling Environmental Problems with the Help of Behavioral Insights, OECD Publishing, Paris. 2017.

DOI: https://doi.org/10.1787/9789264273887-3-en pp 23-25

[13]. (p. 27).

OECD. Greening Household Behavior; A Review for Policy Makers. Environment Policy Paper No. 3. December 2014. https://www.oecd.org/env/consumption-innovation/greening-household-behaviour-2014.htm

Jung, D., and Jeong, W. Nudge: A Tool for Better Policy Impacts and its Limitations under Various Policy Contexts. Public Administration Review. Book Reviews. 2011. pp. 653-656.

Thompson, S. C. G., & Barton, M. A. Ecocentric and Anthropocentric Attitudes Aoward the Environment. Journal of Environmental Psychology. 1995. 14(2), 149–157. https://doi.org/10.1016/S0272-4944(05)80168-9

[23] (p 13).

[24] (p 519).

Giray Berberoglu & Canan Tosunoglu. Exploratory and Confirmatory Factor. Analyses of an Environmental Attitude Scale (EAS) for Turkish University Students. The Journal of Environmental Education. 1995. 26:3, 40-43. DOI: 10.1080/00958964.1995.9941444

[25] (p. 11).

Barr M. Books. Journal of Visual Culture. 2003;2(3):369-372. doi:10.1177/1470412903002003011

Jody M. Hines, Harold R. Hungerford & Audrey N. Tomera. Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis. The Journal of Environmental Education. 1987. 18:2. 1-8.

http://dx.doi.org/10.1080/00958964.1987.9943482

Worsley A, Skrzypiec G. Teenage vegetarianism: prevalence, social and cognitive contexts. Appetite. 1998. 30(2):151-70.

doi: 10.1006/appe.1997.0118. PMID: 9573450

[25] (17).

Masujima, E., and Tanaka, H., Environmental Education in Practice: Through Participation in a UNESCO-ACEID Project for Teacher Education, The Journal of International Development and Cooperation. 1999. 5(1), 103–118.

[1] (p. 7)

Acheson, J. and Lynch, D., Implications of Behavioral Economics for Tax Policy. Irish Government Economic and Evaluation Service, Department of Finance. 2017.

Sent, Esther-Mirjam, 2004, Behavioral Economics: How Psychology Made Its (Limited) Way Back into Economics. History of Political Economy. 36. 10.1215/00182702-36-4, pp. 735-760.

Bhargava, S., and Loewenstein, G., Behavioral Economics and Public Policy. 102: Beyond Nudging. American Economic Review. 2015. 105 (5): 396-401. DOI: 10.1257/aer.p20151049

Bernheim, B.D., and Taubinsky, D., Behavioral Public Economics. National Bureau for Economic Research (NBER). 2018. Working Paper No. 24828.

Kenneth Gillingham and Karen Palmer 2014, Bridging the Energy Efficiency Gap: Policy In sights from Economic Theory and Empirical Evidence, Review of Environmental Economics and Policy, 8, (1), 18-38.