Dinamika Penelitian
Media Komunikasi Penelitian Sosial Keagamaan

SUPPLEMENTARY MATERIAL

Digitalizing Community Empowerment: A Digital Ethnography of Interaction and Transaction Cost Efficiency in Village-Owned Enterprises

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1. Data Extraction and Thematic Synthesis

Data extraction followed the analytical domains reported in the manuscript: platform, interaction form, institutional purpose, transaction-cost mechanism, empowerment effect, and digital burden. Descriptive codes were compared across interviews, digital observation, and documentary material and then synthesized into three higher-order interaction modes, with the efficiency-burden paradox retained as a cross-cutting interpretive pattern. Because the source does not reproduce the complete row-level coding file, the matrix below presents only evidence-to-theme links explicitly supported by the manuscript and supplementary dataset.

Table S1. Data Extraction, Coding, and Thematic Synthesis Matrix

ID	Evidence source	Extracted / coded evidence	Thematic synthesis	Analytical interpretation
DE01	Zoom meetings; interview/observation	Synchronous, agenda-led and hierarchical coordination for policy alignment, evaluation, and collective decisions.	T1. Hierarchical-formal interaction	Formal authority remained visible while travel, scheduling, and formal coordination costs were reduced.
DE02	District WhatsApp group; interview/observation	Asynchronous, multi-directional consultation, policy circulation, peer learning, and rapid problem solving.	T2. Network-organic interaction	Shared channels widened access to distributed expertise while lowering information-search and routine coordination costs.
DE03	Private chats/calls; interview evidence	Dyadic and discreet clarification, sensitive feedback, individual follow-up, and conflict management.	T3. Personal-relational interaction	Relational sensitivity protected trust while enabling lower-cost monitoring and corrective action.
DE04	Daily Report Pendamping (DRP)	Standardized and traceable evidence submission, activity reporting, and program monitoring.	Cross-cutting institutional support	Traceability connected routine field activity to documentation, verification, and accountability processes.
DE05	WhatsApp/Facebook marketing	External market-facing promotion, orders, and customer communication.	Supporting market-facing process	Digital outreach lowered search and communication friction; customer-level records were not reproduced.
DE06	Connectivity reports (11/13)	Connection failures during Zoom meetings and uploads created repeated explanations and alternative communication work.	T4. Efficiency-burden paradox	Visible coordination savings coexisted with connectivity-related rework and time costs.
DE07	Device/battery constraints (4 participants)	Resource constraints reduced reliable participation in digitally mediated work.	T4. Efficiency-burden paradox	Access limitations qualified the inclusiveness of digital facilitation.
DE08	Support for some older managers (3 participants)	Joining meetings, uploading records, and using reporting systems required additional assistance.	T4. Efficiency-burden paradox	Some transaction-cost savings were displaced onto facilitators as digital-literacy support labor.
DE09	Text-based misunderstandings (2 participants)	Loss of tone and non-verbal cues required telephone, private-message, or face-to-face clarification.	T4. Efficiency-burden paradox	Communication speed sometimes produced additional clarification costs.
DE10	Night/weekend WhatsApp communication	Always-on communication created expectations of rapid response beyond formal work hours.	T4. Efficiency-burden paradox	Low-cost reach displaced temporal and cognitive costs onto facilitators.

ID	Evidence source	Extracted / coded evidence	Thematic synthesis	Analytical interpretation
DE11	Participant accounts of fatigue	Message triage, multiple groups, virtual meetings, user support, and digital reporting generated fatigue.	T4. Efficiency-burden paradox	Short-term efficiency can become unsustainable if hidden cognitive labor is ignored.
DE12	Internal financial statements (2023; 2025)	Revenue and operating-expenditure changes were used only as contextual organizational indicators.	Boundary evidence, not a causal theme	Financial change coincided with intensified digital use but cannot isolate a digitalization effect.

2. Study Design and Data-Source Inventory

The study used qualitative digital ethnography to examine the everyday use of digital platforms in BUM Desa facilitation in Kediri Regency, East Java, Indonesia. Field engagement ran from September 2025 to February 2026. The field was treated as an interconnected socio-technical facilitation ecology rather than a single online community.

Table S2. Study Design and Data-Source Inventory

Component	Reported scope	Analytical role
Overall design	Qualitative digital ethnography	Approximately six months of field engagement
Study period	September 2025-February 2026	Field engagement in Kediri Regency, East Java, Indonesia
Field configuration	Interconnected socio-technical facilitation ecology	WhatsApp groups, Zoom meetings, private chats/calls, digital reporting applications, and face-to-face village activities
Focal village/enterprise	Mejono Village and BUM Desa Hapsari Mejono	Focal enterprise for contextual documentary indicators
District WhatsApp group	More than 850 members	District-level BUM Desa coordination space
Intensive WhatsApp window	7 days; 225 messages	Daily range 8-64 messages; mean 32.1 messages/day
Interviews	13 semi-structured interviews	Approximately 60-90 minutes; face-to-face, WhatsApp Call, or Zoom
Other digital observation	Scheduled Zoom activities, private follow-up, Daily Report Pendamping (DRP)	Formal coordination, sensitive follow-up, documentation, and monitoring
Documentary material	Observation notes, relevant screenshots, Zoom agendas/minutes, DRP records, policy documents, social-media posts, and internal income statements	Triangulation and contextual corroboration
Unit of analysis	Interactional practice	How actors used digital channels to coordinate, exchange information, monitor activities, and address operational problems

3. Participant Composition and Interview Record

Purposive sampling included actors directly involved in BUM Desa facilitation who had at least three years of relevant experience and had used digital platforms during at least one program or budget cycle. Recruitment stopped when later interviews repeated established patterns and no additional higher-order theme emerged.

Table S3. Participant Composition and Analytical Relevance

Participant group	n	Analytical relevance
Community Empowerment Experts (TAPM)	3	District-level supervision, coordination, and capacity building
Village Facilitators (PD)	2	Cross-village implementation and technical facilitation
Local Village Facilitators (PLD)	2	Day-to-day village-level support and problem escalation
BUM Desa managers	3	Enterprise operations, marketing, and reporting
Village officials	2	Village governance, oversight, and institutional coordination
District community-empowerment official	1	Policy direction, program oversight, and institutional verification
Total	13	Multiple perspectives across the facilitation ecosystem

Table S4. Interview Record Index and Source Availability

Interview ID	Role code	Participant group	Reported duration	Possible study-level modes
INTV01	TAPM-1	Community Empowerment Experts	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV02	TAPM-2	Community Empowerment Experts	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV03	TAPM-3	Community Empowerment Experts	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV04	PD-1	Village Facilitators	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV05	PD-2	Village Facilitators	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV06	PLD-1	Local Village Facilitators	60-90 minutes	Face-to-face / WhatsApp Call / Zoom

Interview ID	Role code	Participant group	Reported duration	Possible study-level modes
INTV07	PLD-2	Local Village Facilitators	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV08	BUM-1	BUM Desa managers	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV09	BUM-2	BUM Desa managers	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV10	BUM-3	BUM Desa managers	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV11	VO-1	Village officials	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV12	VO-2	Village officials	60-90 minutes	Face-to-face / WhatsApp Call / Zoom
INTV13	DCEO-1	District community-empowerment official	60-90 minutes	Face-to-face / WhatsApp Call / Zoom

4. Interview and WhatsApp Observation Framework

The manuscript reports the substantive domains covered in interviews but does not reproduce the exact verbatim interview schedule. The supplementary material therefore preserves only the reported domains and does not invent question wording.

Table S5. Semi-Structured Interview Domains

Domain ID	Reported interview domain	Analytical link
INT01	Platform use in routine BUM Desa facilitation and enterprise work	Platform / interaction form
INT02	Changes in interaction after digital channels became embedded in facilitation	Interaction form / institutional purpose
INT03	Experienced efficiencies in coordination, information access, monitoring, and operational follow-up	Transaction-cost mechanism
INT04	Operational consequences of digital communication for managers, facilitators, and village actors	Empowerment effect / organizational consequence
INT05	Constraints including connectivity, devices, literacy, misunderstanding, availability pressure, and fatigue	Digital burden / negative case
INT06	Perceived opportunities for strengthening BUM Desa support and digital community empowerment	Empowerment effect / practical implication

Table S6. WhatsApp Observation Summary and Functional Categories

Observation metric	Reported value	Category ID	Functional category
Observation window	7 days	WA01	Policy circulation
Total messages	225	WA02	Consultation
Daily minimum	8	WA03	Problem escalation
Daily maximum	64	WA04	Peer learning
Mean messages/day	32.1	WA05	Documentation
Group size	>850 members	WA06	Activity reporting

Message-level coding template

For auditability, the companion dataset indexes MSG001-MSG225 as placeholders only. A complete message-level coding record would require the following fields: Message_ID, date, time, anonymized sender role, interaction form, functional category, institutional purpose, transaction-cost mechanism, empowerment effect, digital burden, interaction mode, and analytic memo. These fields should be populated only from the original de-identified export if it becomes available.

5. Analytical Coding Framework

Analysis followed iterative data condensation, display, and conclusion verification. Interview accounts, observation notes, and documents were coded for platform, interaction form, institutional purpose, transaction-cost mechanism, empowerment effect, and digital burden. First-cycle descriptive codes were compared across participant groups and reorganized into three higher-order interaction modes.

Table S7. Analytical Coding Framework

Coding dimension	Meaning in the analysis	Reported examples	Higher-order use
Platform	Digital channel through which an exchange occurred	WhatsApp group; Zoom; private chat/call; digital reporting system; social-media marketing	Identifies channel-task fit
Interaction form	Social configuration of communication	Synchronous/asynchronous; group/dyadic; agenda-led/open exchange; formal/informal	Builds interaction mode
Institutional purpose	Task or problem addressed by the interaction	Policy alignment; consultation; reporting; clarification; monitoring; marketing; problem solving	Links platform to task

Coding dimension	Meaning in the analysis	Reported examples	Higher-order use
Transaction-cost mechanism	Organizational friction reported or observed as reduced	Travel; scheduling; information search; routine coordination; documentation; verification; monitoring; conflict resolution; outreach	Maps mode-specific efficiencies
Empowerment effect	Practical capability strengthened through interaction	Access to information; response capacity; peer learning; coordinated action; accountable follow-up	Interprets empowerment relevance
Digital burden	Cost or friction created/displaced by digitalization	Connectivity problems; device constraints; literacy support; availability pressure; fatigue; misunderstanding	Supports efficiency-burden paradox

6. Layered Interaction Architecture and Platform Functions

The principal empirical synthesis is a layered interaction architecture in which different channels carried different forms of authority, participation, and relational exposure. Platform value depended on institutional task and relational sensitivity rather than on technical availability alone.

Table S8. Layered Interaction Architecture and Transaction-Cost Effects

Mode ID	Interaction mode	Typical channel	Institutional task	Cost primarily reduced	Empowerment relevance	Qualifying condition
M1	Hierarchical-formal	Zoom	Policy alignment; evaluation; collective decisions	Travel; scheduling; formal coordination	Connects dispersed actors to authoritative information	Formal hierarchy remained visible; district officials or expert facilitators generally controlled agendas.
M2	Network-organic	WhatsApp group	Daily consultation; peer learning; rapid problem solving	Information search; routine coordination	Widens access to shared expertise and response capacity	Information moved laterally and vertically; participation remained uneven for less confident or digitally constrained users.
M3	Personal-relational	Private chat/call	Sensitive feedback; clarification; follow-up	Monitoring; conflict resolution	Protects trust while enabling corrective action	Used when public correction could create defensiveness or damage working relationships.

Table S9. Platform Functions within the Facilitation Ecology

Channel ID	Digital channel	Primary use	Interaction pattern	Main cost mechanism	Evidence boundary
P01	WhatsApp groups	Daily coordination, questions, documents, photos, policy updates	Asynchronous; multi-directional; rapid	Lower information-search and routine coordination costs	Observed in district coordination group; no message-level content reproduced
P02	Zoom	Formal meetings, policy socialization, evaluation, capacity building	Synchronous; agenda-led; hierarchical	Lower travel, scheduling, and meeting costs	Cross-role reports and observation; one experiential estimate of avoided travel
P03	Private messages/calls	Sensitive feedback, clarification, conflict management, individual follow-up	Dyadic; relational; discreet	Lower monitoring and conflict-resolution costs	Private raw content not reproduced
P04	Digital reporting system	Activity records, evidence submission, program monitoring	Standardized; traceable	Lower documentation, verification, and monitoring costs	DRP referenced; raw system records not reproduced
P05	WhatsApp/Facebook marketing	Promotion, orders, customer communication	External; market-facing	Lower search and outreach costs	Mentioned by managers; customer-level data not reproduced

7. Negative Cases, Constraints, and Displaced Burdens

Qualifying and negative evidence was retained rather than treated as noise. The same infrastructure that reduced visible organizational costs also created new temporal, cognitive, and access-related frictions, forming the efficiency-burden paradox described in the article.

Table S10. Negative Cases, Constraints, and Displaced Burdens

Burden ID	Constraint / burden	Reported evidence	Interpretive significance
B01	Unstable connectivity	11 of 13 participants	Affected Zoom meetings and uploads; sometimes required repeated explanations or a return to telephone or face-to-face communication

Burden ID	Constraint / burden	Reported evidence	Interpretive significance
B02	Device or battery constraints	4 participants	Limited reliable participation in digitally mediated work
B03	Additional support for some older BUM Desa managers	3 participants	Assistance needed to join meetings, upload records, or navigate reporting systems
B04	Text-based misunderstandings	2 participants	Short messages removed tone and non-verbal context, requiring additional clarification
B05	Always-on communication norm	Qualitative recurring pattern	Night, weekend, and out-of-hours messages created expectations of rapid response
B06	Fatigue and cognitive load	Qualitative recurring pattern	Multiple groups, virtual meetings, message triage, user support, and reporting displaced temporal/cognitive costs onto facilitators

8. Contextual Organizational Indicators

Internal annual income statements from BUM Desa Hapsari Mejono were used only as contextual corroboration. The study did not independently audit these statements and did not treat the figures as causal estimates of digitalization. Market conditions, product demand, managerial capacity, seasonality, and government support may also have contributed to the observed changes.

Table S11. Contextual Organizational Indicators from the Focal BUM Desa

Indicator	2023	2025	Absolute change	Percent / point change	Interpretive status
Total revenue	IDR 157,947,900	IDR 223,928,000	+IDR 65,980,100	+41.77%	Contextual financial record
Operating expenditure	IDR 98,093,000	IDR 78,912,000	-IDR 19,181,000	-19.55%	Contextual financial record
Operating-cost ratio	62.10%	35.24%	-26.86 percentage points	-26.86 pp	Derived from financial records
Coordination frequency	About 1/month	About 7/month	+6/month	+600%	Participant and activity-report evidence

9. Interview Evidence Supporting the Analytical Themes

To keep the supplementary file aligned with the published article, this section includes only anonymized interview evidence already reproduced in the main manuscript.

Table S12. Interview Evidence Matrix Derived from the Main Article

Evidence ID	Role code	Channel / mode	Verbatim interview evidence	Analytical contribution	Evidence status
IE01	PD-1	Zoom / hierarchical-formal	“We use Zoom for large meetings involving several subdistricts. We do not need to leave the village; we can join from home or the village office. It saves time and transport costs.”	Reduced travel and scheduling costs while preserving formal coordination.	Verbatim quotation in main article
IE02	TAPM-1	WhatsApp / network-organic	“Every morning I check the WhatsApp groups. There are usually reports from village facilitators. If a problem appears, I respond immediately. It is faster than gathering everyone at the office.”	Shows rapid problem escalation, reusable information, and lower routine coordination costs.	Verbatim quotation in main article
IE03	TAPM-3	Private message / personal-relational	“If there is a problem with a facilitator’s performance, I message them privately first rather than posting it in the group. That is wiser.”	Supports discreet corrective action, trust protection, and lower conflict-resolution costs.	Verbatim quotation in main article
IE04	TAPM-3	WhatsApp / availability pressure	“The work never stops. The WhatsApp groups keep sounding, even at night. Sometimes it feels as though there is no time to rest.”	Supports the efficiency-burden paradox through temporal and cognitive burden.	Verbatim quotation in main article
IE05	PD-1	WhatsApp / response expectation	“There is an expectation that we must reply quickly, even though we are in the field and do not always have the phone in our hands.”	Shows the always-on response norm and pressure on work boundaries.	Verbatim quotation in main article

10. Trustworthiness, Reflexivity, and Ethical Safeguards

Table S13. Trustworthiness, Reflexivity, and Ethical Safeguards

Procedure	Reported implementation	Supplementary handling
Triangulation	Interpretations were compared across participant roles and across interviews, observation, and documentary material.	Cross-source evidence retained in the analytical account
Member checking	Selected summaries were returned to key participants for checking.	Procedure reported; forms not reproduced
Negative/qualifying evidence	Connectivity failures, misunderstandings, fatigue, and other constraints were retained.	Prevents one-sided efficiency interpretation
Insider reflexivity	One researcher occupied an insider position as a Community Empowerment Expert; reflexive notes were used to distinguish professional assumptions from evidence.	Reflexive notes themselves are not reproduced
Cross-role comparison	Accounts were compared across facilitators, managers, village officials, and district-level actors.	Supports role-based triangulation
Consent	Participants were informed about study purpose and intended use; consent was obtained before interviews and observation.	Consent documents not reproduced
Anonymization	Interview quotations are reported by role code. The two documentary screenshots in Section 13 were blurred to obscure visible faces, names, phone numbers, and message details.	The screenshots are privacy-modified illustrations, not unaltered source images. Verify that consent and publication permissions cover their use.
Digital-record handling	Digital records were used only for academic analysis and stored securely.	Raw private records excluded from this file
Translation	Reported quotations were translated from Indonesian while preserving meaning rather than colloquial syntax.	English quotations reproduced; Indonesian originals unavailable in source

11. Documentary Source Inventory and Audit

Table S14. Documentary and Observational Source Inventory

Source ID	Source type	Reported presence	Analytical purpose
D01	Observation notes	Yes	Link online exchanges with meetings, village visits, and enterprise work
D02	Relevant screenshots	Yes	Document digital interaction and reporting practices
D03	Zoom agendas and minutes	Yes	Formal coordination, policy socialization, evaluation
D04	Daily Report Pendamping (DRP) records	Yes	Activity records, evidence submission, program monitoring
D05	Policy documents	Yes	Institutional context and policy alignment
D06	Social-media posts	Yes	Promotion and market-facing communication
D07	Internal income statement - 2023	Yes	Contextual organizational indicator
D08	Internal income statement - 2025	Yes	Contextual organizational indicator

Table S15. Audit Trail and Data-Availability Register

Item	Available in source?	Included here?	Reconstruction action
Study design and setting	Yes	Yes	Copied/summarized from manuscript/supplement
Participant group composition (13)	Yes	Yes	Expanded to role-coded index without demographics
Exact interview schedule	No	No	Only reported domains retained
225-message raw WhatsApp export	No	Index scaffold only	MSG001-MSG225 placeholders; content left blank in companion dataset
Three interaction modes	Yes	Yes	Evidence matrix reproduced
Negative/burden evidence	Yes	Yes	Quantified counts and recurring patterns retained
Financial indicators 2023/2025	Yes	Yes	Summary values and derived changes retained
Illustrative quotations	Yes	Yes	Five manuscript quotations retained

Item	Available in source?	Included here?	Reconstruction action
Consent / ethics statements	Yes (procedural)	Yes	Procedural safeguards summarized

12. Interpretation Boundaries and Data-Availability Note

- The study explains interactional and institutional mechanisms; it does not estimate a counterfactual causal effect of digitalization.
- Empowerment claims concern access to information, coordination, response capacity, and organizational capability rather than household welfare or community-wide participation.
- The study is bounded by one regency, a small purposive participant group, and one seven-day intensive WhatsApp observation window nested within approximately six months of broader field engagement.
- Internal financial records derive from one focal BUM Desa at two annual time points and were not independently audited.
- The Muslim-majority setting provides contextual relevance; religious identity, religious practice, Islamic economic norms, and faith-based organizations were not analyzed as explanatory variables.
- Selected documentary screenshots and archival images already contained in the thesis are reproduced in Section 13 with identifying details obscured by blurring. The broader raw digital archive, complete private-message records, and full WhatsApp export remain unavailable in this supplementary package.
- The Word supplementary file is designed as an audit and transparency document. It should not be interpreted as a substitute for the unavailable raw WhatsApp export or interview transcripts.

Supplementary Data Availability Statement

The supplementary tables provide the most complete audit trail that can be reconstructed from the manuscript and currently available study documentation. Section 13 additionally reproduces selected documentary figures as privacy-blurred illustrations based on the thesis images. Raw digital exports, full private-message records, and interview transcripts are not included in this package.

13. Documentary Figures (Identifying Details Blurred)

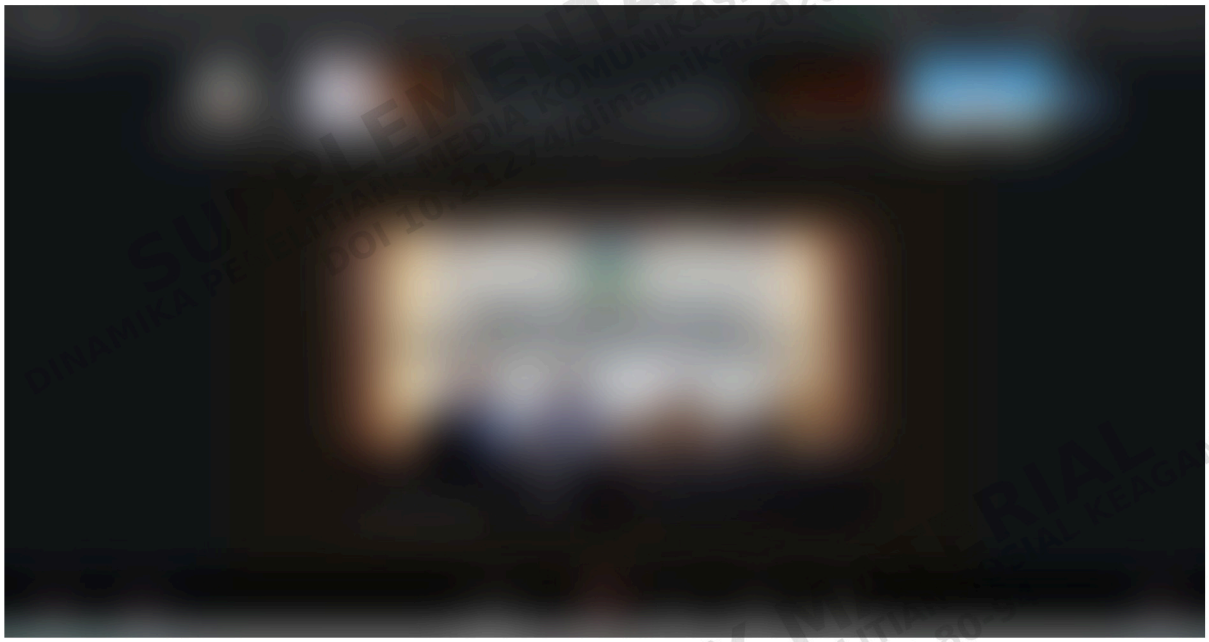


Figure S1. Zoom meeting activity (identifying details blurred)

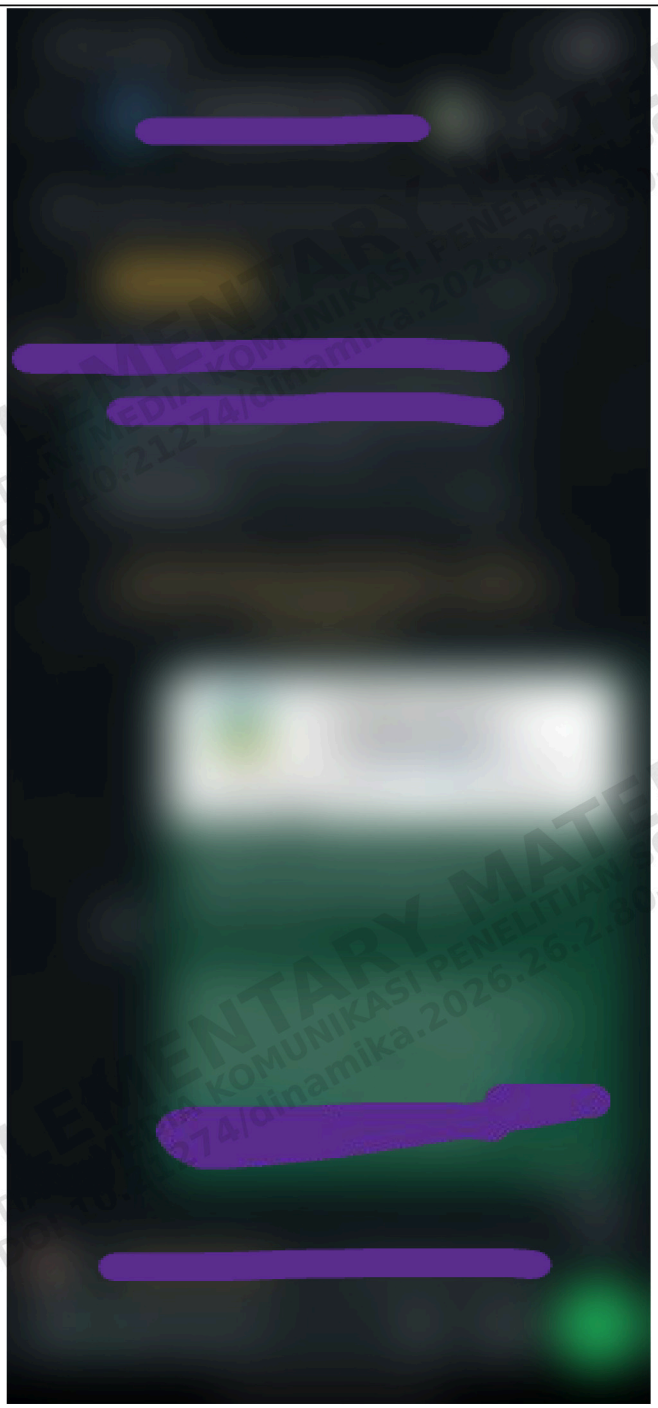


Figure S2. WhatsApp invitation to a Zoom meeting (identifying details blurred)

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