



# The role of digital technology-based Islamic education in strengthening social cohesion: a case study of Aceh's madrasahs after the Helsinki accord

Irwansyah

Fakultas Keguruan dan Ilmu Pendidikan, Sekolah Tinggi Keguruan dan Ilmu Pendidikan,  
Universitas Muhammadiyah Aceh Barat Daya Indonesia

## ARTICLE INFO

### Article history:

Received Jul 10, 2025

Revised Jul 25, 2025

Accepted Aug 06, 2025

### Keywords:

Aceh Madrasah;  
Digital Technology;  
Islamic Education;  
Social Cohesion;  
Student Engagement.

## ABSTRACT

This study investigated the impact of integrating digital technology into Syariah-based Islamic education on student learning outcomes and social cohesion in ten madrasahs across Banda Aceh, a region that the 2005 Helsinki Peace Accord has shaped following decades of conflict. Employing a sequential explanatory mixed-methods design, the research combined survey data from 500 students with qualitative interviews and focus group discussions involving educators, students, and religious leaders. Digital tools—such as Islamic e-learning platforms, interactive da'wah applications, and multimedia Qur'an modules—were examined for their influence on academic engagement, critical thinking, and intergroup harmony. Quantitative analysis revealed significant positive relationships between technology-enhanced instruction and student motivation, critical reflection, and civic responsibility. Structural Equation Modeling (SEM) showed that student engagement partially mediated the relationship between digital pedagogy and social cohesion (total effect  $\beta = 0.68$ ,  $p < .001$ ). Thematic analysis indicated that technology reinforced Islamic learning, promoted inclusivity, and gained wider acceptance when framed within Syariah values and supported by local ulama. The findings suggest that, when thoughtfully implemented, digital Islamic education can act as a peacebuilding mechanism. Recommendations include teacher training, institutional investment, involvement of ulama, and long-term evaluation for sustainability and replication.

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## Corresponding Author:

Irwansyah

Fakultas Keguruan dan Ilmu Pendidikan, Sekolah Tinggi Keguruan dan Ilmu Pendidikan,  
Universitas Muhammadiyah Aceh Barat Daya - Indonesia

Ujung Padang, Susoh, Southwest Aceh Regency, Aceh 23765

[eone\\_cy@yahoo.com](mailto:eone_cy@yahoo.com)

## 1. INTRODUCTION

Since the 2005 Helsinki Memorandum of Understanding, Aceh has experienced a gradual transition from prolonged conflict to a period of relative peace and reconstruction (Sustikarini, 2019). Nevertheless, ensuring sustainable social cohesion—particularly among the younger generation—remains a significant challenge, especially within the region's Syariah-oriented madrasah system (Mardatillah et al, 2025). While these

institutions serve as the cornerstone of formal Islamic education, their reliance on conventional, text-based instruction often limits opportunities to foster critical thinking, empathy, and collaboration—skills essential for building intergroup trust in post-conflict societies (Komatsu, 2024).

In response to these limitations, the integration of digital technology into Islamic pedagogy has emerged as a promising pathway. Globally, technology-enhanced religious education has been shown to increase student motivation, engagement, and ethical reasoning when implemented in culturally sensitive ways (Alhazani, 2025). Digital platforms—ranging from Qur’anic learning apps to interactive da’wah media—are increasingly embraced by educators in majority contexts. Such technologies have demonstrated the capacity to enrich religious learning while also fostering civic awareness and tolerance (Ishaque et al., 2023).

Despite this global momentum, empirical studies in Aceh examining the impact of digital tools in Syariah-based madrasahs remain limited. Existing research largely focuses on infrastructure readiness or teacher attitudes toward technology, with little attention to how digital Islamic education might shape broader social outcomes such as intergroup relations or communal identity. This gap reflects a wider absence of mixed-methods research combining robust statistical modeling with qualitative inquiry in the context of post-conflict Islamic education (Nasir et al, 2024).

To address this gap, the present study investigates how digital technology-based Islamic pedagogy—including e-learning platforms, multimedia Qur’an instruction, and interactive da’wah tools—affects student engagement and social cohesion in ten madrasahs across Banda Aceh. Using a sequential explanatory mixed-methods design, the study integrates survey data from 500 students with interviews and focus group discussions involving educators, school leaders, and religious figures. Structural Equation Modeling (SEM) is employed to assess how student engagement mediates the relationship between digital pedagogy and social cohesion (Azman et al, 2025).

In the context of post-Helsinki Accord Aceh (2005), the integration of Constructivist Learning Theory and Contact Theory becomes highly relevant. Constructivist theory emphasizes that knowledge is actively constructed through social interaction and individual reflection (Halik et al, 2023). In post-conflict Aceh, formal education in madrasahs and public schools is designed to foster a contextual understanding of Sharia—particularly the objectives of *maqāsid al-sharī‘ah*—linked to values of peace, reconciliation, and democracy. Within this framework, students are not merely passive recipients of knowledge but are encouraged to actively construct the meaning of religion in a socially harmonious life, aligning with peace education considerations in post-conflict societies (Alfiatunnur et al, 2024).

Meanwhile, Contact Theory, which highlights the importance of positive interaction between different groups (under conditions of equal status, shared goals, and social norm support), is also applied in the post-Helsinki context of Aceh (Allport, 1954). Constructive interaction has been fostered through programs such as peaceful da’wah, cross-group training (involving former combatants, civil society, and security forces), and socio-economic collaboration with international partners. This approach places Sharia principles as the ethical foundation for intergroup relations, thereby strengthening tolerance, reducing prejudice, and supporting sustainable reconciliation in line with the peacebuilding spirit of post-conflict Aceh (Inayatillah et al, 2024).

This study seeks to examine the impact of digital Islamic pedagogy on student engagement and social cohesion in Aceh’s madrasahs, exploring not only the direct effects of technology-driven instruction but also the mediating role of student engagement in fostering intergroup harmony (Mustapa et al, 2023). Additionally, it investigates how qualitative insights from students, teachers, and community leaders contextualize and explain the quantitative relationships observed in the study.

By merging quantitative analysis with qualitative depth, this study aims to: (1) generate evidence on the role of digital Islamic education in promoting engagement and peacebuilding; (2) inform policy and curriculum development in Syariah-based schools; and (3) contribute to scalable models for integrating digital innovation into Islamic education across post-conflict Muslim-majority regions (Gobo et al, 2021).

The conceptual framework of this study is grounded in constructivist learning theory and contact theory, which suggest that student engagement—particularly when mediated through collaborative and meaningful activities—can foster intergroup understanding and social cohesion. In this context, digital technology-based Islamic pedagogy is understood as the integration of culturally appropriate digital tools (e.g., Qur’anic learning apps, multimedia da’wah content, gamified Islamic lessons) into Syariah-oriented madrasah instruction (Hilman, 2025).

Digital pedagogy enhances learning experiences by making content more interactive, accessible, and relatable, particularly for digital-native students (Nanjundaswamy et al, 2021). When students actively engage with digital materials that are infused with Islamic values, they not only deepen their cognitive understanding but also participate in shared experiences that promote empathy, collaboration, and mutual respect—critical components of social cohesion in post-conflict societies like Aceh.

Moreover, student engagement is expected to serve as a mediating variable that explains how digital pedagogy translates into improved intergroup relationships. This mediated pathway assumes that higher engagement—both emotional and behavioral—leads students to internalize values such as tolerance, responsibility, and cooperation, which are central to social harmony (Ramli, 2025).

The conceptual framework of this study explains how digital technology-based Islamic pedagogy contributes to improving student engagement and social cohesion in Syariah-oriented madrasahs in Aceh. Engagement functions as a mediating factor that links culturally aligned digital learning tools, such as Qur’an applications, multimedia da’wah content, and gamified Islamic lessons, with enhanced intergroup relationships among students. By emphasizing interactive learning, collaboration, and the integration of Islamic values, this framework highlights the potential of digital pedagogy to support both educational quality and social harmony. The framework was developed by the authors to guide the study’s research design and analysis (Hordern & Brooks, 2023).

This framework illustrates how culturally contextualized digital pedagogy can foster student engagement, which in turn strengthens social cohesion in Syariah-based madrasahs. Guided by constructivist and contact theories, it conceptualizes engagement as the mediating mechanism translating technological innovation into enhanced intergroup trust, empathy, and collaborative learning among Aceh’s post-conflict students.

## 2. RESEARCH METHOD

### 2.1 Research Design

This study employed a sequential explanatory mixed-methods design to gain a comprehensive understanding of how digital Islamic pedagogy influences student engagement and social cohesion within Syariah-based madrasahs. The quantitative phase was implemented first to examine causal relationships through statistical modeling, followed by qualitative inquiry to explore contextual interpretations and lived experiences. This design promotes methodological triangulation and enables a multi-layered interpretation of the phenomena under study (Creswell, 2024).

### 2.2 Research Context and Sampling

The research was conducted in ten madrasahs located in Banda Aceh and its surrounding regions, areas historically affected by the 2004 tsunami and long-standing conflict before the Helsinki Accord. The madrasahs included both public and private

institutions with varying levels of digital infrastructure. A purposive sampling technique was adopted to ensure representation across different school sizes, technology adoption levels, and student backgrounds (Cash et al, 2022). In the quantitative phase, 500 students (240 male, 260 female) participated. Maximum variation sampling was applied to capture a broad demographic and institutional spread. In the qualitative phase, 40 participants were involved: 20 students, 10 teachers, and 10 principals.

Table 1. Student Demographics (Quantitative Phase)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	240	48.0
Gender	Female	260	52.0
School Type	Public	300	60.0
School Type	Private	200	40.0

Primary data collected by the authors (Survey, 2025)

In the qualitative phase, the study engaged a diverse group of participants to capture multiple perspectives. These included students, teachers, and school principals from the selected madrasahs, ensuring gender balance where possible. Table 2 summarizes the distribution of participants involved in interviews and focus group discussions.

Table 2. Interview and FGD Participants (Qualitative Phase)

Participant Type	Number	Male (%)	Female (%)
Students	20	50.0	50.0
Teachers	10	40.0	60.0
Principals	10	70.0	30.0

Primary data collected by the authors (Survey, 2025)

### 2.3 Quantitative Phase: Surveys and Statistical Modeling

Data collection was carried out using structured questionnaires, which measured three primary constructs: (1) digital Islamic pedagogy (e.g., Qur'an apps, da'wah videos, gamified modules), (2) student engagement (behavioral, emotional, and cognitive), and (3) social cohesion (intergroup trust, respect, and collaboration). Responses were captured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) (Nardi, 2018). Structural Equation Modeling (SEM) was used to test the mediation hypothesis. The model was analyzed with AMOS v.28 and validated using reliability and fit indices. The SEM equation is expressed as:

$$Y = c'X + bM + e$$

$$M = aX + e$$

Where:

Y = Social Cohesion

X = Digital Pedagogy

M = Student Engagement

a, b, c' = Path coefficients

e = error term

Model validation results:

Cronbach's  $\alpha \geq 0.80$

Composite Reliability  $\geq 0.70$

AVE  $\geq 0.50$

Model Fit:  $\chi^2/df = 2.01$ , CFI = .963, RMSEA = .045 (Hair et al, 2021).

### 2.4 Qualitative Phase: Interviews and Focus Group Discussions

The qualitative phase explored participant perspectives on digital Islamic tools, attitudes, and implementation challenges. Semi-structured interviews and FGDs were conducted with gender sensitivity and cultural consideration. Themes were identified

through reflexive thematic analysis using NVivo 14, aligning with theoretical constructs from contact theory and constructivist learning (Tausch & Menold, 2016).

## 2.6 Ethical Considerations

Ethical clearance was granted by the Research Ethics Committee of Universitas Syiah Kuala. All participants gave written informed consent. Parental approval was obtained for minors. Gender-segregated sessions were offered to respect Acehese cultural and religious norms. Anonymity and confidentiality were maintained throughout (Chang et al., 2024).

## 3. RESULT AND DICUSSION

### 3.1 Quantitative Findings

The quantitative data were analyzed using Structural Equation Modeling (SEM) to examine the relationships between digital pedagogy, student engagement, and social cohesion. The SEM model exhibited good fit:  $\chi^2/df = 2.01$ , CFI = 0.963, RMSEA = 0.045. The model explained 63% of the variance in social cohesion (Thomas, 2023). Table 3 presents the standardized path coefficients for direct, indirect, and total effects among key variables.

Pathway	Standardized Coefficient ( $\beta$ )	p-value	Interpretation
Digital Pedagogy → Student Engagement	0.57	< .001	Strong positive effect
Student Engagement → Social Cohesion	0.48	< .001	Significant mediator
Digital Pedagogy → Social Cohesion (direct)	0.36	< .001	Moderate direct effect
Indirect Effect via Engagement	0.27	< .01	Mediated influence
Total Effect	0.63	< .001	Substantial total impact

Source: Authors' analysis of primary survey data using SEM (AMOS v.28), 2025.

### 3.2 Standardized Path Coefficients from SEM: Effects of Digital Pedagogy, Engagement, and Social Cohesion

Figure 2 presents the SEM-tested conceptual model, showing digital pedagogy's direct effect on social cohesion and its indirect effect via student engagement as a mediator. The path coefficients ( $\beta$  values) indicate that engagement strengthens the overall impact of digital teaching, illustrating how well-designed digital strategies enhance both learning participation and social harmony in Syariah-based madrasahs. (Singh et al., 2025).

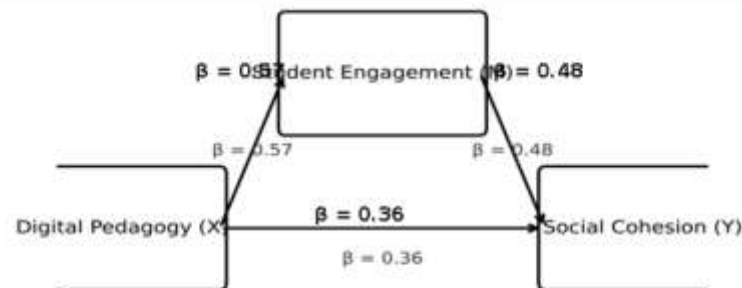


Figure 2. SEM Model: Effects of Digital Pedagogy on Social Cohesion (via Engagement)  
 Source: Authors' analysis of primary survey data (2025)

### 3.3 Qualitative Findings

The thematic analysis of interviews and FGDs uncovered three central themes that contextualize and strengthen the quantitative results, shedding light on the ways digital Islamic pedagogy affects student learning, interaction, and community acceptance in Aceh's Syariah-based madrasahs.

#### Theme 1: Inclusive Learning Through Digital Tools

Students consistently emphasized that the integration of Qur'an applications, gamified quizzes, and Islamic animations facilitated a more personalized and less intimidating learning environment. Several students explained that the ability to practice Qur'anic recitations privately using mobile applications allowed them to build confidence before public recitation in class. One female student remarked, "With the Qur'an app, I can repeat verses as many times as I need, so I'm no longer nervous when reciting in front of my peers."

Another student highlighted that the animations and interactive quizzes made learning more engaging for those who previously struggled with traditional, text-heavy methods, stating, "I used to find tafsir boring, but now I can understand it through short videos and quizzes." This inclusivity extended to students with different learning speeds, as digital platforms allowed both advanced and struggling students to progress at their own pace without fear of embarrassment, thereby reducing performance-related anxiety and fostering greater equity in religious education (Nurcahyo, 2024).

Theme 2: Engagement and Peer Interaction, Teachers and principals observed a significant boost in student participation, collaboration, and cross-group interaction as a result of digital pedagogy. Multimedia da'wah videos, in particular, became catalysts for student-driven projects, encouraging collaboration between students from different social and geographic backgrounds. A senior teacher noted, "Students who rarely spoke in class are now volunteering to edit videos or lead project groups, and they are mingling with classmates they previously didn't interact with."

Several teachers also emphasized that these group activities promoted critical discussion on Islamic values and social issues, fostering both cognitive and social engagement. FGDs with students revealed that collaborative video projects allowed them to express creativity while also learning negotiation, teamwork, and conflict resolution skills. Importantly, these activities bridged divides between urban and rural students within the same madrasahs, contributing to a sense of unity and mutual respect that extended beyond the classroom (Wards, 2021).

Theme 3: Religious Framing of Technology, Acceptance of digital tools among parents, ulama, and community leaders was found to hinge on how these innovations were framed within Islamic contexts. Ulama and school leaders stressed the necessity of ensuring all content adhered strictly to Syariah principles. A local religious leader stated,

“When technology is introduced as a way to strengthen ibadah and da’wah, people here accept it; but if it feels too Western, parents reject it.”

Principals explained that their strategy to hold community workshops—demonstrating Qur’an apps and interactive da’wah platforms as tools for worship—significantly improved acceptance. In several cases, parents became active advocates, encouraging their children to use these tools at home as part of daily religious routines. This religious framing not only enhanced trust and acceptance but also positioned digital pedagogy as a natural extension of traditional Islamic learning rather than a threat to cultural or spiritual norms.

Collectively, these findings illustrate that digital technology, when thoughtfully contextualized, not only enhances academic engagement but also nurtures inclusivity, collaboration, and cultural legitimacy in Syariah-based education. These qualitative insights explain why the quantitative results revealed strong positive effects of digital pedagogy on student engagement ( $\beta = 0.57$ ) and social cohesion (total effect  $\beta = 0.63$ ), as students experienced both individual empowerment and collective solidarity through these interventions.

### 3.4 Integration of Findings

The integration of quantitative and qualitative findings confirms that digital pedagogy, when culturally and religiously contextualized, can foster student engagement and promote social cohesion in Syariah-based education. The mediation role of student engagement, supported by statistical modeling, is explained by real-world student experiences and teacher observations of increased inclusivity and peer collaboration.

### 3.5 Discussion

This study set out to examine how digital technology, when integrated into Syariah-based Islamic education, influences student engagement and social cohesion in Aceh's madrasahs—a region recovering from historical conflict. By combining quantitative modeling and qualitative inquiry, this research uncovers not only the *extent* but also the *mechanisms* through which digital pedagogy contributes to peace-oriented educational outcomes. Importantly, the study addresses several critical research gaps in the current literature and offers novel insights with both theoretical and practical implications.

#### a. Addressing the Research Gap

Existing research on Islamic education in post-conflict settings has largely focused on curriculum reforms, civic values, or the role of traditional religious leaders (Zainal et al., 2020). While some studies have explored digital learning tools in Islamic schools, they often examine these tools in isolation, without connecting them to broader social outcomes such as intergroup relations or peacebuilding. Furthermore, most empirical studies do not use mixed methods or advanced statistical modeling to capture the *mediating mechanisms* that explain *how* digital pedagogy impacts social cohesion (Ishaque et al., 2023).

This study addresses existing theoretical and empirical gaps by (a) examining the indirect influence of digital pedagogy on social cohesion through student engagement, as quantitatively tested using structural equation modeling (SEM); (b) exploring the perceptions and lived experiences of students, teachers, and religious leaders, analyzed qualitatively through thematic methods; and (c) integrating these findings to ground the results within constructivist learning and contact theory while maintaining alignment with the broader Islamic cultural context. This combination of focus, methods, and theoretical grounding constitutes the scientific contribution of this study to the interdisciplinary field of Islamic education, digital pedagogy, and peace studies.

#### b. Digital Pedagogy and Student Engagement as a Mechanism

The SEM analysis confirmed that digital pedagogy significantly predicted student engagement ( $\beta = 0.57, p < .001$ ), and that engagement mediated the effect on social cohesion (indirect effect  $\beta = 0.27$ ). These findings advance engagement theory (Fredricks et al., 2004) by showing that in Islamic learning environments, technology not only increases motivation and participation but also plays a socializing role, shaping students' perceptions of others and promoting intergroup trust (Samad et al, 2024).

This insight was reinforced by qualitative data. Students described Qur'an apps and da'wah video projects as empowering tools that gave them voice and reduced learning anxiety. Teachers observed improved classroom dynamics and collaboration across diverse student groups. Thus, this study provides empirical evidence that engagement is both a measurable construct and an affective experience, influenced by the intersection of technology and religious pedagogy (Abdah, 2024).

#### c. Cultural and Religious Framing of Innovation

Previous literature has warned of resistance toward digital innovations in conservative Islamic communities due to perceived threats to tradition. This study shows that such resistance can be mitigated when digital tools are framed within religious norms and endorsed by local religious leaders. Parents and principals were more receptive to digital innovations when tools were presented as means of ibadah or da'wah, not as Western imports. This finding contributes to the literature by showing how religious legitimacy can shape technology adoption in Muslim-majority educational settings (ZUBAIR, 2023).

#### d. Peacebuilding Through Constructive Digital Contact

One of the most original contributions of this research is the articulation of how digital pedagogy fosters peacebuilding. Drawing on contact theory, the study found that digital group projects—particularly those with religious content—encouraged interaction among students from diverse social, ethnic, and geographic backgrounds. These structured, positive engagements helped dismantle intergroup stereotypes and fostered trust, key dimensions of social cohesion in post-conflict contexts (Wibowo, 2020.) Unlike other studies that address peace education through formal civic curriculum, this study reveals that informal digital interactions—when designed thoughtfully—can achieve similar peacebuilding outcomes. It expands the concept of peace education to include technologically mediated peer learning.

#### e. Barriers to Equitable Implementation

Despite promising findings, the research revealed challenges that mirror broader systemic inequities. Rural and private madrasahs often lacked stable internet or sufficient devices, leading to unequal learning experiences (Sakallı et al, 2021). Teachers reported difficulty in aligning new technologies with existing pedagogical frameworks without formal training. These issues point to a need for policy-level interventions that go beyond the classroom to address infrastructure, training, and curriculum support (Bhattarai & Yousef, 2025).

#### f. Contribution to Theory and Practice

Theoretically, this study contributes to an emerging body of work that blends constructivist learning, Islamic pedagogy, and peacebuilding frameworks, showing how student-centered, digitally mediated Islamic education can nurture empathy, respect, and civic responsibility. Practically, the findings present a replicable model for other Muslim-majority, post-conflict regions by emphasizing (a) the importance of religious framing in adopting digital tools, (b) the role of student engagement as a pathway to

social outcomes, and (c) the value of mixed-methods research in capturing both measurable impacts and the lived experiences of participants.

## 5. CONCLUSION

This study set out to explore whether and how digital technology, when integrated into Syariah-based Islamic education, could contribute to strengthening student engagement and social cohesion within the unique post-conflict context of Aceh's madrasahs. As anticipated in the Introduction, the use of culturally and religiously grounded digital tools was hypothesized to have a transformative potential—not only in improving learning processes but also in cultivating a more cohesive and inclusive school environment. The findings confirmed this proposition by demonstrating that digital pedagogy, when framed appropriately, not only enhances student participation but also fosters empathy, collaboration, and mutual respect across diverse student populations. Crucially, the study revealed that student engagement serves as a key mediating factor in translating technology use into broader social outcomes. This highlights that the role of digital tools extends beyond content delivery; they function as platforms for interaction, identity negotiation, and peacebuilding when applied within an Islamic educational framework. These insights reflect a broader shift from seeing digital learning as a technical intervention to recognizing it as a culturally embedded process with deep pedagogical and societal implications.

Looking ahead, the research offers two important prospects. First, its conceptual model can be adapted and tested in other Muslim-majority or conflict-affected regions to assess its generalizability. Second, the findings provide a foundation for developing long-term teacher training programs, digital curriculum co-designed with religious scholars, and community-based edtech strategies that align with local values. However, one conceptual limitation of generalizing this model to other Muslim-majority regions lies in its strong contextual grounding in Aceh's unique socio-religious and post-conflict setting. The integration of Sharia principles and reconciliation values shapes how digital pedagogy operates here. In regions without a formal Sharia legal framework or a history of armed conflict, these cultural and normative dimensions may not hold the same significance, potentially reducing the model's relevance. For example, peace education components may appear less critical in socially stable societies, while pedagogical approaches aligned with Syariah norms might require modification where Islamic law does not influence governance or education policy. Future studies should, therefore, investigate how this framework can be adapted to different socio-religious configurations while retaining its core principles of engagement, collaboration, and culturally responsive learning. In conclusion, digital Islamic pedagogy—when implemented with cultural sensitivity and pedagogical intention—can be a powerful tool for social transformation. Future research should explore longitudinal impacts, policy integration, and the evolving interplay between faith, technology, and peace education in dynamic social contexts.

## ACKNOWLEDGEMENTS

The authors would like to express sincere gratitude to the principals, teachers, and students of the participating madrasahs in Banda Aceh for their invaluable cooperation. Special thanks to Universitas Syiah Kuala for ethical approval and institutional support. Appreciation is also extended to local religious leaders whose insights enriched this study. This research would not have been possible without the collective engagement of all stakeholders involved.

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