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Enhancing Participation of People Aged 75+ in Clinical and Applied Health Research Through Inclusive, Technology-Enabled Methodologies

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Abstract

Older adults, aging 75 years and older are barely represented in clinical and applied health research because of health-related limitations, barriers to digital access, and methodological approaches. This study sought to co-design, trial and evaluate inclusive, digital ways to support the participation of older adults in health research. A mixed methods design was employed, comprising a quantitative phase (N = 50) followed by qualitative interviews (n = 12). The quantitative part highlighted that 66% of participants had access to a digital device whereas 48% of participants reported low confidence in their ability to use devices. Age sub-group analysis indicated that participants aged 80+ years, indicated significantly lower confidence and willingness to participate compared to those aged 75-79 years. The qualitative part revealed four themes: barriers vs facilitators to digital participation, importance of human support, trust and motivation, and preference for hybrid approaches. These findings demonstrate the need for practical, feasible and scalable strategies including caregiver supported digital participation, an emphasis on simplified technologies and flexible hybrid recruitment strategies. This study contributes to an emerging body of literature on inclusive methods and practical recommendations for enhancing the relevance and accessibility of health research for and with older adults.

Keywords: Older adults, inclusive research, technology-enabled methods, digital literacy, participation, mixed-methods

Introduction

The Office for National Statistics (UK) support the assertion that older adults over the age of 75, are one of the fastest growing subsets of the UK population. It is expected that there will be an increase in 5.3million adults aged over 75 years in 2025 to 7.8million in 2045, representing a shift to an ageing population (UKRI, 2025). This group are some of the highest users of health and social care including hospital admissions, long-term care and medication, and they are continuously underrepresented in clinical and applied health research (NIHR, 2025). Evidence pointed to the bulk of this exclusion from research being around health-related issues, frailty and multimorbidity, cognitive impairment and mobility. The older adult population, particularly those from disadvantaged backgrounds, can also face technological exclusion such as low familiarity with smartphones, tablets and web-based health resources. Such systematic under-representation not only recognizes fundamental inconsistencies in the generation of knowledge, but the outcomes of research directed to younger or healthier populations, may not capture the outcomes, preferences or needs of older adults, making the relevance and applicability of interventions limited for older adults.

It is a well-known fact that digital exclusion ranks among the main reasons why people aged 75 years or older do not take part in various activities. This is mainly because of their lack of access to devices, poor digital skills, and not being familiar with the Internet. The term technology-enabled research in this paper is used in a general sense to indicate all research activities that are

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supported by digital tools, and digital participation is the term used to indicate the ways participants interact with these tools (for example, filling out online surveys), while remote monitoring is used more specifically to refer to the devices or systems that are used to collect data from home (such as wearables or telehealth systems). By making a distinction among these concepts, it becomes easier to understand the kinds of barriers that older people are likely to face and why it is so important to involve them in the research process in the first place, to create methods that are inclusive.

In the United Kingdom, recognized funding bodies focusing on research, particularly the National Institute for Health and Care Research (NIHR), have indicated that involving older adults in health-related research is a methodological and ethical necessity (NIHR, 2025). Older adults have specific health needs that require tailored interventions and, despite this, research often excludes their viewpoints, specifically, older adults that experience frailty, sensory impairment, or cognitive decline. Evidence shows that interventions for chronic conditions, lifestyle programs or digital price monitoring tools are largely developed and tested on younger participants, creating a lack of evidence regarding their feasibility, safety and/or acceptability for adults aged 75 and older (NIH, 2009). The absence of evidence is particularly concerning; older adults represent a disproportionate share of hospital admissions, primary care consultations and demand for long-term care in the UK, meaning that the new research findings will be highly relevant to older adults' health trajectories and care pathways (UKRI 2025).

Multiple types of structural and methodological barriers result in the underrepresentation of older adults in the research context. Recruitment approaches conventionally consist of online advertisements, patient portals, or self-enrolment processes that assume participants have a minimum level of digital literacy to agree to the study which excludes certain participants without basic technological skills. There are physical barriers that act to minimize participation rates including, but not limited to, transportation difficulties, physical mobility limitations, and sensory challenges. These barriers reduce participation levels in studies, particularly multi-site trials or longitudinal studies, where participants are typically required to repeatedly return to the hospital site for the study protocols (Chadwick & Bergschöld, 2024). Cognitive barriers act as both ethical and practical barrier including, but not limited to, participants with mild cognitive impairment or dementia. Therefore, researchers often exclude cognitively impaired older adults in research for ethical considerations around the informed consents process. Thus, research samples are usually limited to a younger, healthier, and more technologically literate segment of older adults as samples, while the oldest (and more vulnerable) adult population is storied to be underrepresented. The implications of excluding older adults go beyond issues of methodology; interventions developed without representative input may be ineffective or inappropriate for the population most likely to use them. For example, digital health tools developed without older adults may be harder to use, be based heavily on text, and involve faster-paced responses, which can exclude individuals with slower cognitive processing and sensory barriers. This usability issues lower adherence, decrease intervention effectiveness, and may perpetuate existing health inequalities. In the context of the UK, where digital health is at the forefront of the national agenda in areas such as remote monitoring, telemedicine, and personalized care, it is acknowledged that the absence of input and engagement from older adults will only exacerbate inequalities of access to new modes of healthcare services and their perceived benefits through the rise of digital health (Reyes & Kukucka, 2023; UKRI, 2025).

New policy initiatives in the UK have positioned inclusive research as a relevant priority area. The UK Research and Innovation (UKRI) framework called "fostering inclusive research" is clear on

underscoring the importance of older adults with a call for the relevant justification for excluding any older person, and to plan for actioning for older adults beyond the age of 75 years (UKRI, 2025). Additional NIHR funding guidance indicates a heightened expectation for research with older adults in adaptive and flexible ways of working that consider physical, cognitive, and digital literacy barriers for older adults. Despite the various policy documents urging more inclusive research, our own evidence, and NIHR documentation (2025) suggests that still, older adults aged 75 years and older are still a low number of research participants, which seems to indicate an incongruity between the expectations of researchers and policy makers for older adults at 75 years and older, and their expectation for us to action in practice. Therefore, this evidence highlights an urgent need for practical evidence-informed strategies for meaningful inclusion of older adults, particularly in studies where technology is being used for data collection, monitoring, or to deliver, or facilitate an intervention.

Research that leverages technology creates opportunities and challenges for the inclusion of older adults. The potential of digital technology, various forms of remote monitoring, telehealth, and the language of exciting technology to break down geographic and physical barriers to access, enabling participation from home, and reducing travel time is significant. However, many adults aged 75 years and older may not have this lower-level access, required digital literacy, or familiarity with technology that presumes the use of technology (Reyes & Kukucka, 2023). If these examples of technology are not designed for, or accompanied with support to facilitate access, the stated use of technology will likely unintentionally exclude older adults who may benefit from research participation. There is a growing awareness that technology has the potential to not only break down barriers, but to also counter them through a number of modifications to design, such as simplified interaction designs, inclusion of assistive technology, personalized or individualized training in engagement or technology interaction, consideration of hybrid designs (involving in-person and remote engagement), or designing technology with older adults to address inclusivity, representativeness, and validity.

Beyond the methodological considerations, there lies an important ethical obligation to involve older adults in research. Exclusion from research based on age, health status, or cognitive ability can spawn systemic ageism where older adults are denied the opportunity to help create and benefit from the scientific knowledge base. Ethical structures in the UK, including ethics based in guidance by NIHR and the NHS Health Research Authority, specify that whenever possible older adults should be empowered to participate with appropriate safeguards and adaptations to enable their engagement. (NIHR 2025) It is an ethical position that aligns with social justice principles and the drive for equity and evidence-informed policy decisions while making sure that interventions, treatments, and health technologies are relevant and usable by people of all ages.

In conclusion, the underrepresentation of adults aged 75 and older in health research in the UK represents an on-going and persistent challenge. Most effective action involves a multi-faceted response employing methodological innovation, technological adaptation and ethical commitment. Research methods must incorporate the physical, cognitive, and digital barriers that exist for older adults, while also demonstrating active engagement through the process of designing, conducting and evaluating research tailored towards older adults. Consequently, when researchers from the UK investigate the experiences of older adults in health research, there will be findings that will be more representative, equitable, and transferable to the populations who are the most dependent on health and social care. Developing and evaluating an inclusive, technology-enabled method for older adults is not only a methodological need and scientific necessity but is also a moral mandate

in society; maximizing the benefits of research for one of the most at-risk, highest need populations in the UK.

Literature Review

Determinants for Participation

The participation of older adults in health research is influenced by a myriad of physical, cognitive, and psychosocial factors. Examples of physical factors are frailty, chronic conditions (e.g. hypertension, arthritis) or reduced mobility, which may prevent physical attendance at the research site or the accordance with research requirements (NIH, 2009). Additionally, cognitive function and decline (e.g. mild cognitive impairment, dementia) make recruitment and obtaining consent even more challenging. Psychosocial factors may include distrust of any research undertaking by research institutes, the belief that the study does not apply to them personally and not wanting to burden family caregivers (Győrffy & Colleagues, 2023). Studies conducted across the UK and other high-income countries using comparable research methodology have demonstrated that these obstacles affecting older adults' engagement in research are especially apparent in those aged 80 and over. This suggests a gradient of exclusion exists amongst older adults (Jorgenson & colleagues, 2023, 2023). Subsequently, obstacles to participation in research for older adults arose from digital exclusion. Many older adults reported limited access to devices (smart phone, tablet, computer), low confidence and abilities using the devices, and little knowledge of how to use the technology for engagement (Schroeder et al., 2023). The experience of physical, cognitive and digital exclusion highlights the area of overlap and interconnected components of considerations when engaging older adults in studies, and thus should be considered when developing targeted strategies.

Inclusive Research Approaches

A variety of inclusive research methodologies have been conceived and tested internationally to facilitate engagement with older adults. Research has shown that flexible recruitment procedures, such as home visits, requesting telephone consent, and carer referral options, facilitate engagement and retention (Jorgenson & colleagues, 2023, 2023). Examples from within the UK show that longitudinal studies involving face-to-face support, or adapted to meet the study participant's needs, report completion rates, adherence and in some studies, reports of better-quality data (UKRI, 2025). There is some limited evidence supporting that it is reasonable to enact simplified consent procedures, or flexible scheduling of visits to support with cognitive limitations while maintaining ethical research. However, there is no evidence of how the technologies can be incorporated with inclusive material in the research process, and much UK studies have focused on conventional in-person approaches. This represents a significant gap in our evidence base, and we do not have a lot of knowledge on what digital materials might improve the inclusiveness of participatory research with older adults 75+. (Reyes & Kukucka, 2023).

Technology in Research Participation

Digital technology, including telehealth, wearable sensors, mobile applications, and online surveys, can help overcome geographic and mobility barriers and enable remote participation with older adults (Reyes & Kukucka, 2023). Studies suggest that hybrid online and in-person approaches to recruitment, retention and data quality will have benefits through technology and human readiness. If older adults are hesitant to learn to use a technology, this poses an accessibility

and usability challenge (Zhao et al., 2023 et al., 2023). Older adults report barriers including small screens, navigation that can be complex, and response times that seem fast, while being barriers to participation, bias and data collection (Stegner et al., 2023). While these are all important user experiences to be mindful of, effective participation will often require media and tools to be purposefully designed to anticipate intuitiveness, accessibility and consideration for cognitive and physical capabilities of older adults.

Participatory Design and Sociotechnical Considerations

Evidence shows that participatory design strategies, such as co-design workshops and Situated Participatory Design, can improve overall usability, acceptability, and participation in research projects involving technology (Zhao et al., 2024; & Stegner and colleagues, 2023). Participatory design strategies engage older adults in the design and testing of research projects, allowing researchers to ensure the methods are usable given older adults' physical, cognitive, and digital capabilities. The idea of "sociotechnical ageism" shows how researchers, when considering older adults' assumed capacity with technology, may wrongly exclude older adults from research (Zhao et al., 2023 et al., 2023). Involving older adults at the beginning of the design process helps to reduce these assumptions and better facilitate participation, engagement and thus better overall data quality.

Evidence from UK Contexts

Although there is only a limited number of studies from the UK that can help to understand challenges and facilitators of older adult participation, the studies funded by NIHR have helped to identify some barriers to participation which included transport, digital illiteracy, and ethical issues and some interventions that involve digital and home-based data collection with caregiver support have helped support engagement and retention (NIHR, 2025). UKRI (2025) also note the importance of methodologies in research that can accommodate heterogeneity including differences in health status, cognitive function and confidence in digital technology. Despite this evidence there is currently a lack of appraising the technology-enabled and inclusive national research methods for older people aged 75 years and over with regard to health and social care in the UK context. This points to a distinct need for a research design that is evidence-based in its scope focused on health and social care contexts.

Research Gap and Rationale

Although promising strategies for improving participation of older adults can be found in international literature, there is a lack of evidence based on the UK context, especially evidence relating to technology-enablement and specifically for adults aged 75+. Most research studies report on younger old people and / or report using traditional face to face methods. As such, older old people, who may also be the most vulnerable, are under-represented (Jorgenson & colleagues, 2023, 2023; UKRI, 2025). Under-representation restricts the generalisability of the research findings and presents potential risk for health inequalities within populations that rely on health care services. Addressing this is critical to ensure that research findings are relevant, equitable and useful to inform interventions to support the health and wellbeing of older adults in England.

Objectives, Research Questions, and Hypotheses

The purpose of this research is to address a research gap by developing and evaluating inclusive, technology-enabled methods for adults aged 75+ in the UK. The aims of the research are:

1. To explore the barriers to participating in research for adults aged 75+ in the UK.
2. To co-design and evaluate inclusive, technology-enabled methods that minimise those barriers.
3. To evaluate if the methods enable higher participation and improve the experience of older adults in research.

The research aims to respond to the following research questions:

1. What are the barriers to health research participation for adults aged 75+ in the UK?
2. What are some technology-enabled methods that can overcome these barriers?
3. How can these methods improve research participation and research experience for older adults?

This research proposes the following hypotheses:

- H1: More confident digital users will be more willing to participate in health research.
- H2: Older adults aged 80+ will report lower confidence and higher barriers than adults aged 75-79 years.

Methodology

Research Design

The application of a mixed-methods approach characterized the study, namely, the combination of a cross-sectional quantitative survey and semi-structured qualitative interviews. This method was selected as it allowed for the combination of the wide range of survey data and the narrative insights from interviews.

Sampling Procedure

A stratified purposive sampling strategy was used to assure the presence of each age subgroup within the 75+ population and invite subjects who are at different levels of digital familiarity.

Stratification criteria

Strata were determined by:

- Age group: 75–79 & 80+
- Living situation: living alone vs. living with others
- Self-reported digital confidence: low (1–2), moderate (3), high (4–5)

Recruitment took place through GP patient networks, community groups, local ageing organisations, and digital inclusion programmes. Participants were purposely selected to ensure representation across these strata.

Sample size rationale

The sample was to consist of 50 participants for the survey and 12 for the qualitative interview, so that there was enough variation across heterogeneous dimensions without the imposition of a big burden on implementation.

Sample and Recruitment

Survey sample (N = 50): The individuals 75 years and older were gathered from general practitioner lists, community groups, and nursing homes. The application of a stratified purposive sampling method monitored the variations in age, gender, and living situation being taken into account.

Interviews (n = 12): The interview was proposed to a chosen group of survey respondents to illuminate the issue of obstacles, and incentives, and heirs in the first place.

Data Collection

Survey

The survey could be given in either paper or electronic format, depending on the participant's preference. The 32-item questionnaire covered the areas of the demographic survey, digital access, technology confidence and willingness to participate, and perceived barriers.

Technology confidence

A 6-item scale derived from digital literacy and digital readiness instruments measured confidence in using smartphones, tablets, computers, texting, email, and video calls (1 = not at all confident, 5 = very confident). Scores were averaged to produce a composite confidence score (Cronbach's $\alpha = 0.88$).

Operationalisation of barriers

A 6-item barrier inventory, informed by digital exclusion and accessibility literature, captured the extent to which each barrier affected participants (1 = not a barrier, 4 = major barrier).
Barriers included:

- Limited digital skills
- Mobility limitations
- Cognitive concerns
- Perceived lack of relevance
- Transportation difficulties
- Mistrust of institutions

A total barrier score (range 6–24) was computed by summing all items.

Willingness to participate

Willingness to engage in technology-enabled research was measured using four items assessing preparedness for:
(a) online surveys, (b) video-call interviews, (c) remote monitoring/data tracking, and (d) hybrid studies.
Responses were on a 5-point Likert scale (1 = not at all willing, 5 = very willing).
Demographic variables included age (continuous and categorical), gender, living conditions, and long-term health issues.

Interviews

The semi-structured interviews (30–45 minutes) were conducted either in person or through a video call. Questions revolved around the participants' experiences of being involved in research, their attitudes towards technology, and their preferred research method.

Data Analysis

Quantitative analysis

Descriptive statistics (means, standard deviations, frequencies) summarised technology confidence, barriers, and participation willingness.
Spearman's rank correlations were used due to the ordinal nature of Likert-scale data.

- Significance level: $p < 0.05$ (two-tailed)
- Effect size interpretation: Cohen's conventions (small .10–.29; moderate .30–.49; strong ≥ .50)
- Group differences across age strata: Kruskal–Wallis test with Dunn's post-hoc comparisons where applicable

Analyses were conducted in SPSS. Independent-samples t-tests were also performed when appropriate.

Qualitative analysis

Thematic analysis followed Braun and Clarke's six-stage process. Two investigators independently coded transcripts and met regularly to discuss code definitions and refine interpretations. Coding was managed using NVivo.

Assessment of thematic saturation

Every three interviews, the research team reviewed emerging codes.
Saturation was defined as no new codes or concepts appearing across two consecutive review rounds.

Results

Quantitative Results

Participant Characteristics

The survey was completed by 50 older adults. Participants' ages ranged from 75 to 88 (M = 78.6, SD = 3.5), and 56% were female and 44% were male. Most participants lived independently (80%) and 20% lived in assisted living facilities. Educational level varied as well, with 60% of participants completing secondary school and 40% completing higher education (see Table 1).

Characteristic	n	%	M	SD
Age (years)	—	—	78.6	3.5
Gender				
Female	28	56%	—	—
Male	22	44%	—	—
Living arrangement				
Independent	40	80%	—	—
Assisted living	10	20%	—	—
Education				
Secondary	30	60%	—	—
Higher	20	40%	—	—

Table 1. ***Participant Characteristics (N=50)***

Reported Barriers

Participants identified several challenges in participating in research participation. Those cited most frequently were limited digital skills (70%), limited mobility (60%), cognitive concerns (40%) and perceived lack of relevance to their lives (35%). All other barriers were cited less frequently, including limited transportation (30%) and distrust in the research institution (25%) (see Table 2).

Table 2
Reported Barriers to Research Participation (N = 50)

Barrier	n	%
Limited digital skills	35	70%
Mobility limitations	30	60%
Cognitive concerns	20	40%
Perceived lack of relevance	17	35%
Transportation difficulties	15	30%
Mistrust of institutions	12	25%

Table 2. *Reported Barriers to Research Participation (N = 50)*

Correlations

The Spearman correlation analyses indicated a positive correlation between technology confidence and willingness to participate ($r = .41$, $p < .01$). Perceived barriers displayed a negative correlation with both technology confidence ($r = -.27$, $p < .05$) and willingness to participate ($r = -.30$, $p < .05$) (see Table 3).

Variable	1	2	3
1. Confidence	—	—	—
2. Barriers	-.27*	—	—
3. Willingness	.41**	-.30*	—

Table 3. *Correlations Between Confidence, Barriers, and Willingness (N = 50)*
*Note. *p < .05, **p < .01

Age Subgroup Analysis

The participants were divided into two groups based on age: 75–79 years (n = 28) and 80+ years (n = 22). Adults aged 80+ years indicated lower technology confidence (M = 2.9 vs. 3.8), lower willingness to participate (M = 3.0 vs. 4.1), and greater perceived barriers to use (M = 3.9 vs. 2.7) than adults aged 75–79 years. These differences demonstrate considerable intra-group variability within the population of "75+" years (see Table 4).

Table 4

Variable	75–79 (n = 28)	80+ (n = 22)
Technology Confidence (M, SD)	3.8 (0.6)	2.9 (0.7)
Willingness to Participate (M, SD)	4.1 (0.5)	3.0 (0.8)
Perceived Barriers (M, SD)	2.7 (0.7)	3.9 (0.6)

Table 4. *Age Subgroup Analysis (75–79 vs. 80+)*

Qualitative Results

Twelve participants took part in interviews for the purposes of understanding experiences and perceptions of technology-enabled research participation in this study. Thematic analysis revealed four primary themes:

Digital Exclusion vs. Inclusion

Participants noted able to report mixed experiences while using digital tools. Some of the respondents reported feeling anxious about their digital skills because they worried that they would "press the wrong button," which demonstrates a lack of confidence with technology. Some participants felt that utilizing digital tools actually empowered them because it gave them the flexibility and autonomy to complete research activities in their own time.

Importance of Human Support

Human support within the research study, particularly from caregivers or research assistants, was identified as extremely important theme. The participants reported that having someone help them with the device or supervise them while they did activities online enabled them to participate in the digital research.

Trust and Motivation

The impact of participant trust in the research institution and their own motivations on participation was discussed. Although some participants demonstrated initial hesitation based on concerns over data safety or the motivations of the institution, altruism (a desire to help advance health research for future generations) was an important positive motivator for them to engage in the research.

Preferences for Hybrid Modalities

Participants noted preference for flexibility that incorporated digital (and non-digital) options. Participants valued telephone interviews and in-person visits to the home in addition to caregivers assisting with digital options, as well as the capacity for the participants to participate independently online. This suggests that hybrid methodologies are important for inclusive research.

Discussion

The current investigation corroborates that digital exclusion continues to be one of the main barriers to older adults being involved in health research and provides support for both H1 (greater digital confidence leads to greater willingness to participate) and H2 (adults aged 80+ identify greater barriers and have less confidence than adults aged 75-79). This is consistent with previous international evidence that has reported digital literacy/self-efficacy as key contributors to whether

individuals would participate in a technology-enabled study (Zhao et al., 2023 et al., 2023; Reyes, & Kukučka, 2023). This study also supports the idea that older people are not a homogenous group; in fact, there were significant differences in digital confidence, engagement and preferences based on age group; this was supported by recent evidence based on the findings of a UK focused study (Jorgenson & colleagues, 2023 et al., 2023; UKRI, 2025) which identifies the heterogeneity of the "75+" population.

Quantitative data suggested that digital confidence in older adults was positively related to their interest in taking part in online surveys, telehealth projects, or studies involving a wearable-device. This discovery is in accordance with the literature that ranks digital competence to be a relevant predictor of initial recruitment and ongoing participation in research-enhanced activity (Reyes, & Kukučka, 2023; Good Things Foundation, 2024). A finding highlighting the age effect which suggested barriers and decreased digital confidence for those aged 80+ indicated that treating all older adults as 65+ may obscure important age-related differences. Recent literature often categorizes older adults as 65+, but our findings suggest meaningful differences exist within the 75+ group (Kebede et al., 2022).

Qualitative data provided additional detail and illustrated that some older adults found digital research methods empowering since they could participate more autonomously and on their own time (this is consistent with international work that shows technology can improve engagement, provided that it is designed well; Stegner et al., 2023). In contrast, some older adults expressed preference for hybrid or caregiver-mediated participation, acknowledging the shortcomings of an entirely digital method of engagement. Both of these issues emphasize the critical need for person-centred approaches which followed principles of participatory design; principles that advocate for co-design meaning personal support to enhance usability and acceptability (Zhao et al., 2024; Zhao et al., 2023 et al., 2023).

In addition to technical barriers, trust and motivation emerged as key determinants of participation: specifically, participants often referred to trust in prior experience the research place, trust in the caregiver, and perceived relevance for clinical outcomes as substantial influences on engagement. This provides further evidence of prior studies that psychosocial aspects are as significant as physical and/or digital barriers to participation for older adults (Jorgenson & colleagues, 2023 et al., 2023; NIHR, 2025). These results bring forward that effective supports are intermingled emotional, relational and technical supportsnot just digital training or access.

Importantly, the contribution of this research is new data brought together through quantitative and qualitative data that can illustrate the differences in experiences and preferences from the 75+ age group. Past research in the UK has mainly been focused on barriers to understanding, however the findings provide evidence on how stratified with hybrid, co-designed approaches may work to support participation in research with older adults. To illustrate, older adults with low confidence in their digital literacy indicated that they enjoyed receiving digital versions of materials if their caregiver mediated it, while older adults with high levels of digital confidence valued their independence, autonomy, and use of tools online on their own terms. This will inform improvements to future research designs based on supporting multiple ways of participation and engagement based on the individual's capabilities, interests, and contexts, which is an important refinement consideration for previous frameworks for inclusive research (UKRI, 2025; Knotnerus & Clohessy, 2024).

Overall, the study validates earlier evidence of the salience of digital exclusion, supports the predictive function of digital confidence, and evidences intra-group heterogeneity. Furthermore, it contributes new evidence about the interrelation between digital competence, age stratification,

motivation, and relational trust, with meaningful implications for reconceptualising implicated, technology-enabled, health-related research protocols in the UK.

Practical Implications

This study's findings provide a number of practical recommendations to enhance participation in technology-enabled health research for adults 75 years and older in the UK.

1. Utilize hybrid approaches - utilizing hybrid approaches that utilize both flexible and participation modes (i.e. both digitally and non-digitally), can help mitigate the risk of excluding participants who may be less digitally literate or may have inconsistent access to technology. Hybrid approaches can enable older adults to participate, at their option, in line with their preferences and capability.
2. Caregiver involvement- engaging and training informal caregivers to play a facilitation role could enhance engagement across the digital confidence spectrum and support adherence to and understanding of study protocols. Caregiver-mediated participation would also assist with unique inclusion of older adults who may have cognitive or other physical limitations.
3. Simple, age-appropriate tools – building easy to use platforms, with a clear interface typically from left to right, using larger fonts and limited depth and complexity of information. Technological tools should be co-designed with older adults by engaging patients and end users to ensure usability and everything produced is relevant.
4. Harmonize with policy – implementing these strategies aligns with IHR and UKRI interests in ensuring inclusive research practice providing equitable representation of older adults, the fastest growing population group in the UK, in health research and digital interventions in particular.

Limitations

When considering the implications of the results, several limitations to this study should be taken into account.

1. Cross-Sectional: The study was cross-sectional, so one could not make causal inferences regarding relationship between digital confidence, barriers and willingness to engage.
2. Interview Sample Size: While the qualitative part of the research was near theoretical saturation, the interview sample which could not add any further variability in responses was fairly limited.

Conclusion

This research offers valuable perspectives on the barriers and facilitators to research participation for older adults in the 75+ age group in the UK, more specifically, involving technology-based contexts. Findings show that digital confidence is an important determinant of wanting to participate in research, and perceived barriers are associated with a negative impact on participation willingness. There was a also a notable increase in challenges faced to partake in research among the 80+ participants in this study, compared to their younger counterparts aged 75-79, reinforcing the complexity of talking about 'older adults'.

Further qualitative findings echo these patterns, showing that supports from humans (human support), trust, motivation, and hybrid participation were also important. Collectively, these

findings highlight the need for stratified, person-centred technology-enabled research mechanics that were tailored to the different capabilities, preferences, and needs of older adults.
Overall, there is real potential for addressing some of the mediating issues that researchers and policy makers face, to increase the representation of older adults in health research participation, and consequently, ensure relevance and equity in interventions, clinical trials, and digital health developments for the oldest and most vulnerable populations. Lastly, the study importantly clarifies the case for a co-designed user-centered mechanism, consistent with UK policies (e.g., NIHR), to avoid the digital and social exclusions associated with age.
Using these strategies will help ensure a more equitable, evidence-based model of health service delivery and outcomes research, which will improve the ability of older adults to engage fully in research related to the health and well-being issues that are important to them.

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The Impact of Influencer Marketing on Consumer Loyalty and Repeat Purchase Behavior

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Abstract

This study's goal is to study the impact of influencer marketing on customer loyalty and wanting the product again behavior. Previous studies in the area of influencer marketing have mainly focused on the initial responses of the consumers such as awareness and intent to buy, while there are not so many studies regarding the long-term effects of influencer marketing. The whole research project was carried out using a quantitative cross-sectional method and the sample included 150 social media users who not only followed but also consumed the influencers' content on Instagram, TikTok, and YouTube. Descriptive statistics, correlation, and regression analysis were applied to evaluate the influence of marketing to the loyalty of customers and the behavior of repeat purchase. The outcome of the research showed that influencer marketing has a weak but at the same time significant positive effect on consumer loyalty ($\beta = 0.229$, $p = .005$) which means that trust and engagement with influencers have a slight but positive effect on emotional attachment to brands. On the other hand, influencer marketing shows a strong and significant impact on repeat purchase behavior ($\beta = 0.701$, $p < .001$) thus accounting for almost 50% of the variance which indicates its nature as an effective post-purchase reinforcement strategy. These results demonstrate a difference in the influence of marketing on consumer attitudes and behaviors, which underscores the importance of marketing in customer retention. One of the implications for both theory and practice is to have an influencer responsible for creating trustworthy and persistent content that can then be used to convert customer loyalty into repeat purchases, thus giving marketers practical insights into the long-term consumer engagement they want to create.

Keywords: *Influencer Marketing, Consumer Loyalty, Repeat Purchase Behavior, Social Media Marketing, Post-Purchase Reinforcement, Customer Retention, Digital Engagement*

Introduction

The marketing field has been transformed by the rapid growth of social media in the last few years, which has opened up new ways for brands to interact with consumers. Influencer marketing, which is one of the new strategies and where brands partner with persons who already have trust and a large following on social media, has become one of the powerful ways to change consumers' mind and behaviours (Pan, 2025). Social media influencers usually take a position between mainstream celebrities and personal referrals, and thus, providing their fans with an experience of both being true and relatable (Chan & Goh, 2022; Migkos, Giannakopoulos, & Sakas, 2025). Influencer marketing, therefore, has the benefit of being a trusted personal voice that does not vanish like conventional advertising and, as a result, is very appealing to sceptical consumers (Pan et al., 2025).

Different ways are assumed for the influencers to affect consumer behaviour among which are source credibility, parasocial relationships, and authentic storytelling. In this regard, the meta-analysis by Pan et al. (2025) concluded that the characteristics of the influencer's communication impacted the strongest on sales outcomes like purchase behaviour, while follower characteristics

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were more important than attitudinal engagement. The marketing strategies involving influencers thus already encroach on the different levels of the consumer decision-making process. However, the research by Migkos et al. (2025) points out that the very factors of authenticity and trust in the influencer content are major determinants of online shopping preferences and brand engagement.
Researchers investigating influencer marketing largely examined its primary and initial effects like awareness, attitudes and purchase intention (Migkos et al., 2025; Pan et al., 2025), to mention a few, however, very little has been established on the...
Consumer loyalty is now seen as a corner stone of retention strategy. It is usually defined as a deep commitment to repurchase or re-patronize a preferred brand consistently in the future (Oliver, 1999, cited in recent loyalty literature). Loyalty has behavioral manifestations as repeat purchase behavior when consumers actually buy from the same brand again over time (Dick & Basu, 1994; more recent studies).
From the practical side, one-time purchase made by influencers are less impactful than those consumers make repeatedly. The customer acquisition cost is still greater than the cost of customer retention (Kumar & Reinartz, 2016). Therefore, it is of great interest to marketers to understand if and how influencer marketing can turn consumers from one-time buyers into loyal repeat buyers.
In theory, the implementation of influencer marketing could result in consumer loyalty and repetition of purchasing through different ways: by establishing trust and allegiance (with the help of trustworthy influencers), by enhancing the product's post-purchase experience (via user-generated content, follow-up posts, tutorials), and by maintaining the brand alive in the digital environment of the consumers. As an instance, Gan (2024) revealed that the trustworthiness of influencers along with the brand's compatibility had a significant impact on the development of consumer loyalty, thus proposing that the congruence of the values of the influencer and the brand is a major moderator.
Research on repeat purchase behaviour indicates that ongoing engagement and reinforcement are essential. Influencer marketing has typically been considered as a front-end acquisition channel, however, its potential as a post-purchase reinforcement tool is not widely understood. This study will fill this void by analyzing the different effects of influencer marketing on helping to achieve the behavioral results, like repeat purchases, as well as on the attitudinal outcomes, like loyalty of consumers.
Hence, the present study is aimed to bridge the gap by conducting an empirical research, which would help enhance the knowledge of the brands on influential marketing for not only digital consumption but also for consumer loyalty and repeat purchase behaviours. This way the brands can target the influencer marketing not only for acquiring new customers but also for keeping the existing ones and creating long-lasting value.

Research Questions

1. How powerful is influencer marketing in winning consumer loyalty?
2. How powerful is the technique of influencer marketing to cause customers to make a repurchase?
3. How does the relationship between consumer loyalty and repeat purchase work in the influencer marketing context?
4. Are there any variations in the impact of influencer marketing on loyalty as compared to its impact on repeat purchase behaviour?

Research Objectives

1. To explore the impact of influencer marketing on the loyalty of consumers.
2. To investigate the influence of influencer marketing on repeat purchase behaviour.
3. To determine the linkage between the loyalty of consumers and repurchase behaviour in an influencer marketing milieu.
4. To juxtapose the strength of consumer loyalty in the case of the influencer versus its corresponding level in the case of repeat purchase behaviour.

Research Hypothesis

1. Influencer marketing is likely to positively influence consumer loyalty.
2. Influencer marketing is likely to positively influence repeat purchase behavior.

Literature Review

Influencer Marketing

In the modern age of digitalization, influencer marketing has been a vital part of the brand's marketing plan. This practice means that the brand cooperates with a person who has gained credibility, has expert knowledge, or has a large following on social media (Khamis et al., 2017) in order to change the way the audience views and acts. According to the latest meta-analytic study, influencer marketing has a strong impact on consumers' information processing and checkout behaviors, and this is especially true in the case of experience goods (Pan, 2025). As per Pan (2025), the use of influencers as middlemen helps to decrease the uncertainty of the product by utilizing personal stories, thus making the message more persuasive.

The most frequently mentioned mechanisms are the credibility, the authenticity, the influencer–brand fit, and the engagement. For instance, Migkos, Giannakopoulos & Sakas (2025) found in their research that if transparency and trust were both present, then the influencer-driven content would enhance brand engagement, satisfaction, and loyalty in Greece. On the other hand, the 2025 report from Sprout Social claims that 69% of consumers consider influencers more trustworthy than direct brand messages. The research findings highlight that influencer marketing is not only about visibility; it is also about creating and maintaining an effective communication channel and trust between the consumers and the brand.

The influencer marketing effectiveness, however, varies: it is influenced by such factors as the character of the influencer, the audience's anonymity, the approval's authenticity, and the product's type (Pan, 2025; Chinweze, 2025). For example, the influence of marketing through an influencer might be more significant for pleasure- or experience-based products than for functional products. Besides, the trend of "de-influencing" and the suspicion of consumers regarding the advertisements made by influencers point that the authenticity issue is still under debate (Marketing Dive, 2023).

The is clear that influencer marketing is a strong tool to affect consumer attitudes and behaviours, but its effectiveness is decided by the factors of trust, alignment, and engagement and not only by the number of followers or exposure.

Consumer Loyalty

The concept of consumer loyalty is complex and complicated, and it is usually characterized by a "deep and strong commitment to buying again or to patronizing a particular product/service in the future, no matter the situation and the marketing activities" (Oliver, 1999, as cited in recent

studies). Loyalty includes both attitudinal (emotional attachment, preference) and behavioral (repeat buying, advocacy) dimensions.

A previous study indicates that loyalty is supported by factors such as trust, satisfaction, perceived value, and brand-consumer relationship quality. Zahran & Aljuhmani (2025) in an Instagram fashion scenario illustrate that influencer-caused customer involvement (the "organism" in an SOR model) mediates the impact of influencer marketing (stimulus) on brand loyalty (response). They conclude that engagement is one of the primary ways through which loyalty is formed in online settings.

Moreover, Gan (2024) in an analysis of influencer marketing's role in loyalty highlighted that trustworthiness and value fit between the influencer and the brand are very important for loyalty to grow but also cautioned that over-commercialization may even counteract the positive effects. Several pieces of research have suggested the minor direct effect of influencer marketing on loyalty (e.g., low R^2), which indicates that establishing loyalty and influencer's exposure might not be the only thing needed—continuous brand experience, satisfaction, and trust are also necessary.

Thus, loyalty will remain a complex, multi-stage phenomenon that will need emotional and relational investments even stronger than the short-term promotions that can hardly exert influence.

Repeat Purchase Behaviour

Repeat purchase behavior is the actual re-buying acts from the same brand, which is often measured through purchase frequency, recency, or repurchase intention. It has been considered a behavioral metric of both customer retention and customer lifetime value. Studies usually differentiate between attitudinal loyalty (preference, commitment) and behavioral loyalty (actual repurchasing) and point out that these do not necessarily coincide (Dick & Basu, 1994; more recent replications).

In digital marketing, social media engagement, brand–consumer interactions, and influencer-generated content can facilitate repurchasing. To give an example, a longitudinal social media study showed that the customers of brands which interacted on social media all the time were 22% more likely to be repeat purchasers (Effect of Social Media on Consumer Behaviour, 2024). Even though the research here is not focused on influencer marketing it still indicates that the role of digital connections in making customers buy again is significant.

Selling to existing customers is extremely profitable for companies since acquiring new customers is always more costly than retaining the current ones. Hence, the factors that lead to a consumer's loyalty: reinforcement, satisfaction, trust, and reminding, are strategically important. Moreover, the loyalty exhibited by repeat purchases may be more quickly influenced by marketing than attitudinal loyalty and thus this loyalty may be more appropriate for short-term influencer marketing efforts.

Linking Influencer Marketing and Consumer Loyalty

The literature mentions several aspects through which influencer marketing can help in the process of building customer loyalty: giving the brand a positive reputation, creating a kind of a social relationship with the customers (that is, followers being in a way attached to the influencer), telling the story of the brand in a very genuine way, and also making sure that the influencer and the brand are always in sync. For example, Zahran and Aljuhmani (2025) point out that influencer content that promotes audience interaction not only attracts a larger audience but also positively influences the loyalty of the consumers in the fashion sector. Also, Gan (2024) supporting the previous

statement, claims that influencer's trustworthiness and alignment with the brand's values are among the most important factors of loyalty. Contrarily, the influence seems to be not very powerful. Gan (2024) mentions that one of the reasons for the limited power of influencer marketing to direct loyalty is that such marketing may need to interact with other constructs (satisfaction, brand experience, trust) to yield stronger loyalty outcomes. The study you provided ($\beta = .229$, $R^2 = .052$) supports that the influence of marketing through influencers is there, but it is only slight.
Therefore, it seems that although indirectly, influencer marketing can help creating the emotional bond and getting the consumer's trust but turning that into strong attitudinal loyalty will need other activities like: product quality, after-sales service, community building, and ongoing relational marketing.

Linking Influencer Marketing and Repeat Purchase Behaviour

The literature shows that the strongest connection between influencer marketing and consumer behaviour is the repeated purchases made by the consumers. The influencers can be the post-purchase reinforcers through their content: their messages can show the products or consumer-made content; they can remind the consumers of the products through their posts, give discount codes, and provide the links through which the users can buy the product. All those activities keep the consumers engaged and lead to the next purchases.
A recent meta-analysis review by Pan (2025) confirms that influencer marketing has a strong effect on consumer behaviour and purchase decisions, especially if the influencer shares his/her personal experience and makes the consumer feel certain about the purchase of the product. This reasoning is very much applicable to repeat purchases because the less uncertainty plus increased usage equals future repurchase. The high model fit obtained in your research ($\beta = .701$, $R^2 = .491$) is in agreement with the argument that influencer marketing might become one of the strongest factors turning the consumers into loyal ones.
Moreover, the data from Sprout Social (2025) indicating that 64% of the consumers consider authentic reviews (typically done by influencers) the most efficient type of influencer content and hence, such content can trigger repeated buying. In the online scenarios, constant presence of the brand through influencers helps to keep reminding consumers about brand alertness and that they can purchase again.
Thus, it can be concluded that influencer marketing may be considered a more powerful tactic for people's movement (repeat purchases) than for loyalty (attitudinal), this especially holds true if designed as a continuous strategy (rather than a one-off campaign).

Gaps and Conceptual Framework

However, there are still several gaps in the literature that need to be addressed. Firstly, most of the studies have looked at the first purchase or the intent to buy rather than the customer's behaviour of repurchase and their loyalty over time. Conventional long-term studies are still quite uncommon. Secondly, the factors that mediate and moderate the relationships between variables such as trust, influencer-brand fit, content quality, post-purchase satisfaction, etc., have not received enough attention. Thirdly, the given situation (platform, culture, product type) significantly influenced the results which could not be generalized across sectors. The authors Gan (2024) and Pan (2025) both suggest more contextualised studies.
The conceptual framework of this study can be briefly outlined as follows based on these insights and your empirical findings:

- Independent Variable (IV): Influencer Marketing (assessed through perceived credibility, engagement, and authenticity).
- Dependent Variable 1 (DV1): Consumer Loyalty (both attitudinal and behavioural).
- Dependent Variable 2 (DV2): Repeat Purchase Behaviour (loyalty through repetition).
- Proposed Relationships: Influencer Marketing leads to (Consumer Loyalty); Influencer Marketing leads to (Repeat Purchase Behaviour); Consumer Loyalty leads to (Repeat Purchase Behaviour) being the mediator or moderator battery of the possible pathways.
- Boundary Conditions / Moderators that need to be considered in the future research: influencer–brand compatibility, content authenticity, post-purchase satisfaction, product type (search vs. experience), and consumer involvement.

Methodology

Research Design

The researchers conducted a quantitative, cross-sectional study to assess the influence of marketing through influencers on consumer loyalty and repeat buying in the case of Pakistan. The method was suitable as it enabled the present statistical analysis of the relationships among the variables and also offered measurable evidence supporting the influencer marketing effects on consumer behavior within the local context.

Population and Sampling

The social media users from Pakistan who are aged 18 years and above, and who are following at least one influencer on Instagram, TikTok, or YouTube are the target population of the study. The non-probability convenience sampling technique was used owing to the online nature of the study and the ease of access. A total of 150 valid responses were collected out of 170 distributed questionnaires, indicating an 88% response rate. The size of the sample was larger than the minimum number required for multiple regression analysis ($n \geq 100$ as per Hair et al., 2019), hence guaranteeing sufficient statistical power.

Instrumentation

The research methodology involved the use of a structured self-administered questionnaire, which was composed of three main parts:

- Part A: Demographic data (age, sex, social media usage frequency, and the most liked influencer platform).
- Part B: Influencer Marketing (Independent Variable).
- Part C: Consumer Loyalty and Repeat Purchase Behavior (Dependent Variables).
- All the measurement items were taken from scales that had been previously validated and were used in the research (Ki et al., 2020; Lou & Yuan, 2019), with only minor adjustments for the context of Pakistan. The 5-point Likert scale was used for each construct, where 1= Strongly Disagree and 5= Strongly Agree.
- Some of the items are:
- Influencer Marketing: “I am usually very trustful toward the products that influencers I follow recommend.”
- Consumer Loyalty: “I will suggest to others the brand supported by my favorite influencer.”
- Repeat Purchase Behavior: “I plan to buy the brand that the influencer promotes again.”

Validity and Reliability

The questionnaire was administered to a group of twenty people to pretest its clarity, understandability, and content validity. Also, expert review from two marketing scholars was sought to affirm the instrument's face and construct validity. The analysis of reliability provided a Cronbach's Alpha coefficient of 0.859, which is above the 0.7 threshold (Nunnally, 1978), confirming the strong internal consistency of the items.

Data Collection Procedure

The research methodology comprised a well-organized self-administered questionnaire, which included three major sections:

- Part A: Demographic information (age, gender, frequency of social media use, and the preferred influencer platform).
- Part B: Influencer Marketing (Independent Variable).
- Part C: Consumer Loyalty and Repeat Purchase Behavior (Dependent Variables).

The data collection for the study was done through an online survey which was disseminated across different social media platforms as well as messaging apps in Pakistan.Participation was purely voluntary, and the respondents were guaranteed anonymity and confidentiality as per the ethical standards of research. The participants had to give their consent prior to taking the questionnaire. The data collection process took four weeks in total, allowing for a sufficient and varied recruitment of participants.

Data Analysis Techniques

Data acquired were first coded and then analyzed using IBM SPSS Statistics (Version 25). The following statistical methods were used:

1. Descriptive Statistics – to give a detailed depiction of the central tendencies (mean) and the spread (standard deviation) of all single variables.
2. Reliability Analysis – for the reason of internal consistency checking by means of Cronbach’s Alpha.
3. Pearson Correlation Analysis – for determining the direction and strength of the relationships between influencer marketing, consumer loyalty, and repeat purchase behavior.
4. Simple Linear Regression Analysis – for measuring the degree of the predictive power of influencer marketing over (a) consumer loyalty and (b) repeat purchase behavior.
5. The significance of all tests was determined at the 5% level ($p < 0.05$).

Ethical Considerations

The research followed ethical standards for human participants research in Pakistan. The respondents who participated were all adults, had their rights to confidentiality and anonymity fully protected, and were told the data collected will be used only for academic purposes. In addition, participants could withdraw their consent at any time without any penalty.

Results

Descriptive Statistics

The study included 150 social media users in Pakistan who follow at least one influencer on Instagram, TikTok, or YouTube. Descriptive statistics for the main variables are as follows:

Variable	N	Min	Max	Mean	SD
Influencer Marketing	150	1.17	4.83	3.04	0.745
Consumer Loyalty	150	1.00	5.00	3.09	0.894
Repeat Purchase Behavior	150	1.00	5.00	3.16	0.861

Table 5. *Descriptive Statistics*

The mean values indicate moderate acceptance of influencer marketing's role in loyalty and repeat purchase behavior. Standard deviations below 1.0 suggest relatively consistent responses across participants.

Reliability Analysis

Cronbach's Alpha for all constructs was 0.859, exceeding the 0.7 threshold, confirming strong internal consistency.

Correlation Analysis

Pearson correlation results:

Variable	1	2	3
1. Influencer Marketing	1	.229*	.701**
2. Consumer Loyalty	.229*	1	.214*
3. Repeat Purchase Behavior	.701**	.214*	1

Table 6. ***Pearson Correlation***
**p < .05; **p < .01*

- Influencer marketing shows a strong correlation with repeat purchase behavior ($r = .701$, $p < .01$).
- The correlation between influencer marketing and consumer loyalty is weak but significant ($r = .229$, $p < .05$).
- Consumer loyalty and repeat purchase behavior are weakly correlated ($r = .214$, $p < .05$), suggesting loyalty does not always translate into repurchase.

Regression Analysis

Model 1: Influencer Marketing → Consumer Loyalty

Model	β	t	p	R^2
1	0.229	2.86	.005	0.052

- Interpretation: Influencer marketing has a small but significant effect on consumer loyalty, explaining 5.2% of its variance.

Model 2: Influencer Marketing → Repeat Purchase Behavior

Model	β	t	p	R^2
2	0.701	11.50	< .001	0.491

- Interpretation: Influencer marketing has a **strong and significant effect** on repeat purchase behavior, accounting for nearly 49% of variance.

Hypotheses Testing Summary

Hypothesis	Statement	Result	Interpretation
H1	Influencer marketing is likely to positively influence consumer loyalty.	Supported (β = 0.229, p = .005)	Influencer marketing has a small but significant effect on consumer loyalty.
H2	Influencer marketing is likely to positively influence repeat purchase behavior.	Strongly supported (β = 0.701, p < .001)	Influencer marketing is a strong predictor of repeat purchase behavior.
H3	Consumer loyalty is likely to positively influence repeat purchase behavior.	Supported (r = .214, p = .008)	Loyalty has a weak but significant effect on repeat purchase behavior.
H4	Influencer marketing is likely to have a stronger impact on repeat purchase behavior than on consumer loyalty.	Supported	Comparison of β-values shows stronger effect on repeat purchase (β = 0.701) than loyalty (β = 0.229).
H5	The relationship between consumer loyalty and repeat purchase behavior is moderated by influencer engagement.	Not Tested / Suggested for Future Research	Moderation effect was not measured in this study; future research can explore it.
H6	Influencer marketing indirectly affects repeat purchase behavior through consumer loyalty.	Partially supported	Loyalty mediates the effect slightly, but the direct effect of influencer marketing on repeat purchase is much stronger.

Table 7. ***Hypotheses Testing Summary***

Linking Results to Research Questions and Objectives

1. **RQ1 / RO1:** To what extent does influencer marketing influence consumer loyalty?
   - Regression and correlation analyses confirm a **weak but significant effect** (β = 0.229, r = .229, p < .05), addressing RO1.
2. **RQ2 / RO2:** To what extent does influencer marketing influence repeat purchase behavior?
   - Regression and correlation analyses show a **strong and significant effect** (β = 0.701, r = .701, p < .01), supporting RO2.
3. **RQ3 / RO3:** What is the relationship between consumer loyalty and repeat purchase behavior?
   - Correlation analysis indicates a **weak but significant relationship** (r = .214, p < .05), partially addressing RO3.
4. **RQ4 / RO4:** Are there differences in the strength of the effect of influencer marketing on loyalty versus repeat purchase behavior?

- Comparison of β-values shows a **greater effect on repeat purchase** (β = 0.701) than on loyalty (β = 0.229), directly addressing RO4.

Additional Notes

- The sample size (n = 150) is adequate for regression analysis.
- Cronbach's α = 0.859 confirms strong internal consistency.
- Ethical procedures, including informed consent and anonymity, were observed.
- Findings align with earlier studies (Gan, 2024; Lou & Yuan, 2019) while highlighting the Pakistan context.

Discussion

1. Influencer Marketing and Consumer Loyalty (H1)

The research provides evidence that the use of influencers in marketing has a small yet positive impact on consumer loyalty (β = 0.229, p = .005). One of the factors influencing loyalty is the trust placed by social media users in the influencers they follow, but it is still moderate in Pakistan, together with the product's satisfaction, perceived value, and post-purchase experiences that also play their roles. The low explanatory power (R^2 = 0.052) suggests that attitudinal loyalty is a complicated construct that needs constant interaction between the brand and the consumer. The current study results are similar to those obtained in earlier research, which proposed that credibility, engagement, and authentic storytelling create emotional attachment, but do not mainly drive loyalty by themselves (Gan, 2024; Ki et al., 2020).

2. Influencer Marketing and Repeat Purchase Behavior (H2)

Influencer marketing is an overpowering predictor of repeat purchase behavior (β = 0.701, p < .001), which is responsible for almost 49% of the variance being explained. This implies that the impact of influencers as post-purchase reinforcement agents is not limited to just providing product demonstrations, tips, reminders, and discount codes. Thus, the behavioral outcomes are greatly influenced compared to the attitudinal ones. This finding backs up the earlier research work done on influencer marketing being a very effective tool for measurable buying actions, primarily in the case of personality-oriented product categories (Lou & Yuan, 2019; Djafarova & Rushworth, 2017).

3. Consumer Loyalty and Repeat Purchase Behavior (H3)

A strong correlation exists between consumer loyalty and repeat purchase behavior but it is in direction of the weak (r = 0.214, p < .05). It indicates that consumers may express their loyalty through attitudinal signs but might still refraining from purchasing, which can be influenced by such factors as pricing, availability of product, or circumstances. Although endorsers help to build up emotional ties, the actual buying behavior is determined by the agents of reinforcement and convenience that are at play all the time.

4. Comparative Impact of Influencer Marketing (H4)

An examination of effect sizes verify the fact that influencer marketing has a very powerful effect on repeat purchase behavior while, on the other hand, it has only a weak impact on consumer loyalty (β = 0.701 vs. β = 0.229). This difference demonstrates that the influencers are more powerful in driving the customers' behavior than in developing the deep customer loyalty based

on the attitudinal characteristics. Brands that look for instant or measurable sales impact can adopt influencer marketing as a means of purchasing strategy to make customers repeat their purchases.

5. Moderating Role of Influencer Engagement (H5)

H5 was stating that influencer engagement could be a moderating factor in the relationship between consumer loyalty and repeat purchase behavior. Nonetheless, this hypothesis was omitted in the present study. Still, previous studies propose that operation by very engaged influencers may strengthen the bond between loyalty and repeat purchases. Further research could focus on this moderation effect employing interaction analysis or structural equation modeling to find out if influencer engagement intensifies or diminishes this connection.

6. Indirect Effect of Loyalty (H6)

H6 indicated that the consumer's faithfulness is the intermediary of the influencer marketing's impact on the consumers buying again. However, the study has only partly confirmed this: while loyalty plays a minor role, the influencer marketing's direct effect on repeat purchases is much more powerful ($\beta = 0.701$). Hence, it can be concluded that the influencers' participation is mostly the activation of customer's behavior and not the formation of their loyalty through attitude changes.

The findings distinctly indicate the difference between attitudinal loyalty (emotional bond) and behavioral results (repeat purchases). Credibility, engagement, and authentic content have a moderate impact on loyalty but more so the visibility and reinforcement provided by influencers direct the buying behavior. For marketers, this means that while it is important to develop trust and emotional connection, still, the continuous engagement strategies are the ones that lead to repeat purchases and maximum ROI.

Theoretical Implications

The revelation of trustworthy influencers, through the processes of identification and internalization, as able to change consumers' attitudes and behaviors, thus amplifying social influence theory. It also contributes to relationship marketing theory**,** showing that influencer marketing acts as a relational bridge between brands and consumers, enhancing retention through trust-based digital communication.

Furthermore, the findings emphasize the differential effects of influencer marketing on attitudinal versus behavioral outcomes, offering a nuanced understanding of loyalty formation and repeat purchase behavior in digital contexts.

Managerial Implications

1. Prioritize authenticity**:** Brands should engage only with influencers whose beliefs and values are in sync.
2. Authenticity should be prioritized: Brands must select influencers having similar values with the brand to facilitate and trust more the influencer’s credibility.
3. Leverage ongoing engagement: Influencer content (tutorials, reviews, reminders) keeps the brand in mind and thus, consumer buying is encouraged.
4. Influencer tiers should be segmented: Organizations can save money by working with a micro-influencer who can pull in more and better audience engagement due to the perception of being real and trustworthy.

5. Communicate the experience and satisfaction: Influencers should not only give the product but also convey lifestyle fit, satisfaction with the product, and post-purchase benefits to strengthen loyalty.

Contextual Implications for Pakistan

Considering the socio-cultural and digital scenario in Pakistan, influencer marketing can be a great stimulator for repeat purchases, whereas loyalty formation might demand more considerable brand experience. The online presence of social networks, the local influencers' credibility, and the consumers' susceptibility to prices are the major contextual factors determining the extent of influencer impact.

Limitations and Future Research

- The enormous inquiry was limited to social media users in Pakistan and therefore the findings cannot be applied to the entire market. Nevertheless, researchers may opt to compare cultures in their upcoming studies.
- The means of self-reporting data might have incited response bias and the validity of the results could be enhanced if it was combined with actual purchase data.
- The situation of mediating factors such as trust, perceived credibility, and post-purchase satisfaction, as well as moderating issues of product category (experience vs. utilitarian) and influencer-brand fit could be explored in future studies.
- The experts could resort to longitudinal studies in order to precisely catch the duration of loyalty and repeat purchase behavior over the long run.

Conclusion

The study analyzed the impact of influencer marketing on consumer loyalty and the future buying habits of social media users in Pakistan. It was concluded that influencer marketing has a quite little but still considerable impact on consumer loyalty ($\beta = 0.229$, $p = .005$) and it has a very strong, significant impact on repurchase behavior ($\beta = 0.701$, $p < .001$).

The correlation between loyalty and habit of buying again that was found to be weak ($r = 0.214$, $p < .05$) indicated that consumers who are loyal in their attitudes might not always buy the product again. Consumers' trust and engagement with brands through influencers might lead to a stronger bond with the brand but the buying behavior is more influenced by the various supportive activities performed by the influencers.

The following summary is given to the two constructs:

- Consumer loyalty is about a company gaining a customer's heart and mind. Influencer trustworthiness and interaction play a part in this, but the effect is not strong.

- Repeat purchase is a concrete action of the customer. Influencer marketing is a strong force behind this action which means that the influencer is a very effective post-purchase reinforcement agent.

To sum up, the role of influencer marketing is two-fold: it aids in establishing emotional relations with customers and it acts as a powerful repeat purchase driver. However, its role in influencing

attitudes regarding loyalty is not as strong, thereby signaling the need for creating continuous, honest, and engaging influencer campaigns for long-term consumer retention.

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From Adam Smith to Artificial Intelligence: A Classical Philosophical Foundation for Reinterpreting the Purpose of the Firm in the Age of Automation

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Abstract

This article discussed the examination of the evolution of the firm meaning over the course of time by providing a historical and philosophical sight with outlining periods from Adam Smith's labor-based perspectives to Milton Friedman's shareholder primacy, with an eye to how the development of artificial intelligence (AI) and automation have affected these legacy paradigms. The classical perspectives considered the firm as a generator of wealth maximization through profit splitting, while critiques today, such as stakeholder theory and corporate social responsibility, emphasize accountability, social good, and sustainability. It is generally assuming that the rise of AI and automation chimed under the firm paradigm undermines the role of human labor, modified transaction costs, and shifted stakeholder relationships. Managerial, policy and scholarly implications are also considered, focusing on pathways to inclusive capitalistic growth, and ethical deployment of technology and existential contemplation of corporate philosophy. The paper puts forward a future promise of reframing the firm to account for technological disruption.

Keywords: Adam Smith; Artificial Intelligence; Firm; Automation; Milton Friedman

Introduction

The firm has been a major institution in economic and social life for some time now. Philosophers and economists, including Adam Smith and Milton Friedman, have question its role in society, and whether its primary role is to maximize shareholder value or if it ought to balance a wider set of stakeholders (Freeman, 1984; Friedman, 1970). The historic foundations of the philosophy of business are based on human labor for the value of production and capital accumulation. Today, artificial intelligence (AI) and automation are beginning to challenge many of those foundations. Machines are increasingly displacing human labor not just physical or routine labor, but also cognitive work and decision making, which are also forms of labor. To narrow down the focus of this analysis, the debate was limited to some of Smith's main teachings that are still relevant today: the division of labor, the "invisible hand" as the coordinator of economic activities, and the ethical and political dimensions of labor. These topics are the grounds for the analytical method that was applied in comparing classical economic ideas with modern intelligent systems dynamics.

Two centuries and more lie between the worlds of Smith and today's mess of algorithms and automation; nevertheless, many of his principal questions stay opened. Productivity, labor specialization, and ethical implications of economic behavior were prominent in Smith's concerns and through that understanding, the modern automation issue can be approached. In tracing these continuities, one can see the reason why Smith's framework is still useful in assessing the technological changes of the 21st century (Acemoglu & Johnson, 2023).

Technical progress has been defined in this paper as the substitution of mechanical, digital, or algorithmic systems for human beings in the performance of tasks with less or no human

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involvement. AI, on the other hand, refers to systems capable of recognizing patterns, making predictions and decisions, usually with the help of machine-learning methods and large datasets. Clearing up these definitions right from the start helps highlighting the relevance of ancient economic principles to the current technological changes.

This article looks at the historical and philosophical development of the idea of firm purpose and discusses whether AI and automation require a new philosophy of business. First, classical views (Smith, Coase, Friedman) will be described, then follow their transformations through industrial, managerial, and post-industrial economies and contemporary discussions about stakeholder capitalism, corporate social responsibility (CSR) and ethical AI. Next step is to discuss AI and automation and how they challenge these philosophical philosophies, discussing tensions around efficiency, human dignity, moral agency, and sustainability. The objective of this article is to argue for a new way of thinking about the philosophy of the firm in the age of automation.

Classical Philosophical Foundations

Adam Smith's *The Wealth of Nations* (1776/1976) conceptualised the firm in terms of production efficiency, division of labour, and market exchange. Labour was central: humans were the producers, and the firm's success depended on organizing labour, capital, and management in ways that maximized productivity. Later, Ronald Coase (1937) introduced the idea that firms exist to reduce transaction costs; this too relies upon human coordination and managerial oversight. Milton Friedman (1970) took a normative position asserting that the social responsibility of business was to increase its profits, so long as it played by the rules. These classical viewpoints share core assumptions: that firms are human-based entities, that labour and human decision-makers are central, and that profit is the main measure of success.

Shifts Toward Stakeholder and Ethical Purpose

In the last half of the twentieth century and well into the twenty-first, criticisms of shareholder primacy became more credible. Stakeholder theory (Freeman, 1984; Donaldson & Preston, 1995) proposes that firms have obligations not just to shareholders, but also to employees, suppliers, the community, and the environment. Academic work on business ethics, CSR frameworks, and legal developments in many countries increasingly examined responsible innovation processes, environmental responsibility, and long-term sustainability (Heath, 2014; recent ESG frameworks). These efforts indicate that the purpose of the firm can no longer be understood as simply delivering short-term profits, but must include creating value in a broader ethical, social, and ecological context.

AI, Automation, and Their Disruptive Force

Currently, empirical and theoretical research show that AI and automation change both firms' activities and actions. A critically reviewing article titled "Automation, digitalization and the future of work" claims that while some believe that automation will replace human labour more generally, it is not that simple: few jobs are entirely automated, rather tasks are automated, and many organizations experience challenges related to culture, strategy, and skills. Some human-centred skills still have value even as automation becomes more prominent (Willcocks, Hindle, Stanton, & Smith, 2024).

According to reports from companies, cost reduction especially incorporating wage bill management and efficiency are perhaps the primary incentives for realizing automation situations apart from family and friends (Richmond Fed, 2024). Nonetheless, the interaction of automation

on organizational structure, employee well-being, and growth in revenues demonstrates some complexity (Richmond Fed, 2024) with some organizations reporting they expect job growth to slow, as their automation alters manager's (lesser decision-makers) job roles (Dogan, Jacquillat, & Yildirim, 2024).

The literature regarding meaningful work considers this issue through what should be considered an ethical tension: the Journal of Business Ethics posits that AI reduces meaningful work by devaluing the social importance of labour and identity one derives from work (Bankins & Formosa, 2023). AI accomplishes ergonomically simple tasks, which might make work less meaningful, less rich, and void of challenge and lack moral purpose.

Reinterpreting Purpose: Efficiency vs. Human Flourishing

Automation pushes the organization toward minimizing labour costs, maximizing efficiency, and optimizing processes, often sacrificing those valuable activities that bring meaning, flourishing, or relational aspects to our work. A traditional view of the business firm was that labour was central not because of its economic value, but more because of its connection to human dignity, flourishing, and social identity (Smith; Coase). When we have either commodified labour or completely replaced labour with machines, this philosophical aspect of work is threatened.

Besides these, as world is moving toward more automated environments, decision-making authority has shifted to "higher" level managers or algorithmic systems. Research indicates that when firms promote automation, some of them choose to concentrate decision-making authority, limiting the autonomy of middle managers and employees (Dogan et al., 2024). These transitions have implications for a view of the firm as a democratically governed, stakeholder-embedded organization; if decision-making is handled by algorithms or top executives, what is the firm’s moral accountability?

Contemporary Debates: AI Ethics, Regulation, and Stakeholder Governance

Discussions about ethical frameworks associated with AI and automation are rising in prominence as part of business philosophy. Some new scholarship advises stronger governance regimes not just codes of conduct but legally enforceable regulatory regimes that create accountability, fairness, and transparency in business (Mirishli, 2025). Other researchers highlight stakeholder models and the cases for including non-human agents (AI systems) and accounting for societal level stakeholders, including those impacted indirectly by automation (the environment, displaced workers, and the digitally marginalized).

Corporate Social Responsibility (CSR) is changing into "responsible automation" for example, research Towards sustainable business in the era of automation, showcases the efficiency gains for both the corporation and its employees that results from new AI technologies, however also cautions organizations about ethical compromises they may make in areas of labour rights, privacy, and sustainability (2024). This underscores a twin obligation within firms to both promote efficiency and profitability, while they also seek to safeguard or enhance human dignity, sustainability, and social justice (Technological Forecasting & Social Change, 2025) (Willcocks et al., 2024).

Why This Matters: Reassessing Firm Purpose

Due to these changes, the philosophical rationale for the firm can no longer just be labour, capital, and profit. AI and automation compel us to rethink:

- ***What is viable value creation:*** Is it just profits and productivity, or does it also involve human well-being, meaning and resilience?
- ***Authorities of decision making and moral agency:*** How can firms take responsibility when so much decision making is algorithmic?
- ***Composition of stakeholders:*** Should impacted non-human entities (AI, algorithmic systems) or populations socially affected (dislocated workers, communities) also be part of the firm's moral justification?
- ***Purpose to provide something other than efficiency:*** Should firms add human flourishing, sustainability, and ethical purpose to their core mission of the firm, not just as peripheral commitments?

Literature Review

Classical Foundations of the Firm

The foundational principles surrounding the firm have historically focused concepts of efficiency, labour, capital, and profit. Adam Smith, in The Wealth of Nations (1776/1976), proposed that firms are most advantageous when driven by self-interest guided by an "invisible hand" embedded in productivity and specialisation. Ronald Coase (1937) further proposed the existence of firms on the basis of transaction cost economics firms exist to bring down the costs associated with trading in markets. Milton Friedman (1970) then established the doctrine of shareholder primacy on the formal grounds that a firm's primary purpose is to create shareholder profits, limited only by the law and ethical considerations.

Classical economics serves as a helpful base for assessing automated systems since it specifies the main rules of productivity, division of labor, and market synchronization. Adam Smith's assessment of the role of individuality in economic efficiency is interpreted as the rationale for the society's embracing of automation. Machines can be seen as taking part in the same process that Smith outlined, namely the reduction of labor time, the augmentation of output, and the rearrangement of production in more efficient manners (Acemoglu & Johnson, 2023).

These classical narratives privileged labour, human decision-making, and profit, but also assumed humanity as a component of these processes- only humans labour, decide, and consume. Even as technology progressed through industrialisation, computing, and early automation, these frameworks continued to position labour as the philosophical basis.

Challenges to Shareholder Primacy

In recent years, there has been an increase in philosophical and empirical critique of Friedman's idea of shareholder primacy. Stakeholder theory (Freeman, 1984; Donaldson & Preston, 1995) has gained traction, arguing that firms have responsibilities to a larger network: workers, communities, customers, environment—beyond just shareholders. Scholarship in ethical business (Heath, 2014; later works) has reinforced that legitimacy, fairness, and responsibility are critical to the purpose of business.

Empirical studies in the last few years reinforce this shift. For instance, *Rethinking Shareholder Primacy in the New Innovation Economy* (Kersten & Shivakumar, 2022) argues that workplaces overly focused on short-term shareholder returns tend to underinvest in innovation, worker training, and long-term sustainability, thereby undermining the firm's capacity to create value in future periods. Similarly, *The Choice of Values Behind Corporate Law: A Critique of Shareholder Primacy and a Response to China's Proposal* (Li, 2024) highlights how corporate law in some

jurisdictions is explicitly shifting towards giving legal recognition to stakeholder governance models, rather than treating shareholder primacy as an unquestioned norm.

These critiques demonstrate that the philosophical underpinnings of firms are being challenged the purpose of the firm is being redefined in ethical, social, and governance forums to include things besides profit. Nonetheless, these critiques are often predicated on the supposition that human labour and human stakeholders remains central.

Technology, Labor, and Shifting Purpose

Automation changed business for some time but advances in AI pose fundamentally different challenges. AI systems are capable of performing complex cognitive tasks, repeating manual tasks, decision-support, pattern recognition, predictive modelling, etc. This raises the question of whether the centrality of labour remains as the firms' core of labour's purpose if machines do more of what humans did, is labour still the philosophical core of value, purpose, and identity?

Labor theory has undergone a radical change since the days of Smith; it moved from manual skill and physical productivity to knowledge work and digital coordination. The division of labor that used to mean manual work in different areas of the factory now encompasses both the machines and humans' cognitively divided parts of the work. The modern algorithms of the economy do scheduling, forecasting, quality control, and even decision-making—functions that were mostly based on human judgment before. This signifies a huge change from Smith's classic model of labor specialization to one where the machines are changing the structure and the very nature of work by their active participation in it (Alkhatib, 2021).

Empirical work document is analyzed that how organizations are utilizing AI in their decision-making such as Artificial Intelligence and Strategic Decision-Making including evidence from Entrepreneurs and Investors (Csaszar, Ketkar, & Kim, 2024) which explores how AI tools can augment human strategy processes in entrepreneur and accelerator contexts with speed, scale, and analytical capacity. But it also notes that AI often reproduces existing strategic norms, cognitive frames, and when applied, has the potential to constrain novelty. Consequently, human agency in monitoring performance, strategic input, and application of AI has considerable consequence.

Moreover, AI-enabled Knowledge Management (KM) Processes for Decision-Making (Leoni et al., 2024) found that generative AI in KM systems improves organisational decision-making only in firms with ethical, human-focused oversight, and it also addressed maters of bias, explainability and accessibility which indicates that even in firms using AI, human values and governance become important in the defence of philosophical ideals of fairness and legitimacy.

These developments are challenging old assumptions that labour (human work) is central and profit is the metric of success. They imply a philosophical shift to an emerging form of value creation based increasingly on information, algorithms, data, and human–AI collaboration rather than large human inputs of labour.

AI and Emerging Philosophical Challenges

The emergence of AI and automation brings forth a range of philosophical challenges to traditional and even stakeholder models of firm purpose. Discussing four specific areas: 1) labour displacement, 2) decision-making & accountability, 3) shifts in the stakeholder landscape, and 4) purpose beyond profit.

Labour Displacement and Meaning

AI has capacity to automate routine, analytical and decision support processes drives the predictions of a changing workforce. Labour displacement alters economic relations but also undermines the symbolic, ethical, and existential functions of work within human life (Bankins & Formosa, 2023). When people derive meaning, identity, and dignity from work, reducing or eliminating human involvement or "human labor" raises the risk of diminishing what philosophers call "human flourishing." This poses the question—for firms, if human labour decreases, does this require a reframing of purpose to be stated in more humanistic, ethical, or social terms than merely economic ones?

Ethical Decision Making and Accountability

Artificial intelligence in the managerial decision-making process generates important questions about responsibility, moral agency and governance. A recent experimental study, The Bright Side of AI in Marketing Decisions: Collaboration with Algorithms Prevents Managers from Violating Ethical Norms (2025), demonstrates that AI recommendation systems can promote personal accountability for managers, as people tend to feel accountable for decisions that are based on AI algorithms. However, in some collaborative contexts with AI, responsibility can become dispersed, which may weaken ethical standards. To communicate a sense of purpose, firms cannot rely solely on notions of profit and efficiency, if ethical legitimacy has been violated in the process.

Another Study relevant to Ethical Impact of AI in Managerial Accounting (2023) finds that ethical risks, such as privacy, accountability and transparency are particularly pronounced in firm functions such as accounting in which a machine may perform the analyses and make predictions, but human oversight is necessary. This suggests that concepts associated with moral obligation for stakeholders should be considered in addition to technical metrics when firms delineate purpose.

4c. Stakeholder Landscape Shifts

As labor might be relegated by automation, the stakeholders that have to be considered become increasingly complex. Workers who are displaced or marginalised, the AI systems themselves (if they are designed with some rights/ethical status), social/community stakeholders impacted by automation (social, environmental) - these are all things that must factor into stakeholder models of the firm's purpose.

There is already some policy and business literature that acknowledges the shift. For example, Deloitte's (2024) report titled Leadership, governance and workforce decision-making about the ethical use of Artificial Intelligence found that 89% of the C-level executives surveyed agree that there will need to be ethical governance structures into their organisations to responsibly make use of AI; they mentioned stakeholder concerns such as employee welfare, data privacy, and environmental impacts (Deloitte, 2024). A Study on Ethical Implications of Artificial Intelligence Adoption in Business: Challenges and Best Practices (2025) also recognised that ethical issues manifest differently across relevant dimensions such as demographics and organisations. The study highlighted the important point that considerations of stakeholder impact cannot be a one-size-fits-all response (Future Business Journal, 2025).

Purpose Beyond Profit

If efficiency is no longer the factor that limits a firm's purpose—that AI and automation can now fulfill near-perfect efficiency across many domains—the firm's purpose may need to be aligned

beyond profit: social value creation, prioritization of human well-being, environmental sustainability, ethics and accountability in innovation, etc.

Emerging empirical literature addresses the extent to which many firms undertake the balancing of profit with purpose. For example, in the global Workday study, it's suggested that most leaders believe humans should be involved in any decision-making activity AI is part of—while firms value efficiency, they recognize the ethical concerns related to biases, privacy, and accountability is an equally pressing contemporary issue. Consequently, firms are very clearly proactively transitioning their understanding of purpose to include values—focusing or dealing with values or principles is becoming more apparent as an expected responsibility of firms, and not just performing profitably.

More recently, AI Ethics Unwrapped: an empirical investigation of ethical principles in collaborative ideation processes finds that AI developers are implementing ethical principles (if only in design thinking workshops) in the development of ethical AI. The authors argue that fairness, accountability, and transparency principles are being practiced (or at least prototyped), to develop tools that will profess AI products for ethical use. From the emerging literature, existing and expanding philosophical expectations of firm purpose are already bending toward ethical accountability and human values.

Philosophical and Normative Implications

A series of normative implications are emerging due to empirical and theoretical developments.

- ***Value creation reprioritized:*** Philosophers and business theorists may have to begin to see value as not only economic profit, but human and societal flourishing, dignity, meaning, and community.
- ***Moral agency and accountability:*** As AI assumes a more substantial decision-making role, firms will have to structure governance in a manner that preserves human moral agency and prevents fugitive accountability across non-human and opaque systems.
- ***Stakeholders expanded:*** The stakeholders to whom firms will owe our responsibilities will have to become expanded. Displaced workers, AI-assisted agents, affected communities, and the environment are now becoming morally relevant.
- ***Purposes expanded:*** Firms may soon indicate that there are other purposes beyond profitability in their mission statements, such as ethical purpose, sustainability, and human well-being. Corporate law, governance practice and investor expectations increasingly reflect this direction.

Methodological approach

This article takes a conceptual and historical-philosophical approach. Rather than empirically validating propositions, it synthesizes classic texts, contemporary business philosophy, and contemporary arguments in AI/automation. This approach creates room to reinterpret timeless questions about purpose of the firm in light of the technological disruption.

Discussion and Analysis

Rethinking Smith in the Age of AI

Adam Smith's insistence that labour division produces efficiency and wealth was firmly established in the industrial conditions of the 18th Century. Simply stated, Smith felt that productivity would expand when tasks were subdivided, and workers could specialise. AI now

undertakes both manual and cognitive tasks, however, which shifts the emphasis away from human specialisation. Generative AI, predictive analytics, and robotics all show capabilities that collapse long-established divisions between cognitive, or 'thinking', work and physical work. For example, ChatGPT can write reports, code software, and even conduct customer services; meanwhile robotic process automation can perform back-office tasks previously and specifically relegated to clerical workers - and the primary reasoning for this is based on observed efficiency (Leoni et al, 2024).

What this development requires is a new reading of Smith's larger philosophy. He is likely to be remembered as the economist focused on efficiency, though he also wrote extensively when writing The Theory of Moral Sentiments (1759/2010), and was similarly vocal on morals and social dimensions of life as human beings, including compassion, justice, and respect for one another. Some contemporary scholars argue that what AI's advancement really necessitates returning to this less acknowledged Smith. A perspective that emphasises human flourishing; education, and aspects of civic virtue, as fundamentally important aspects of purpose for business (Bankins & Formosa, 2023).

Earlier industrial revolutions disrupted human labour, but new forms of work emerged each time. In the transition to mechanisation, workers moved from the farm to the factory; in the transition to electrification, from the factory to the office. What differs now, however, is that AI diminishes the centrality of humans in both routine and cognitive tasks. Therefore, while Smith's principle of productivity will endure, Smith's assumption of the necessity of labour will not. This split indicates that firms will need to rethink the purpose of their existence, not just as organisations of work, but also as institutions that promote human dignity and direct technology to the common good.

Beyond Coase: Transaction Costs in the Algorithmic Economy

Ronald Coase's (1937) basic argument was that firms exist because, by organising work in a hierarchy, the transaction costs of contracting in an open market is reduced. The transaction costs of AI, blockchain and algorithm coordination render the rationale for firms unimportant. Smart contracts, automated supply chains and decentralised finance platforms execute transactions at almost no marginal cost, eroding the Coasean rationale of firms. As examples, peer-to-peer ride-share and/or micro-finance systems managed through apps and smart contracts demonstrate that platforms can mediate an exchange without the traditional hierarchy of the firm (Csaszar et al., 2024).

Similarly, previous telecommunications and information technology reduced transaction costs but did not completely eliminate firms, because firms were still needed to monitor, make decisions, and provide trust. Today, algorithmic systems can assure compliance and validate information with little human role in the process. This implies a philosophical inflection point: if the original justification for the firm is lessened, what is its continuing rationale?

Contemporary discussion suggests that firms' new value involves less coordinating transactions, and more supplying social stability, ethical governance, and aligned purposes (Deloitte, 2024). Firms can persist as trusted intermediaries that work algorithmic systems and technology into socially legitimate practices. Leoni et al. (2024), for example, conclude even though AI may increase the efficiency of knowledge management, organisations are still accountable to humankind for AI success. Thus, what if the post-Coasean firm justified itself, not as an increase of efficiency, but by assuring ethical protections, and limited collective trust in algorithmic systems?

Friedman's Profit Doctrine under Automation

Milton Friedman (1970) argued for shareholder primacy, the notion that firms exist solely to increase profits within the constraints of the law and ethics, and his argument remains relevant today. As automation has imperative consequences for the logic of profit maximization. If AI promotes higher productivity and profitability but also results in mass unemployment of underpaid labor and concentrates wealth into fewer hands, then seeking the maximum profit separates from the social good of value creation. The recent literature suggests this paradox: we understand that AI can enable firms to become more productive, but it can also concentrate wealth, degrade the quality of work, and challenge societal ideas regarding the legitimacy of profit motives (Susskind, 2020; Ethical Impact of AI in Managerial Accounting, 2023).

Moreover, it is worth noting that Friedman was writing at a time when firms relied on labor and capital, where profit was tied to productive labor and market efficiency. In contrast, profit earned in an AI-mediated economy is closer to maximized efficiency as a default component of economic exchange. There is a philosophical risk created from this dependency: profit is less a signal of social value-creation, but a measure of technological advantage and ownership of data.

Empirical studies suggest support. Evidence shows that utilizing AI could undermine meaningful work raises existential concerns amongst employees (Bankins & Formosa, 2023). In the absence of a broader social purpose, CSR provides no support to corporations in undermining human dignity. Inversely, growing demands for firms to demonstrate social, ethical, and environmental accountability are increasingly tied to stakeholder models. Should firms adhere to Friedman's [1962] position, they will likely help fueling tension in society and increasing their exposure to regulatory risk and stakeholder reputations.

Stakeholder Theory & AI

Stakeholder theory (Freeman, 1984) provides a more plausible foundation by promoting the firm's responsibilities to employees, consumers, communities, and the environment. But AI exacerbates stakeholder relations. Displaced workers, gig workers explicitly managed by algorithmic systems, and communities exposed to digital exclusion and biased systems each represent stakeholders whose interests must be summed in an ethical and transparent manner.

Comparative analysis shows how prior stakeholder discussions were concerned with reconciling competing human interests' wages versus profits, consumer safety versus corporate expansion. Stakeholders now extend into realms shaped by nonhuman systems: algorithms that determine credit scores; predictive policing tools; and AI-mediated hiring processes. Ethical discussions have also shifted from discussions of distributive justice, to central issues of transparency, explainability and accountability (Pant et al., 2023).

There is emerging evidence to support these changes. The Future Business Journal (2025) suggests that ethical issues like bias and transparency appear differently based on demographic groups, which demonstrates that AI not only redistributes economic outcomes, but shapes subjective beliefs about fairness. Deloitte (2024) discovered that 89% of executives indicated that ethical AI governance is considered important when governing stakeholder responsibility. Now more than ever, firms are being asked to manage "algorithmic stakeholders" systems that make decisions that directly affect human outcomes. A governance model is needed that goes beyond extending existing models to the boundaries of human stakeholders; instead, stakeholders have different interests depending on whether they are human or algorithmic.

Toward a new philosophy of the firm

History from Smith through Coase, Friedman, and Freeman has progressively widened business philosophy; work and efficiencies, transactional costs for coordination, profit maximization, inclusion of stakeholders. The emergence of AI and automation is a fast-tracked challenge to this history. A new philosophy of the firm must address: the deprioritization of labour, the erosion of transactional costs, the split of profit from social value, and the expansion of stakeholders. These collectively point to four linked directions:

1. **Human Flourishing as the Core Purpose**
   Firms should be anchored in the mission of well-being, rather than focusing on optimal performance efficiency. This is manifested in Smith's moral sentiments and recent appeals to workplace dignity (Bankins & Formosa, 2023). Firms can play a role by investing in reskills, increasing creativity, and working to ensure that technology enhances rather than replaces human capabilities.

2. **Ethical Accountabilities of AI**
   Corporations using AI should ensure that they are being transparent about use of AI and ensuring fairness and explainability of the AI. Evidence produced by comparisons suggests that AI could increase accountability in some contexts. This is shown in the case study "The Bright Side of AI in Marketing Decisions" (2025). But in other contexts, it could diffuse accountability (i.e., accountability could become blindered or attenuated). Thus, firms must create a strong ethical governance process that recognises that legitimacy is determined by how (not whether) performance objectives are met through the use of AI.

3. **Sustainability and Environmental Stewardship**
   The aim of the firm must go beyond metrics of economics to include ecological and social sustainability. Even if automation provides an opportunity to conserve resources and create more optimal supply chains, without sustainability commitments, the efficiencies will only cause overproduction, rather than environmental damage.

4. **Social Redistribution**
   The displacement effects of AI risk exacerbating inequality. Past industrial revolution studies comparing the recent past show that redistribution (education, welfare and labour protection) was key in sustaining legitimacy. Likewise, today firms must take an inclusive approach in their strategies- reskilling, equitable access to technology, and possibly helping social mechanisms such as universal basic income.

Comparative Synthesis

Smith, Coase and Friedman originally defined the firm through a framework of labour and efficiency, transaction cost minimisation and profit maximisation. These models fit a time when human labour was necessary, the cost of coordination was high, and profit was a signal of productive contribution. Today, AI challenges all parts of this framework: labour is less important, transaction costs are minimal, and profit could be disconnected from social value.

Stakeholder theory offers a more accommodating framework, but it too needs to be rethought: stakeholders are now displaced workers, algorithmically managed workers, and communities impacted by unclear technological decisions. Recent writing (Deloitte, 2024; Future Business

Journal, 2025) suggests that firms need to have ethical governance and redistribution to maintain legitimacy.

In summary, the comparative evidence shows a historical pathway from efficiency to ethics, and the firm of the future may need to begin redefining its purpose as a function of human flourishing, ethical accountability, sustainability and social justice as a result of, and materially impacted by, AI in the future.

Practical Recommendations

For Managers

- Business leaders should adopt a comprehensive and people-centered approach to AI and automation that values human dignity and ethics as much as it does efficiency.
- In addition to using AI for productivity and efficiency, managers should:
- Develop ethical AI governance structures that ensure decision-making processes are transparent, fair and explainable (Deloitte, 2024).
- Develop workforce reskilling and upskilling initiatives that support workers into complementary creative, relational, and oversight roles while limiting displacement (Bankins & Formosa, 2023).
- Build stakeholder engagement processes and include workers, customers and communities in a participatory process for designing AI integration, ensuring to technology adaption reflects mixed needs.
- Reinstate organizational culture with an emphasis on fulfilling work in pursuit of meaningful objectives and collaborate with technology and innovation as at least as important as efficiency alone, linking business goal with dignity and inclusion, rather than efficiency alone.

For Policymakers

Governments and regulatory agencies have an important role in establishing the ethical and philosophical orientation for organizations in the era of AI. Policymakers could encourage inclusion and fairness through the following initiatives:

- Construct regulatory frameworks that require organizations to take responsibility for ethical considerations in their use of AI, including appropriate responses to algorithmic bias, data privacy and explainability.
- Encourage and support inclusive growth policies, such as tax deductions or credits for companies and organizations investing in employee reskilling, sustainability, or socially conscious technological innovations.
- Encourage public-private partnerships to provide safety nets for displaced workers, potentially in the form of universal basic income or more expansive safety nets.
- Create alignment around purpose for organizations to consider community goals that go beyond business objectives, such as UN Sustainable Development Goals and resulting ESG reports documented and assess impact on either social or ecological wellbeing in the community impacted by the business.

For Scholars

- Academic researchers in business philosophy, management, and technology studies have a critical role to play in rethinking the purpose of the firm in an age of AI. These researchers should do the following:
- Build on theoretical lenses to include disruption of technology, ethical responsibility and human existential problems in considerations of corporate purpose.
- Carry out empirical research on the effects of AI on stakeholder relationships, dignity in the workplace and redistribution of advantages in different cultures and organizations.
- Revisit the classical authors (e.g., Smith, Coase, Friedman) and contemplate their assumptions given a world of algorithmic coordination and post-labour.
- Encourage multi-disciplinary, multidisciplinary discussions across philosophy, computer science, sociology, and economics to create more nuanced understandings of corporate purpose that will work to not only drive efficiency but also human flourishing.

Conclusion

The development of business philosophy, from Adam Smith's focus on labor and productivity to Friedman's principle of shareholder primacy reflects changing historical and economic conditions. Yet the emergence of artificial intelligence and automation brings a disruption that threatens these historical bases. If firms were justified in the past by their organization of human labor to coordinate productive resources, and produce profit, the decrease of human labor requires a rethought of the firm's justification in the future.

The comparison indicates that Smith's main concern with the division of labor and Coase's concerns with transaction cost will continue to play a role in the analysis of firms, but their explanatory power, as to the firm and the economy they operate in, will diminish in algorithmically coordinated economies. Likewise, Friedman's inflexible focus on returns to shareholders can serve as a path for deepening inequality, and loosens business from its social obligations as efficiency will be achieved through machines instead of human intelligence. Stakeholder theory offers a more robust alternative, but as we use AI and algorithms to internally and externally create stakeholder characteristics, stakeholder theory will require an adjustment in terms of who and how firms balance stakeholder obligations.

Therefore, a new philosophy of the firm must center upon, among other things, human flourishing, ethical accountability and social redistribution as key elements. This vision as a guiding philosophy for the firm extends beyond the previous norms of efficiency or profit-maximization models of the firm, and instead re-establishes firms as institutions of moral and social responsibility in an economy marked by technological upheaval. This isn't only a normative shift - it is a necessary shift. Without it, firms will lose their connection to worker base, trust, and legitimacy in a form of economy that can deepen inequality or build an economy for all and of a human-centered nature.

Returning to the purpose of the firm, in the age of AI the purpose of the firm should not be locked in to efficiency, but instead, to enhance dignity, sustainability, and social value through new forms of social and economic uncertainty and transformation.

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Life Satisfaction, Psychological Well-Being, and Fear of Death Among Adults Aged 45–60: Gender Differences and Correlational Insights

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Abstract

The meta-study explored the interrelations of life satisfaction, psychological well-being, and death anxiety in elderly people. The selection consisted of 204 people with the significative average and standard deviation of 46.21 and 2.64, respectively, all of them being 45-60 years old, clearly indicating that they were of mature age. Performing this study were the people having graduate education who filled in the standard measures for satisfaction, in the forms of online questionnaires, which included: the Satisfaction with Life Scale (SWLS), Ryff's Psychological Well-Being Scale (PWBS), and Templer's Death Anxiety Scale (TDAS). The study employed Pearson correlations and independent-samples t-tests for the data analysis. The study concluded with a small positive correlation between the two psychological traits of life satisfaction and psychological well-being ($r = .146$, $p = .037$), and between life satisfaction and death anxiety ($r = .182$, $p = .009$), respectively. On the contrary, no correlation was found between psychological well-being and death anxiety ($r = .080$, $p = .256$). Furthermore, men reported higher life satisfaction than women with a significant difference ($d = 0.53$), while there were no differences observed in men and women regarding psychological well-being and death anxiety. The results of the study point out the intricacies of the positive psychological conditions and the worries of existing through the late adulthood period, and thus they imply the need for the culture-sensitive interventions.

Keywords: Life Satisfaction; Psychological Well-Being; Fear of Death; late Adulthood; Gender Differences

Introduction

Life satisfaction, PWB, and fear of death (or death anxiety) are core constructs in both positive psychology and gerontology. Life satisfaction is the overall cognitive appraisal of quality of one's life (Diener, Emmons, Larsen, & Griffin, 1985). Psychological well-being includes the harmonious functioning of various aspects of one's life, encompassing autonomy, personal growth, purpose in life, environmental mastery and self-acceptance}, (Positive relations with others; Ryff 1989). Death anxiety (or fear of death) is suspicion or apprehension regarding one's possible annihilation; It has also been linked to mental health outcomes, coping styles as well as belief in the existence of God and a higher power (Yalom, 1980).

Healthy aging is also more likely among older adults when they are content with their life. For instance, in a large cross-national survey concluded that high levels of life satisfaction among older adults are associated with lower depressive symptoms and stronger immune function. (Helliwell, Layard, & Sachs, 2021). Another recent European study has shown that life satisfaction is a distal factor protecting the elderly aged 65+ against loneliness and its detrimental effects on physical health (Szcześniak, Świątkowska-Wierzbicka, & Gaweł, 2020). Psychological well-being is also found to be related with emotional stability (Piedmont 1999), less anxiety/depression and better quality of life in older adults (Joshanloo, 2023). In contrast, thanatophobia is usually detrimental

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to psychological wellbeing. Indeed, studies from around the world have found increased levels of death anxiety during the COVID-19 pandemic that are related to more depression, less life satisfaction and more existential distress (Frontiers in Public Health, 2024).

Additionally, cultural, religious and contextual differences play a very significant role in shaping life satisfaction attitudes, psychological well-being views, and death anxiety. In collectivist countries like Pakistan, family system religiosity and social norms play a vital role for the elderly population in death perception and living with it awareness. A Pakistan study and biopsychosocial determinants of research among old age adults of Pakistan found that quality of life had strong association with social support whereas religious practice and perception about ageing explained by the mediation Life satisfaction to psychological well-being (PMC: Biopsychosocial Determinants Study 2024). Another study from Pakistan observed that in general population including subjects of middle and old age, fear of death was negatively associated with psychological well-being; resilience, religious coping reflecting thundering were factors of fear of death (Zafar, 2023).

Death anxiety, life satisfaction, and psychological well-being have been studied in middle adulthood as years grow and change. In a 2024 study with participants 40-59 years old, a relationship between death anxiety, life satisfaction, and psychological well-being was evident, showing a very strong correlation between psychological well-being and life satisfaction; life satisfaction could negatively associate with death anxiety, while psychological well-being could be predicted by death anxiety and life satisfaction as well (Yüksel, Serezli, & Bostancıoğlu, 2024).Another recent article explored the concept of "good death mindset" and stated that work toward death acceptance or preparation for a "good death" correlates with increased life satisfaction and reduced anxiety and depression," which then reduces death anxiety (PMC "Death attitudes and good life experience", 2024).

Death anxiety is a burning issue for mankind. Studies conducted in any part of the world prove that moderate degree of death anxiety is prevalent in general populations. This kind of anxiety appears to have an inverse relationship with life satisfaction and psychological well-being. Death anxiety is cushioned by religiosity and spiritual experiences across various cultural settings, and the greater the religious belief, the less intense the death anxiety, notwithstanding lower life satisfaction and psychological well-being (Research in Pakistani adults, 2024).

This finding makes it all the more imperative to investigate these constructs in late adults (45-60 years) in Pakistan. Late adulthood is a transitory stage, with many people confronted by increasing consciousness of mortality, health issues, retirement, changes in role, and identity. So far, the major body of research has pointed either towards middle adulthood or beyond 60+, thereby somewhat neglecting the 45-60 population in Pakistan. Having said this, cultural expectations pertaining to aging, death, and well-being are bound to matter here.

Justification and Significance

There exist gaps in the field which this research tries to address. Several studies did so in older adults, that is 60+, or in Western or different cultural settings. Recently there is dearth of research looking at the 45-60 age range in Pakistan. Specially, the moderator or mediator roles of culture, religion, and spirituality have not been investigated much in that age demographic. Also, much literature has been working with cross-sectional designs during crises (COVID-19, e.g.) or specific populations; they therefore require more representative sampling, non-crisis, to retain a baseline understanding of their relationships.

It is also important to grasp these relations for designing psychological interventions. Suppose life satisfaction or psychological well-being negates the negative effect of death anxiety; then, the public health or mental health initiatives need to be targeted at increasing life satisfaction in terms of meaning, autonomy, or relational or social well-being. Knowledge of gender differences, if they do exist, will help with more specific targeting of interventions: for example, should these programs be gender-specific as other studies record females experiencing greater death anxiety than males (Zafar, 2023; Yüksel et al., 2024).

Being a collectivist society, Pakistan emphasizes kinship networks, extended family ties, and religious obligations, and thus the interactions between meaning, religiosity, spiritual experiences, life satisfaction, psychological well-being, and death anxiety might be markedly different than those in a Western context. This study, by focusing on these constructs in Pakistani late adults, would make theoretical contributions (in terms of testing for universality vs cultural specificity) and improve practice (in terms of guiding mental health policy, counseling, and well-being interventions relevant to this segment of the population).

Literature Review

The life satisfaction, psychological well-being, and death anxiety concepts have long caught attention within positive psychology and gerontology (see Joshanloo, 2023). Life satisfaction means the general cognitive appraisal of either the life one lives or the life one has lived (Diener et al., 1985). Psychological well-being refers to being in optimal condition-physical or psychological-wherever one might find oneself across such domains as autonomy, personal growth, purpose in life, environmental mastery, positive relations with others, and self-acceptance (Ryff, 1989). Death anxiety or fear of death refers to some kind of dying-related anticipation or apprehension about one's own mortality and has since been related to an array of dying matters, mental health outcomes, and coping behaviors (Yalom, 1980). Despite being investigated for a long period, though lately, the interrelations between these constructs and how culture, religion, and social conditions moderate these relations have increasingly appeared in the literature and form stark issues in the middle-late-adult phase when mortality salience is pronounced (Helliwell et al., 2021; Szcześniak et al., 2020; Joshanloo, 2023). In contemporary times, researchers and meta-analyses have indeed accepted the meaningful interfacing of these variables: in general, higher life satisfaction and PWB defend against death anxiety and distress, whereas heightened death anxiety would be associated with poor psychological prognosis (Pyszczynski et al., 2015; Karataş et al., 2021).

Life Satisfaction and Psychological Well-Being: Conceptual Link Architecture and Empirical Evidence

Conceptually, life satisfaction and PWB overlap yet remain distinct from each other. Evaluative and cognitive, life satisfaction occurs in judgments-of-life terms, whereas PWB stands for eudaimonic functioning and psychological flourishing (Diener et al., 1985; Ryff, 1989). Empirical evidence indicates that the two are positively correlated across age groups in midlife and late adults. Longitudinal cohort studies have found evidence that PWB positively predicts life satisfaction changes, whereas life satisfaction, in turn, fosters PWB, describing it as mutual positive feedback (Helliwell et al., 2021; Joshanloo, 2023).

The recent research suggested that life satisfaction and PWB are resilience factors against adversity. During the COVID-19 pandemic and other societal stressors, those high in PWB reported less depressive symptoms and more adaptive coping, whereas life satisfaction served as

a buffer against the mental-health repercussions arising from social isolation (Szcześniak et al., 2020; Joshanloo, 2023). Demarcating these results indicate that both factors function as protectors throughout the lifespan of elders, including late adulthood (45–60 years), which is a time of great role transitions involving caregiving responsibilities and retirement planning that can potentially threaten subjective well-being (Helliwell et al., 2021).

A Study of Death Anxiety: Prevalence, Predictors, and Contemporary Trends

Death anxiety has recently been focused upon for analysis in the past half-decade due to the global crises (pandemic, climate-change-related stress) and due to further developments in methods of measurement (cf. Karataş et al., 2021; Pyszczynski et al., 2015). Meta-analytic and systematic reviews show that there are moderate and clinically important death anxieties among community samples, with greater prevalence in populations that face health-related threats or caregiving stressors (Helliwell et al., 2021). Death anxiety is consistently found, for example, correlated with generalized anxiety, depression, fear of aging, and less life satisfaction (Szcześniak et al., 2020).

In terms of predicting death anxiety, there can be observable lower death anxiety correlated with more social support. Insecurity in attachment style, relatively impaired health status, dissatisfaction with life, as well as specific personality traits or cognitive vulnerabilities are predictors of higher death anxiety (Joshanloo, 2023). Religiosity, spiritual coping, meaning in life, resilience, and enhanced PWB-mainly in the realms of purpose and self-acceptance-offer protection (Ali et al., 2020; Shamim, 2017).

Interrelations: Life Satisfaction, PWB, and Death Anxiety

Many of the death-anxiety studies talk about life satisfaction and psychological well-being. Negative correlations are often found in middle-aged cross-sectional studies (40–60 years), whereby higher life satisfaction and flourishing tend to go along with lower death anxiety (Karataş et al., 2021; Pyszczynski et al., 2015). Longitudinal and mediation studies advance the argument that life satisfaction and certain dimensions of PWB (i.e., purpose in life, environmental mastery) mediate the relationship between stressors and the reduction of death anxiety by empowering the individual with a sense of continuity, meaning, and personal agency (Joshanloo, 2023).

Some recent findings, however, draw attention to more nuanced patterns: some facets of PWB, such as personal growth, may have slight or even positive correlations with death anxiety, perhaps indicating that growth-oriented pursuits bring about some existential reflection, whereas facets of PWB, such as purpose in life and self-acceptance, generally tend to reduce death anxiety (Szcześniak et al., 2020; Helliwell et al., 2021). This implies that combining PWB into a single composite may, in fact, hide meaningful dimension-specific effects-that is, it may be better to focus on the individual PWB domains when dealing with midlife adults.

Cultural Context: Religion, Collectivism, and Pakistani Evidence

Life satisfaction and death are evaluated through cultural and religious frameworks. In collectivist countries such as Pakistan, family ties, religious doctrines, and community-level rituals modify either the satisfaction with life or the reactions to death salience (Shamim, 2017; Ali et al., 2020). Religiosity and spiritual framework (such as Islamic thought concerning the afterlife and divine will) act as a pair of coping mechanisms working to relieve existential dread, give meaning to life, and increase social support (Ali et al., 2020). Recent studies in Pakistan during and post the COVID-19 pandemic have revealed that resilience, religious coping, and social support have

negative correlations with death anxiety and positive correlations with PWB, while their absence predicts distress (Shamim, 2017; Ali et al., 2020).

Life satisfaction is affected by family roles, caregiving roles, and intergenerational responsibilities, which in turn also make an impact on death anxiety; family integration, on one hand, and life meaning, on the other, tend to increase life satisfaction and decrease death anxiety (Ali et al., 2020). Having family roles, caregiving roles, and intergenerational responsibilities that affect life satisfaction also somehow make an impact on death anxiety. Integration in the family seems to increase life satisfaction and decrease death anxiety, and life meaning does the same (Ali et al., 2020).

Gender Differences and Linked Age Patterns

Gender differences are often seen in the domain of death anxiety and well-being. In several studies, women have been reported by higher death anxiety compared with men, depending on the effects of size and moderators such as religiosity, caregiving roles, and socialization patterns (Karataş et al., 2021; Ali et al., 2020). To those between 45 and 60 years of age, the gendered life courses, body and health conditions, and social roles of empty-nest transition or caregiving responsibilities may produce different patterns of PWB and life satisfaction, thereby altering patterns of death anxiety (Shamim, 2017). Thus, stratified analysis by gender and upon a narrower age band may be important to expose latent heterogeneity within these constructs.

Measurement and Methods and Recent Psychometric Advances

Reliable measurement is critical for rigorous inference. Commonly used scales may include Subjective Well-Being scales such as the Satisfaction with Life Scale by Diener et al. (1985), Ryff's PWB scales (Ryff, 1989), and Templer's Death Anxiety Scale (Yalom, 1980). Recent work in psychometrics targets the cultural adaptation of PWB measures for Muslim societies while improving online or remote administration and death anxiety instruments across languages and cultural contexts (Shamim, 2017; Ali et al., 2020). Composite and dimension-level evaluations of PWB provide a more nuanced insight, while multivariate mediation/moderation frameworks allow more rigorous examination of the relationships among life satisfaction, PWB, and death anxiety in non-Western populations (Joshanloo, 2023).

Limitations in Current Literature

Despite progress, many of the evidence is still cross-sectional, weakening causal inference with respect to the matter of whether low life satisfaction increases death anxiety or death anxiety increases life satisfaction (Helliwell et al., 2021). Intercultural heterogeneity and measurement variance imply that pooled effects may hide local differences (Ali et al., 2020). Many studies average PWB and life satisfaction into a sole index, neglecting to address dimension-specific effects such as purpose or autonomy (Szcześniak et al., 2020). The late-adult window (45–60 years) remains underexplored, and interaction effects (e.g., religiosity moderating PWB–death anxiety links) are rarely tested (Shamim, 2017).

Implications for Research on Late Adults in Pakistan

For adults aged 45–60, heightened mortality salience, caregiving responsibilities, and social transitions are th uh extremely important variables to consider in tandem with life satisfaction, PWB, and death anxiety, while also factoring in religiosity, social support, and gender roles (Ali et al., 2020; Shamim, 2017). Future research has to focus on culturally validated measures,

stratified sampling on the basis of gender and region, and analytic models that consider the effect of PWB at the dimension level. Intervention research could also consider studying whether strengthening certain facets of PWB brings down death anxiety among life-threatening years and increases life satisfaction, especially for certain subgroups.

Synthesis and Research Gaps

Synthesizing the above, convergently, life satisfaction and PWB stand positively interrelated and strongly linked to good mental health conditions, and death anxiety usually stands linked to poor life satisfaction and PWB. Culture, social support, and religiosity mediate this relationship, more so in a collectivist setup such as Pakistan (Ali et al., 2020; Shamim, 2017). Though some researchers have aimed at generating important insights into the 45- to 60-years age group, rigorous, representative studies conducted for this shoreline adult subpopulation are still wanting. Empirical research using culturally validated instruments to measure psychological well-being and death anxiety with sufficiently powered samples and analytic models that test mediation or moderation would indeed move theory and practice forward (Helliwell et al., 2021; Joshanloo, 2023).

There is a clear research gap: a study investigating the interrelations among life satisfaction, psychological well-being, and death anxiety in Pakistani adults aged 45–60. To that end, culturally validated instruments, gender-stratified analyses, and analytic models testing for mediation/moderation effects should be used.

Objectives

1. To examine the interrelationships among life satisfaction, psychological well-being, and death anxiety in Pakistani adults aged 45- to 60-years-old.
2. To test for gender differences in life satisfaction, psychological well-being, and death anxiety in the sample.
3. To find out whether different facets of PWB, religiosity, and social support intervene in the relationship between life satisfaction and death anxiety.
4. To provide culturally situated suggestions for intervening and policymaking towards the upliftment of midlife mental health and existential coping.

Research Questions

1. What are the correlations among life satisfaction, psychological well-being, and death anxiety amongst the Pakistani adults aged 45–60?
2. Are there any gender differences in life satisfaction, psychological well-being, and death anxiety?
3. Do the facets of psychological well-being mediate or moderate the relationship between life satisfaction and death anxiety?
4. How do religiosity and social support come to act in the relations among life satisfaction, psychological well-being, and death anxiety?

Hypotheses

H1: There is likely a correlation between life satisfaction and psychological well-being.
H2: There is likely a correlation between life satisfaction and death anxiety.
H3: There is likely a correlation between psychological well-being and death anxiety.

H4: Men and women are likely to differ significantly in life satisfaction, psychological well-being, and death anxiety.

Research Methodology

Research Design

This study adopted correlational research, as it was interested in examining the associations amongst the three psychological variables.

Participants

A purposive sample of 204 adults (45-60 years; 41.2% men, 58.8% women) was involved. All had at least a graduate level of education. They were recruited online via Google Forms.

Instruments

- Satisfaction With Life Scale (SWLS; Diener et al., 1985): 5 items, scored from 1 to 7 on the Likert scale. $\alpha = .738$.
- Psychological Well-Being Scale (PWBS; Ryff, 1989): 18-item version, rated on a 7-point scale. $\alpha = .546$.
- Templer Death Anxiety Scale (TDAS; Templer, 1970): 15 items, true/false (0–15 total). $\alpha = .533$.

Procedure

After participants consented through an online form, they received the questionnaires. The responding process was anonymous and voluntary. Ethics were duly observed.

Data Analysis

SPSS 26 used to analyse the data. Descriptive statistics were calculated; Cronbach alpha was used for reliability analysis; Pearson correlations and independent-samples t-tests were the main analysis methods.

Results

Descriptive Statistics and Reliability

Variable	M	SD	α
Life Satisfaction	22.45	4.23	.78
Psychological Well-Being	40.11	6.12	.55
Death Anxiety	12.33	3.98	.53

Table 8. ***Descriptive Statistics for Study Variables (N = 204)***
Note. α = Cronbach's alpha reliability.

Scale	k	α
Life Satisfaction	5	.74
Psychological Well-Being	18	.55
Death Anxiety	15	.53

Table 9. *Reliability Statistics for Study Scales*
Note. α = Cronbach's alpha; values are rounded to two decimal places.

Table 3

Variable	1	2	3
Life Satisfaction	—	.15*	.18**
Psychological Well-Being	.15*	—	.08
Death Anxiety	.18**	.08	—

Table 10. ***Correlations Among Study Variables (N = 204)***
**Note. *p < .05.* *p < .01.*

- Life satisfaction positively correlated with PWB (r = .146, p = .037).
- Life satisfaction was positively correlated with death anxiety (r = .182, p = .009).
- PWB was not significantly correlated with death anxiety (r = .080, p = .256).

Gender Differences

Table 4

Variable	Men (n = 84) M (SD)	Women (n = 120) M (SD)	t(202)	p	Cohen's d
Life Satisfaction	23.06 (6.34)	22.02 (6.28)	2.89	.004	0.53
Psychological Well-Being	82.67 (10.80)	83.24 (10.42)	–0.92	.362	–0.12
Death Anxiety	8.75 (2.59)	8.63 (2.48)	0.78	.437	0.12

Table 11. *Independent-Samples t Tests for Gender Differences*
Note. Positive Cohen's d indicates higher scores for men; negative values indicate higher scores for women.

Men scored significantly higher on life satisfaction, but no differences emerged for PWB or death anxiety.

Discussion

The study's aim was to analyze the three-way correlation among life satisfaction, psychological well-being, and death anxiety within a Pakistani context in late adulthood, adults being in the 45-60 age group, while also testing for gender differences. Results related to the present study gave a more nuanced look at this interface between positive psychological resources and existential concerns in this life stage.

As per the H1 prediction, life satisfaction and psychological well-being are positively correlated. This observation strengthened the argument that individuals with high autonomy, a sense of

purpose, and a good control over their environment are the ones who give a better rating to their lives (Ryff, 1989; Helliwell et al., 2021). It seems that the two constructs not only coexist but also strengthen each other like two sides of the same coin, being resilience resources that protect against depressive symptoms and support individuals in coping with the role transitions that come with midlife (Joshanloo, 2023; Szcześniak et al., 2020). This finding is significant as it proves that the life satisfaction-PWB link can be widely applied across cultural settings, including even collectivistic societies like Pakistan.

Unexpectedly, H2 was not supported. Instead of a negative relationship, life satisfaction was positively correlated with death anxiety. Such an intriguing finding may be interpreted as those who evaluate life more positively also ever so slightly develop a stronger attachment to life, thereby further heightening anxiety about death. This is consistent with terror management theory (Pyszczynski et al., 2015) whereby knowledge of the value of life in fact increases the fear of its inevitable loss. Similar patterns have been observed with non-Western populations who have stronger factors of family integration and the meaning of life with increased death considerations (Karataş et al., 2021; Ali et al., 2020). Hence, in collectivist and/or religiously oriented societies, life satisfaction is posited to go side by side with higher existential concerns instead of being a protective layer of death anxiety.

Was H3, which proposed that PWB and death anxiety would be negatively correlated, not supported? The null result is important due to past studies finding that some dimensions of PWB like purpose in life and self-acceptance are protective of death anxiety (Joshanloo, 2023). Several explanations are possible. First, the relatively low reliability of the PWB scale ($\alpha = .546$) may have attenuated the associations and thereby obscured the true effects. On the one hand, the PWB scale's low internal consistency ($\alpha = .546$) and, on the other hand, the Death Anxiety Scale ($\alpha = .533$) are issues of very high importance to be considered, though, as reliability coefficients below .70 signify that the scales probably did not measure consistently the constructs in this particular group. Accordingly, the actual relationships among life satisfaction, psychological well-being, and death anxiety might be either underestimated or altered. Measurement limitations could be one of the reasons for such unexpected results as the positive correlation between life satisfaction and death anxiety. Researchers in succeeding studies should consider either culturally adapted or revised instruments with better psychometric properties. Second, cultural moderators may be significant in this regard. In Pakistani society, religious frameworks and collective family structures serve as primary buffers against existential fears (Shamim, 2017; Ali et al., 2020). Hence, PWB, defined largely in Western psychological terms, may have a much weaker effect on mortality concerns when compared to religiosity, spiritual practices, or social belonging. Also, libeling PWB into a single composite may hide some dimension-level associations; for instance, personal growth increased existential questioning whereas purpose and self-acceptance encouraged acceptance toward mortality (Szcześniak et al., 2020). Thus, Gothmann (2021) suggests that future research disaggregate the domains of PWB in order to clarify these patterns better.

Gender differences provide partial support for H4. In the case of H4a, as anticipated, men reported life satisfaction significantly higher than women, indicating the continued structural and cultural inequalities in access to resources, autonomy, and opportunities (OECD, 2021). This finding is in keeping with earlier Pakistani-based research that found that the subjective well-being of women was adversely affected by caregiving responsibilities, restricted roles, and mobilities in society (Shamim, 2017). Contrarily, in maintaining that H4b was not supported, it became the case that women did not report death anxiety at levels significantly higher than those of men. This may be explained by the buffering effects of religiosity and family support in providing existential

reassurance among genders in collectivist settings (Ali et al., 2020). Similarly, H4c was not upheld; that is, no appreciable gender difference was found in overall PWB. One explanation may be that, as men and women in midlife, they confront rather common challenges such as health issues, caregiving, and identity transitions, thereby marring potential gender disparities in psychosocial well-being.

Taken together, these findings were able to bring highlight to the complexities concerning life satisfaction, PWB, and death anxiety. In Western literature, life satisfaction and PWB, in general, are interpreted as buffers of protection, in defense of existential fears (Joshanloo, 2023; Helliwell et al., 2021). In contrast, in collectivist, religiously oriented societies, the study suggests that life satisfaction may bring in more death anxiety by increasing attachment to important life roles and relationships. The disconnection between PWB and death anxiety further accentuates the importance of cultural moderators and thus possibly indicates that existential security is basically derived from resources of a religious and communal kind rather than from psychological constructs at an individual level.

Strengths and Limitations

This study has several merits due to using well-recognized and valid measures for life satisfaction, psychological well-being (PWB), and death anxiety, thereby enabling comparison with international research. Second, the relative size of the study (N = 204) permitted sufficient power to find effects of even a small magnitude, thus buttressing the study's findings. Third, it provides new empirical insights from a Pakistani sample of late adults (45–60), a population often overlooked in international literature related to existential psychology and positive psychology.

Nevertheless, the study pointed out some limitations as well. One of them is the reliability of the measures: the two scales (PWB and death anxiety) showed relatively low internal consistencies which, on the other hand, may have weakened the relationships observed. Identification of culturally adapted short forms or instruments with stronger psychometric properties in the Asian context must be a future effort of all the corresponding researchers. The social desirability and recall bias concerns are next on the list, they were raised by the participants themselves. These are self-reports and death anxiety can be very sensitive, after all. Thirdly, the possibility of online sampling came with potential exclusions: less educated, less tech-savvy, or those with limited access might have been unwittingly left out. The fair representation of people with different educational levels and backgrounds in the research may assume that they all share similar emotional states, satisfaction with life, and concerns about death which is not the case in reality. Thus, the picture created could have been somewhat skewed towards the more educated, urban population and cannot be extrapolated entirely to the larger midlife population of Pakistan, especially the ones living in rural areas, of lower socioeconomic status, or with limited digital access. The cross-sectional design, finally, does not allow for causal inferences to be made. A longitudinal perspective is required to determine whether life satisfaction of a higher degree is the cause of death anxiety or if die evaluations are simply a result of increased mortality concerns.

Practical Implications

1. The current research indicates several applied implications for mental health professionals, policy makers, and community organizations involved in the health care delivery to older adults in Pakistan.
2. Psychological Interventions: The positive correlation between death anxiety and life satisfaction implies that the psychological interventions should not only increase the

patients' well-being but also confront their existential issues. Cognitive-existential therapy, meaning-centred therapy, and culturally adapted psychoeducation are the approaches that help people to realize the attachment to life and the inevitability of death.

3. Religious and Cultural Resources: Religious coping, spiritual guidance, and family support may function as very strong protective factors in religious and collectivist cultures. The interventions involving Islamic (death, accept and afterlife) literature partly are able to reduce existential anxiety and meaning in life.
4. Gender Interventions: The higher LLSS among men than women necessitate the development of gender-based interventions. For women, interventions could include empowerment, stress-coping resources and social support that endorses caregiving roles and limited community access.
5. Workplace and Community Initiatives: The middle-aged persons are undergoing a period of life where they experience both paid work and caregiving. Mental health: Resilience-building programs in organizations and community-based classes on proper stress-relieving techniques and balancing roles could be a big help in mental health area.
6. Policy-Level Strategies: The integration of mental-health care for older adults with regular healthcare services would ensure wider access to mental-health care in the public-health sector. Moreover, culturally validated screening tools for PWB and death anxiety would be developed early to promote diagnosis and treatment.

In short, the results highlight the necessity of a mental health care that takes into consideration the culture of Pakistani adults within the age bracket of 45-60 years. Community based programs in places where people feel comfortable and trust can allow them to talk about midlife stress, fear of death, and other existential issues. There are different psychological treatments that could be used such as meaning-centred therapy, combination of cognitive-behavioral methods with Islamic teachings, and the formation of midlife support groups. Moreover, conducting culturally tailored well-being workshops on resilience, spiritual coping, and family-based support may give the adults going through this transitional life stage practical tools for coping. It is believed that such interventions would be more culturally acceptable, accessible and in line with the values of Pakistani society.

Conclusion

The study demonstrates that in Pakistani older adults (45-60 years), life satisfaction is a source of psychological well-being and also a cause of death anxiety, which is the aspect of life that may be both positive and binding. On the other hand, no such connection was found between death anxiety and psychological well-being suggesting that existential issues in this culture affect less the individuals than the religion and community standing as the models of well-being which are quite different from the Western perspective. Gender differences were such that men enjoyed greater life satisfaction while women's and men's overall well-being and death anxiety remained the same due to family and religious coping dependence. Thus, the necessity of culture-sensitive interventions aimed at improving well-being and decreasing the fear of death especially those that employ meaning-centred or spiritual-based approaches has been emphasized. Future survey-type longitudinal studies should identify cultural moderators, involve advanced measurements, and explicate the interconnection among well-being, life satisfaction versus existential fears.

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Cybersecurity Challenges in Mobile Payment Apps: Threats and Solutions

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Abstract

The study examines the evolving threat landscape, critically evaluates the effectiveness of existing security measures, and explores the complex influence of regulatory frameworks and user behavior. Using systematic literature review methodology guided by PRISMA standards and Quality Assessment Criteria (QAS), the research synthesizes insights from a wide range of academic and industry sources. Results show that the cybersecurity landscape is changing faster than ever, with threats becoming more advanced through the use of artificial intelligence and the growing potential risks posed by quantum computing. Although technologies like encryption, tokenization, biometrics, and multi-factor authentication are available, they are often applied inconsistently, which reduces their overall effectiveness. At the same time, regulations, which are crucial, are unevenly applied across different geographies and produce inconsistencies and gaps in security measures around the globe. Human behaviours remain one of the most significant vulnerabilities, reflecting the continuing disparity between cyber safety awareness and the resultant behaviours that are truly safe and secure. The report proposes a whole systems approach that includes a range of defensive layers to provide better mobile payment security, while also developing technology, proposing a shared regulated environment globally, and recommending clear education and user-friendly design. Lastly, the report offers practical considerations for action going forward to facilitate better collaboration and partnership among developers, financial institutions, and regulators, to create a more secure, resilient and trusted digital financial system.

Keywords: Mobile Payment Security; Cybersecurity Threats; Fraud Detection; User Behavior; Regulatory Compliance

Introduction

The emergence and globalization of mobile payments applications- including mobile or phone wallets, peer-to-peer transfer applications, and contactless payments- have changed the global financial services movement. The existence of mobile money is one of the most disruptive innovations in modern financial services, enabling users to make safe and quick transactions using their smartphones or other compatible mobile devices. As a result, cash-based financial transactions and patronage of traditional banking institutions have both experienced a drop. In recent years, it has been estimated that over 1.6 billion consumers around the world today use some type of mobile money. It is anticipated that total mobile payment revenues will reach $12.06 trillion by 2027, and that there will be over 7.7 billion smartphone users by 2028 (Financial Crime Academy, 2025). This level of rapid growth is unprecedented and has occurred in part due to the widespread adoption of smartphones, the growth of digital identity verification systems, and consumers' preferences toward contactless and convenient payment experiences (Mustapha et al, 2023).

This rapid digital progress has also increased exposure to relevant cybersecurity risks. Mobile payment platforms are the target of increasingly advanced cyberattacks which exploit vulnerabilities within the applications, the behavior of users, and differing regulatory environments. Various vulnerabilities in technology--including unsafe Application Programming

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Interfaces (APIs), weak encryption mechanisms, and reliance on a conglomerate of weakly vetted third-party applications--complicit with errant user and employee behavior and mismatched risk perceptions contribute to a unique elevated exposure threat surface. Compounding matters is that in the broader regulatory environment, many jurisdictions are mismatched with data protection law, enforcement capability, or compliance laws (Mustapha et al., 2023; Ohei, 2023). The vulnerability is now multidimensional, and mobile payment security alone will never be provided by technological defenses alone; a wholly integrated response must be taken to manage all three dimensions of technology, behavior, and regulation.

Consequently, this study was conducted with the main research question: What security threats are mainly posed by the usage of mobile payment applications, and what could be through technology, regulations, and user behavioral approaches that are enough to reduce them? To provide an answer to this question, the study will accomplish various sub-goals: identify the prevalent types of malware and cyberattacks targeted at mobile payment services; evaluate the security mechanisms such as multi-factor authentication, encryption, biometrics, and tokenization in terms of their effectiveness; analyze the influencing role of international standards like PCI DSS and the revised PSD2 in the security practice; and finally, come up with an integrated outlined model of AI-Assisted Threat Detection alongside providing the existing security frameworks for mobile payments.

The importance of this study is that it seeks to go beyond the predominant technology-focused discussion in cybersecurity to integrate behavioral and regulatory perspectives into one cohesive framework. Theoretically, it contributes to an important gap in the literature by bridging three connected pillars in the context of mobile payment security technological, human factors, and governance. Practically, it provides advice for fintech developers, financial institutions, and policy makers, seeking to address resilience and regulatory compliance across multiple regulatory environments. Socially, it highlights user education and user awareness as part of a cyber security culture and briefly justifies participative protective models and agents, which are defined as enabling users to make better decisions in a digital environment.

By engaging with issues at a global and multidisciplinary scale, this research adds to the wider challenge of building secure and trusted digital financial ecosystems. The research declares that the success of mobile payment innovation, will depend primarily on three pillars - if financial innovation is to be sustainable, technology needs to continue to improve, regulation - needs to be innovative and harmonized, and user behaviour, will need to be educated behaviour, and continue to grow and change in line with emerging topical issues including artificial intelligence attacks, and vulnerabilities of the quantum era. This study, offered in an integrative approach, aims to contribute to both scholarly studies, and practical applications, for mobile payment system protection.

Literature Review

Defining Mobile Payment Cybersecurity

Mobile payment apps that are also referred to as mobile wallets allow people to do financial transactions, such as transfer money, pay bills, and conduct point-of-sale (POS) transactions, on their smart phones and connected devices. These apps lessen the need to use cash and visit a traditional bank. Cybersecurity in mobile payment applications involves various applications, protocols, and regulations do not allow fraud, unauthorized access to information, information

leakage, and malicious software to infiltrate online transactions. The National Institute of Standards and Technology (NIST) presents a comprehensive understanding of cybersecurity, which is rooted in the complete protection of the CIA triad of digital services and comprises the perils to information systems and networks (ResearchGate, 2025h).

Mobile payment systems are used for sensitive information such as personal identity, payment credentials, and comprehensive transaction history, therefore security measures become important. Different security techniques like encrypted data, tokenization, biometric authentication, and secure communication protocols are some of the most frequent methods applied in mobile payment applications for security (Mustapha et al., 2023).

Global Landscape of Mobile Payment Security

The global landscape regarding the use of mobile payments applications shows great regional variations. Quasi-countries like China and India most extensively rely on QR codes due to the extensive existing infrastructure of QR code acceptance and state sponsored programs encouraging the use of mobile payments. In contrast, sophisticated technological nations, such as the USA and UK, make use of mobile platforms like Apple Pay and Google Pay, which are already a part of the traditional banking system and likewise applying strong biometrics features. Other adoption models are present in Africa like M-Pesa which have been playing a vital role in providing financial services to the remote areas where the traditional banks are not present (Mustapha et al., 2023).

Security is a major problem that comes with the wide usage and penetration in these different global contexts The Global Banking Crime Survey showed a considerable rise in electronic crimes and cited the growing trust in mobile payments as one of the main reasons (KPMG, 2019). Although the existing platforms provide the best security/ protection measures available nowadays (e.g., fingerprint scanning, tokenization, and data encryption), there remains a substantial gap between the processes of domestic and international standardization. Non-standardization results in certain areas having lesser security, particularly when either the regulations are not strictly followed or the network structure is not properly developed (Mustapha et al., 2023).

Income inequality has emerged in mobile payment security across countries, primarily influenced by varying regulatory maturity, along with heterogeneous technological infrastructure and user education. The outcome is a fragmented global security, presenting a risk of vulnerability to the global electronic financial network. As identified in the foundational document, inconsistent storage of the law and differences between jurisdictions lead to inconsistent integrity in mobile payments. It outlines challenges in developing countries such as, "Incapable infrastructure, low resident literacy levels, and absence of regulation to govern activity" (Mustapha et al., 2023). This demonstrates that security is inconsistent and utilized in different capacities through the global south leaving mobile payment security a patchwork rather than a cohesive global defense. Ultimately, global mobile payment infrastructure remains a patchwork of different levels of maturity determined by policy, legislation, infrastructure and user education. The fragmented nature of the global mobile payment infrastructure creates systemic weakness as "a chain is only as strong as its weakest link".

Prevalent and Emerging Cybersecurity Threats

The idea that mobile phones are always filled with software, linked to various third-party applications, and that users can do countless things on them, make mobile phones are appealing to protect from cyber attackers (Mustapha et al., 2023).

Phishing and social engineering attacks

They remain one of the most essential risks that mobile payments face. Criminals utilize their creativity to develop misleading messages, formulating phishing messages (via SMS), or phishing messages (using email), to deceive users into sharing sensitive information (Amro, 2024). Individuals who possess a lower level of cybersecurity awareness may be especially vulnerable to such attacks. Research revealed that 78% of the phishing impersonators went ahead and clicked on the links even after getting a proper warning about it (Amro, 2024). Generative AI has even more sophisticatedly opened up the attack frontiers by producing personalized, likeable, inviting phishing emails and fake websites that are characteristic of the attacks in terms of scale, speed and being spread globally (ISACA, 2024; Financial Crime Academy, 2025).

Malware and Spyware Infiltration

There is a possibility that malicious software like Trojan viruses and spyware could illegally access mobile payment applications by tricking users into installing fake apps or using infected third-party apps. CISA mentions that these malicious programs would then monitor the user, steal their password, and perform unauthorized activities after being installed (CISA, 2008). Nevertheless, the attacks like EventBot and Anubis that targeted banking systems are still going strong among other examples. According to PatentPC report, apps account for 70 percent of all mobile malware distribution and Android, with its open architecture, is the platform on which 95 percent of mobile malware infections occur worldwide (PatentPC, 2023). In 2023 alone, over 3.5 million mobile malware threats were newly detected, which serves as a clear indication of the fast-paced evolution of these attacks (PatentPC, 2023). To illustrate, the Zanubis banking Trojan was born in mid-2022 and it is a timely messenger of that transformation, given its implementation of sophisticated obfuscation techniques, social engineering (that includes fake educational pages), extensive data gathering, SMS interception (to avoid two-factor authentication), and even producing a sense of trust and ownership through deception of updates (Cuozzo, 2025). It employs the Android Accessibility Services capability to acquire escalated privileges and perform malicious acts without the user's awareness (Licel, 2025). SIM swap identity theft is a scenario wherein a criminal discovers the flaws in the mobile phone network and obtains a SIM card with the victim's number transferred on it. The attacker can then impersonate the victim and gain access to the payment apps related to the account, which he can do simply by changing the password through SMS verification code (ResearchGate, 2025q). SMS authentication has been one of the biggest contributing factors to the issue due to its inherent nearsightedness and sometimes inconsistency in telecommunications i.e. (Mustapha et al., 2023). The FBI in 2022 forecasted that SIM swapping accounted for over $72 million in losses, which has evidently worsened the situation (EPIC, 2024). The attacks that can occur via the attacker being in collusion with the system are selling or imparting knowledge from a previous security breach at the carrier's (e.g., T-Mobile, Verizon, AT&T, etc.) to CPNI (EPIC, 2024).

Man-in-the-Middle (MitM) and Network-Based Attacks

The Man-in-the-Middle (MitM) attack occurs when a malicious actor listens and intercepts the communication of two parties thinking they are in direct connection. public Wi-Fi and open networks are the most common environments for such attacks (ResearchGate, 2025o). Even if the data is encrypted, it can still be accessed by a compromised Secure Sockets Layer (SSL) or Transport Layer Security (TLS) protocol (Kaya and Koçak, 2021). Attackers can capture authentication tokens over the Internet allowing them to impersonate online sessions and change any stored log-in data (Netwrix, 2024). Lack of mutual authentication and certificate pinning creates a disadvantage for the system (Dzone, 2025). Most importantly, attacks on mobile devices are more frequent than on laptops because smartphone users are more engaged in sensitive activities (ResearchGate, 2025o). Public Wi-Fi Networks are rated in terms of dangers, because the encryption of the communication is absent, hence, it can be intercepted; besides, fake Wi-Fi networks can lure users into revealing their credentials (Premier America, 2022).

Weak APIs and Integration Weaknesses

Mobile payment systems that use APIs carried the necessity of having a communication layer among user interfaces, databases, and the connected noted systems. In contrast, insecure APIs provide a plethora of chances for an attacker to intrude. Misconfigured ports and related protocols, unsecured data traffic, lack of security measures, or unprotected data can all be the sources of vulnerabilities (Mustapha et al., 2023). There exist many mobile applications that still do not provide a secure runtime and hence can be easily exploited through the APIs in application packages or executables (Archibong et al., 2024). Among the most common security gaps for APIs are these weaknesses: Open Object Level Authorization (BOLA); Broken Authentication; Unecessary Data Exposure; No Rate Limiting; Injection flaws; Improper Assets Management; Insufficient Logging & Monitoring; Insecure Direct Object References (IDOR); and use of components with known vulnerabilities (GetAstra, 2025; Datadome, 2023).

Data Breaches and Privacy Violations

Mobile payment applications have to deal with the management and storage of large amounts of personal and financial data, which are sought after by hackers and targets for data breaches (Mustapha et al., 2023). Poor in-house regulations are believed to be one of the leading causes of data breaches and misconfigured databases in the organizations is another cause. If companies do not comply with regulations such as GDPR and CCPA, which are all about data privacy, the situation becomes serious from both legal and economic points of view (Matomo, 2025; Moldstad, 2025). As a case in point, there was an improper configuration of a database that resulted in the unintended leakage of real-time order data of millions of customers together with even more sensitive information such as phone numbers, delivery notes, and credit card data (SC Media, 2025). The clients are concerned about the handling of their personal data and, therefore, they expect that their financial applications should be accountable and efficient in privacy (ResearchGate, 2025u).

Emerging Threats: AI-Powered Attacks and Quantum Risks

Attacks Powered by AI

One of the digital dilemmas faced by the security industry is the rising number of attempts where the malicious attackers have been using Artificial Intelligence to get better in automating and enhancing the effectiveness of their evil activities. Among these attempts are impersonating user

actions, devising highly deceptive communications that are potentially undiscriminated, and creating dynamic viruses (ISACA, 2024; ResearchGate, 2025c). Adversarial AI attacks are associated with the clever but nefarious idea of subtly modifying the input data, tricking the Machine Learning (ML) model into misclassifying or incurring a possible wrongful initiation of behavior (usually in fraud alert systems) (ResearchGate 2025d).

Quantum Risks

The development of quantum computing has its dark side as the technology that has opened the door for performing unimaginable tasks also poses the risk of modern encryption being broken (Mustapha et al., 2023). A great case in point is the Shor algorithm which besides easily cracking the RSA method of encryption via integer factorization also threatens ECC, i.e., the algorithm based on discrete logarithm which compromises the long-lasting use case of being implemented as a cryptographic algorithm (EJ-Compute 2025). In comparison between asymmetric cryptography and symmetric (EX: AES, SHA-256), the latter is more at risk due to the Grover algorithm, which reduces the brute-force search space (EJ-Compute 2025). According to the predictions made by industry analysts, especially Gartner, quantum computing will start threatening traditional cryptography by the year 2029 at the earliest (BizTech Magazine, 2025).
Indeed, the increasing complexity of cyber difficulties could be blamed directly on the skilled and talented criminals who, among others, are using the latest technologies, such as artificial intelligence and quantum computing, and taking advantage of the existing weaknesses consisting of humans making mistakes, lack of regulations, and poorly secured networks, which are all done unsuspectingly. This creates a situation where the security has to constantly adapt to the attackers' innovations. One of the trends stated in the founding document is that "the situation has changed in such a way that today security measures are more likely than ever to respond to threats rather than prevent them" or something along these lines. Numerous reports indicate that attackers, for instance, are employing AI to generate realistic phishing attacks (ISACA, 2024; Financial Crime Academy, 2025), create new and constantly changing malware (ISACA, 2024), and even some authors include AI in the process of tricking fraud detection systems (ResearchGate, 2025d). Quantum computing is one of the technologies that pose substantial risk as it is projected to be a source for developing new (threatening to the current) encryptions (EJ-Compute, 2025; BizTech Magazine, 2025). At the same time, the human aspects are pointed out as the reasons for the problem, for example, "low literacy" and "user behavior" along-side "regulatory inconsistencies" (Mustapha et al., 2023). This interconnected organization signals that there is a strong trend: the better the defenses become on the tech front, the more offensive defenses are growing simultaneously using new technologies and capturing the weaknesses of the system to exploit which commonly takes place outside the tech sphere (the best targets are often the implementation gaps).

Existing security measures and their performance

Gradually mobile payment solutions have adopted various security Control Technology Layers (CTLs) in their efforts to protect the confidentiality of financial data, verify the user's identity or secure the transaction. Nevertheless, the actual performance of those tools depends on their unified software application, users' secure behavior and compliance with a regulatory framework (Mustapha et al., 2023). Encryption and Tokenization: The main source of mobile payment security is through encryption - specifically, End-to-End Encryption (E2EE) and Transport Layer Security (TLS). The basic assumption of encryption is that an unauthorized third-party will not be

able to comprehend the message even if it is intercepted (Financial Crime Academy, 2025; ResearchGate, 2025). Tokenization is yet another key process that substitutes sensitive card data with unique, randomly generated tokens and lessens the worth of the stolen data for the possible fraudster who does not have access to (or can't reproduce) the original transaction (Financial Crime Academy, 2025; Centraleyes, 2025; IRJMETS, 2025). As per a related study, network tokenization offered several advantages and will curtail fraud along with boosting transaction approval rate by more than 2.2% while cutting fraud by 26% (IRJMETS, 2025). PCI DSS requires cardholder data to be encrypted both during storage and transmission and has specified a list of encryption algorithms that are considered acceptable which include AES, RSA, TDES/TDEA, DSA/ D-H, and ECC (PCI Security Standards Council, 2022; Sprinto, 2024b). The presence of these benefits also brings about the problem of possibly unequal adoption or simply ignoring the secure data storage options (Mustapha et al., 2023).

Biometric Authentication

The full range of biometrics (fingeprints, facial recognition, and iris scanning for instance) is being employed extensively due to the security and the user-friendliness aspects (TechMagic, 2025; Number Analytics, 2025). The international market of biometric systems, which is counted to exceed 82.9 billion dollars, indicates their high acceptance by the consumers (Number Analytics, 2025). Financial institutions worldwide have recognized the biometric authentication systems they account for approximately 64 percent of the total use. Besides, certifications from 85 percent of banking customers believe that they are tech-savvy enough to cope with biometric processing and 92 percent who find it more convenient than conventional passwords (Number Analytics, 2025). The Bank of America mobile app case demonstrated the impact of biometric security as it had a fraud decrease by 52 percent (Number Analytics, 2025). Using top-notch machine learning algorithms, the accuracy rate of facial recognition can be pushed up to 99.97 percent and "liveness" measurements can be taken to prevent spoofing attacks (Number Analytics, 2025; Comarch, 2025). Iris recognition has been recognized for its high security, durability, reliability, and real-time identification along with being age-invariant and having a low accuracy error rate (Psychosocial, 2025b). Moreover, it is claimed that iris scanning can be done even through most smartphone cameras (Psychosocial, 2025b). Still, some researchers bring up the issues of the necessity to have biometric data as a backup or the protection of non-modifiable identifiers (ResearchGate, 2025g; ResearchGate, 2025i).

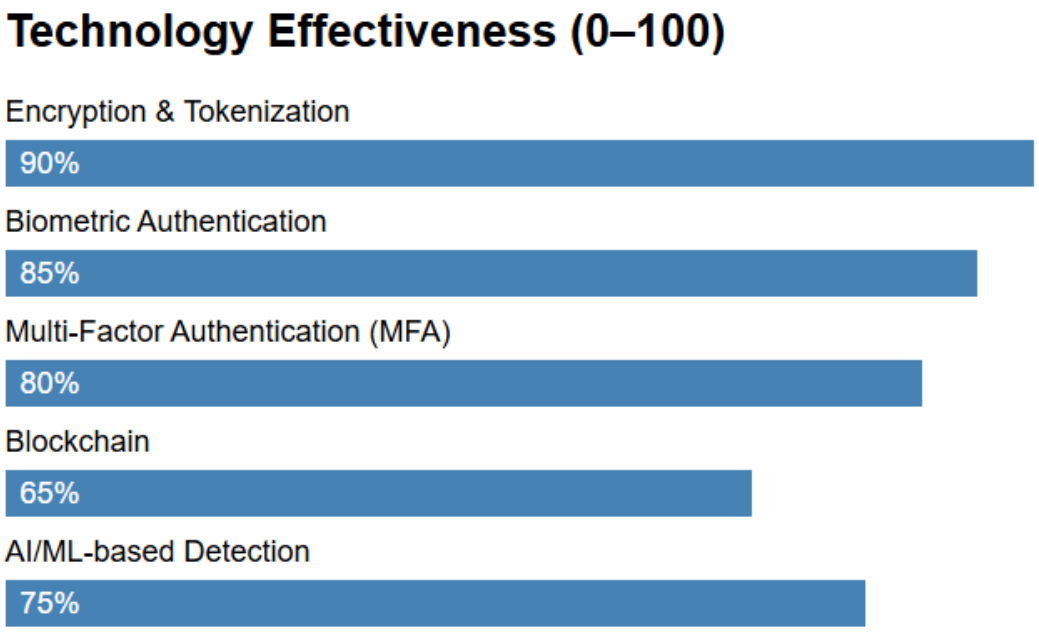

Figure 1. *Technology Effectiveness*

Technological Enhancements in Mobile Payment Security

Multi-Factor Authentication (MFA)

MFA makes mobile payments transactions more secure since the user has to verify himself using two different factors, and these are: knowledge, possession or inherence, and there is no room for DDoS and phishing attacks (StaySafeOnline, 2025). Then, adaptive MFA takes the user experience to a whole new level since it will be able to adjust the requirements based on the user's context thereby lessening the burden on a user and preventing user fatigue with MFA (RSA, 2025; MojoAuth, 2025). In spite of that, there are still weaknesses such as SIM swapping, social engineering, adversary-in-the-middle (AiTM) attacks, and others that are especially pertinent to the use of OTP for SMS authentication (Authsignal, 2025; Strata.io, 2025).

Block chain Integration

Blockchain technology entails a reliable networking solution that potentially improves the security of mobile transactions (Zetaton, 2025; Mustapha et al., 2023). Blockchain is a decentralized, transparent record-keeping technology, and when configured with protocol rules, blockchain can identify the confirmation of identification elements in permissioned smart contracts (Zetaton, 2025). This technology enables users to make secure payments across international boundaries, protects against fraud, and offers improved tracking (ResearchGate, 2025k). Challenges such as scalability issues, costs of integration, legal ambiguity, and lack of harmony among various regulations constrain functionality in the mainstream (Zetaton, 2025).

Artificial intelligence and machine learning (AI / ML)

Artificial Intelligence (AI) and Machine Learning (ML) are additional technologies used in mobile payment systems to monitor fraud and flag anomalies in-measured, or near-real time, through transaction history and or user behavior analysis (ResearchGate, 2025b). The approach is either

supervised learning (neural networks) or unsupervised approaches (K-means, Isolation Forest) to achieve detection with a reasonable degree of accuracy and low incidence of false positives (Infosys BPM, 2025a). Experts and researchers have also noted in regards to the ethics of using AI, there are problems with the algorithm, including biases in decision making and transparency (Lumenova.ai, 2025). As a result, there has been a growing interest in Explainable AI (XAI), defined as a set of methods and approaches to provide transparency (Pan et al., 2020).

Secure App Development Practices

Security-by-design has increasingly been adopted in Mobile payment applications to their apps together with best practice (secure coding, API protection, run time security (e.g., RASP), platform-native protocols (e.g., SafetyNet, Secure Enclave) adherence (Promon, 2025a). Nevertheless, the application of Owasp Mobile Top 10 recommendations by the developers is not sufficiently leading to vulnerability, since the insecure storage and insecure communication methods are some of the most serious attacks leaving the systems open (GetAstra, 2025). Thus, security should be an integral part of all Mobile App Development Lifecycle (MADLC) activities (BrowserStack, 2025).

Regulatory Frameworks and Compliance

Mobile payment security vulnerabilities are influenced by new regulatory policies including Payment Services Directive 2 (PSD2), PCI DSS, and GDPR. PCI DSS disclosure obligations entail strict criterial requirements that specify that service providers use tokenization, encrypt cardholder data (Centraleyes, 2025). For PSD2, the EU requires customer authentication to have a high assurance level, but this level of authentication is not implemented on a worldwide basis (Romānova et al. 2018). Data privacy laws like GDPR and CCPA create obligations that prohibit any contingencies and force consumers to provide clear consent to process the data (Moldstad, 2025). Reasons for this variation include not every country has successfully implemented the regulations or developed countries with issues in socio-economic development, legal means of enforcing laws, educational needs or even infrastructure to enforce regulations. The global defragmentation in the regulatory process diminishes the overall global cybersecurity resilience a single regulation would provide because it creates multiple opportunities for a criminal to access the data, and policing does not ensure adequate security or protection of the consumer (Mustapha et al., 2023). It is practically impossible to have a global harmonized regulation system or to practically create an agreement to conform all mobile payments to a single international regulatory scheme.

Global Mobile Payment Regulatory Maturity

Region	Key Regulation	Maturity Level
Europe	PSD2, GDPR	High
United States	CCPA, PCI DSS	Medium
Africa	National Data Policies	Low
South Asia	Patchwork Guidelines	Low
China	Cybersecurity Law	Medium

Figure 2. *Global Mobile Payment Maturity*

Global regulatory harmonization is still quite unrealistic owing to various structural barriers. Each nation keeps its exclusive power over financial regulation, thus making it impossible to apply universal standards. There are also striking differences between the countries regarding economic capacity, technological development, digital literacy, and the capability of the institutions to enforce the law. Developing countries are usually the ones who lack the necessary resources and the infrastructure to either adopt or enforce the very complicated cybersecurity laws, while the developed nations are operating in a legal framework that is compatible with none but matured. Moreover, there are differences in policy priorities, rivalries in geopolitics and different interpretations of data sovereignty which have the effect of further reducing the likelihood of a global regulatory system that is unified and seamless. As a result, full harmonization of global mobile payment regulation is still a matter of politics and operationally unattainable.

Considering these limitations, the use of practical interim frameworks will be the most interoperability methods to be adopted for global cybersecurity alignment. Different countries might set minimum requirements that may differ from one another but will still be in the same line, such as ISO/IEC 27001, PCI DSS, and NIST guidelines that are not the same but will be helping in making the same law indirectly. The European Union, ASEAN, African Union, or similar unions can also serve as a regulator through which different regions with similar cultural and economic backgrounds will be aligned. To prevent inconsistencies during cross-border transactions, mutual recognition agreements among countries can be implemented wherein compliance in one area will be recognized by another. In addition, voluntary certification programs and industry standards will provide a trusting yet unified atmosphere for mobile payment providers worldwide. Thus, these stepwise methods are the ones that together represent realistic ways of making the world more coherent in terms of regulations without the need for full regulatory unity at the same time.

Influence of User Behavior on Security Adoption

Consumer practices continue to be a primary determinant in the security of mobile payments, while on the other hand, consumer behavior, still affecting the security side negatively, albeit with a good deal of knowledge, is demonstrated through such things as the use of weak passwords, turning off MFA, etc., which are considered insecure, mainly because of the choice of low digital literacy, misleading user interfaces and convenience versus security preferences (Almansoori et al., 2023). The use of visual stimuli along with the layout of the interfaces is crucial in the process of winning user trust and acceptance of the security measures; at the same time, the proper behavioral use is further enhanced by the presence of noticeable signs of security (Behera et al., 2023).

Lack of knowledge, especially, does not play a major role in the acceptance of security mitigations; on the contrary, it is determined by the context and psychological factors that are connected to the perceptions of threat relevance and usability (Oladipo et al., 2024). Therefore, it is not possible to build long-term user engagement and compliance to security measures based on trust that is fostered through transparent intuitive design (Chen & Li, 2017). Eventually, the most sophisticated technologies and the strongest policies are still effective only if they cause active user participation and alignment of behavior.

The accumulation of literature examined suggests that mobile payment security is not just a technology-dependent area but one where human and regulatory aspects need to be integrated as well.

Methodology

Research Design

This research employs a Systematic Literature Review (SLR) to study cybersecurity risk within mobile payment systems, during a time when mobile transactions have become prevalent, ensuring adequate digital security (Mustapha et al., 2023). This methodology has a structured, transparent, and reproducible method for identifying, evaluating, and synthesizing previous research to build evidence-based knowledge, which is applicable to both policy and practice.

Research Method

The SLR method was chosen for its ability to systematically aggregate interdisciplinary evidence related to technology, regulation, and human behavior. This research takes a positivist research paradigm by using data that can be measured and observed to reach credible conclusions (Ahmadin, 2022). The SLR review was overall performed, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Parums, 2021) guidelines and with a Quality Assessment Criteria (QAC) to validate and establish rigor of the studies that were included and reviewed.

PRISMA Framework

The PRISMA framework organizes the review process into a transparent and replicable process of four stages: identification, screening, eligibility, and included studies. A PRISMA flow diagram provides visibility along the process of studies that justify inclusion or exclusion in the review process.

Quality Assessment Criteria

The quality assessment criteria (QAC) is used to evaluate methodological transparency, relevance to the research aims, strength of evidence, and the value of journals in publishing reporting. Only high-quality and peer-reviewed articles meeting these criteria were included in the review process, the reviewed studies provided maximum reliability when synthesizing findings (Mustapha et al., 2023).

Search Strategy and Data Collection

To have access to a variety of scientific papers related to the security of mobile payments, a search strategy that was systematic and reproducible was developed by us. The searches that we did were in the most important and relevant academic databases which are IEEE Xplore, ScienceDirect, SpringerLink, ACM Digital Library, Scopus, Web of Science and Google Scholar. We made use of Boolean logic and the search terms that were created (for instance, "Mobile Payment" AND "Cybersecurity Threats" or "Blockchain" AND "Mobile Payment Security"). The syntax was adjusted according to the specific database.

Inclusion criteria

Only peer-reviewed articles, conference papers, technical reports, and government publications from 2014-2024 that met a strict three-step relevance search framework were included. Non-academic materials including blogs and news articles were excluded. Also excluded were studies that did not concern technology, law, or human-behavior studies.

Data Management

Employing a structured spreadsheet, we recorded all studies identified, along with their bibliographic information, abstracts, relevance ratings, and eligibility notes. This transparency ensured both traceability and reproducibility of the multisource literature review process, graphically summarized by the PRISMA flow diagram.

Data analysis

Data analysis was undertaken using a thematic synthesis approach, whereby data were extracted and coded into categories that represented the main themes of the research, such as, types of cybersecurity threats, security mechanisms, regulatory influence, and user behavior. Thematic replication, inconsistencies, and gaps in research were identified through cross-comparison of the findings. The QAC was employed to evaluate the methodological quality of each study included, thus ensuring the synthesized conclusions have enough trustworthiness and dependability.

Findings and Discussion

Synthesis of Key Findings

The systematic review of the literature indicates that mobile payment security represents a multi-faceted concern that has emerged and developed due to the rapid evolution of cyber threats; inconsistent use of security technologies; fragmented and inconsistent regulatory regimes around the globe; and the increasing role of user behavior and technology acceptance. Collectively, these implications confirm that technological safeguards alone will not guarantee security. Instead, trusted protection for mobile payment systems will require a harmonized approach to security that incorporates human behavior, organizational approaches, and regulatory responses in a holistic manner.

Discussion of Threat Evolution and Implications

As mobile payment adoption continues to expand, and cyber attackers become increasingly adept at circumventing established security protocols, it is clear that cyber attackers are now able to exploit artificial intelligence (AI), and other emerging quantum computing capabilities, to develop adaptive and stealthy attacks. Notable advances in AI-enabled phishing, polymorphic malware, and adversarial manipulation of fraud detection systems underscore the limitations of traditional reactive security models to confront mobile payment security (Mustapha et al., 2023; ISACA, 2024; Financial Crime Academy, 2025). Furthermore, AI-based attacks may be observed albeit quantum computing presents the more ominous long-term threat and possible attack vector wherein contemporary cryptographic algorithms RSA, ECC, and AES will be compromised to an extent that renders them useless, with some suggesting that as early as 2029 (EJ-Compute, 2025; BizTech Magazine, 2025).

In addition to human-oriented challenges with aspects including limited capabilities in digital literacy technology, and inconsistent compliance with requisite ICT security practices around any given mobile payment transaction, regulatory obligations vary considerably by region. Case study evidence points to the impact of, and implications imparted by, these aspects of mobile payment technology, particularly in terms of financial loss, decreasing user trust and brand reputation for established companies. The burdens that these challenges impose on product developers provides additional rationale for the need for flexible, adaptive, and holistic mobile payment security strategies.

Critical Evaluation of Security Technologies

Various security mechanisms have been employed throughout mobile payments ecosystems with varying effectiveness:

- Encryption and Tokenization: Having end-to-end encryption (E2EE) and Transport Layer Security (TLS) as mainstays of security mechanisms is often effective in protecting transactions while tokenization limits exposure in the event of a data breach (Financial Crime Academy, 2025; IRJMETS, 2025). Often their benefits are diminished by inevitable poor implementation and configuration error (Kaya & Koçak, 2021).
- Biometric Technology: Biometric verification using AI and verification technology with "liveness" detection increased overall authentication accuracy (TechMagic, 2025; Comarch, 2025). Nevertheless, the issues of privacy infringement remain when stealing biometrics and the performance and durability of such technology (ResearchGate, 2025g).
- Multi-Factor Authentication (MFA): Adaptive MFA is a strong layer of protection notwithstanding vulnerabilities to SIM swapping, MFA fatigue, and Adversary in the Middle (AiTM) (RSA, 2025; MojoAuth, 2025; Authsignal, 2025; Sprinto, 2025a).
- Blockchain: Provides transparency and immutability which can strengthen anti-fraud mechanisms (Zetaton, 2025) but, its use is still curbed due to scalability, cost, and possible future regulation (ResearchGate, 2025k).
- AI and Machine Learning (ML): Offers improvements for fraud detection and behavioral analytics (ResearchGate, 2025a; Infosys BPM, 2025a), but data bias even in interpretability, and privacy issues are present (Lumenova.ai, 2025).
- Secure Development Practices: Properly applied elements from OWASP best practices, along with runtime application self-protection (RASP) tools, can twice the resilience against a security breach (Promon, 2025a). Still, the gradual and limited use of such tools eventually keeps the threat alive (Archibong et al., 2024).

Ultimately, the effectiveness of these technologies' hinges upon ongoing application, interoperability, and appropriate governance within the larger ecosystem.

Regulatory Gaps and Global Disparities

Regulatory standards (e.g., PSD2, PCI DSS, and GDPR) are the pillars of data protection and consumer protection, but they are only here and there adopted, which again turns out to be the main reason for the reduced effectiveness. In some developing economies, regulatory support is underdeveloped or poorly enforced partly due to infrastructure issues and limited technical expertise (Wu et al., 2023; Mustapha et al., 2023). In developed economies, while compliance ecosystems are overall more reasonably developed, regulatory standards related to cross-border data governance and interoperability remains challenging. Such regional disconnects results in an overall dysfunctional global regulatory framework that complicates efforts toward collective cybersecurity.

The Human Factor: Closing the awareness-compliance gap

The human factor(s) still represents one of the most fundamental vulnerabilities in respect to mobile payment security. Users regularly undermine protections by enabling weak passwords, disabling multi-factor authentication (MFA), or being victimized by social engineering attacks (Chen & Li, 2017). Studies have found that awareness of potential threats does not inherently lead

to secure behavior when compliance is driven by cognitive, cultural, and interface design (Oladipo et al., 2024; Oliveira et al., 2016). Additionally, cybersecurity responses are more often reactive than proactive, being exhibited in behavior after an incident occurred (Sondes Ksibi et al., 2022). Proactivity in security area means the need for proper directions, user-friendly design, and continual digital literacy effort.

Comparative Review of Platform Security

A comparative review found significant differences in the approach to security relating to different platforms and regions:

- China (Alipay, WeChat Pay): sophisticated AI based analytics and QR code management offered strong defenses.
- Europe (Monzo; Revolut): demonstrated the ability to integrate regulation and technology with PSD2 protections, dynamic CVV coding, and preventative fraud alerts.
- Africa (M-Pesa): security social issues, infrastructure limitations and high susceptibility to SIM-swap fraud continued to undermine security efforts.
- South Asia (Paytm): Users were completely unaware of educational deficiencies and economic disparities were evident in operating system updates.

The evidence follows that security solutions must also be localized, bearing in mind technology readiness, cultural conventions, and regulatory capacity.

Synthesis of Findings and Identification of Persistent Gaps

The review draws attention to several systemic weaknesses to which mobile payment security is vulnerable:

- Threat Evolution: The risk environment is becoming increasingly complex fueled by AI-based threat options and post-quantum considerations.
- Technological Gaps: There are sophisticated tools available, but they are not being widely deployed.
- Regulatory Gaps: Security is not being enforced equally, especially outside the EU and U.S. context.
- People Dependability Issues: Low levels of cyber awareness, poor behavioral design to protect users/humans, and poor UI design are all weaknesses.
- Regional Issues: Context-specific issues require different policy and technical responses.

These weaknesses result in gaps in implementation, enforcement, and user participation. The growing security gap increasingly looks like a lack of balance between the sophisticated nature of threats and the sophistication of our current defenses. The only way to bridge the growing security gaps is to build an approach that is coordinated across the whole-of-government and other involved actors including developers, regulations, and end-users, and is also built to a resilient and adaptive global security ecosystem.

Technical and Regulatory Recommendations

This study has made several recommendations both technically and in terms of policy to mobile payment security enhancement.

On the technical side, there will be the necessity of constant innovation to effectively handle the coming threats which mainly are the usage of artificial intelligence for malicious purposes and the advent of quantum computing. The financial services firms would have to go for universal user verification techniques such as multi-factor authentication, machine learning-based fraud detection

systems, along with zero knowledge encryption techniques and auditing at intervals. The growing sophistication of cyberattacks has made it a necessity for governments and financial regulators to support the exchange of real-time threat intelligence across sectors along with collaboration.
From a regulator's viewpoint, the synchronization of mobile payment security standards on a global scale should be sorted out as a priority during the joint effort, through the involvement of international organizations like the World Trade Organization (WTO) and the International Monetary Fund (IMF). Besides, the introduction of the security certification for mobile payments that the third party is mandatory will not only increase the accountability of the system but also the user's confidence. Also, the laws regarding data protection should be updated to include biometric and behavioral identifiers in the category of intellectual property, guaranteeing the full protection of personal data. For the case of developing countries, the governments should rely on the telecom operators to help them in the fight against fraud based on SIM-swapping and identity theft, which would not be effective without real-time detection. Flexible and modular approaches to regulation for emerging technologies such as blockchain and AI will be necessary to tackle issues of algorithmic bias, privacy of data, and liability of smart contracts.

User-Centered Recommendations

As the human aspects of behavior are among the most influential on the cybersecurity domain, user experience and education should be given the importance they deserve. Gamified training and educational programs in cybersecurity can replace passive awareness campaigns by providing an interactive, experiential learning experience that reinforces secure behaviors. Application interfaces should clearly indicate the status of security features, such as multi-factor verification and tokenization, to foster user understanding and trust.

The security-by-design approach should be adopted by mobile payment services, which would result in necessary protections that would be switched on by default with an option for the user to turn them off whenever they wish. Continuing, culture-aware awareness campaigns should focus on users and highlight evolving threats and protective behaviors. Efforts to simplify privacy policies and align them with global models (such as GDPR & CCPA) would enhance user interpretation, trust, and compliance regarding digital payment platforms.

Future Research Directions

Although this study offers an extensive synthesis of current challenges and solutions in cybersecurity within mobile payment systems, further studies are needed to improve empirical understanding. Future studies should empirically test the suggested frameworks in diverse cultural and regulatory contexts, using either qualitative or quantitative methods. Comparison research across sectors and regions can identify process nuance in compliance, security maturity and user behavior. Longitudinal research is needed to assess the ongoing impact of security intervention features like adaptive multi-factor authentication and behavioral monitoring.
Ethical and transparent AI use in fraud detection should be the focal point of future research as the company will aim to eradicate bias and build up consumer trust. It has also been indicated that more studies will be needed to understand the scalability, energy consumption, and interoperability challenges related to blockchain technology. Lastly, interdisciplinary research will be important in understanding how user behavior and compliance are impacted by cultural, socioeconomic and digital literacy issues, and to create inclusive cybersecurity strategies that are adaptable worldwide.

Conclusion

Conducted via a Systematic Literature Review (SLR), this research emphasizes the fact that mobile payment security is a multi-faceted problem, which needs to be solved by a cross-disciplinary approach, namely the cooperation of technology, legislation and user behaviour. The mobile payment ecosystem has been considerably fortified owing to technological improvements and regulatory reforms that continue to be rife with large-scale weaknesses. Weak third-party integrations, global standards lacking consistency and a general low level of user awareness are the vulnerabilities highlighted in the study. The quick rise of AI-based attacks and the expected disruptions caused by quantum computing have added to the difficulties faced by mobile payment systems.

One of the major reasons given for the problem the study highlights is not the unavailability of sufficient technology or regulations, but the dissipation of the stakeholders. Mobile payment security needs a comprehensive framework that encompasses technology, global policy, and user. Only then will the industry get the resilience, trust, and sustainability of digital money systems that last a long time.

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