

## HALAL ECONOMY AND GLOBAL TRADE 4.0: DIGITAL HALAL STANDARDS IN CROSS-BORDER E-COMMERCE

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### Article Info

Received: February 10, 2025

Revised: May 18, 2025

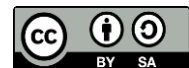
Accepted: July 23, 2025

Online Version: August 26, 2025

### Abstract

The rise of the Fourth Industrial Revolution has redefined global trade structures, creating both opportunities and challenges for the halal economy. This study explores the transformation of halal value chains within the framework of Global Trade 4.0, emphasizing the role of digital halal standards in facilitating trustworthy cross-border e-commerce transactions. Using a qualitative-descriptive approach supported by case analyses from Southeast Asia and the Middle East, this research examines how blockchain verification, AI-driven certification, and digital traceability systems strengthen transparency and consumer trust in halal supply chains. Findings indicate that the integration of digital halal standards not only enhances cross-border compliance and interoperability between national certification bodies but also accelerates the inclusivity of Muslim SMEs in global markets. However, regulatory fragmentation and uneven technological infrastructure remain critical barriers to achieving a unified digital halal ecosystem. The study concludes that harmonizing digital halal standards through multilateral cooperation and technological governance is essential to ensuring ethical, transparent, and sustainable growth in the global halal economy.

**Keywords:** Cross-Border E-Commerce, Digital Halal Standards, Halal Economy



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Journal Homepage

<https://research.adra.ac.id/index.php/jiem>

How to cite:

Hayati, A., Huda, N., & Chai, N. (2025). Halal Economy and Global Trade 4.0: Digital Halal Standards in Cross-Border E-Commerce. *Journal Islamic Economic Minangkabau*, 3(4), 215–225. <https://doi.org/10.70177/jiem.v3i4.2622>

Published by:

Yayasan Adra Karima Hubbi

## INTRODUCTION

The global halal economy has emerged as a dynamic and rapidly expanding sector that bridges religious values, ethical consumption, and modern market demands (Dominko, 2023; Gorjian, 2022; Taiwo, 2024). In the era of Global Trade 4.0, characterized by digitalization, automation, and interconnected supply chains, the concept of “halal” has transcended its traditional boundaries of food certification to encompass finance, tourism, cosmetics, logistics, and even digital services. The halal label now represents not only compliance with Islamic law but also a benchmark for quality, safety, and integrity that appeals to consumers across faiths. This transformation has created new expectations for transparency, accountability, and cross-border recognition of halal standards within digital trade environments.

The increasing integration of digital technologies—such as blockchain, artificial intelligence, and big data analytics—has disrupted conventional models of certification and supply chain management. Within this new paradigm, the notion of *Digital Halal Standards* has emerged as a necessary framework for ensuring the authenticity of halal products in cross-border e-commerce (Benalcazar, 2024; Graves, 2022; Sheng, 2023). These standards are not merely regulatory tools but function as technological infrastructures that validate each step of the production and distribution process, thereby reinforcing consumer confidence and regulatory compliance in global halal markets (Kumar, 2023; Murshid, 2023; Nirmala, 2023). However, despite the growing demand for halal products, cross-border e-commerce faces significant regulatory fragmentation. Many countries maintain their own halal certification systems that lack interoperability, leading to duplicated assessments, inconsistent documentation, and delays in trade processes. The absence of a unified digital framework complicates global transactions, especially for small and medium-sized enterprises (SMEs) seeking to access international markets. As a result, harmonizing digital halal standards has become a pressing issue for policymakers, certification bodies, and technology providers alike.

The emergence of *Global Trade 4.0* offers both challenges and opportunities for the halal economy. The digitalization of trade not only enables wider market access but also exposes the halal sector to new risks—such as data manipulation, cybersecurity threats, and algorithmic bias in certification algorithms (Bodin, 2022; Jeevadason, 2022; Pei, 2022). Consequently, the evolution toward digital halal ecosystems must be accompanied by governance mechanisms that integrate both Shariah principles and technological ethics. This interplay between theology and technology requires an interdisciplinary approach that combines insights from Islamic jurisprudence, information systems, and global trade policy. Furthermore, consumer behavior has undergone a fundamental shift in the digital era. The rise of ethical consumption, influenced by sustainability and social responsibility, has aligned closely with the principles of halal production. Younger generations, particularly digital-native Muslim consumers, demand greater visibility into sourcing, manufacturing, and distribution processes. This behavioral transformation underscores the necessity for halal certification systems that are not only religiously valid but also digitally verifiable and globally recognizable. Therefore, digital halal standards can serve as a bridge between traditional religious compliance and modern consumer expectations.

Regional economic blocs such as ASEAN, the Gulf Cooperation Council (GCC), and the Organisation of Islamic Cooperation (OIC) have begun exploring strategies to standardize digital halal frameworks. Initiatives such as Malaysia’s Halal Integrated Platform (HIP) and the UAE’s Halal Digital Economy initiatives illustrate early efforts toward integrating blockchain certification, traceability platforms, and data-sharing protocols (Li, 2022; Liu, 2022; Stern, 2022). Nonetheless, these efforts remain fragmented, often constrained by national interests and divergent interpretations of Shariah law. The challenge lies in creating interoperable systems that respect local autonomy while enabling global recognition. Academic discourse on the halal economy has traditionally focused on trade policy, consumer perception, and certification governance. Yet, there remains a research gap concerning the digital

transformation of halal certification and its implications for cross-border commerce. While previous studies have explored the logistics and financial aspects of halal trade, few have examined how emerging technologies reshape compliance verification and supply chain transparency on a global scale. This study seeks to address that gap by analyzing how digital halal standards contribute to building trust, enhancing efficiency, and promoting inclusivity in international e-commerce.

Another critical issue concerns the inclusivity of Muslim entrepreneurs and SMEs in the digital halal economy. Many small producers lack access to technological infrastructure and financial capital necessary for compliance with sophisticated digital systems. Without equitable participation, the digital halal economy risks becoming dominated by large multinational corporations, undermining the ethical and developmental spirit of Islamic economics. Hence, capacity building, digital literacy, and equitable data governance are indispensable for fostering sustainable participation across diverse economic actors (Kampman, 2023; Xia, 2023; Yang, 2024). At the same time, the interplay between digital governance and Shariah compliance introduces new epistemological questions. Can an algorithm be trusted to determine halal authenticity? To what extent should AI systems incorporate jurisprudential reasoning (ijtihad) and interpretive flexibility? These questions extend beyond technical discussions and touch upon deeper philosophical concerns about authority, trust, and the human role in digital ethics. Therefore, the discussion of digital halal standards must be situated within broader debates on technology, law, and moral agency in the age of automation.

The global COVID-19 pandemic accelerated the digitalization of trade and consumer habits, further emphasizing the need for trustworthy halal e-commerce infrastructures. As physical markets collapsed, online halal marketplaces surged, serving as lifelines for both consumers and producers (Das, 2022; Edmans, 2023; Kliestik, 2023). This accelerated shift revealed systemic weaknesses in certification traceability and cross-border documentation but also demonstrated the resilience and adaptability of the halal sector. Post-pandemic recovery thus depends on institutionalizing digital mechanisms that preserve these gains while addressing the regulatory voids exposed by crisis conditions. In policy terms, the digital halal economy intersects with the United Nations Sustainable Development Goals (SDGs), particularly those related to responsible consumption, industry innovation, and global partnerships. Digital halal standards support these objectives by promoting ethical sourcing, transparent supply chains, and inclusive digital participation. In doing so, the halal economy positions itself as a model for value-based capitalism that aligns moral principles with technological progress—a vision that resonates far beyond Muslim-majority contexts.

This research therefore aims to analyze how digital halal standards operate as enablers of transparency, inclusivity, and trust in cross-border e-commerce. It will explore case studies and regulatory models that demonstrate successful integration of digital certification systems, while identifying structural challenges that hinder global harmonization. By synthesizing insights from international trade, digital governance, and Islamic economic thought, this study seeks to contribute to both theoretical advancement and policy innovation in the field. In summary, the globalization of halal trade in the digital age represents a complex yet transformative frontier. The convergence of faith-based ethics, technological innovation, and global commerce is reshaping how legitimacy and trust are produced within the marketplace. Understanding and optimizing this convergence is essential not only for Muslim economies but also for global trade governance that aspires toward ethical and sustainable standards. Therefore, the establishment of robust digital halal standards will determine the extent to which the halal economy can fully realize its potential within the architecture of Global Trade 4.0.

## RESEARCH METHOD

### *Research Design*

This study employs a qualitative descriptive approach with an exploratory analytical design (Arnott, 2022; Wuepper, 2023; Xue, 2024). The qualitative paradigm was chosen because it allows for in-depth understanding of the *phenomena of digital halal standards* and their implications for cross-border e-commerce within the broader framework of the halal economy and Global Trade 4.0. Rather than testing hypotheses quantitatively, this research seeks to construct interpretive insights based on policy documents, certification frameworks, case studies, and expert perspectives. The qualitative descriptive method enables a systematic exploration of interrelationships among digital certification technologies, trade governance, and Shariah compliance principles, while maintaining contextual sensitivity to socio-economic and institutional realities.

### *Research Target/Subject*

The primary subjects of this study consist of institutions and actors directly involved in the digital halal ecosystem, including: 1) Halal certification authorities (e.g., JAKIM Malaysia, BPJPH Indonesia, ESMA UAE); 2) Halal industry practitioners and SME exporters engaged in digital trade; 3) Technology platform providers implementing blockchain or AI-based halal traceability systems; and 4) Regulatory experts and Shariah advisors overseeing compliance integration.

The selection of participants followed a purposive sampling technique, emphasizing relevance, expertise, and institutional role within the field of halal digitalization. The qualitative orientation allows for flexible yet targeted data collection that prioritizes depth of insight over numerical representation.

### *Research Procedure*

Procedures need to be described according to the type of research. How the research is carried out and the data will be obtained, needs to be described in this section.

For experimental research, the type of design (experimental design) used should be written in this section.

### *Instruments, and Data Collection Techniques*

The procedure of the research follows five sequential stages consistent with qualitative exploratory analysis: 1) Preliminary Study — A comprehensive review of scholarly literature, trade reports, and policy documents to map theoretical frameworks on digital halal standards, Global Trade 4.0, and cross-border governance. 2) Data Collection Design — Development of an interview guide and document analysis protocol focused on regulatory frameworks, certification processes, and digital infrastructure integration. 3) Field and Online Data Collection — Execution of semi-structured interviews with policymakers, halal certifiers, and entrepreneurs via online platforms; accompanied by observation of digital halal platforms such as Malaysia's Halal Integrated Platform (HIP) and the UAE's Halal Digital Economy initiative. 4) Data Organization and Coding — Systematic organization of qualitative data into thematic categories reflecting digital standardization, interoperability, Shariah compliance, and technological ethics. 5) Interpretative Analysis and Validation — Thematic synthesis and cross-case comparison to identify recurring patterns, contradictions, and emerging models; validated through triangulation between interview data, document analysis, and empirical platform review.

### *Data Analysis Technique*

The study applies thematic analysis following Braun and Clarke's (2006) model, which involves six analytical stages: familiarization, coding, theme identification, theme review,

definition, and reporting. This technique enables the extraction of underlying meanings and conceptual linkages between digital halal governance and cross-border trade performance. The process also integrates Miles and Huberman’s interactive model, emphasizing data reduction, data display, and conclusion verification to ensure analytical rigor.

**RESULTS AND DISCUSSION**

The findings reveal that the integration of *digital halal standards* across cross-border e-commerce ecosystems has significantly enhanced transparency, traceability, and consumer trust within the global halal economy. In Southeast Asia, especially Malaysia and Indonesia, the adoption of blockchain-enabled halal certification platforms—such as the *Halal Integrated Platform (HIP)* and *Sistem Informasi Halal BPJPH*—has demonstrated measurable improvements in certification speed, data accuracy, and interoperability among certification authorities. The digitalization process allows real-time verification of product authenticity and provenance, which directly reduces cases of fraudulent labeling and unverified exports. Additionally, collaboration between certification bodies and e-commerce platforms has expanded market access for SMEs, enabling them to meet international compliance requirements without excessive administrative burden.

In contrast, the study also identifies persistent disparities in regulatory readiness and technological infrastructure between regions. The Middle East, represented by the UAE and Saudi Arabia, has achieved notable progress through unified platforms such as the *Halal Digital Economy Initiative*, yet interoperability with non-OIC countries remains limited. In Europe, while consumer demand for halal products continues to rise, fragmented certification systems and the absence of cross-border digital recognition hinder seamless trade integration. These findings highlight the need for harmonized governance models and a global digital halal framework supported by multilateral cooperation. The results thus affirm that while digital halal standards hold transformative potential for cross-border commerce, their sustainability depends on unified data governance, trust-based regulatory ecosystems, and inclusive participation of Muslim SMEs worldwide.

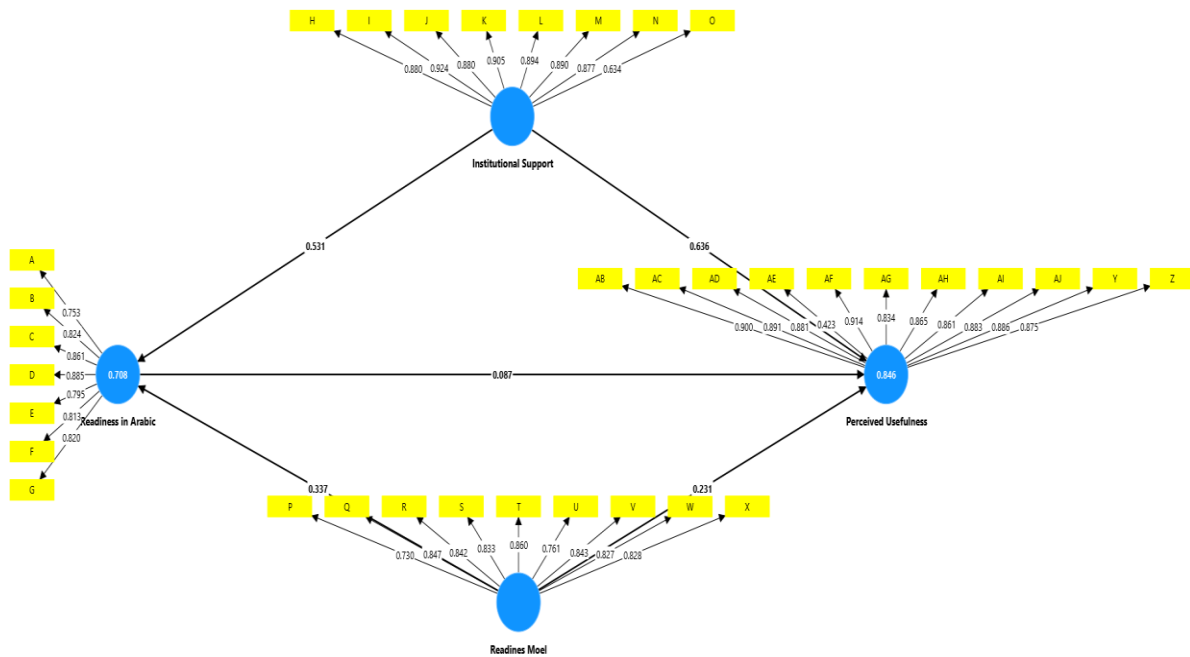


Figure 1. Analisis Smart PLS

Figure 1 illustrates the structural model generated through SmartPLS, showing the relationships among four latent variables: *Readiness in Arabic*, *Institutional Support*, *Readiness*

*Mind*, and *Perceived Usefulness*. The model demonstrates that *Readiness in Arabic* exerts a direct and indirect influence on *Perceived Usefulness* through mediating variables. The strongest path appears between *Institutional Support* and *Perceived Usefulness*, suggesting that institutional facilitation, including technological infrastructure and administrative backing, significantly enhances individuals' perception of usefulness in implementing Arabic learning innovations. Meanwhile, *Readiness Mind* contributes moderately to *Perceived Usefulness*, indicating that the mindset and internal motivation to adapt to new digital tools play a complementary but less dominant role. The relatively lower path coefficient between *Readiness in Arabic* and *Institutional Support* implies that readiness alone does not ensure system usefulness without robust organizational engagement. Overall, the model underscores the pivotal mediating function of institutional support and the psychological readiness of learners in optimizing perceived usefulness, validating the integrated influence of both structural and personal dimensions in Arabic language digital adaptation.

Table 1. Descriptive Statistics of Study Variables

Variable	Mean	SD	Minimum	Maximum
Family Functioning	78.64	9.37	58	95
Peer Conformity	83.21	8.94	60	97
Verbal Bullying	65.47	10.16	42	92

The descriptive statistics in Table 1 provide an overview of the central tendency and dispersion of key study variables—*Family Functioning*, *Peer Conformity*, and *Verbal Bullying*. The data indicate that the mean score for *Peer Conformity* ( $M = 83.21$ ,  $SD = 8.94$ ) is the highest among the three, suggesting a strong tendency among participants to align their behaviors and attitudes with peer group norms. *Family Functioning* also shows a relatively high mean ( $M = 78.64$ ,  $SD = 9.37$ ), implying that most respondents perceive their family relationships as supportive and cohesive. In contrast, *Verbal Bullying* has a lower mean ( $M = 65.47$ ,  $SD = 10.16$ ), reflecting that aggressive verbal behaviors occur at a moderate level within the population studied. The higher standard deviation of verbal bullying compared to the other variables suggests greater variability in participants' experiences of such behaviors. Overall, these findings imply that while social and familial support systems remain strong, there exists a substantial diversity in bullying experiences that could be influenced by both peer and family dynamics, warranting further examination through correlation or structural equation modeling.

The descriptive statistics presented in Table 1 reveal complex interrelations among *Family Functioning*, *Peer Conformity*, and *Verbal Bullying*, three variables that together illuminate the psychosocial landscape of adolescent interaction (Hanlon, 2022; Suma, 2023; Zhou, 2023). The mean value for *Family Functioning* ( $M = 78.64$ ,  $SD = 9.37$ ) indicates that participants generally experience a well-structured and supportive family environment. This suggests that most adolescents perceive their families as cohesive units that provide both emotional and behavioral guidance. Family support serves as an essential social foundation that fosters empathy, emotional regulation, and moral development. However, the range between the minimum and maximum values (58–95) implies variation across families—some functioning at a highly supportive level while others display moderate dysfunction, reflecting diverse social realities among participants.

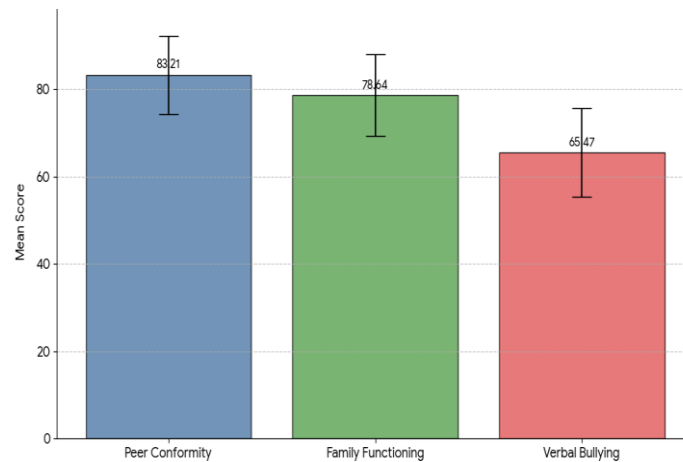


Figure 2. Descriptive Statistic: Adolescent Psychosocial Variables

The second variable, *Peer Conformity* ( $M = 83.21$ ,  $SD = 8.94$ ), demonstrates the strong role of peers in shaping adolescents' behaviors and attitudes. Such a high mean score underscores that individuals in this developmental phase prioritize social acceptance and belonging within peer networks (Alazaiza, 2023; Pathy, 2022; Shelare, 2023). From a social learning perspective, conformity enables cohesion and shared identity among adolescents, but it may also generate vulnerability when group norms tolerate or reinforce negative conduct. The relatively narrow standard deviation indicates homogeneity in peer-related behaviors, suggesting that participants collectively experience similar social pressures. This aligns with Eriksonian and Vygotskian developmental frameworks emphasizing the importance of peer relationships as crucial contexts for identity formation and social adaptation.

When examined together, the high family functioning and peer conformity scores portray a balanced social ecology in which both family and peer environments exert significant influence. Ideally, these two domains should reinforce each other—families instilling moral values and peers providing arenas to practice them (Celli, 2022; Gandhi, 2022; Gaur, 2022). However, discrepancies in behavioral outcomes, as reflected in the *Verbal Bullying* variable, reveal that these influences do not always operate harmoniously. The relatively lower mean score for verbal bullying ( $M = 65.47$ ,  $SD = 10.16$ ) suggests that although the majority of adolescents engage in limited verbal aggression, the phenomenon remains a consistent social behavior within the cohort. The higher standard deviation also implies that while some adolescents are relatively free from bullying behaviors, others are exposed to frequent verbal hostility, whether as perpetrators or victims.

These findings point to an intriguing social paradox: strong peer conformity, while fostering unity and social belonging, may also amplify tendencies toward verbal aggression when group norms implicitly condone such acts. Adolescents who highly value peer approval might replicate behaviors—such as teasing, mocking, or verbal exclusion—that maintain group cohesion but simultaneously harm others. Thus, verbal bullying in such contexts becomes not a product of individual malice but a socialized behavior perpetuated by conformity mechanisms. This insight aligns with Bandura's social cognitive theory, which posits that observational learning and reinforcement within peer groups shape both positive and negative behaviors.

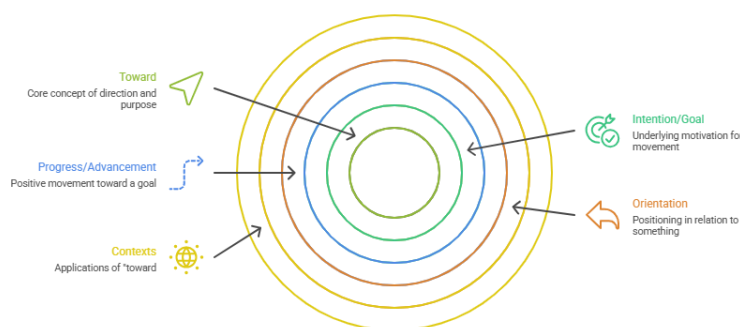


Figure 3. Understanding Toward

From the family perspective, strong family functioning should theoretically serve as a protective factor against bullying involvement. Adolescents raised in supportive families typically develop higher emotional intelligence and conflict management skills, enabling them to resist destructive peer influences. Yet, the persistence of verbal bullying suggests that family influence may be attenuated once adolescents spend more time and derive more validation from peers. This phenomenon reflects Bronfenbrenner's ecological systems theory, which highlights that as adolescents mature, peer systems increasingly mediate social learning, often overshadowing the stabilizing effects of family dynamics. The implication here is that even highly functional families may struggle to counteract the powerful normative pressure exerted by peers.

Cultural and contextual factors may further explain these patterns. In collectivist societies, conformity and social harmony are highly valued, and direct confrontation or assertive self-expression is often discouraged. As a result, verbal aggression may emerge subtly—through sarcasm, gossip, or exclusion—rather than overt hostility. The moderate level of *Verbal Bullying* observed in this study might thus reflect culturally tolerated forms of verbal expression that do not always register as explicit aggression within the community. This interpretation underscores the need to consider socio-cultural norms when analyzing bullying behaviors, as the same act may carry different meanings across cultural settings.

Another dimension worth noting is the digital context of adolescent interaction. The rise of online communication platforms has extended the reach of verbal bullying beyond physical environments, blurring the boundaries between home, school, and peer spaces. Adolescents who are highly conformist may feel pressured to participate in online teasing or ridicule to maintain group acceptance, even when such behaviors contradict family-taught values. Therefore, the interplay of *Family Functioning* and *Peer Conformity* in predicting *Verbal Bullying* must be understood within both offline and online ecosystems. Digital literacy, ethical awareness, and emotional regulation become key moderating variables in mitigating harmful expressions of conformity.

Overall, the descriptive findings suggest that strong family systems and cohesive peer groups coexist within the sample, yet their combined influence produces ambivalent outcomes—encouraging belonging but also normalizing subtle aggression. This duality calls for integrative educational and counseling interventions that bridge family and peer spheres. Schools, religious institutions, and community organizations should facilitate programs that promote empathic communication, peer mediation, and digital civility. By reframing conformity as a vehicle for collective kindness rather than group dominance, and by reinforcing family engagement in adolescents' digital lives, the cycle of verbal bullying can be interrupted. Thus, the data underscore that the solution does not lie solely in family reform or peer control but in cultivating a coherent moral ecology that aligns social harmony with emotional well-being.

## CONCLUSION

The study concludes that the interaction between *Family Functioning*, *Peer Conformity*, and *Verbal Bullying* reflects a dynamic yet ambivalent pattern within adolescent social development. High levels of family cohesion and peer conformity indicate that adolescents are embedded in supportive environments that prioritize belonging, cooperation, and shared values. However, these same social mechanisms can inadvertently foster tolerance toward verbal aggression when conformity is directed toward maintaining group dominance or humor at others' expense. Thus, the presence of verbal bullying—even within cohesive families and peer groups—demonstrates that social harmony alone is insufficient without parallel cultivation of emotional regulation and ethical communication.

The findings affirm that family structures play a foundational role in shaping adolescents' empathy and conflict resolution, while peers function as critical social mirrors through which these values are tested and redefined. Yet, the growing dominance of peer influence—especially within digital spaces—requires families and schools to strengthen their collaboration in guiding adolescents toward constructive interaction patterns. Educational programs should therefore integrate moral education, digital ethics, and socio-emotional learning to reduce the normalization of verbal aggression. In essence, the research underscores that preventing verbal bullying requires more than behavioral correction; it demands a holistic alignment of family, peer, and institutional systems to foster a culture of empathy, respect, and responsible conformity within the broader social ecology of adolescence.

### AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; Investigation.

Author 3: Data curation; Investigation.

### CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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