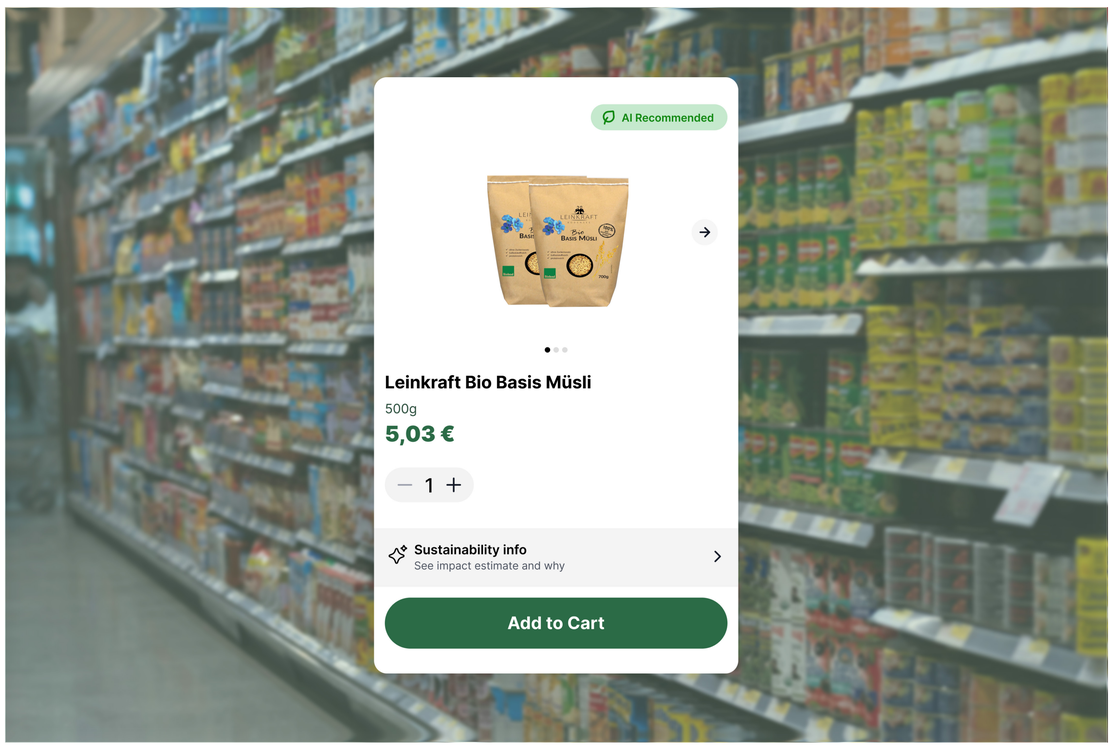
Pallavi Krishna *Master Thesis 2025/2026*

Explainable AI for Sustainable Decision-Making

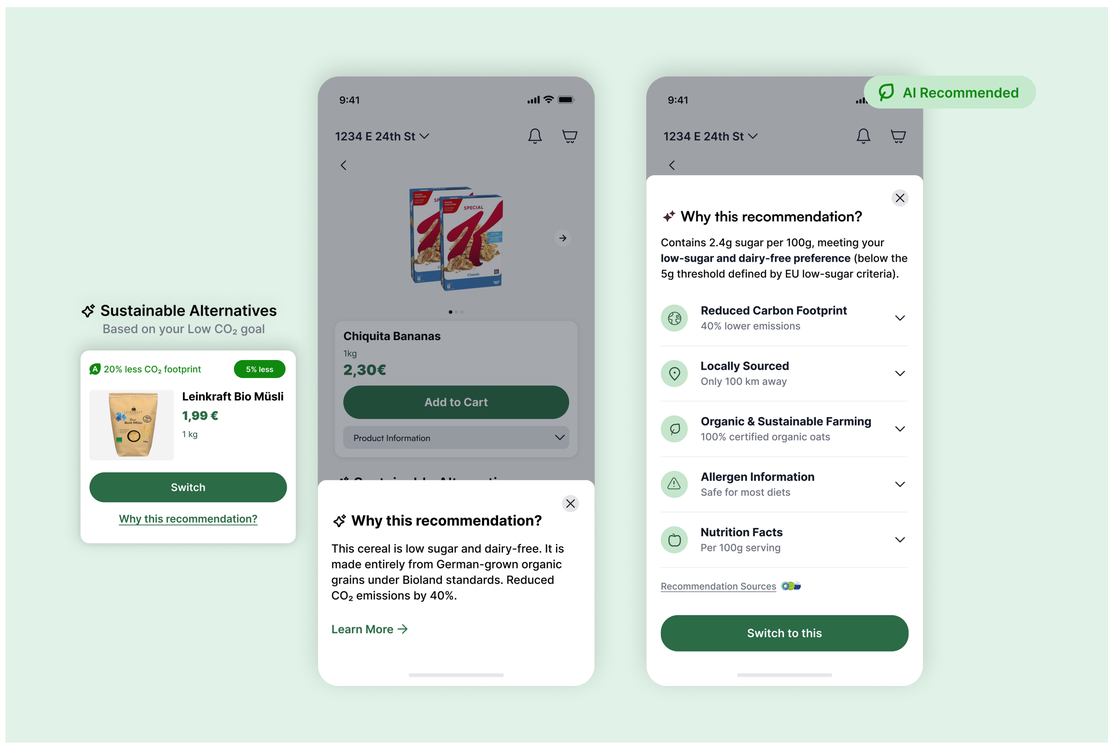
Abstract

Online grocery shopping is usually quick, habitual, and shaped by practical constraints like budget, convenience, and dietary needs. In this setting, sustainability often matters, but it tends to influence choices only when it fits alongside those stronger priorities. This thesis examines how explainable AI (XAI) can be designed at the interface level to support sustainable swaps in a way that feels credible, helpful, and easy to use during grocery shopping.

The study followed a mixed-methods approach in three phases: an exploratory survey, semi-structured interviews, and a prototype-based evaluation. Hypotheses created from synthesising the exploratory findings were examined through within-subject A/B tests focusing on explanation access, progressive disclosure, impact framing, personal relevance, choice architecture, fairness through comparability, and post-decision reinforcement. Overall, the findings suggest that explainability works best when it respects the reality of grocery shopping: lightweight by default, available on demand, and designed to support fast decisions rather than slow them down.



Online grocery shopping



Explainable AI Interface

Special Focus

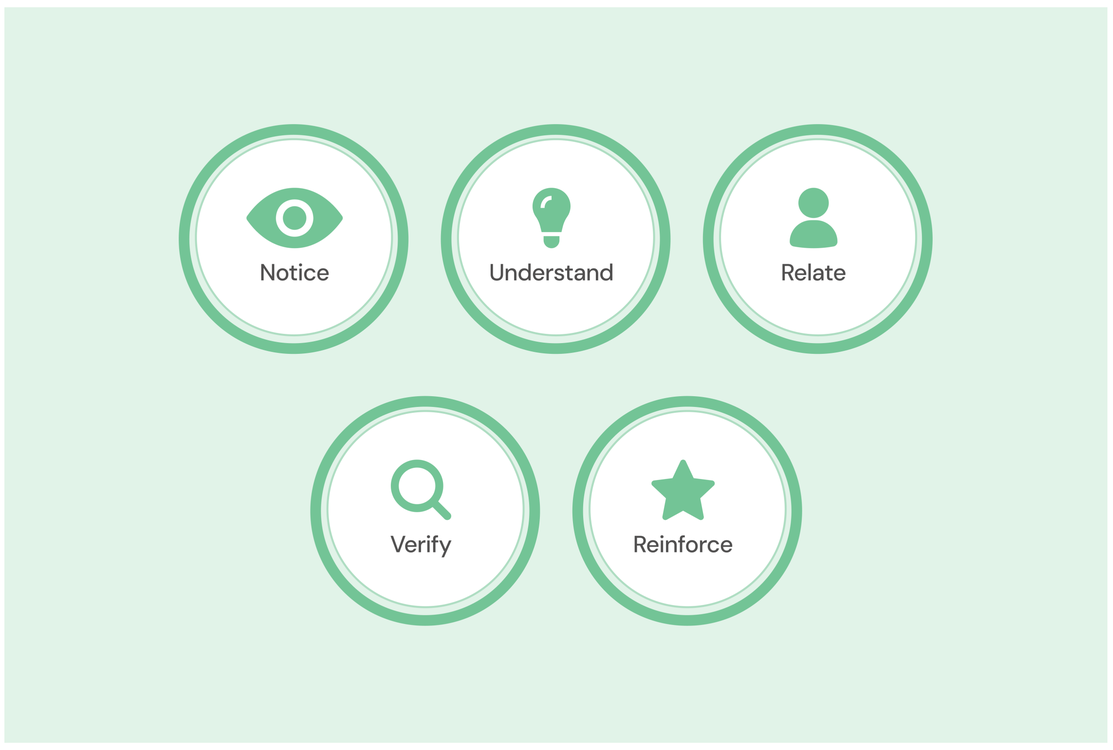
This thesis focuses on how explainable AI can be applied at the interface level to support sustainable decision-making in online grocery shopping, where choices are often routine and made under time pressure. Rather than evaluating model performance, it examines how user-facing explanations can be embedded into the shopping flow to support understanding and interpretation at the moment of choice.

Building on the exploratory survey and interviews, behavioural themes were synthesised to prioritise what to test and translated into seven hypothesis-driven A/B prototype comparisons. These comparisons examined whether explanation and interaction patterns such as explanation access and transparency, progressive disclosure, impact framing, personal relevance and personalisation (via stated goals), choice architecture, fairness through cross-option comparability, and post-decision reinforcement feedback could improve the nudge effect while remaining usable within fast shopping decisions.

Result and Future Work

The key findings show that XAI nudges are most effective when they fit the reality of online grocery shopping. Explanations worked best when they stayed lightweight by default and provided clarity on demand, without slowing the shopping flow. The strongest effects appeared when explanations increased personal relevance and improved perceived fairness and credibility through comparability across options. Impact framing and post-decision feedback added meaning and motivation, but were more dependent on situational relevance and attention.

Future work should validate these patterns in more realistic shopping conditions with a larger participant pool and repeated shopping sessions. It should also refine how sustainability information and uncertainty are communicated while preserving user control through on-demand access and opt-out options, so explainability remains helpful without adding friction.



XAI Sustainability Nudge Framework

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