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The Role of Interdisciplinary Collaboration in App-Development for Aquaculture

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ABSTRACT

This study explores app-development supporting Indonesia's fisheries digital ecosystem, aligned with the National Medium-Term Development Plan (2020-2024) that emphasizes digitalization to strengthen agriculture and fisheries. Focusing on interdisciplinary collaboration and group communication, the research examines how these elements influence the design and effectiveness of ICT for development (ICT4D). A qualitative case study approach was used, data collected from observations and interviews with app-developers in startups and the aquaculture community. The interview analysis follows two coding cycles: the first examines interdisciplinary collaboration and group communication dynamics and knowledge integration, while the second focuses on technology's impact on aquaculture practices. Findings reveal key categories—communication frequency and quality, role clarification, and knowledge management—vital to effective collaboration. Communication barriers can be mitigated through conflict resolution and training, while knowledge integration boost aquaculture efficiency and productivity. Applying structuration theory, this study shows how innovation-supportive organizational structures enhance individual agency, while rigid policies can stifle creativity. This research contributes to ICT4D literature by providing insights into collaboration strategies and organizational dynamics that influence technology development in traditional sectors, offering a framework for similar digital initiatives.

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INTRODUCTION

The digital ecosystem with a focus on information and communication technology for development (ICT4D) plays a crucial role in supporting agricultural sectors. However, the utilization of this technology (app or digital software) is still below its maximum potential, mainly due to constraints such as limited digital access by farmers and fishermen, internet-divides, and knowledge practices. This highlights an urgent need to develop applications that can enhance engagement and efficiency across the production to distribution process.

Research in the field of ICT4D not only focused on the creation of technology but also involves strong interdisciplinary collaboration among researchers and developers from various fields (Heeks, 2008). Collaboration is a vital relationship pattern for cooperation between various parties in an activity or program (Arifin et al., 2024). This collaboration is crucial for addressing the complexities in developing effective and sustainable solutions. In alignment with Indonesia's National Medium-Term Development Plan 2020-2024 (Rencana Pembangunan Jangka Menengah Nasional), which underscores digitalization to empower farming and fisheries, this study investigates how interdisciplinary collaboration and group communication impact application development (app-development), design and effectiveness.

Agency, defined as the capacity of individuals or groups to act autonomously within a social structure, is particularly significant in app-development team. Structuration theory suggests a dynamic interplay between agency and structure: individual actions shape social structures, which, in turn, shape future actions. Application developers and designers, as agents, have the power to significantly influence the design and functionality of app, ensuring that the final products respond to user needs and reflect best industry practices. This agency, coupled with interdisciplinary collaboration, enables developers to address challenges within the fisheries sector innovatively and effectively.

Despite these advances, gaps remain in understanding how interdisciplinary collaboration can be optimized especially in contexts like Indonesia's fisheries digital ecosystem. Interdisciplinary collaboration is a crucial approach in effective app-development, especially in the context of information and communication technology for development (ICT4D) (Avgerou, 2017; Ramadani et al., 2018; Zheng, 2015). This collaboration involves the blending of expertise from various disciplines contributing to the creation of comprehensive and innovative solutions (Pham, 2019; Robb et al., 2020). Practically, interdisciplinary collaboration not only enriches the app-development as well as the design processes but also enhances the quality and relevance of the developed solutions.

Interdisciplinary collaboration allows app-development team to adopt the advanced "lean start-up" methods to create "agile software," which emphasize rapid and responsive adaptation to user needs and dynamic market conditions (Robb et al., 2020). Furthermore, while advanced methods have gained traction, there is limited research on their applicability in ICT4D for traditional sectors such as agriculture and fisheries. The notion above follows a literature review that highlights various aspects and theories relevant to interdisciplinary collaboration in the context of app-development, demonstrating how the integration of various disciplines can

strengthen both the process and the final outcomes of the software (app). The link between interdisciplinary collaboration and development-communication (DevComm) can be understood through the ICT4D lens, where collaboration is not just limited to discipline integration but also includes effective communication within the app-development team (Puron-Cid, 2012; Zheng, 2015; Zheng et al., 2018). The communication in app-development involves the exchange of information and coordination among various stakeholders, becomes key to translating the needs of developers and users into effectively functioning applications.

Seibold explains that interdisciplinary collaboration in app-development often demands a deep understanding of social issues such as participation and voice, effectiveness and influence, as well as intergroup conflicts. This highlights the importance of understanding the dynamics of workgroups and how they manage complexity and conflicts that may arise (Seibold, 2017). The "Vigilant Group" concept supports the idea that workgroups that are alert and vigilant about internal and external dynamics can achieve more effective decisions (Littlejohn & Foss, 2021). Previous research has shown that the effectiveness of interdisciplinary collaboration heavily depends on the team members' ability to communicate and interact effectively, integrating various perspectives and expertise to achieve sustainable and effective solutions (Lwoga & Sangeda, 2018; Sein et al., 2019).

Communication in app-development, especially those supporting sectors like fisheries, requires a deep understanding of the complex social and economic context. This means that team members from different disciplines—such as ecology, economics, and information technology—must be able to communicate their knowledge in a way that is understandable and applicable by other team members (Kramer et al., 2017; Seibold, 2017). This interaction not only enhances app-development but also ensures that the solutions produced are relevant and practically applicable in the real-world context of end-users.

Effective communication is crucial for identifying and addressing social issues that may be faced by specific user communities, especially within ICT4D. As explained by Seibold (2017), issues such as inequality, marginalization, and intergroup conflicts can significantly affect how technology is accepted and used within communities. Therefore, app-development can use communication that is sensitive to social issues to ensure that the software (apps) are not only technically capable but also socially inclusive. Furthermore, principles of effective communication support the practice of "lean start-up" and agile software development, integrating continuous user feedback and adapting products based on that feedback (Batra et al., 2017; Freitas et al., 2014). This is a manifestation of active two-way communication, where users are not just passive recipients but active participants in the development process.

Through a literature review, it is clear that interdisciplinary collaboration and development-communicatio (DEvComm) are two closely intertwined concepts, both playing crucial roles in achieving successful, effective, and sustainable app-development processes. By ensuring that all team members, regardless of their disciplinary backgrounds, can communicate and collaborate effectively, it can be guaranteed that the developed applications not only meet technical specifications but also support broader social development. The review also formulates this research's novelty, which focus on the socio-techno approach, which research explores

various aspects which interplay social, technical as well as group-communication dimension that shape app-development process. Another key novelty is the use of structuration as a theory to analyze the communication process in app-development. Group communication is crucially important in ensuring the effectiveness of interdisciplinary collaboration, especially in app-development (Batra et al., 2017). This communication not only facilitates information exchange among team members but also plays a crucial role in decision-making and conflict resolution that can arise from differing perspectives among disciplines.

However, communication within interdisciplinary groups faces certain challenges, such as cognitive dissonance and role conflicts that may arise from differing disciplinary backgrounds. Studies indicate that groups often struggle to integrate heterogeneous information. How groups overcome these challenges—through negotiation, mediation, or integration—is crucial to the overall success of the development process (Leonardi & Lewis, 2017). Based on the recent studies above, this research formalize a research question: How do interdisciplinary collaboration and effective communication influence the design, development, and implementation of applications within the digital ecosystem for the fisheries sectors? How can these applications address the specific challenges faced by fishermen in adopting new technologies?

RESEARCH METHOD

This research employs a qualitative approach with a case study design to gain in-depth understanding of the phenomenon of interdisciplinary collaboration in app-development. The case defined as follows: the interdisciplinary collaboration and communication dynamics within start-up companies involved in app-development, as part of efforts to enhance the digital ecosystem in Indonesia's fisheries industry. The in-depth understanding sought is within a socio-techno setting within app-development. The case study is used to enable generalization (Yin, 2018), from multiple sources to give a clear understanding of the social phenomenon defined above.

The research locations include interactions within start-up companies that are part of the MIKTI Institute. This approach allows for instrumental case analysis that provides insights into the application of technology in aquaculture. Key informant include multiple sources, from 6 individuals with the criteria: have 5-10 years of experience in the digital ecosystem and have recently been involved in the app-development of in the aquaculture sector. For reliability and validity, the research used triangulation, additional key informant will be interviewed and secondary data will be analyzed through documents and other source of data such as science articles.

Data analysis utilized the qualitative approaches processed through thematic analysis that includes 2 stages of coding cycles (Miles & Huberman, 2019). This approach allows for the identification of specific themes and examines the interconnections between categories that emerge from the data, providing comprehensive insights into the use of applications and ICT4D practices in the context of aquaculture. The discussion will include the latest development in

aquaculture, examining group communication arguments that shape the structuration-agency framework.

RESULTS AND DISCUSSION

The app-development process, which can take 3-8 months, is heavily influenced by communication methods within the developer team. During which group participants discuss various issues, from those directly related to app-development to daily operations within the development. In the 1st cycle coding phase of this research, the focus of the analysis is on "Interdisciplinary Communication Dynamics," which includes a detailed exploration of how teams from various disciplines communicate to achieve common goals in app-development. Data from interviews and observations were categorized into several sub-categories reflecting key aspects of interdisciplinary communication as seen in Figure 1.

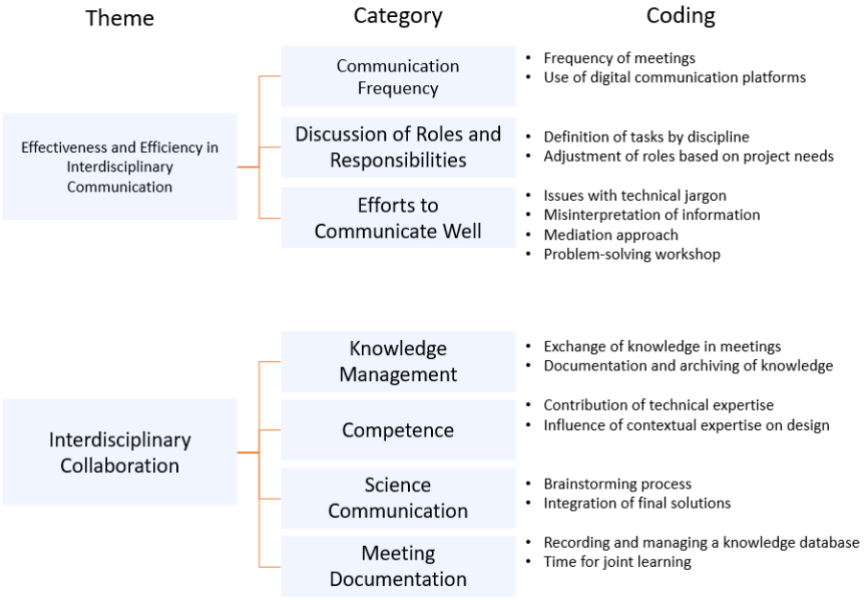

Figure 1 Themes and categories in 1st cycle coding

1. Communication Frequency explained to determine how often and through what media the team communicates. Results show that teams using a combination of daily and weekly communications, both through face-to-face meetings and digital platforms, tend to have better project coordination.
2. Clarification of Roles and Responsibilities has proven crucial for setting expectations and minimizing conflicts. The analysis shows that teams with clear role documentation and routine updating of responsibilities have clearer task clarity and significant reduction of misunderstandings.
3. Communication Issues such as misinterpretations and technical jargon often occur, especially among team members from technical and non-technical backgrounds. This indicates the need for effective communication training and the use of visual aids to facilitate cross-disciplinary understanding.

4. Efforts to Communicate Well demonstrate an initiative by team members to adopt best communication practices, including regular Q&A sessions and the use of feedback loops to enhance transparency.

The analysis at this stage is very useful for understanding how interdisciplinary communication is structured and operates within the context of app-development. This approach allows researchers to identify both strengths and areas needing improvement in team communication, which directly affects efficiency and effectiveness in app-development. Continuing the discussion of 1st cycle coding for this research, the second focus is on "Integration of Knowledge and Expertise." In this phase of the discussion, researchers examine how knowledge from various disciplines is involved in the app-development process, as well as how individual expertise contributes to the final product.

1. Source of Knowledge is identified as one of the key elements in the integration process. Teams that effectively manage and utilize knowledge sources achieve more innovative and relevant outcomes. Data shows that teams with structured access to a shared knowledge database and regularly joint learning sessions significant improve in knowledge integration.
2. Influence of Expertise is a category that showcases how the specific expertise of individuals within the team influences the overall process and outcomes of development. Analysis reveals that the presence of specialists in specific fields, such as user interface design or data analysis, directly enhances the quality and usability of developed applications. This expertise also facilitates adopting of new technologies and more efficient methods.
3. Ideas Integration discusses how contributions from various disciplines are combined to create coherent solutions. Analysis shows that teams adopting a repetitive approach, where ideas are continuously developed and refined through discussions and prototyping, achieve a higher level of integration.
4. Knowledge Management is examined to assess how teams store, access, and utilize shared knowledge. Data indicates that teams with mature knowledge management systems are quicker to adapt to changes and implement innovations in their projects.

At this stage of 1st cycle coding, it is found that the integration of knowledge and expertise not only enhances the quality of the final product but also strengthens the overall capabilities of the team in facing technical and market challenges. This integrative process plays a crucial role in ensuring that the outputs from interdisciplinary collaboration truly meet user needs and evolving industry standards. Experts state that learning emerges through collaboration, reflection, and negotiation within a social context (Firmansyah et al., 2024). Continuing the analysis in the 2nd cycle coding phase, the focus shifts to "The Influence of Technology on Aquaculture Practices." This stage allows us to assess how developed applications and technologies interact with aquaculture practices and result in changes in operations and management of this sector.

Technology Effectiveness in Aquaculture

In this category, we explore the extent to which developed technologies meet practical needs in the aquaculture sector. Analysis shows that technologies such as "digitized auto-feeders" significantly enhance feeding efficiency, reduce waste, and improve fish stock health. The use of applications that allow remote monitoring and control has expanded the operational management capabilities of aquaculture, giving users the ability to make decisions based on accurate real-time data. However, there are some thematic conversations in the app-development that holds the continued use of auto-feeder technology.

1. Technological Barriers: In this category discussion, we identify challenges faced by users in adopting new technologies. Some of the main challenges encountered include lack of compatibility with existing infrastructure, operational complexity, and the need for more in-depth user training. The lack of technical support in operating application often leads to reluctance in full implementation, necessitating further design iterations to improve user interfaces.
2. Economic Benefits: Analysis in this category reveals the economic impact of new technology usage on aquaculture operations. Results show that technology implementation not only reduces operational costs but also increases production output. Digitization of processes and integration of data analysis provide better predictive capabilities, optimizing resource allocation and operation times, which directly enhance profitability.
3. Practice Changes: In this category, we assess how aquaculture practices have changed as a result of integrating new technologies. Analysis shows a shift from traditional methods to more data-focused practices, with significant improvements in operational efficiency and desires. Technology provides the ability to perform real-time environmental monitoring, which aids in evidence-based and more accurate decision-making.

In the next stage, the 2nd cycle coding, the research delves deeper into how specific technologies advances affect various aspects of aquaculture operations. This process clarifies the relationship between technology development and its application in real-world contexts, revealing how technological innovations not only improve but also transform the aquaculture sector. This analysis provides vital insights into the potential and limitations of technology applications in the dynamic aquaculture industry context.

Research Results: 2nd Cycle Coding

The 2nd cycle coding explores interdisciplinary collaboration and communication dynamics, integration of knowledge and expertise, as well as the influence of technology on aquaculture practices within the framework of structuration. The theory refers to how Structure (norms, rules, and procedures existing within the development of applications and aquaculture operations) and agency (the actions of individuals and groups involved in the process) interact with and influence each other. The main focus of the structuration analysis is to assess how

organizational structure and technology support or hinder individual agency in adopting and using technological innovations.

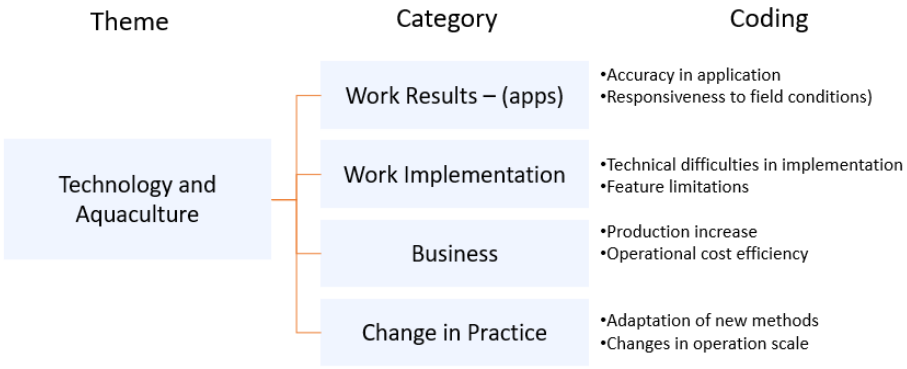

Figure 2 Themes and categories in the 2nd coding cycle

In Figure 2, the analysis indicates that organizational structures that support open communication and interdisciplinary collaboration facilitate individual agency in contributing to the development and implementation of technology (change in practice). These structures include effective knowledge management systems, adequate documentation procedures, and policies that support innovation and experimentation. With structures like these, individuals feel empowered to experiment and recommend innovative solutions, which in turn enhances the quality and effectiveness of the developed technology. Communication is key to business stability, especially in start-ups (Cahyani, 2020), and can be implemented at management levels. On the other hand, there are also situations where existing structures constrain agency. For example, rigid corporate policies or strict hierarchical systems can hinder individual initiative and creativity, which are important in the process of developing innovative applications. Technological structures that are inflexible or difficult to integrate with existing systems can reduce individuals' ability to use the technology effectively, limiting the adoption and integration of technology in aquaculture practices.

This discussion also delves into the concept of the duality of structure in Giddens' Theory of Structuration, which states that structure constrain actions but also enables agency (Kinseng, 2017; Nordbäck et al., 2017; Pilny et al., 2017). New technologies often change the operational structure of aquaculture—for example, through the digitalization of previously manual processes—thus creating new opportunities for agency. These changes can enhance individuals' capacity to utilize technology in improving efficiency and productivity, as well as in managing aquaculture resources more sustainably.

Table 1 App-development Impact Analysis and Strategy Matrix

Factor	Impact on Team Dynamics	Impact on Project Outcomes	Potential Solutions
Communication Quality	Enhances or diminishes group cohesion depending on clarity and frequency.	Directly affects the accuracy and timeliness of project deliverables.	Implement regular training sessions on effective communication; use visual aids and clear documentation.
Trust Among Team Members	Affects morale and the willingness to share critical feedback.	Impacts the reliability of project data and final product quality.	Build trust through team-building activities; ensure transparent decision-making processes.
Expertise Recognition	Influences job satisfaction and individual contribution levels.	Affects the scientific and technical integrity of the app.	Establish merit-based recognition and reward systems; involve multiple expert reviews in project phases.
Hierarchy and Power Relations	May create barriers to open communication and innovation.	Can lead to decisions based on flawed data or favoritism, affecting product efficacy.	Flatten organizational structures where feasible; encourage a culture of equality and open dialogue.
Economic Interests vs. Innovation	Economic pressures can demotivate teams if innovation is consistently deprioritized.	Could lead to short-term gains but long-term sustainability issues.	Balance economic goals with innovation objectives; allocate resources for exploratory projects.

Grounded in the Structuration theory, this research shows that the interaction between organizational structure and technology with individual agency plays a key role in the success or failure of adopting technological innovations. When designing and implementing new technologies, it is important for developers to consider how the structures they create will affect user agency and conversely, how user agency can shape the evolution of that technology. Thus, recommendations for best practices and further improvements can focus on creating structures that support and expand agency, while minimizing conflicts between the two. The following discussion will involve organic and more authentic examples that are found during the research which then can be initiated as a healthy debate among researcher alike. Some examples discuss the reality in which are experience by real practitioners and professionals in the field of app-developing within the scope of the research.

The Communication quality reflects effort to improve the overall communication environment within in a group which doesn't have to really understand the whole situation, this can be employed the sincerity and also how the "trust" factor plays among the communicators. However, some argues that most cases, the practices involve inexperienced team member. As Seen in the table 1, scientific Information in the practice of science communication among expert within the app-development is one the many cases in which "trust" play an important role. Many claim that biologists involved in the app-development to describe the aquaculture practice doesn't reflect their expertise and rely on the "closeness" to the owner or higher management levels, fails to show their trust-worthiness. To some level of extent in the project there are not even biologist base evidence present anymore. The developer, such as software engineer and designer felt that they are driven by false data or unreliable arguments. The short time period and with so much list of things to do, left them with contempt and just like to continue and finish the projects without questioning anything. The biologist recruitment and the fact it's within the reach of the owner puts the engineer and designer into the "silent treatment" and yet again puts them into the low hierarchy in the organization order.

This scenario highlights the central theme of structuration within the organization, illustrating how structural elements—like hierarchy, power relations, and recruitment policies—shape and are shaped by the actions and interactions of individuals within the company. The proximity of biologists to upper management, often not based on merit but on favoritism, distorts the flow of accurate information and undermines the efficacy of technological developments. As a result, other team members experience a diminishment in their agency, feeling compelled to follow directives based on flawed data without the opportunity for critique or improvement. This cycle of misinformation and undervalued professional input not only stifles innovation but also perpetuates a culture where true expertise and critical feedback are marginalized, highlighting the need for structural reform to foster a more equitable and effective organizational environment.

Many of the engineer and designer are also burdened by how meeting documentation does not have important role anymore as many of the important points given in the meeting are interchangeable and or completely changed throughout the projects. "Scientific facts are generally considered unchanging", based on data or scientific findings within the aquaculture ecosystem such as water quality parameters, fish growth rates, and breeding techniques. These foundational elements are crucial for developing sustainable practices, optimizing feed efficiency, and ensuring the health and productivity of aquatic species under various environmental conditions. The research findings, however, challenge the notion that scientific facts are immutable. They illustrate that technological advancements and new methodologies can significantly alter our understanding and management practices in aquaculture. For instance, the introduction of IoT-based monitoring systems has transformed traditional paradigms of water quality management by providing real-time data, leading to more dynamic and responsive strategies. This demonstrates that while foundational sciences provide critical baseline information, they are continually subject to refinement and change as new insights and technologies emerge. Moreover, there are substantive shifts prompted by stringent schedules

and economic interests. For example, an innovative app-development strategy driven by economic motivations is the creation of an app designed to manage short-term loans, which facilitate larger profits. This reflects a broader trend where economic imperatives catalyze technological innovations, reshaping traditional practices and introducing new dynamics into the sector.

Unfortunately, one of the IoT-based monitoring systems, which utilized a microphone as a sensor to listen to fish behaviour, is no longer being advanced due to economic interests. This decision reflects a shift in priorities where financial considerations outweigh the potential benefits of innovative technology that could enhance understanding and management of aquaculture environments. Addressing issues related to agency within organizational structures, especially where economic interests overshadow innovation, requires a strategic and multifaceted approach. Here are several solutions to enhance individual agency and promote a more balanced decision-making environment:

1. Empowerment through Participation: Establish more involvement of diverse team members in decision-making processes by regular innovation meetings to encouraged to propose and discuss new ideas.
2. Transparent Communication Channels: Develop open channels communication where feedback and concerns regarding project directions or technology implementations can be freely expressed without fear of repercussion.
3. Decentralizing Decision-Making: Reduce the hierarchical gap by delegating more decision-making power to mid and lower-level employees.

This research also needed to extend knowledge in the app-development phenomenon in many setting and also approach. Suggestion for future research includes on optimizing interdisciplinary communication frameworks to bridge gaps in terminology and understanding between technical and non-technical team members in aquaculture app development. How Trust-building and transparency should be investigated as key factors in enhancing group communication dynamics, especially within hierarchical organizational structures, to balance managerial influence with equitable employee contributions. Additionally, participatory communication approaches should be examined for their effectiveness in fostering inclusivity and agency in decision-making processes.

CONCLUSION

Addressing the challenges of structuration and agency in app-development, particularly aquaculture innovation, it is essential to focus on the role of interdisciplinary collaboration and scientific information within group communication. Empowering employees through participative decision-making and decentralizing authority—especially when recruiting experts like biologists or managing knowledge about current technological trends in fisheries—can foster a more innovative environment. Furthermore, bridging scientific expertise with practical digital app-development will allow for more targeted solutions that directly address the needs of farmers and fishermen. Fostering a culture that values each member's input, while also aligning economic and innovative goals, is critical for sustained growth and success in today's

rapidly evolving agricultural and fisheries sectors. Suggestions for future research include bridging terminology gaps, examining the impact of trust-building on collaboration dynamics, and fostering participatory communication within app-development.

REFERENCES

Arifin, S., Listia, D., Tini, R., Azinuddin, M. Bin, & Rachmad, T. H. (2024). Collaborative Communication Strategies in Preventing Conflicts of Interest in the Management of Gili Iyang Oxygen Tourism. *Ekspresi Dan Persepsi : Jurnal Ilmu Komunikasi*, *7*(2), 340–353.

Avgerou, C. (2017). Theoretical framing of ICT4D research. In *In International conference on social implications of computers in developing countries* (p. (pp. 10-23).). Springer. https://doi.org/10.1007/978-3-319-59111-7

Batra, D., Xia, W., & Zhang, M. (2017). Collaboration in agile software development: Concept and dimensions. *Communications of the Association for Information Systems*, *41*(1), 429–449. https://doi.org/10.17705/1cais.04120

Cahyani, I. P. (2020). Membangun Engagement Melalui Platform Digital. *Ekspresi Dan Persepsi : Jurnal Ilmu Komunikasi*, *3*(2), 76.

Firmansyah, D., Lubis, D. P., Muljono, P., & Purnaningsih, N. (2024). The Process of Adopting Information and Communication Technology Innovations in Online Learning for Students with Autism Spectrum Disorder During the COVID-19 Pandemic. *Ekspresi Dan Persepsi : Jurnal Ilmu Komunikasi*, *7*(2), 313–328.

Freitas, R. C. De, Andrade, J., Junior, D. O., Yukio, F., Hino, A., Neto, J. S., Vicente, L. M., Marques, A., Alberto, L., & Dias, V. (2014). *Applying Interdisciplinarity and Agile Methods in the Development of an Embedded System*. 1–2. https://doi.org/10.1109/ITNG.2014.44

Heeks, R. (2008). ICT4D 2.0: The next phase of applying ICT for international development. *Computer*, *41*(6), 26–31. https://doi.org/10.1109/MC.2008.192

Kinseng, R. A. (2017). Strukturgensi : Sebuah teori tindakan. *Jurnal Sosiologi Pedesaan*, *5*(2), 127–137.

Kramer, M. W., Hoelscher, C. S., Nguyen, C., Anthony, E., Cooper, O. D., Kramer, M. W., Hoelscher, C. S., Nguyen, C., & Anthony, E. (2017). *Structuration processes in an interagency collaboration : enabling and constraining participation and efficiency*. *9882*(December). https://doi.org/10.1080/00909882.2017.1355558

Leonardi, P. M., & Lewis, L. L. (2017). Teams, time, decisions, and change: articles in honor of (and by) David R. Seibold. *Journal of Applied Communication Research*, *45*(4), 359–364. https://doi.org/10.1080/00909882.2017.1355592

Littlejohn, S. W., & Foss, K. A. (2021). *Theories Of Human Communication*. In *Waveland Press* (Issue twleve edition).

Lwoga, E. T., & Sangeda, R. Z. (2018). *ICTs and development in developing countries A systematic review of reviews*.

Miles, M. B., & Huberman, A. M. (2019). *Qualitative Data Analysis A Methods Sourcebook* (third edit).

Nordbäck, E. S., Myers, K. K., & McPhee, R. D. (2017). Workplace flexibility and communication flows: a structurational view. *Journal of Applied Communication Research*, *45*(4), 397–412. https://doi.org/10.1080/00909882.2017.1355560

Pham, H. T. (2019). The application of structuration theory in studying collaboration between librarians and academic staff in universities in Australia and Vietnam. *Information Research*, *24*(3).

Pilny, A., Poole, M. S., Reichelmann, A., Klein, B., Pilny, A., Poole, M. S., Reichelmann, A., & Klein, B. (2017). *A structurational group decision-making perspective on the commons dilemma : results from an online public goods game*. *August*. https://doi.org/10.1080/00909882.2017.1355559

Puron-Cid, G. (2012). Applying extending structuration theory: A study of an IT-enabled budget reform in the context of interdisciplinary collaboration. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 2239–2248. https://doi.org/10.1109/HICSS.2012.117

Ramadani, L., Kurnia, S., & Breidbach, C. F. (2018). In search for holistic ICT4D research: A systematic literature review. *Proceedings of the Annual Hawaii International Conference on System Sciences*, *2018-Janua*, 2424–2433. https://doi.org/10.24251/hicss.2018.304

Robb, C. C., Rahn, D., & Buffardi, K. (2020). Bridging the gap: A model for interdisciplinary collaboration between entrepreneurship and software engineering students. *Journal of Education for Business*, *95*(5), 321–330. https://doi.org/10.1080/08832323.2019.1644275

Seibold, D. R. (2017). A tribute to those associated with this tribute, with great gratitude. *Journal of Applied Communication Research*, *45*(4), 445–454. https://doi.org/10.1080/00909882.2017.1355593

Sein, M. K., Thapa, D., Hatakka, M., & Sæbø, Ø. (2019). A holistic perspective on the theoretical foundations for ICT4D research. In *Information Technology for Development* (Vol. 25, Issue 1, pp. 7–25). https://doi.org/10.1080/02681102.2018.1503589

Yin, R. K. (2018). *Case study research and applications: Design and methods 6th ed*.

Zheng, Y. (2015). ICT4D , Overview of Theories in . *The International Encyclopedia of Digital Communication and Society*, 1–10. https://doi.org/10.1002/9781118767771.wbiedcs153

Zheng, Y., Hataka, M., Sahay, S., & Andersson, A. (2018). *Conceptualizing development in information and communication technology for development (ICT4D)*.