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Dark Patterns in Digital Financial Services: Consumer Impact from a Financial and Technological Perspective

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Abstract

Digital Financial Services (DFS) have transformed financial accessibility through mobile banking, digital wallets, and online lending. However, this rapid growth has also led to the rise of dark patterns—deceptive UI/UX strategies that manipulate consumer behavior, leading to unintended financial transactions, hidden fees, or excessive data sharing.

This paper examines the impact of dark patterns in DFS, exploring their psychological foundations and technological enablers. These patterns exploit cognitive biases such as loss aversion and decision fatigue, making users unknowingly opt into subscriptions, incur hidden charges, or accept unfavorable loan terms. AI-driven personalization and big data analytics further amplify these deceptive tactics, using behavioral insights to subtly influence financial decisions.

To counter these harmful practices, this study proposes a multi-faceted approach. Stricter regulatory frameworks must be implemented to enforce transparency and ethical financial design. Industry-wide self-regulation, including responsible UI/UX standards, is crucial to ensuring consumer autonomy. Additionally, improving financial and digital literacy can empower users to recognize and resist manipulative designs. From a financial and technological perspective, this paper discusses dark patterns

through the analysis of survey data to provide such evidence of their impacts in real-world contexts. It identifies common deceptive means, regulatory difficulties, and ways to counteract their bad effects. This study develops a comprehensive risk analysis of depriving digital financial practices and the implications for consumers through the embracement of empirical data and new ways of designing in an ethically meaningful manner, as well as regulating it.

By addressing the intersection of finance, technology, and behavioral science, this paper underscores the urgency of fostering ethical digital financial ecosystems. Ensuring transparency and user trust is essential for a sustainable and consumer-friendly financial landscape.

Keywords: *Dark Patterns, Digital Financial Services (DFS), FinTech, User Interface (UI) Design, User Experience (UX) Manipulation.*

1. Introduction

1.1 Evolution of Financial Technology (FinTech)

The rapid advancement of financial technology (FinTech) has transformed how individuals and businesses interact with financial services. Digital platforms now offer a wide array of services, including online banking, mobile payments, peer-to-peer lending, robo-advisory investment management, and blockchain-based transactions. These innovations have increased convenience, enhanced accessibility, and improved financial inclusion across the globe. FinTech has particularly benefited underserved populations by reducing barriers to entry, streamlining processes, and lowering transaction costs.

1.2 The Role of Digital Financial Services (DFS)

Digital Financial Services (DFS) encompass a broad range of financial products and services delivered through digital channels, such as mobile applications and web-based platforms. The widespread adoption of DFS has facilitated real-time transactions, improved financial literacy, and enabled automated decision-making in areas like investment and credit scoring. While these advancements have made financial services more efficient and user-friendly, they have also introduced new challenges, particularly concerning ethical design practices and consumer protection.

1.3 Understanding Dark Patterns in FinTech

Despite the numerous benefits of DFS, there is a growing concern regarding the use of manipulative user interface (UI) and user experience (UX) design techniques known as **dark patterns**. Dark patterns refer to design choices that intentionally deceive, coerce, or mislead users into taking actions that may not align with their best interests. These deceptive tactics exploit cognitive biases, nudge users toward unintended financial commitments, and obscure critical information such as hidden fees or unfavorable terms. In the FinTech industry, dark patterns can significantly impact consumers' financial well-being, leading to unintended expenses, increased debt, or loss of trust in digital financial services.

1.4 Financial and Technological Impact of Dark Patterns

The integration of artificial intelligence (AI), big data, and behavioral analytics in DFS has enabled financial service providers to refine dark patterns, making them more effective and harder to detect. Financially, these deceptive practices can push users toward excessive spending, hidden charges, or difficulty in canceling subscriptions. Technologically, dark patterns leverage personalized algorithms, automated nudging, and A/B testing to continuously optimize user manipulation. This not only leads to

financial instability for users but also raises ethical concerns regarding transparency, informed consent, and fair business practices.

1.5 Research Objectives and Scope

This research aims to provide a comprehensive analysis of dark patterns in DFS, focusing on their financial and technological implications. The key objectives include:

- Identifying and categorizing common dark patterns in FinTech applications.
- Examining the psychological mechanisms and cognitive biases exploited by these tactics.
- Analyzing the role of AI, machine learning, and data analytics in enabling dark patterns.
- Assessing the impact of dark patterns on consumer financial decision-making and overall financial stability.
- Proposing ethical frameworks and regulatory measures to mitigate the harmful effects of dark patterns in DFS.

1.6. Significance of the Study

As FinTech continues to evolve and shape the financial landscape, it is crucial to address the ethical concerns surrounding UI/UX design practices. By shedding light on deceptive design strategies, this study aims to empower policymakers, industry stakeholders, and consumers to advocate for transparent and responsible digital financial services. Strengthening consumer protection laws, promoting ethical design standards, and increasing financial literacy can help mitigate the risks posed by dark patterns, fostering a more equitable and trustworthy digital financial ecosystem.

Through this research, we seek to bridge the gap between technological innovation and ethical responsibility, ensuring that FinTech serves as an enabler of financial empowerment rather than a tool for manipulation

2. Literature Review

2.1 Dark Patterns: Definition, Types, and Prevalence

Arunesh Mathur et al. [2] define dark patterns as user interface design choices that benefit an online service by coercing, steering, or deceiving users into making unintended and potentially harmful decisions. These patterns are not merely instances of poor design but rather deliberate attempts to exploit users' cognitive biases and vulnerabilities.

Mathur et al. conducted a large-scale study of shopping websites and identified 1,818 instances of dark patterns across approximately 53,000 product pages from around 11,000 websites. They categorized these patterns into 15 types within 7 broader categories, highlighting the diverse range of deceptive practices employed by online services. These categories include:

- **Obstruction:** Making it difficult for users to perform a desired action, such as canceling a subscription or deleting an account.
- **Sneaking:** Hiding important information or sneaking additional items into a user's cart without their explicit consent.
- **Urgency:** Creating a false sense of urgency to pressure users into making a purchase, such as displaying countdown timers or limited-time offers.
- **Misdirection:** Using visual cues and language to steer users towards a specific choice, often at the expense of their best interests.
- **Social Proof:** Manipulating users' perceptions of social norms to encourage them to take a particular action, such as displaying fake reviews or testimonials.
- **Forced Action:** Requiring users to perform an action they may not want to in order to access a service or continue using a platform.
- **Interface Interference:** Using visual elements to distract users from critical information or to make it difficult for them to navigate the interface.

Alberto Monge Roffarello, Kai Lukoff, and Luigi De Russis [4] focus on attention capture damaging patterns (ACDPs), which lead to attentional harms. Their systematic literature review identified eleven common types of ACDPs, such as Time Fog and Infinite Scroll.

2.2 Psychological Underpinnings of Dark Patterns

Dark patterns are effective because they exploit well-documented psychological principles and cognitive biases. These biases, which are often unconscious, can influence users' decision-making processes in predictable ways. Some of the key psychological principles underlying dark patterns include:

- **Loss Aversion:** The tendency to feel the pain of a loss more strongly than the pleasure of an equivalent gain. Dark patterns often exploit loss aversion by framing choices in terms of potential losses, such as "Don't miss out on this limited-time offer!"

- **Scarcity Effect:** The tendency to value things more when they are perceived as scarce or limited. Dark patterns use scarcity tactics, such as countdown timers and limited-quantity warnings, to create a sense of urgency and encourage impulsive purchases.
- **Social Proof:** The tendency to rely on the behavior of others to guide one's own actions. Dark patterns exploit social proof by displaying fake reviews, testimonials, or popularity indicators to create the impression that a product or service is desirable.
- **Anchoring Bias:** The tendency to rely too heavily on the first piece of information received (the "anchor") when making decisions. Dark patterns can manipulate the anchoring bias by presenting an initial price or offer that is artificially high, making subsequent offers seem more attractive.
- **Framing Effect:** The way in which information is presented can significantly influence decision-making. Dark patterns exploit the framing effect by presenting choices in a way that emphasizes the positive aspects of one option and the negative aspects of another, even if the underlying information is the same.
- **Default Bias:** The tendency to stick with the default option, even if it is not the most beneficial. Dark patterns exploit the default bias by pre-selecting options that benefit the service provider, such as automatically enrolling users in recurring subscriptions or adding unnecessary items to their shopping carts.

2.3 Technological Enablers of Dark Patterns

The proliferation of dark patterns in DFS is facilitated by several key technological trends, including:

- **Big Data:** The vast amounts of data collected by digital platforms enable them to personalize dark patterns and target specific users based on their individual vulnerabilities and preferences.
- **Algorithms:** Sophisticated algorithms can be used to optimize the effectiveness of dark patterns, testing different variations and identifying the most persuasive techniques for manipulating user behavior.
- **Artificial Intelligence (AI):** AI-powered chatbots and virtual assistants can be used to engage users in deceptive conversations, guiding them towards specific financial decisions without their full awareness.

- **A/B Testing:** This allows companies to test different versions of a webpage or app to see which one is more effective at achieving a desired outcome, such as increasing sales or sign-ups. This can be used to optimize dark patterns and make them more effective.

2.4 Impact of Dark Patterns on Consumers

Dark patterns can have a significant negative impact on consumers' financial well-being, leading to:

- **Unnecessary Purchases:** Dark patterns can trick users into buying products or services they do not need or cannot afford.
- **Unexpected Fees:** Hidden fees and charges can significantly increase the cost of DFS, eroding consumers' savings and increasing their debt burden.
- **Recurring Subscriptions:** Dark patterns can automatically enroll users in recurring subscriptions without their explicit consent, leading to ongoing charges that are difficult to cancel.
- **Data Privacy Violations:** Dark patterns can manipulate users into sharing their personal data without fully understanding the implications, increasing their risk of identity theft and financial fraud.
- **Poor Financial Decisions:** By exploiting cognitive biases and psychological vulnerabilities, dark patterns can lead users to make suboptimal financial decisions that harm their long-term financial security.
- **Erosion of Trust:** The use of dark patterns can erode consumer trust in DFS providers, making them less likely to use these services in the future.

2.5 Regulatory and Ethical Considerations

The use of dark patterns raises significant regulatory and ethical concerns. While some jurisdictions have begun to address these practices through legislation and enforcement actions, many gaps remain in the existing legal framework. Some of the key regulatory and ethical considerations include:

- **Consumer Protection Laws:** Existing consumer protection laws may not adequately address the unique challenges posed by dark patterns in the digital environment.

- **Data Privacy Regulations:** Data privacy regulations, such as the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA), aim to protect consumer privacy but may not fully address the manipulative use of data in dark patterns .
- **Industry Self-Regulation:** Industry self-regulation can play a role in mitigating the use of dark patterns, but it may not be sufficient to address the problem fully.
- **Ethical Design Principles:** Incorporating ethical design principles into the development of DFS can help to prevent the creation and implementation of dark patterns.
- **Transparency and Disclosure:** Increasing transparency and disclosure about the design choices and algorithms used in DFS can help consumers make more informed decisions.

3.0 Methodology

An assessment of dark pattern usage in online financial products was conducted through surveys directed at consumer participants. The research collected information from participants regarding their encounters with undisclosed fees, deceptive navigation, and difficulties in terminating payments. The research data concentrated on evaluating customer trust, as well as reported financial losses and difficulties with customer service.

Multiple demographics were part of the survey, including users from different age categories, economic backgrounds, and geographical locations. The research instrument contained both quantitative and qualitative elements, allowing participants to share detailed instances of deceptive financial service practices.

3.1 Survey Analysis

The survey examined consumer experiences with dark patterns in digital financial services. Data was collected on various deceptive tactics used by financial platforms, including hidden fees, misleading UI designs, and unauthorized transactions. The survey also assessed consumer trust levels and the effectiveness of customer support in resolving issues related to dark patterns.

3.2 Data Collection and Participant Demographics

- **Participant Size:** The survey included a diverse group of respondents across different financial literacy levels and socioeconomic statuses.
- **Age Groups:** Participants ranged from young adults (18-24) to senior citizens (55+), ensuring insights across multiple age demographics.

- **Geographical Distribution:** Respondents were from various regions, highlighting differences in financial service experiences across locations.
- **Survey Methodology:** A combination of multiple-choice questions, Likert scale ratings, and open-ended responses was used to obtain both statistical insights and personal experiences.

3.3 Key Findings and Analysis

3.3.1 Key Findings

The survey results highlight significant consumer challenges with dark patterns in digital financial services. The key findings are:

- I. **Hidden Charges:** 68.1% of respondents reported encountering unexpected fees after signing up for financial services.
- II. **Forced Subscriptions:** 53.2% of users struggled to cancel services, often due to misleading or difficult-to-navigate cancellation processes.
- III. **UI Manipulation:** 59.6% of participants felt misled by design elements such as pre-selected options and unclear navigation.
- IV. **Misleading Offers & Rewards:** 51.1% reported receiving offers that were not as advertised, leading to unexpected conditions or costs.
- V. **Unauthorized Transactions:** 55.3% experienced unauthorized charges due to pre-checked boxes or deceptive consent mechanisms.
- VI. **Customer Support Issues:** 42.6% reported difficulties with customer support, including automated responses and a lack of human assistance.
- VII. **Confusing App Design:** 38.3% found financial apps intentionally misleading, making it hard to manage services or opt out of subscriptions.
- VIII. **Trust Levels:** The average trust rating in digital financial services was **4.6/10**, indicating widespread consumer dissatisfaction.

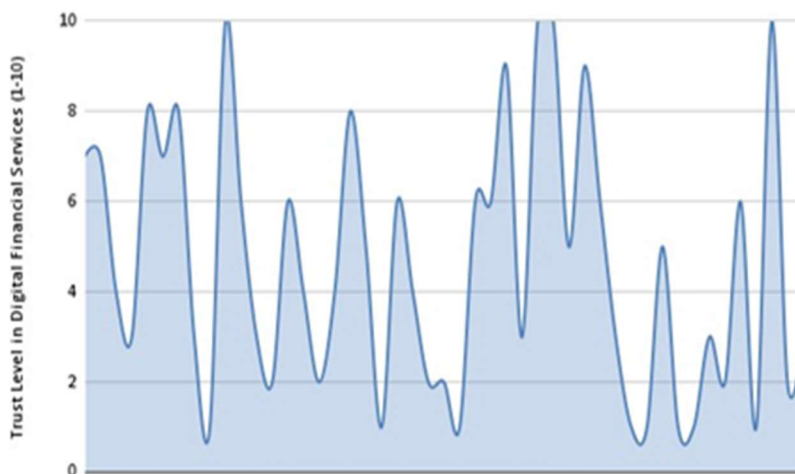
3.3.2 Analysis of Results

The findings suggest that dark patterns significantly impact consumer trust and financial well-being. The survey data points to the widespread use of deceptive design elements in digital financial platforms, leading to financial losses, frustration, and erosion of consumer confidence. Some critical insights include:

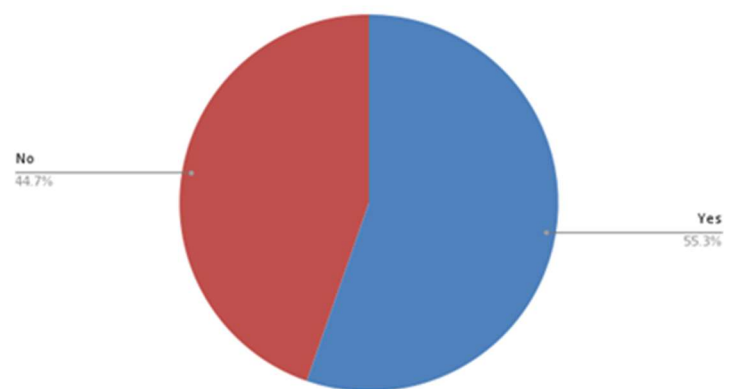
- **The Role of Hidden Fees:** A significant percentage of respondents encountered hidden charges, which indicates a systemic issue with transparency in financial products. This aligns with previous studies that highlight how financial institutions leverage dark patterns to generate additional revenue.
- **Forced Continuity and Cancellation Barriers:** The difficulty in unsubscribing from services suggests intentional obfuscation, making it challenging for users to exit financial commitments.
- **Manipulative UI Designs and Pre-Checked Options:** Many respondents fell victim to deceptive interfaces that subtly nudged them into making unintended financial decisions. This manipulation can have lasting financial consequences, particularly for less financially literate individuals.
- **Customer Support as a Hindrance:** A high percentage of respondents struggled to get meaningful assistance, suggesting that some companies use poor customer support as a deterrent to resolving issues effectively.
- **Low Consumer Trust Levels:** The overall trust rating of 4.6/10 is an indicator of the growing skepticism among consumers regarding digital financial platforms. This suggests a need for regulatory oversight and increased consumer awareness campaigns.

The results underscore the urgency of addressing dark patterns through better financial education, stricter regulations, and ethical design practices. Enhanced transparency and consumer protection measures are critical to ensuring fair financial experiences in the digital age.

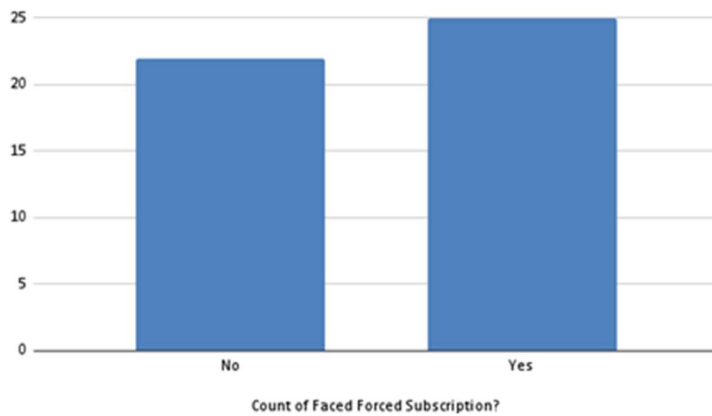
Trust Level in Digital Financial Services (1-10)



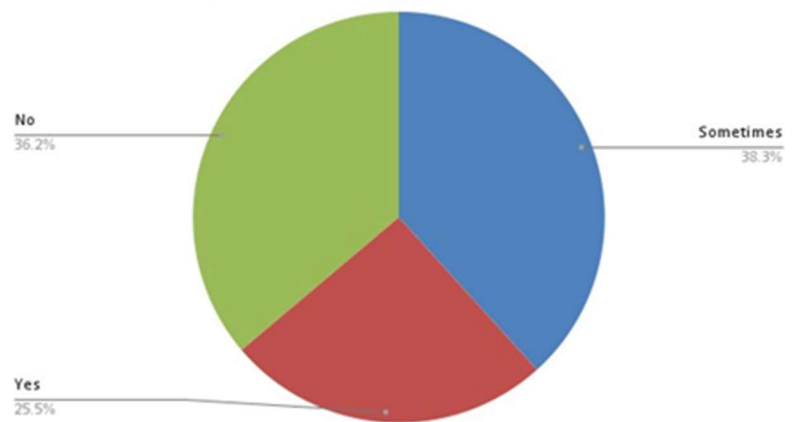
Count of Unauthorized Transactions Observed?



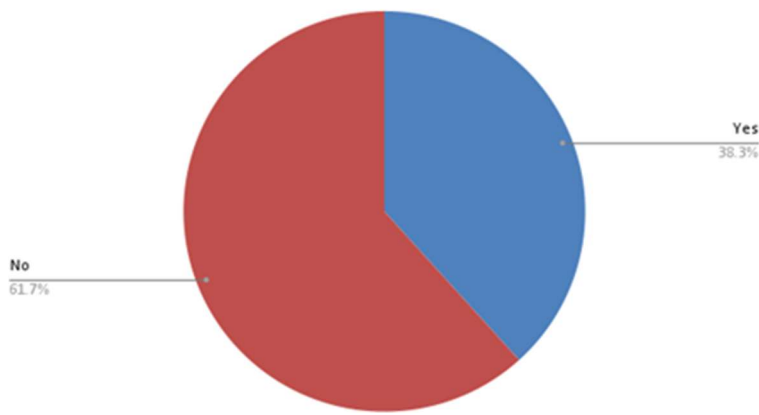
Count of Faced Forced Subscription?



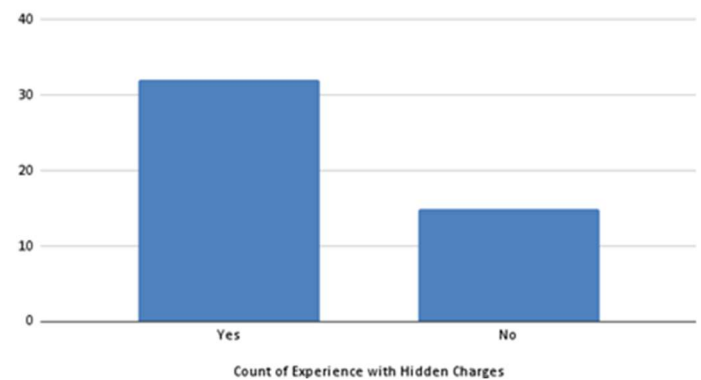
Count of Difficulty Understanding Terms & Conditions?



Count of Found App Design Confusing/Misleading?



Count of Experience with Hidden Charges



3.4 Implications for Regulation and Industry Practices

The study underscores the importance of implementing stringent policies to combat deceptive digital financial practices. Key recommendations include:

- **Regulatory Frameworks:** Strengthening consumer protection laws to explicitly address digital dark patterns.
- **Transparency Requirements:** Mandating clear disclosure of pricing, fees, and contract terms.
- **User-Centric Design Standards:** Encouraging ethical UI/UX practices that prioritize consumer welfare.
- **Industry Accountability:** Implementing independent audits to assess and penalize unethical financial service providers.

By addressing these issues, regulatory bodies and financial service providers can create a fairer and more transparent digital financial landscape for consumers.

4.0 Discussion

4.1 Financial Implications

Dark patterns have profound financial consequences, affecting both individual consumers and the broader financial system. By exploiting user vulnerabilities, these deceptive practices can lead to suboptimal financial decisions with long-term negative impacts.

4.1.1 Increased Debt Burden

Unnecessary purchases, hidden fees, and recurring subscriptions contribute to mounting consumer debt. This makes financial security difficult to achieve, especially for individuals already facing economic constraints.

4.1.2 Reduced Savings

Dark patterns often encourage impulsive spending and direct consumers toward financial products with lower returns. This erosion of savings can have severe long-term consequences for financial well-being.

4.1.3 Financial Distress

The cumulative effect of dark patterns can result in financial distress, including difficulties in paying bills, deteriorating credit scores, and, in extreme cases, bankruptcy.

4.0.1 Exacerbation of Inequality

Vulnerable populations, such as those with lower financial literacy or cognitive impairments, are disproportionately affected by dark patterns. This exacerbates existing financial inequalities and places these groups at greater risk of exploitation.

4.1 Technological Perspective

The increasing reliance on digital financial services underscores the need for ethical design and accountability in technology deployment. The use of big data, algorithms, and artificial intelligence (AI) to manipulate user behavior raises ethical concerns.

4.1.1 Algorithmic Transparency

Greater transparency is required in how algorithms collect, process, and utilize user data. Financial service providers must disclose the mechanisms behind their decision-making processes.

4.1.2 Ethical AI Development

AI systems should be designed and deployed in a manner that upholds ethical standards and prioritizes consumer protection over exploitative engagement strategies.

4.1.3 User Control and Autonomy

Users should be given greater control over their personal data and the algorithms influencing their financial decisions. This includes clearer consent mechanisms and options to opt out of manipulative digital practices.

4.2 Mitigation Strategies

Addressing the harmful effects of dark patterns in digital financial services (DFS) requires a combination of regulatory interventions, industry self-regulation, and consumer education.

4.2.1 Regulatory Measures

- **Strengthening Consumer Protection Laws:** Laws must be updated to explicitly address dark patterns in digital environments.
- **Enforcement Actions:** Regulatory bodies should proactively investigate and penalize companies engaging in deceptive practices.
- **Data Privacy Regulations:** Stronger regulations are required to prevent data manipulation for exploitative design tactics.

4.1.4 Industry Self-Regulation

- **Ethical Design Guidelines:** Industry organizations should establish and enforce ethical design standards that prohibit the use of dark patterns.
- **Independent Audits:** Regular audits of DFS platforms should be conducted to identify and rectify dark pattern usage.
- **Transparency and Disclosure:** Companies should provide clear disclosures regarding their design choices and the algorithms used to influence user behavior.

4.1.5 Consumer Education

- **Financial Literacy Programs:** Consumers should be educated on recognizing and avoiding dark patterns in financial products.
- **Public Awareness Campaigns:** Mass awareness initiatives can help users identify manipulative design practices and take informed actions.
- **Encouraging Critical Thinking:** Consumers should be encouraged to critically evaluate the financial information presented to them and question manipulative interfaces.

4.2 The Role of Developers

Brinda Sampat, Emmanuel Mogaji, and Nguyen Phong Nguyen emphasize the importance of understanding FinTech developers' perspectives on dark patterns. Their research identifies key themes such as customer vulnerability, technical limitations, and regulatory gaps.

4.3 The Role of Policymakers

Stuart Mills et al. propose a **dark pattern auditing framework (DPAF)** to support policymaker efforts in addressing deceptive practices. They highlight the connection between dark patterns and the behavioral science concept of **sludge**, which refers to unnecessary friction that impedes consumer decision-making.

5.0 Conclusion

Dark patterns pose a significant threat to consumers' financial well-being in the digital age. By exploiting psychological vulnerabilities and leveraging sophisticated technologies, these deceptive design practices can lead to unnecessary purchases, unexpected fees, data privacy violations, and poor financial decisions. Mitigating the harmful effects of dark patterns requires a multi-faceted approach involving regulatory measures, industry self-regulation, and user education. By working together, policymakers, industry stakeholders, and consumers can create a more transparent, ethical, and consumer-friendly digital financial landscape.

5.1 Implications for Consumers

The impact of dark patterns extends beyond individual financial losses. Consumers face long-term consequences such as increased financial stress, reduced trust in digital financial services, and difficulty in managing their financial decisions effectively. The prevalence of these manipulative practices underscores the need for improved financial literacy and awareness.

5.2 Implications for the Financial Industry

The widespread use of dark patterns in digital financial services can damage the reputation of financial institutions and fintech companies. Ethical concerns surrounding these deceptive practices may lead to regulatory crackdowns, legal repercussions, and loss of consumer trust. Financial service providers must adopt transparent and ethical design practices to build long-term consumer confidence.

6.0 Future Research Directions

Future research should focus on:

6.1 Enhancing Detection Mechanisms

- Developing more sophisticated methods for detecting and classifying dark patterns.
- Leveraging AI and machine learning to automate the identification of deceptive design elements.
- Conducting large-scale studies to assess the prevalence of dark patterns across different financial platforms.

6.2 Understanding Consumer Behavior

- Investigating the long-term impact of dark patterns on consumers' financial behavior.
- Evaluating the psychological and cognitive biases that make consumers susceptible to dark patterns.
- Exploring how demographic factors, such as age, income level, and digital literacy, influence susceptibility.

6.3 Evaluating Mitigation Strategies

- Assessing the effectiveness of regulatory interventions in curbing dark patterns.
- Exploring the role of ethical design guidelines in reducing deceptive practices.
- Studying the impact of consumer education initiatives on awareness and resistance to dark patterns.

6.4 Ethical and Technological Considerations

- Examining the ethical implications of using AI and big data in digital financial services.
- Investigating the role of algorithmic accountability in ensuring fair and transparent digital transactions.
- Analyzing how social media and online advertising contribute to the proliferation of dark patterns.

6.5 Broader Societal and Security Concerns

- Understanding the role of platform-user power dynamics in shaping algorithmic decision-making .

- Exploring the impact of technology-facilitated financial exploitation on vulnerable populations, particularly women and marginalized groups .
- Investigating the use of machine learning and AI in cyber defense systems for the banking industry .

These research directions will contribute to a deeper understanding of the challenges posed by dark patterns in DFS and inform the development of effective solutions to protect consumers in the digital age.

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