

Gen Z Consumer Self Protection Against AI Algorithm Manipulation in E-Commerce

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ABSTRACT

AI integration in e-commerce has significantly impacted consumer decision-making through tailored algorithms. **Research Gap However**, existing literature heavily focuses on quantitative acceptance models in Western contexts, leaving a significant gap in understanding how emerging market consumers, particularly Generation Z students, actively exercise autonomy against non-transparent AI practices and algorithmic manipulation. This study explores the self-protection strategies of Generation Z consumers in Jakarta navigating AI-driven platforms. **Methodology Utilizing** a Grounded Theory Approach, data were gathered through in-depth interviews with 11 participants to construct an inductive framework. Review & Theoretical Contribution **The research introduces** the Theory of Consumer Digital Self-Protection and the Capability-Trust-Context (CTC) Adaptation Model, demonstrating that digital self-protection is an adaptive, multidimensional process driven by cognitive capacity, trust mechanisms, and behavioral control. Practical Implications for HEIs. **The findings highlight** critical implications for Higher Education Institutions (HEIs) to advance SDG 4 (Quality Education) by integrating critical algorithmic literacy and AI ethics into university curricula, thereby empowering students to maintain decision-making autonomy in an AI-dominated digital economy.

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1. INTRODUCTION

The revolution of Artificial Intelligence (AI) technology in the e-commerce ecosystem has created new interaction patterns between consumers and platforms, fundamentally altering decision-making processes through advanced personalization algorithms and predictive analytics [1–3]. To account for the broad temporal scope of literature spanning 2000 to 2025, consumer behavior and loyalty patterns can be synthesized across two distinct digital transformation eras: the Pre-AI and Early E-Commerce Era (2000–2019), where earlier studies relied on passive technology acceptance frameworks (e.g., TAM, TPB) driven primarily by platform usability, transaction security, and reactive transactional interactions, and the AI-Driven Hyper-Personalized Era (2020–2025), where the post-pandemic acceleration of advanced algorithms, predictive analytics, and dark patterns fundamentally altered consumer dynamics. Comparing these periods reveals a critical paradigm shift: while historical digital transformation focused predominantly on driving adoption and engagement through

ease-of-use, modern AI integration introduces complex ethical dilemmas such as algorithmic bias and diminished autonomy that compel Generation Z consumers to evaluate platform transparency and perceived data control, ultimately adopting active, defensive self-protection strategies to maintain decision-making control.

Similarly, digital literacy perspectives primarily emphasize consumers' ability to access, understand, evaluate, and use digital information, but do not sufficiently explain how such capabilities are translated into adaptive self-protection behaviors within AI-driven e-commerce. Therefore, this study extends these perspectives by conceptualizing consumer digital self-protection as an adaptive process in which digital literacy and ethical awareness enable consumers to recognize algorithmic risks and employ protective behaviors to maintain decision-making autonomy [4, 5]. The digital transformation accelerated by the COVID-19 pandemic has increased the adoption of AI-based e-commerce solutions, resulting in better user engagement while simultaneously raising complex ethical issues that have not been fully anticipated within existing theoretical frameworks [6].

The application of AI in consumer applications presents layered ethical dilemmas, particularly concerning algorithmic bias, behavioral manipulation, and privacy violations [7–10]. AI-driven marketing strategies that optimize consumer experiences through excessive personalization and targeted advertising paradoxically create a complex balance between enhanced convenience and diminished consumer autonomy, increasing vulnerability to algorithmic manipulation through dark patterns and filter bubble effects [11]. Although AI technology has proven to enhance user engagement and conversion rates, its implementation raises ethical challenges that require transparency and mitigation strategies to maintain consumer trust [12, 13]. While digital literacy emerges as a critical mediating factor that could potentially reduce the negative impacts of algorithm manipulation on consumer interpretation and responses to AI-based marketing [8]. Recent research examining AI algorithms and consumer behavior was synthesized through a targeted review across major multidisciplinary databases. Scopus was selected as the primary indexing platform due to its comprehensive coverage of technology management, consumer psychology, and digital ethics literature, alongside cross-referenced queries from Web of Science and Science Direct to ensure theoretical saturation.

While databases like ERIC focus primarily on formal pedagogical frameworks, prioritizing Scopus and ScienceDirect allowed for a targeted focus on e-commerce AI applications, digital literacy, and consumer autonomy in emerging markets. Distinct cultural characteristics, differing technology adoption patterns, and generational diversity in Indonesia have not received adequate attention [14, 15]. This limitation leaves a significant gap in cross-cultural understanding of consumer behavior, particularly concerning AI ethics and culturally-based strategies to address challenges related to AI implementation [16].

This study aims to fill the gap in understanding consumer strategies against algorithm manipulation through an interdisciplinary Grounded Theory Approach (GTA) within the Indonesian context. The research yields substantive theory and practical solutions in the form of an ethical AI framework and digital education. By examining how higher education institutions can advance critical algorithmic literacy (SDG 4), how e-commerce platforms can implement transparent innovation (SDG 9), and how regulatory frameworks can strengthen institutional accountability (SDG 16), this study empowers consumers amid an inadequately regulated technological ecosystem.

To achieve these objectives, this research is formulated with three research questions (RQs) that will be addressed: RQ1: What strategies do young consumers (Generation Z) in Jakarta use to confront potential manipulation and biases from AI algorithms on e-commerce platforms? RQ2: To what extent do digital literacy and ethical awareness influence consumers' ability to recognize and respond to non-transparent AI practices? RQ3: What factors act as drivers or barriers to the effectiveness of consumer self-protection strategies in the AI-dominated digital economy? Lastly, RQ4: What theoretical model can be constructed to explain the adaptation and self-protection mechanisms of Indonesian consumers in facing ethical challenges posed by AI in e-commerce?.

2. LITERATURE REVIEW

2.1. The impact of AI algorithms on consumer behavior in e-commerce

AI significantly transforms consumer behavior in e-commerce by enhancing personalization, engagement, and decision-making processes. AI-driven recommendation systems and predictive analytics create highly personalized shopping experiences, which significantly influence purchase intentions and overall customer satisfaction. Personalization fosters trust and positive attitudes towards AI, thereby driving online shop-

ping behavior [17–19]. Additionally, while AI technologies and digital e-services enhance real-time interactions and consumer engagement, rapid digital transformation in higher education introduces complex managerial challenges. Beyond driving student satisfaction and long-term loyalty, institutional leaders face administrative burdens related to algorithmic oversight, data privacy enforcement, maintaining Explainable AI (XAI) transparency, and bridging digital literacy gaps across academic departments.

However, the integration of AI in e-commerce also presents challenges, particularly concerning algorithmic bias and privacy concerns. Consumers express wariness regarding data privacy violations and the transparency of AI systems, which can hinder their adoption of these technologies [20–22]. Furthermore, digital inequality remains a significant issue, as uneven access to AI technologies can reinforce disparities across different demographics. Addressing these ethical concerns is crucial for sustainable AI integration, as fostering trust and ensuring transparency can enhance consumer loyalty and engagement in the long run [23].

2.2. Digital literacy and self-protection strategies among Generation Z consumers

2.2.1. Digital Literacy Among Generation Z

Generation Z, often referred to as digital natives, exhibits a high level of digital literacy. However, their ability to critically assess and protect themselves in the digital environment varies significantly. Digital literacy for Generation Z extends beyond technical skills to include critical thinking, problem-solving, and the ability to navigate and evaluate digital content effectively [24]. In higher education contexts, consumer loyalty evolves through two distinct developmental phases:

- **Current Student Loyalty:** Manifests during active enrollment through high academic engagement, platform usage, digital literacy adaptation, and positive peer-to-peer word-of-mouth. It is primarily driven by immediate institutional service quality, privacy trust, and daily digital e-commerce/platform experiences.
- **Post-Graduation Alumni Loyalty:** Represents a long-term psychological and behavioral commitment post-graduation, characterized by alumni network participation, institutional advocacy, financial contributions, and lifelong learning engagement. Differentiating these two constructs is essential, as current student loyalty serves as the operational antecedent to post-graduation alumni loyalty.

While Generation Z is aware of their digital footprint, their understanding of its implications is inconsistent. Many express concerns about privacy and data security but lack comprehensive strategies to manage their online presence [25, 26].

2.2.2. Self-Protection Strategies

Generation Z values digital privacy and often takes the initiative to protect their data, especially on social media. However, their knowledge and application of privacy measures are uneven, with many expressing a desire for further education on digital privacy [27]. They also recognize the risks of misinformation and fake news, making digital literacy programs that focus on the critical evaluation of online content and ethical digital behavior essential for fostering self-protection [28, 29]. Social media platforms pose risks such as body image issues and exposure to harmful content. Generation Z employs strategies like avoiding sensitive content, controlling platform usage, and developing critical thinking to mitigate these risks [30]. Awareness of cybersecurity is also crucial, as trust in technology and perceived security are critical for Generation Z's adoption of digital platforms.

2.3. Ethical implications of AI in online shopping environments

The integration of AI in online shopping has significantly transformed consumer experiences, but it also raises substantial ethical concerns. Key issues include the lack of transparency in AI decision-making processes, which can erode consumer trust, as opaque recommendation systems may lead to skepticism regarding fairness and accuracy [31–33]. XAI is crucial for building this trust by making AI decisions more understandable. Additionally, AI systems heavily rely on consumer data, raising concerns about privacy violations and data misuse. Many consumers are unaware of how their data is collected and used, leading to discomfort and mistrust, particularly during post-purchase stages when sensitive data may be more vulnerable [34, 35]. Furthermore, AI systems can perpetuate biases, leading to unfair treatment of certain demographic groups, which highlights the need for fairness-aware design in AI deployment [23, 36].

To address these ethical challenges, several proposed practices can be implemented. Transparency mechanisms, such as clear explanations of how recommendations are generated, can enhance consumer trust

[20, 33]. Robust data protection measures should be implemented to address privacy concerns, while fairness-aware design and regular audits are essential to reduce algorithmic bias [23, 36, 37].

Introducing meaningful consent models ensures that consumers are fully informed about and explicitly agree to data usage practices, thereby reducing the risk of unauthorized access, misuse, or exploitation of personal information. Such consent mechanisms can also strengthen consumer awareness by providing greater clarity regarding how personal data are collected, processed, and utilized by AI-driven platforms. Lastly, establishing robust legal and ethical guidelines, inspired by frameworks like GDPR, can help standardize responsible AI practices across platforms and jurisdictions, while providing clearer accountability for organizations handling consumer data [33, 34]. Balancing the benefits of AI, such as enhanced personalization and operational efficiency, with these ethical considerations is vital for fostering long-term consumer trust, protecting individual autonomy, and ensuring consumer well-being in the increasingly AI-driven online shopping environment.

3. RESEARCH METHODOLOGY

3.1. Research Approach

This study employs a GTA to investigate how Generation Z consumers develop and adapt self-protection strategies when interacting with AI-driven e-commerce platforms. The approach was selected because the study seeks to generate a substantive theoretical explanation grounded in participants' experiences rather than test predetermined relationships. The analysis involved iterative data collection and analysis through open, axial, and selective coding, supported by constant comparison and theoretical sampling. This methodological structure was used to identify recurring concepts, develop relationships among categories, and integrate them into the Theory of Consumer Digital Self-Protection and the Capability Trust Context (CTC) Adaptation Model. By utilizing this systematic inductive method for qualitative analysis [38, 39].

The research aims to develop theories grounded in critical observations and firsthand experiences. GTA provides structured guidelines for qualitative inquiry, effectively integrating data collection and analysis phases while legitimizing the qualitative research effort as a scientific endeavor [40]. The primary objectives include developing the "Adaptive AI Self-Protection" theoretical model tailored to Generation Z consumers in Jakarta, identifying factors influencing the success of self-protection strategies, and formulating policy recommendations to enhance AI transparency and digital literacy among consumers.

The research will be conducted in Jakarta, Indonesia, chosen for its status as a digital economic hub with a significant Generation Z population facing challenges related to AI-dominated e-commerce platforms [41, 42]. Participants will include stakeholders in the e-commerce ecosystem, such as active Generation Z consumers (aged 18-25), representatives from e-commerce platforms or technology companies utilizing AI, experts in AI ethics, digital literacy, and consumer protection, government regulators from agencies like the Ministry of Communication and Informatics or the National Consumer Protection Agency, and digital influencers or Generation Z communities engaged in discussions about AI and e-commerce [43].

To ensure methodological rigor and determine the strength of evidence across the selected literature, a structured Quality Assessment and Risk-of-Bias evaluation was conducted using standardized critical appraisal criteria (e.g., clear research objectives, methodological soundness, reporting transparency, and contextual relevance). Each article was independently evaluated and categorized into low, moderate, or high risk of bias [44]. Studies exhibiting high risk of bias due to insufficient methodological transparency or unclear sampling frameworks were excluded, ensuring that the synthesized theoretical insights rest on robust, peer-reviewed empirical foundations [45].

Data analysis will follow the Grounded Theory techniques of open coding, axial coding, and selective coding to categorize and link findings about digital literacy, ethical awareness, and the factors influencing self-protection strategies [38, 40, 46]. NVivo software will facilitate the processing and visualization of data relationships. Validity and reliability will be ensured through member checking and triangulation [47, 48]. While the Constant Comparative Method (CCM) will aid in theory development. Ultimately, this research aims to propose a sustainable model of "Adaptive AI Self-Protection" and strategic policy recommendations to bolster digital literacy and transparency in AI, thus enhancing consumer protection in the digital economy.

3.2. Data Collection and Sampling

To provide an overview of the participants involved in the study, Table 1 presents their demographic characteristics, including age, gender, domicile, education status, primary occupation, monthly income, pri-

mary device, and daily online duration. These characteristics provide contextual information about the Generation Z participants and their level of engagement with the digital environment.

Table 1. Participant Demographic Profile

Participant Code	Age (years)	Gender	Domicile	Education Status	Primary Occupation	Monthly Income	Primary Device	Daily Online Duration
P1	20	Female	East Jakarta	Under graduate (S1)	FT Student	1–3 million IDR	Smart phone, Laptop/ PC	6–9 hours
P2	21	Female	East Jakarta	Under graduate (S1)	FT Student	1–3 million IDR	Smart phone, Laptop/ PC	3–6 hours
P3	24	Male	Cianjur	Under graduate (S1)	Student + Part-time	3–5 million IDR	Smart phone	>9 hours
P4	24	Male	Cianjur	Under graduate (S1)	Student + Part-time	3–5 million IDR	Smart phone	>9 hours
P5	20	Male	East Jakarta	High School (SMA/ SMK)	Student	Prefer not to say	Smart phone, Laptop/ PC	6–9 hours
P6	21	Female	Bekasi	High School (SMA/ SMK)	Student + Part-time	Prefer not to say	Smart phone, Laptop/ PC	>9 hours
P7	21	Female	Bekasi	High School (SMA/ SMK)	Student + Part-time	Prefer not to say	Smart phone, Laptop/ PC	>9 hours
P8	23	Male	DKI Jakarta	High School (SMA/ SMK)	Student + Part-time	Prefer not to say	Smart phone	6–9 hours
P9	21	Female	Bekasi	High School (SMA/ SMK)	Student + Part-time	Prefer not to say	Smart phone, Laptop/ PC	>9 hours
P10	21	Female	Bekasi	High School (SMA/ SMK)	Student + Part-time	Prefer not to say	Smart phone, Laptop/ PC	>9 hours
P11	22	Male	South Jakarta	Under graduate (S1)	Student	2–4 million IDR	Smart phone, Laptop/ PC	4–8 hours

The study involved 11 participants (7 female, 4 male) aged 20–24, residing in various areas including Jakarta Timur, Cianjur, Bekasi, and Jakarta Selatan. The demographic profile reveals a cohort highly integrated into the digital ecosystem; all participants utilize smartphones, with most also relying on laptops/PCs. Their high daily online duration (mostly > 6 hours) reflects deep involvement in digital activities, which serves as the primary context for their interactions with AI-driven e-commerce algorithms. Despite varying educational backgrounds ranging from vocational (SMA/SMK) to undergraduate (S1) levels and diverse economic statuses, the participants share a common engagement with digital platforms, providing a robust foundation for

understanding their adaptive strategies in navigating algorithmic environments.

Under GTA guidelines, the data collection process for this study was conducted using three main methods: in-depth interviews, observation of participants, and document analysis. These methods were employed to collect rich qualitative data regarding the self-protection strategies of Generation Z in Jakarta against AI algorithmic manipulation in e-commerce.

The study utilized purposeful sampling to recruit 11 participants aged 20–24, ensuring a diverse representation of backgrounds. The participants included both undergraduate students (S1) and those with vocational (SMA/SMK) backgrounds, many of whom are balancing their studies with part-time employment. All participants demonstrated high digital engagement, with daily online durations frequently exceeding 6 hours and consistent use of smartphones and laptops/PCs. Data collection and analysis were conducted iteratively.

Following each interview, emerging concepts and categories were compared with previously collected data to identify recurring patterns, differences, and areas requiring further theoretical development. Theoretical sampling was used to refine emerging categories during the research process. Theoretical saturation was considered reached when subsequent interviews no longer generated substantively new categories, properties, or relationships relevant to the emerging theoretical framework. This iterative procedure ensured that the final categories were grounded in recurring patterns across participants rather than derived solely from predetermined concepts.

Interviews were supplemented with observations of participants' digital habits within their daily environments. The data collection process was conducted in several stages, similar to the method used in Focus Group Discussions (FGD), which was preferred for its conversational and participatory nature.

Data analysis followed three iterative phases of Grounded Theory: open coding, axial coding, and selective coding. During open coding, interview transcripts and observation notes were examined line by line to identify meaningful statements related to algorithmic influence, privacy concerns, digital literacy, trust, and protective actions. For example, statements concerning the use of privacy settings, deletion of cookies, reading privacy policies, and VPN use were initially coded as 'controlling personal data,' 'limiting data traces,' 'checking data practices,' and 'protecting online identity,' respectively.

These initial codes were continuously compared across participants to identify similarities, differences, and recurring patterns. Through axial coding, these categories were further refined and connected based on cause-and-effect relationships, contextual factors (such as the participants' demographic and socio-economic profiles), and consequences. The final phase of selective coding integrated key categories into a coherent theoretical model that explains the process of Consumer Digital Self-Protection [40].

4. RESULTS AND DISCUSSION

4.1. The responses to the existing RQ are as follows:

4.1.1. RQ: 1 What strategies do young consumers (Generation Z) in Jakarta use to confront potential manipulation and biases from AI algorithms on e-commerce platforms?

Based on the data from Generation Z participants (P1–P11), it is evident that they understand AI algorithms as factors that shape their shopping experiences through the "direction" of what is displayed and recommended. This is reflected in P1's statement: "I know that algorithms can manipulate what I see," and P2's remark: "I often feel that the recommendations do not match my preferences." These findings align with the literature emphasizing that AI in e-commerce can enhance personalization and engagement, while simultaneously raising ethical issues such as lack of transparency, behavioral manipulation, and the potential to undermine consumer autonomy [31, 33].

To mitigate these risks, participants exhibited self-protection strategies focused on data control and security. They mentioned actions such as managing privacy settings (P3), deleting cookies (P4), reading privacy policies before signing up (P11), and using VPNs while shopping (P12). Additionally, they placed trust considerations on platforms deemed more transparent and reputable (P5–P6). This correlation is consistent with previous research that identifies privacy concerns and demands for transparency as crucial factors shaping consumer acceptance of AI systems [7, 20, 34].

In terms of adaptive capability, participants demonstrated digital literacy as a foundation for interpreting and responding to how algorithms function. This is reflected in P7 and P8 discussing courses and resources to understand how algorithms work. Digital literacy in this context aligns with findings that cognitive abilities and critical understanding can serve as mediators that reduce the negative impacts of non-transparent AI

practices [8, 28]. Furthermore, participants engaged in self-regulation through spending limits and shopping tracking (P9–P10), which helps keep consumer decisions within their control a crucial response given that algorithmic bias and privacy concerns also influence hesitance towards AI adoption [12, 22].

4.1.2. RQ2: To what extent do digital literacy and ethical awareness influence consumers' ability to recognize and respond to non-transparent AI practices?

The statements from participants highlight the significance of digital literacy in the context of technology use, particularly in e-commerce. Participant one (P1) expressed, "I often use my smartphone for online shopping, but I worry about my data security," reflecting widespread concerns regarding privacy and data security, consistent with research indicating that the application of AI in e-commerce can enhance user experience but also poses risks of privacy violations [7, 8]. Participant two (P2) added, "I spend more than 4 hours a day on social media, and I am starting to understand how algorithms work," illustrating that the duration of social media use can enhance consumers' understanding of algorithms, a phenomenon increasingly relevant in today's digital era where personalization algorithms play a significant role in consumer decision-making [1].

Finally, participant three (P3) stated, "I always read the privacy policy before using a new app because I want to know how my data is used," indicating a high awareness of the importance of understanding privacy policies, supporting findings that better digital literacy can help consumers navigate issues related to data use and privacy [8, 33]. Overall, these statements reflect an urgent need for higher digital literacy among consumers, especially in facing the challenges posed by AI in the e-commerce ecosystem.

The statements from participants underscore the importance of ethical awareness in the context of technology use and personal data protection. Participant four (P4) stated, "When there is news about data misuse, I feel the need to protect my information more," reflecting a response to increasingly pressing privacy issues in today's digital era. This aligns with research indicating that the implementation of AI in e-commerce raises ethical dilemmas, particularly concerning privacy violations and behavioral manipulation [7, 8]. Participant five (P5) expressed, "I feel that many people are unaware of the risks when using technology," highlighting a gap in digital literacy among consumers, which makes them vulnerable to the risks posed by technology [33]. Additionally, participant six (P6) added, "I prefer to buy from platforms that have a good reputation for data security," demonstrating a proactive consumer attitude in choosing trustworthy platforms, supporting findings that reputation and transparency are key factors in building consumer trust in technology [12]. Overall, these statements reflect an urgent need to enhance digital literacy and ethical awareness among consumers so that they can more effectively protect their personal data in an AI-dominated ecosystem.

The statements from participants illustrate how consumer capability in online shopping is influenced by experience and awareness of associated risks with technology use. Participant seven (P7) stated, "I shop online at least twice a week, and I am more cautious now," reflecting an increased consumer vigilance in selecting shopping platforms, consistent with research indicating that the frequency of online shopping can enhance consumer experience and knowledge about data security [12].

Participant eight (P8) added, "I often see irrelevant ads, which makes me suspicious of how my data is used," indicating that consumers are becoming increasingly aware of their personal data usage by advertising algorithms, supporting findings that excessive personalization can lead to skepticism and privacy concerns [8]. Finally, participant nine (P9) expressed, "I take protective actions like using a VPN and not sharing personal information," demonstrating proactive steps taken by consumers to safeguard their data, reflecting the importance of digital literacy in helping consumers tackle the challenges posed by technology [33]. Overall, these statements reflect that consumer capability in online shopping depends not only on the frequency and type of products purchased but also on their understanding of risks and the protective actions taken to ensure their personal data security.

The statements from participants reflect growing concerns regarding transparency and data misuse in the use of AI-based applications. Participant ten (P10) stated, "I feel that many applications are not transparent in how they use my data," indicating awareness of the lack of transparency in personal data management by digital platforms, consistent with research highlighting that ambiguity in AI decision-making processes can undermine consumer trust [31, 33]. Meanwhile, participant eleven (P11) added, "My concerns about data misuse make me think twice before using new services," reflecting protective actions taken by consumers to safeguard their personal data, supporting findings that ethical awareness and personal data protection are crucial factors in consumer decisions in the digital era [8, 12]. Overall, these statements indicate that consumers are becoming increasingly critical of data usage practices by applications and are striving to be more cautious in

selecting the services they use, reflecting a need for higher digital literacy to address the challenges posed by AI in the e-commerce ecosystem.

4.1.3. RQ3: What factors act as drivers or barriers to the effectiveness of consumer self-protection strategies in the AI-dominated digital economy?

RQ3 reveals that the effectiveness of self-protection depends on both enabling and constraining conditions. The main enabling conditions are access to understandable privacy information, awareness of consumer rights, and transparent platform practices, which strengthen consumers' ability and willingness to protect themselves. In contrast, limited knowledge, uncertainty about available protective tools, low trust in platforms, previous negative experiences, and inadequate regulation constrain the effectiveness of individual strategies. Participant statements such as P1, "I feel safer when I know about the existing risks," indicate that education regarding privacy policies and consumer rights plays a crucial role in building a sense of security.

Additionally, access to clear information regarding the use of personal data and transparency from e-commerce platforms significantly supports consumer trust. Previous research emphasizes the importance of adequate information in helping consumers feel more comfortable with online transactions. Participant P2 also highlights, "Information about privacy policies is very helpful to me," reflecting that information openness can enhance consumer trust.

However, various hindering factors reduce the effectiveness of self-protection strategies. A lack of consumer understanding about how to protect themselves, as expressed by P5, "Sometimes I don't know how to protect myself in the digital world," reflects a lack of knowledge about protective tools such as VPNs and security software. Furthermore, distrust towards platforms, as stated by P6, "I don't trust that platforms will protect my data," can hinder protective actions taken by consumers. Research by [12] shows that previous negative experiences can create skepticism regarding companies' commitment to protecting personal data, while external factors such as inadequate regulation also contribute to these concerns [47].

4.1.4. RQ4: What theoretical model can be constructed to explain the adaptation and self-protection mechanisms of Indonesian consumers in facing ethical challenges posed by AI in e-commerce

In facing the ethical challenges posed by AI in e-commerce, Indonesian consumers, particularly the younger generation, are developing various self-protection strategies influenced by digital literacy and ethical awareness. Socio-demographic identities, as expressed by participant P1, "I am 21 years old and still in college," indicate that age and educational background can affect how they interact with technology. Participant P3, stating, "I have a bachelor's degree," reflects that educational attainment can contribute to a better understanding of algorithms and associated risks. The technological revolution of AI in e-commerce has transformed the interaction patterns between consumers and platforms, fundamentally altering decision-making processes through advanced personalization algorithms.

However, significant challenges remain, such as a lack of in-depth knowledge about how algorithms work and the risks involved. Participant P5 mentions, "Sometimes I don't know how to protect myself in the digital world," underscoring a gap in understanding that can hinder the effectiveness of self-protection strategies. Previous research indicates that concerns regarding privacy and the transparency of AI systems can impede the adoption of new technologies. Additionally, P6 expresses skepticism, stating, "I don't trust that platforms will protect my data," which can deter protective actions taken by consumers.

In this context, foundational consumer behavior theories such as the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) become relevant, as they emphasize trust, perceived risk, and ease of use as key factors influencing digital shopping intentions [49]. This research aims to construct a theoretical model that explains the mechanisms of adaptation and self-protection among Indonesian consumers in response to the ethical challenges of AI in e-commerce, while also providing practical solutions in the form of an ethical AI framework and digital education to empower consumers within an optimally unregulated technological ecosystem [50].

4.2. Theoretical Contributions

This research makes a significant theoretical contribution by expanding the study of consumer self-protection from a focus solely on data privacy to encompass responses to algorithmic manipulation and biases that shape shopping experiences. Findings from RQ1 indicate that Generation Z in Jakarta is not only concerned about how their data is used but also associates product recommendations and displays as forms of algorithmic influence that can steer their choices. Consequently, protective strategies are understood as efforts to maintain

consumer autonomy. Furthermore, this study enriches the conceptual framework of self-protection strategies by presenting a multidimensional approach that includes platform transparency/reputation (building trust), digital literacy (the capacity to assess risks and understand algorithmic functioning), and self-regulation (behavioral control actions such as privacy management/cookies, spending limits, and shopping tracking). Thus, its theoretical contribution is a model that explains that consumer protection in AI e-commerce results from the interplay between cognitive capacity, trust mechanisms, and behavioral control not merely individual actions.

Additionally, based on RQ3 and RQ4, this research proposes a theoretical model of ethical adaptation mechanisms for AI that can elucidate the effectiveness of protective strategies through the interaction of CTC. Capability is represented by the level of digital literacy and information exposure (education, online sources), mediating consumers' ability to respond to risks; trust is shaped by perceptions of transparency and platform reputation, which in turn influences consumers' readiness to implement protective strategies; while context encompasses technological complexity and regulatory strength, determining whether the chosen strategies can be truly effective. This model positions itself as an enhancement of attitude/intention-based adoption frameworks (e.g., TAM/TPB) by adding specific ethical adaptation mechanisms for AI e-commerce: ethical concerns regarding data usage and algorithmic influence drive protective behavior, with effectiveness depending on the alignment between consumer capabilities, trust quality in the platform, and external conditions.

4.3. Conceptual Model

Here is the conceptual model that illustrates the relationships between the elements in the Theory of Consumer Digital Self-Protection:

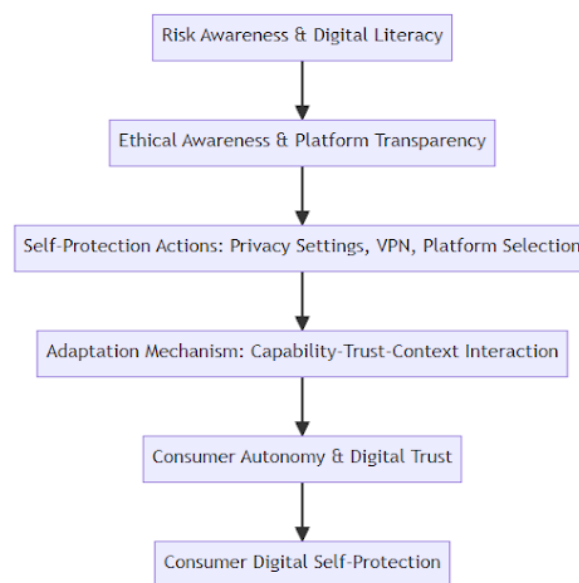


Figure 1. The Conceptual Model of Theory of Consumer Digital Self-Protection

Figure 1 illustrates the structural workflow and core theoretical relationships within the Theory of Consumer Digital Self-Protection:

- **Antecedents (Risk Awareness & Digital Literacy Ethical Awareness & Platform Transparency):** High digital literacy enables consumers to recognize algorithmic manipulation and dark patterns. This cognitive baseline triggers ethical awareness regarding data privacy and leads consumers to scrutinize platform transparency.
- **Behavioral Activation (Ethical Awareness Self-Protection Actions):** Once ethical concerns and transparency gaps are identified, consumers enact concrete behavioral controls, such as altering privacy settings, using VPNs, deleting cookies, or migrating to transparent platforms.

- The Core Mediation (Self-Protection Actions CTC Adaptation Mechanism): Individual protective actions do not operate in isolation; they are mediated through the Capability-Trust-Context (CTC) Adaptation Mechanism. Here, individual Capability (literacy), perceived platform Trust (transparency/reputation), and the environmental Context (regulatory enforcement) determine whether these self-protection actions effectively safeguard the user.
- Outcome (CTC Mechanism Consumer Autonomy & Digital Trust Consumer Digital Self-Protection): Successful adaptation restores consumer decision-making autonomy and establishes sustainable digital trust, culminating in the overarching framework of Consumer Digital Self-Protection.

5. MANAGERIAL IMPLICATION

This research makes a significant theoretical contribution by extending the study of consumer self-protection from a focus solely on data privacy to encompass responses to algorithmic manipulation and biases that shape shopping experiences. Findings indicate that Generation Z in Jakarta is not only concerned about how their data is utilized but also associates product recommendations and displays as forms of algorithmic influence that can steer their choices. Consequently, protective strategies are understood as efforts to maintain consumer autonomy. The proposed conceptual framework includes platform transparency/reputation, digital literacy, and self-regulation, which interact to form a model of consumer protection in AI-driven e-commerce.

To effectively address algorithmic risks and support Generation Z students, university managers should implement targeted operational strategies across three core areas:

- Upgrading Digital Campus Platforms: University IT administrators must embed XAI principles into internal learning management systems (LMS) and student portals, ensuring clear opt-in data consent models, transparent recommendation logic, and robust privacy controls.
- Strengthening Student Support Services: Academic affairs and student services should establish dedicated "Algorithmic Literacy AI Advisory Desks" and integrate hands-on workshops into orientation programs to equip students with practical skills for navigating algorithmic manipulation, dark patterns, and data privacy risks.
- Managing Institutional Reputation: University leaders must establish transparent data governance committees and publish annual digital ethics audits, reinforcing the university's reputation as an ethical, student-centered digital institution that prioritizes data sovereignty and consumer autonomy.

6. CONCLUSION

This research has successfully developed the Theory of Consumer Digital Self-Protection, providing a comprehensive understanding of how Generation Z consumers in Jakarta navigate and respond to algorithmic manipulation within e-commerce platforms. Through a GTA, this study highlights that digital self-protection is not merely a technical endeavor but a complex, adaptive process driven by a synergy of risk awareness, digital literacy, and ethical consciousness.

The findings demonstrate that when consumers possess a high level of digital literacy, they are better equipped to critically evaluate algorithmic influences, thereby enhancing their autonomy in decision-making. Furthermore, the study identifies that social interaction and peer-to-peer knowledge sharing serve as critical catalysts for reinforcing protective strategies, transforming individual awareness into collective digital resilience.

Ultimately, this research contributes to the literature on consumer behavior by offering a multidimensional model the CTC Adaptation Model which explains how consumers balance their trust in platform transparency against the inherent risks of AI-driven environments. The results underscore the necessity for a collaborative approach involving platform providers, policymakers, and consumers to foster a more transparent, ethical, and secure digital marketplace. As AI continues to evolve, this study serves as a foundational framework for future efforts to empower consumers and ensure that digital autonomy remains a central tenet of the e-commerce experience.

7. DECLARATIONS

7.1. About Authors

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7.2. Author Contributions

Conceptualization: EE and FH; Methodology: MK; Software: HB and AE; Validation: EE and AE; Formal Analysis: FH and HB; Investigation: MK; Resources: EE; Data Curation: FH; Writing Original Draft Preparation: EE and AE; Writing Review and Editing: FH and HB; Visualization: MK. All authors, EE, MK, FH, HB and AE, have read and agreed to the published version of the manuscript.

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