

AI-Driven Nudges for Encouraging Eco-Friendly Consumer Behaviour: A Behavioural and Technical Perspective

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Abstract: *Environmental threat is a concern these days. People are becoming more aware of the need to be eco-friendly. Artificial Intelligence is being used more and more because it can help design personalized messages that encourage people to make choices. The idea of using cues to influence people's behaviour is called nudge theory. Traditional ways of trying to change people's behaviour often do not work well because they are not personalized. This study looks at how Artificial Intelligence can be used to encourage people to make choices. The study found that it is very important to consider the implications of these messages and to make sure they are clear and reliable. It also talks about the issues that can arise such as concerns about privacy and the impact of algorithms. The study provides a framework for how Artificial Intelligence can be used to encourage behaviour and how it can be done in a way that is ethical. The goal of this study is to encourage researchers, policymakers and digital platforms to use Artificial Intelligence to encourage behaviour. This can help achieve the goal of sustainability, which's a key part of the Sustainable Development Goals. The Sustainable Development Goals aim to balance social and environmental needs by 2030. There is still a lot to learn about how people respond to Artificial Intelligence messages especially when it comes to combining technical knowledge. This study does not provide a framework for using Artificial Intelligence in this way and more research is needed. Artificial Intelligence can have an impact on people's behaviour and can encourage them to make sustainable choices. Environment-friendly habits need to be encouraged. Artificial Intelligence can help with this. This study looks at how Artificial Intelligence can be used to encourage environmental decisions, such as buying green products using energy efficiently and reducing waste. The study examines how people think and make decisions and how Artificial Intelligence can be used to influence these decisions. It also looks at how Artificial Intelligence technologies, such as recommendations and predictive analytics can be used to encourage sustainable behaviour. A lot of data has been analysed to understand how well Artificial Intelligence messages work. The analysis has helped identify the framework and the ethical issues that need to be considered such, as transparency and data privacy. The research shows that Artificial Intelligence can help make messages more effective and can be used to encourage people to make choices.*

Keywords: Artificial Intelligence (AI), nudges, sustainable behaviour, personalized messages, data privacy, eco-friendly, Theory of Planned Behaviour (TPB), Fogg Behaviour Model (FBM), Prospect Theory, Nudge Theory, Machine Learning (ML), predictive analytics, digital nudging, sustainability marketing, e-commerce, Sustainable Development Goals (SDGs)

1. Introduction

There is a problem in the world because of the way we are treating the environment. This is why we are looking at marketing and trying to be more sustainable. Some studies have found that people do not always do what they say they will do when it comes to living in a way that's good for the earth. We are talking about things like buying products, managing waste using energy wisely and making good choices when we travel. Lots of people say they want to make these kinds of choices.

The way we make people change their behaviour is important. We can use something called nudging to help people make choices. This is about making changes that help people decide what to do. It does not take away their freedom to choose. The old way of doing this was to use the same approach for everyone.

We can use intelligence to look at how people behave and what they like. This can help us create messages that're just right for each person. We can use things like machine learning and natural language processing to make these messages work better.

This paper is about creating a way of doing things that combines how people behave with what artificial intelligence can do. We are also thinking about the issues and making sure

we do things in a fair way. We looked at what other people have found out and used that information to make sure that using intelligence to help people make better choices is a good idea and does not hurt anyone. The goal is to help people live in a way that's good for the earth and, for them and to make sure that green marketing and sustainability are really working.

2. Literature Review

2.1 AI-Driven Sustainability Marketing

Research shows that people think highly of brands that care about the environment when those brands use artificial intelligence to talk about sustainability. Many brands and online platforms now use AI to create messages about sustainability recommend products and create engaging campaigns. For instance, AI can suggest eco- products based on what you have bought before what you have browsed and what you seem to like. It can also predict that you are more likely to respond to offers or information about products. [Wedel and Kannan, 2016] [Kumar et al., 2019] [Libai et al., 2020] [Huang and Rust, 2021] [Chatterjee et al., 2021] [Kumar et al., 2025]

Studies have found that when brands use AI to personalize their sustainability messages people pay attention and engage more. This is because AI helps brands understand their

customers better by grouping them based on their age, interests, attitudes towards the environment and behaviour. By doing brands can target their messages more effectively. Artificial intelligence is used to make sustainability messages more relevant and valuable to consumers, which increases attention, engagement and conversation. AI-driven recommendation engines and predictive analytics play a role in enhancing consumer engagement with eco-friendly products and sustainability content. [Kumar et al., 2019] [Huang and Rust, 2021]

The use of AI, in sustainability marketing enables brands to segment consumers based on demographics, psychographics, environmental attitudes and behavioural profiles.

This segmentation allows for granular and dynamic targeting of sustainability messages.

2.2 Integration of Cognitive and Behavioural Theories into AI-based Nudge Design

Some research work integrates cognitive and behavioural theories into AI-based nudge design, empirically testing models that address the intention-behaviour gap in sustainable consumption. Key theories include:

- 1) **Nudge Theory:** emphasizing choice architecture and bounded rationality.
- 2) **Prospect Theory:** which illustrates that people assess gains and losses differently when faced with uncertainty. [Tversky & Kahneman, 1979]
- 3) **The Theory of Planned Behaviour (TPB):** focusing on attitudes, subjective norms, and perceived behavioural control. [Ajzen, 1991]
- 4) **The Fogg Behaviour Model (FBM):** which posits that behaviour arises from the convergence of motivation, ability, and prompts. [Fogg, 2009]

Conversely, technical papers emphasize metrics of algorithmic performance without thoroughly linking their design decisions to psychological theories. [Ribeiro et al., 2016] [Doshi-Velez & Kim, 2017]

The combination of behavioural theory and technical design often has a narrow focus. Numerous research efforts consider behavioural constructs as variables, while the AI framework is viewed as a 'black box'. [Guidotti et al., 2018] [Rudin, 2019] This division limits the understanding of how particular AI mechanisms engage with cognitive processes to drive behavioural change.

Current studies often utilize the aforementioned theories to formulate hypotheses regarding how consumers might react to messages, defaults, and recommendations generated by AI. [Stieglitz et al., 2023] [Sharma & Paço, 2025] For instance, AI systems can customize social norm communications according to nearby peer actions or modify the cognitive effort needed to choose a green option by making choices simpler or by automatically selecting eco-friendly defaults. [Stieglitz et al., 2023] [Kumar et al., 2025]

2.3 AI Technology Stimuli and Sustainable Consumption

AI technologies triggers responses that can shape consumer perceptions, emotions, and behaviour. Features such as real-time feedback on energy usage, personalized carbon footprint dashboards, or context-aware push notifications are examples of how AI can enhance perceived value and engagement in sustainability contexts. [Stieglitz et al., 2023] [Curtin University, 2025]. Empirical research suggests that AI-driven interfaces can:

- 1) Increase consumers' awareness of their environmental impact. [Stieglitz et al., 2023]
- 2) Provide tailored recommendations that reduce cognitive overload. [Huang & Rust, 2021] [Kumar et al., 2025]
- 3) Create interactive and gamified experiences that sustain engagement over time. [Sharma & Paço, 2025]

But many of these studies are context-specific, focusing on a single application area, for example, mobility apps or green e-commerce platforms, and specific user segments. This hinders cross-domain and cross-cultural generalizability, complicating comparisons of AI stimulus effectiveness. [Wirtz et al., 2020] There is also a requirement for comprehensive and systematic evaluations that connect specific technical features like feedback modalities with behavioural outcomes. [Rahwan et al., 2021]

2.4 Digital Nudging in Environmental Contexts

Literature on digital nudging highlights its potential to reduce the attitude-behaviour gap in environmental contexts, for example, smart home applications [Stieglitz et al., 2023]. However, the technical perspective is not developed enough so that the AI nudges can be effective enough.

Nudges can be used from the digitalisation perspective which can motivate consumers towards certain preferences. Digital nudges can be implemented in areas like:

- 1) IoT (Internet of Things) devices and automated home system can suggest for energy- saving settings through AI. [Stieglitz et al., 2023]
- 2) Several online retailers give options for eco-friendly shipping, that instigates consumer to opt for that. [Kumar et al., 2025]
- 3) Nudges can be used even while booking flights online, where it shows options like lower-carbon rail alternatives or displaying emission level. [Sharma & Paço, 2025]
- 4) The above-mentioned nudges are majorly at the user-interface level, and do not actually describe the AI systems that generate and adapt these nudges. [Doshi-Velez & Kim, 2017; Guidotti et al., 2018]

2.5 Consumer Trust and Ethical Concerns

The trust of the consumer is the most important determinant of the effectiveness and acceptability of AI-driven nudges. [Wirtz et al., 2020] Although AI improves behavioural prediction and the ability to deliver highly personalized interventions, [Huang & Rust, 2021] on the contrary, it also raises concerns around:

2.5.1. Privacy and data protection, where there is use of personal data of the consumer. [Floridi et al., 2018] [Jobin et al., 2019]

2.5.2. Transparency and explainability, where AI recommendations are opaque or cases where consumers are not aware about the usage of their personal data. [Mökander et al., 2022] [Ribeiro et al., 2016] [Doshi-Velez & Kim, 2017]

2.5.3. Autonomy and manipulation, if the nudges exploit cognitive biases in ways that undermine informed and voluntary choices. [Floridi et al., 2018] [Rahwan et al., 2021] [Rudin, 2019]

3. Research Gap

A remarkable gap has been identified in integrating behavioural theories with technical development of AI nudges. This has been concluded from secondary research data. Nudging (behavioural) theories emphasize on psychological concepts, but on the contrary technical studies focus on algorithmic efficiency.

A qualitative study has been done to understand how AI system promotes sustainable behaviour effectively and ethically. But the quantitative study has not been done, which may find out the long-term effects of technologies and could help in understanding the scalable use of AI nudges in real-world situations.

4. Objectives

- 1) To see how technologies like machine learning, recommendation systems and prediction analysis help create reminders that encourage people to make eco-friendly choices on different digital platforms.
- 2) To check if behavioural theories can help design AI reminders that match what motivates consumers and how they make decisions.
- 3) To look into how ethical design and transparency in AI reminder systems can build trust with consumers and make eco-friendly interventions more effective.
- 4) To gather insights, from research and real-life examples to create a comprehensive guide that brings together behavioural science and AI expertise to promote sustainable consumption habits.
- 5) To identify challenges and best practices in balancing AI personalization accuracy with interpretability and ethical considerations in the context of eco-friendly consumer nudging.

5. Research Questions

- 1) How do different AI technologies, such as recommenders, predictive analytics and Dynamic default settings work in generating personalized nudges that make people more likely to choose eco- options on e-commerce, streaming and social media platforms?
- 2) How do behavioural theories, such as Nudge Theory, the Theory of Planned Behaviour and the Fogg Behaviour Model explain how people respond to AI-driven green nudges?

- 3) How do transparency, explainability and autonomy-supportive design features in AI nudging systems influence consumer trust, perceived fairness and acceptance of eco- friendly recommendations?
- 4) What are the common design patterns that people use when they make AI-driven nudges and what kind of results do they get?
- 5) When we make AI-based eco- nudges we have to balance a few things. We want the nudges to be personalized and accurate. We also want people to be able to understand how the nudges work. We have to make sure the nudges are fair and do not manipulate people. What are the trade-offs, between these things?

6. Research Methodology

6.1 Research Design

This study looks at how artificial intelligence can help people make earth choices when they buy things. It does this by combining what we know about how people behave with what we know about intelligence. Of doing new research it looks at what other people have already written about artificial intelligence and how it can help people make better choices for the earth. It also looks at what companies have done to make people behave in an earth friendly way. This way we can see the picture and understand how different subjects, like economics and computer science are connected to artificial intelligence and how people behave when they use computers and buy things.

6.2 Data Source

Secondary data was collected from industry case studies and reports show real-world examples of AI-based solutions. These include:

- Green-commerce features
- Mobility apps
- Home energy platforms

For instance, some companies use AI to make their e-commerce platforms more eco-friendly. They do this by optimizing delivery routes and reducing energy consumption. Mobility apps also use AI to promote transportation. They help users find the routes and modes of transport. Smart home energy platforms use AI to optimize energy usage. They learn a home's energy patterns. Make adjustments to reduce waste. These are a few examples of AI-based sustainable interventions. They show how AI can be used to make an impact, on the environment. Reports and case studies highlight these successes.

They provide insights into what works and what doesn't. By studying these examples others can. Apply similar solutions. AI-based sustainable interventions are crucial. They help reduce impact and promote eco-friendly practices. Green-commerce features, mobility apps and smart home energy platforms are the beginning.

6.3 Analytical Framework

The study looked at AI nudging systems in a lot of ways focusing on three main things:

6.3.1. Behavioural Foundations:

The people doing the research used some ideas like the Theory of Planned Behaviour, the Fogg Behaviour Model and Prospect Theory to see how AI nudging systems affect what people want to do how they think and what they choose. These ideas helped them figure out what is going on in people's minds when they get these AI nudges. They found out that AI nudging systems can affect things like what people like what other people think they should do how they feel about losing something and how they can change their habits.

6.3.2. AI Technology:

The research looked at the technology behind AI nudging systems, like machine learning and ways to recommend things to people. They also looked at how AI systems can predict what people will do and how they can learn from what people do. The researchers thought about what kind of information's used to make these systems work what the systems are trying to do how they can talk to people and how they can be part of the things people use every day like websites and apps.

6.3.3. Ethical and Trust Considerations:

The study thought about some big questions, like can people trust AI nudging systems and is it okay to use them. They looked at things like being honest with people about what the systemiser doing explaining how they work, getting peoples permission to use them keeping people's information private being fair and being sensitive, to different cultures. The researchers also thought about how to make sure AI nudging systems are used in a way, including what rules and standards should be followed and what companies should do to make sure they are using these systems responsibly when it comes to AI nudging systems.

7. Findings**7.1 AI Technology Stimuli and Perceived Value**

The first important thing we found out is that AI technology really helps people see the value in being sustainable and actually gets them involved. When we get suggestions that're just for us and things are easy to use because they automatically do what we like we are more likely to choose eco-friendly options. AI also helps us do things for the environment by giving us little reminders that make it easy for us to do the right thing.

For example, when we shop online the website can show us products that're good for the earth and also what we like. Sometimes the prices of things can change to make us want to buy the option. Another thing that happens is that the computers, in our homes can figure out when we are using a lot of energy and suggest ways for us to use less so we can actually do something to help the environment when it matters.

7.2 Behavioural Theories as Design Foundations

The second big thing we found out is that ideas about how people behave are really helpful when we want to create intelligence that can gently push people in a certain direction. The people who design these systems can focus on things that

make people do something because the artificial intelligence is based on ideas, like the Theory of Planned Behaviour, the Health Belief Model and Prospect Theory. This means designers can use these ideas to make the artificial intelligence nudges really effective. The artificial intelligence nudges are based on these behaviour ideas, like the Theory of Planned Behaviour, the Health Belief Model and Prospect Theory. [Ajzen, I., 1991]

For examples,

- Timing prompts to coincide with moments of high motivation or key decision points, as suggested by FBM. [Fogg, B. J., 2009]
- Framing outcomes in terms of losses (e.g., wasted energy, higher bills) or gains (e.g., savings, contribution to community goals) consistent with Prospect Theory [Tversky, A., & Kahneman, D., 1979]
- Using social norm messages and comparing with peers can change what people think is normal. [Ajzen, I., 1991]

7.3 Ethical AI Design, Transparency and Trust

Ethical design means being clear about how much and what kind of nudging is used. When AI interventions are pushy and not transparent people lose trust. This leads to a backlash that hurts both our faith in AI systems and our support for initiatives. We need to make sure AI is designed in a way that's fair and open. This way we can keep people's trust. Make sure they support efforts to be more sustainable. Clear boundaries around AI nudging are key to maintaining trust. If we do it right, we can build confidence, in AI systems an promote sustainability. [Floridi et al., 2018]

When we talk about options it is really important to be clear about why we think they are good choices. The people who make these options should tell us what makes them special and why we should pick them. They should also be honest about what information they use to make these suggestions. If we do not like these green options, it should be easy for us to say no to them. This way people feel like they are in charge of their decisions and they do not feel like someone is trying to trick them into doing something. Transparency practices, like these support the autonomy of options and reduce perceptions of manipulation of green options. [Jobin et al., 2019]

Culturally sensitive design is very important. We also need to pay attention to groups that're vulnerable. We must keep checking for bad results that we did not mean to happen. These are parts of using AI nudging in a responsible way. [Rahwan et al., 2021]

People think that it is really important for Artificial Intelligence to be fair and open. This is so that consumers can trust the Artificial Intelligence when it tries to get them to do something. Consumers are more likely to do what the Artificial Intelligence suggests if they think the Artificial Intelligence is being honest with them and if the suggestions are good, for them and make sense for their life. Artificial Intelligence needs to be transparent and fair so that consumers can trust the Artificial Intelligence and its green recommendations. [Wirtz et al., 2020] [Mökander et al., 2022]

7.4 AI-Driven Sustainability Marketing and Long-Term Commitment

AI systems can help people make eco-habits a part of their daily routine. They do this by encouraging green choices through content that fits each person. Loyalty programs and personalized experiences also play a role. The goal is to make sustainable choices easy and rewarding, for everyone. AI systems use tailored content to promote choices. This helps people develop habits that're good for the environment. [Wedel & Kannan, 2016]

For example, many fitness apps that track and show us our health progress like how many steps we take each day or calories we burn can make users feel better, about themselves as healthy people. These fitness apps can help people feel like they are really taking care of themselves and being active. [Kumar et al., 2019]

Using intelligence to promote sustainable products can really change the way people think about companies that care about the environment. This can help people stick with these eco-brands and keep buying sustainable products for a long time. Sustainability marketing with the help of intelligence is a great way to make people think that sustainable products and behaviours are important. Artificial intelligence can make sustainability marketing more effective. Help people understand why sustainable products and behaviours are good, for the environment. [Libai et al., 2020] [Huang & Rust, 2021]

This can change over time not the little things we do every day like taking more walks. It can also change the things we like. The way we live like using a specific app or wearing a certain device or even joining a running club. We do not see big changes, in how people behave for a long time. We need to study this for a time to see if people really keep making these changes after the first few weeks like after a 30-day challenge to see if people keep using a specific app or wearing a certain wearable device and if they keep going to a running club. [Chatterjee et al., 2021]

7.5 Trade-offs Between Accuracy, Interpretability, and Ethics

Simpler models are easier to understand. They do not give us precise results. They also do not give us results that can change easily. Simpler models are more straightforward which is a thing. Simpler models are not as good at giving us very exact answers. Simpler models are not as good at giving us answers that can change quickly like models are not as dynamic, as other models. [Doshi-Velez & Kim, 2017]

Best practices from research include:

7.5.1. having a person review decision

7.5.2. keeping records of how models work

7.5.3. checking how models affect people

These practices help ensure that models are used in a responsible way. Models should be set up to have oversight, for sensitive decisions. This is especially true when decisions can greatly affect people's lives. Keeping track of model documentation helps in understanding how models make

decisions. Impact assessments are also crucial. They help identify any issues with model use. By following these practices, we can ensure that models are used fairly and transparently. Models and human oversight go hand in hand for making decisions. Human oversight and model documentation are key. They help in making sure models are used in a way that respects people. [Ribeiro et al., 2016] [Guidotti et al., 2018]

The study finds that it is really hard to balance how well something predicts things how easy it is to understand and doing what is right when it comes to intelligence that helps the environment. Artificial intelligence models that are very complicated can do a job of predicting things but the artificial intelligence models are not clear about how they work. The study is talking about intelligence and it says that artificial intelligence has a lot of problems. Artificial intelligence has to be good, at predicting things and artificial intelligence has to be easy to understand and artificial intelligence has to do what is right. [Rudin, 2019]

8. Conclusion

This study shows that when we combine knowledge of how people behave and technical skills to design intelligence, we can create artificial intelligence reminders that really work to get people to make environmentally friendly choices. We can encourage people to buy things in a way that's good for the planet by giving them personalized reminders that fit with how they think and what motivates them.

We have to think about what's right and wrong when we do this so this study also gives us a plan that brings together ideas about how people behave and artificial intelligence technology. This plan helps people who design things and make policies to create intelligence reminders that are fair and work for people, from different cultures.

This paper looks at how artificial intelligence, what people buy and taking care of the planet are connected and how we can create new and responsible artificial intelligence solutions that encourage people to take care of the environment. But we need to do research over time to see how artificial intelligence reminders work in different cultures and to make sure our plan is good so we can make it better and make sure it really works.

9. Managerial Implications

We can make a plan that helps people make choices and also does what is right. This plan can be used by managers who want to use technology in a way that's fair and good. The idea is to use technology and ethics so people can trust what they are doing and it will last for a long time. Managers can use this plan to help people make choices that are good, for them and the earth. The goal is to make sure people keep doing what is right and good because they want to not just because they have to.

9.1 Implement Personalized Nudges

To help people buy things in a way that's good for the environment when they shop online companies can give people suggestions that are just for them. They can use

computers to help with this like systems that suggest things people might like and tools that try to figure out what people will want. These tools can help companies give people ideas about how to be kinder to the earth when they shop. Companies can also try to push people in the right direction by sending them messages that are based on things that people have learned about how humans behave. For example, they can use ideas from things, like The Theory of Planned Behaviour or Prospect Theory to write messages that will really get through to people and make them think about the environment when they buy things online.

9.2 Prioritizing Ethical Designing

To make consumers trust them organizations should be open about what they do. They should explain why they make recommendations and tell people how they use their data. This way people will not think they are being tricked.

Organizations should also make sure they are fair to everyone no matter where they are from. For example, when it comes to India, they should make sure their messages are suitable for people in India. This is important because people are different in places and organizations should respect that. They should adapt their messages like the nudges they give to people to fit cultures like the culture, in India.

9.3 Drive Long Term Strategies

This strategy is about moving from campaigns to something that will last. We will use intelligence to help people develop good habits that they can keep for a long time. We want to make people loyal to our brand. We will do this by creating programmes and challenges that people can take part in. We will also work with people who make policies to make sure we are making a difference and that our work is in line with the Sustainable Development Goals.

We will always check to see if what we are doing is having any effects. If it is we will. Try something else. We will also try things to see what works best like using one idea and then trying another idea to see which one is better. The goal is to make people trust us and want to buy from us. We will use intelligence to gently push people in the right direction and we will keep checking to make sure this is working. We will use this information to make our artificial intelligence better and to get the results we want from peoples buying behaviour. The way they trust us. The Sustainable Development Goals are very important, to us. We want to make sure we are doing our part to help.

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