Designing a Qualitative Case Study Methodology to Map the Information Systems Development Process in Distributed Digital Communities

Supina Batubara, Eko Hariyanto, Hanifah Balqis

Abstract

Conventional information system development approaches, such as SDLC and Agile, are insufficient for comprehending development processes that transpire beyond organized corporate settings. A prevalent phenomenon is system development propelled by decentralized communities, driven by voluntary engagement and autonomous collaboration. This paper provides a qualitative case study methodology framework aimed at mapping information systems development processes within distributed digital communities. This paradigm amalgamates diverse data collecting methodologies, including comprehensive interviews and digital content analysis, with systematic analytical strategies such as Grounded Theory. We contend that this methodology is adept at facilitating a profound comprehension of the dynamics, obstacles, and determinants influencing IS development in a non-hierarchical environment. This paper's primary contribution is a novel methodological approach designed to assist academics in efficiently investigating and constructing theories regarding the distinctive process of information systems development within informal organizational contexts.

Keywords: Information Systems Development, Digital Communities, Qualitative Case Study, Decentralized Development, Methodological Framework

Supina Batubara[1]
[1,2]Faculty Science Computasi and Digital Intelligent, Universitas Pembangunan Panca Budi, Indonesia
e-mail: supinabatubara@dosen.pancabudi.ac.id[1]

Eko Hariyanto[2], Hanifa Balqis[3]
[3]Student of Faculty Science Computasi and Digital Intelligent, Universitas Pembangunan Panca Budi, Indonesia
e-mail: ekohariyanto@dosen.pancabudi.ac.id[2], phdmateupsi@gmail.com[3]
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Introduction

Information Systems Development (ISD) has historically been governed by sequential and centralized frameworks, including the SDLC, followed by adaptive approaches like Agile. Although these techniques enhance the velocity and flexibility of systems development with a focus on team collaboration and swift delivery [1], current frameworks continue to be entrenched in the presuppositions of a hierarchical corporate structure [2]. The principal emphasis of ISD research is confined to how formal organizations (businesses) can enhance their internal efficiency and project frameworks [3]. The rise of digital ecosystems has required an expansion of research approaches to investigate phenomena beyond corporate borders.

The development of information systems powered by distributed digital communities is becoming increasingly significant. These communities, defined by their volunteer, non-commercial, and decentralized characteristics, inherently develop intricate digital solutions [4]. For instance, fandom-driven initiatives or open-source communities generate efficient data management systems in the absence of formal project managers or monetary incentives [5]. This nascent, intrinsically driven development process markedly contrasts with those regulated by contracts and conventional management. Consequently, the direct implementation of traditional research approaches intended for corporate settings inadequately addresses the social dynamics, voluntary participation, and grassroots decision-making processes essential for effective systems development in these contexts.

This establishes a significant methodological deficiency in the current state of ISD research. The existing literature provides insufficient direction on effectively researching and delineating the comprehensive processes of systems development in environments devoid of explicitly established roles and phases. Current research primarily emphasizes sociological assessments or examines only limited adaptations of Agile approaches, without a comprehensive foundation for theoretical investigation. This article's originality resides in overcoming these restrictions by enhancing research methodology: we present a tailored framework that integrates Grounded Theory with digital data gathering techniques to accurately delineate decentralized ISD procedures.

This paper aims to establish a systematic qualitative case study framework for recording and assessing information systems development processes within distributed digital communities. This will tackle the fundamental research inquiry: How can academics systematically delineate the intricate and dynamic processes of information systems evolution in decentralized contexts? This article will outline a comprehensive framework, encompassing key informant identification and the data coding process, thereby offering a valid and replicable guide for future research on community-based system development.

Literature Review : Justification for a Novel Methodology

2.1. Constraints of Traditional ISD Methodologies in Decentralized Environments

Conventional Information Systems Development (ISD) approaches, like the Sequential Waterfall Model and structured variants of Agile, were predominantly formulated for hierarchical corporate settings. The fundamental premise is that processes encompass formal roles, defined requirements collection, and distinct management authority. This structure becomes inadequate when utilized in Distributed Digital Communities. These techniques neglect to consider numerous essential attributes of decentralized development:

1. Lack of Formal Roles: Traditional methodologies are inadequate for delineating processes in which roles (analyst, developer, manager) are dynamic, voluntary, and attained via contribution rather than official designation [1].
2. Motivations and Turnover: They overlook the influence of intrinsic motivation and elevated participant turnover, which fundamentally modifies task governance and knowledge management [2].

3. Process Emergence: They emphasize structured, prescriptive phases, whereas decentralized growth typically unfolds organically from the grassroots level [3].

Consequently, employing conventional ISD approaches to analyze these communities will produce partial or erroneous representations of the underlying process dynamics.

2.2. The Appropriateness of Grounded Theory for Methodological Framework

To rectify the shortcomings of traditional prescriptive approaches, an appropriate research methodology should be inductive and focused on theory development. This is where Grounded Theory (GT) proves essential. GT is a systematic approach aimed at formulating theory directly based on empirical facts, particularly beneficial for examining complicated phenomena when current theories fall short [4].

GT is selected as the primary analytical instrument for the proposed framework due to:

1. Process Discovery: It enables researchers to transcend mere description and uncover the fundamental processes comprising the series of events and interactions that define the decentralized ISD cycle.
2. Contextual Depth: Grounded Theory compels the researcher to remain receptive to emergent concepts, such as "Passion-Driven Task Allocation" or "Consensus Governance," which are essential components in a decentralized society yet lacking in conventional models [5].
3. Model Construction: The ultimate result of the GT methodology (the theoretical model) corresponds precisely with the study objective: to develop a conceptual model of the ISD process.

2.3. Bridging the Divide: Integrating GT with Digital Case Study Strategy

Although GT supplies the analytical engine, it requires adaptation to address the difficulties of Distributed Digital Communities. The literature study indicates that previous research on online communities frequently exhibits insufficient methodological rigor on data triangulation across various digital platforms, such as the integration of data from chat logs, code repositories, and interviews.

Our suggested framework addresses this methodological deficiency by amalgamating GT principles with a comprehensive, staged strategy for qualitative case study creation. This integration offers the essential tools for:

1. Identifying Elusive Informants: Formulating targeted techniques for sampling essential volunteer contributors [6].
2. Triangulating Digital Artifacts: Methodically coding and correlating various data types from comprehensive interviews (social context) with digital documents (process artifacts) to guarantee the authenticity and trustworthiness of the resultant process map [7].

The proposed technique advances the subject by providing a comprehensive, context-specific framework for delineating intricate, organically evolved ISD processes that existing research acknowledges but fails to adequately represent.

Research Methodology : The Proposed Qualitative Case Study Methodology

This section outlines a methodological approach intended to methodically delineate the Information Systems Development (ISD) process within an environment devoid of formal and hierarchical organizations. We utilized a qualitative methodology with a case study framework, informed by the tenets of Grounded Theory (GT).

3.1. Justification for Qualitative and Grounded Theory Methodology

This research employed a qualitative methodology as its principal aim was to conduct an in-depth exploration and comprehension of processes that cannot be quantified. GT was used as the analytical framework because it facilitates the inductive construction of theory—a conceptual model of the ISD process—directly from empirical data (emergent theory), which is crucial for investigating phenomena that remain unexamined in the literature.

3.2. Case Selection and Parameters

We advocate for the implementation of a Single Case Study, wherein a Distributed Digital Community (e.g., the BTS fanbase) functions as a revelatory case study.

1. Boundary Definition: The parameters of the case study are delineated conceptually (the ISD process executed by community members) and temporally (the duration during which a particular digital project was built).
2. sample Strategy: The sample employed purposive sampling, aligned with specific aims, focusing on key informants actively engaged in the system development process, including volunteer developers, informal project leaders, and community data analysts. Sampling will cease upon the attainment of theoretical saturation.

3.3. Strategies for Data Collection in Decentralized Environments

To guarantee data veracity and triangulation in a virtual setting, three principal data collection methods are recommended:

1. In-Depth Interviews: Executed semi-structured interviews with principal informants to investigate motivations, collaborative obstacles, and workflow accounts. Interviews will concentrate on personal experiences and informal decision-making procedures.
2. Digital Artifact Analysis: Gathering and examining artifacts that are remnants of the ISD process. This encompasses chat records (Discord/Telegram), planning documents (Google Docs/Trello boards), and source code repositories (GitHub). This data corroborates the process knowledge acquired from the interviews.
3. Virtual Ethnography/Observation: Engaging in restricted participant observation within collaborative groups and forums to comprehend team dynamics, tool utilization, and spontaneous interactions.

3.4. Analytical Procedures (Implementation of Grounded Theory)

Data analysis was performed iteratively and concurrently with data gathering, in alignment with the principles of Grounded Theory Implementation:

1. Open Coding: Raw data (transcripts and papers) were deconstructed into smaller bits and coded to discern preliminary concepts. The objective was to identify numerous emergent phenomena.
2. Axial Coding: Preliminary thoughts were consolidated into broader groups. At this juncture, the researcher commences the identification of links between categories, such as the correlation between "Intrinsic Motivation" (causal condition) and "Variable Time Commitment" (consequence).
3. Selective Coding: The principal categories are synthesized into a central category that delineates the comprehensive ISD process. The result of this phase is the suggested Conceptual Model of the ISD Process.

3.5. Ensuring Rigor and Credibility

Methodological rigor is guaranteed by:

1. Triangulation: Employing evidence from interviews, records, and observations to corroborate collective conclusions.
2. Member Checking: Soliciting key informants to evaluate interpretations of procedures or principal findings to verify data accuracy.
3. Audit Trail: Thoroughly documenting all methodological decisions and the coding procedure.

This methodological approach aims to guarantee that the resultant ISD process model is both legitimate and experimentally anchored within a decentralized community environment.

Results: The Proposed Conceptual Framework for Mapping ISD Processes

This section delineates the outcomes of the methodological design process, namely a proposed conceptual framework for delineating the Information Systems Development (ISD) process within distributed digital communities. This framework is a direct result of the design science approach that preceded the empirical case study.

4.1. Overview of the Conceptual Model

This section provides an overview of the suggested conceptual model intended to supplant conventional sequential models. Our model delineates the ISD process as a sequence of stages influenced by contextual factors and governed by grassroots elements.

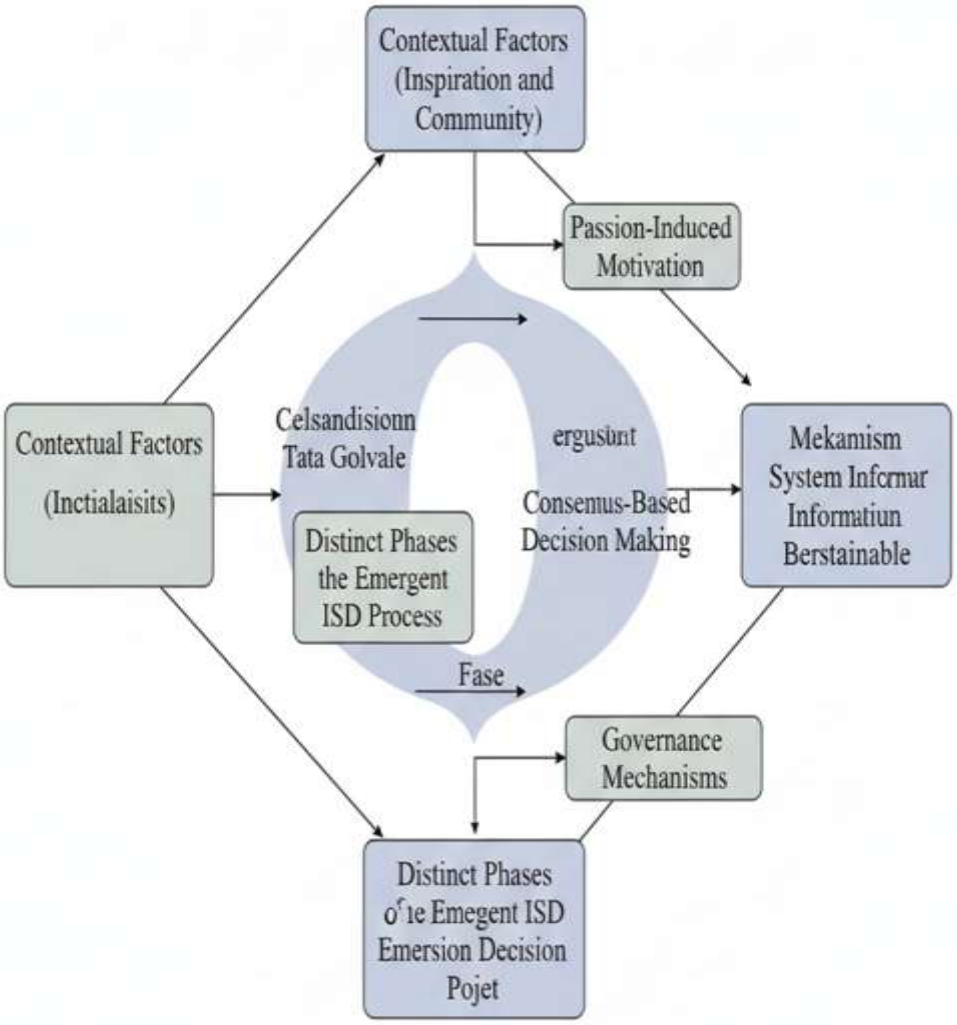

Figure 1. Conceptual Model

This conceptual paradigm comprises three primary components:

1. Contextual Factors (Inspiration and Community): Elements that catalyze Information Systems development (e.g., Passion-Induced Motivation).
2. Distinct Phases of the Emergent ISD Process: Phases specific to decentralized communities.
3. Governance Mechanisms: Elements that regulate and sustain project continuity (e.g., Consensus-Based Decision Making).

4.2. Comprehensive Mapping of Emergent ISD Phases

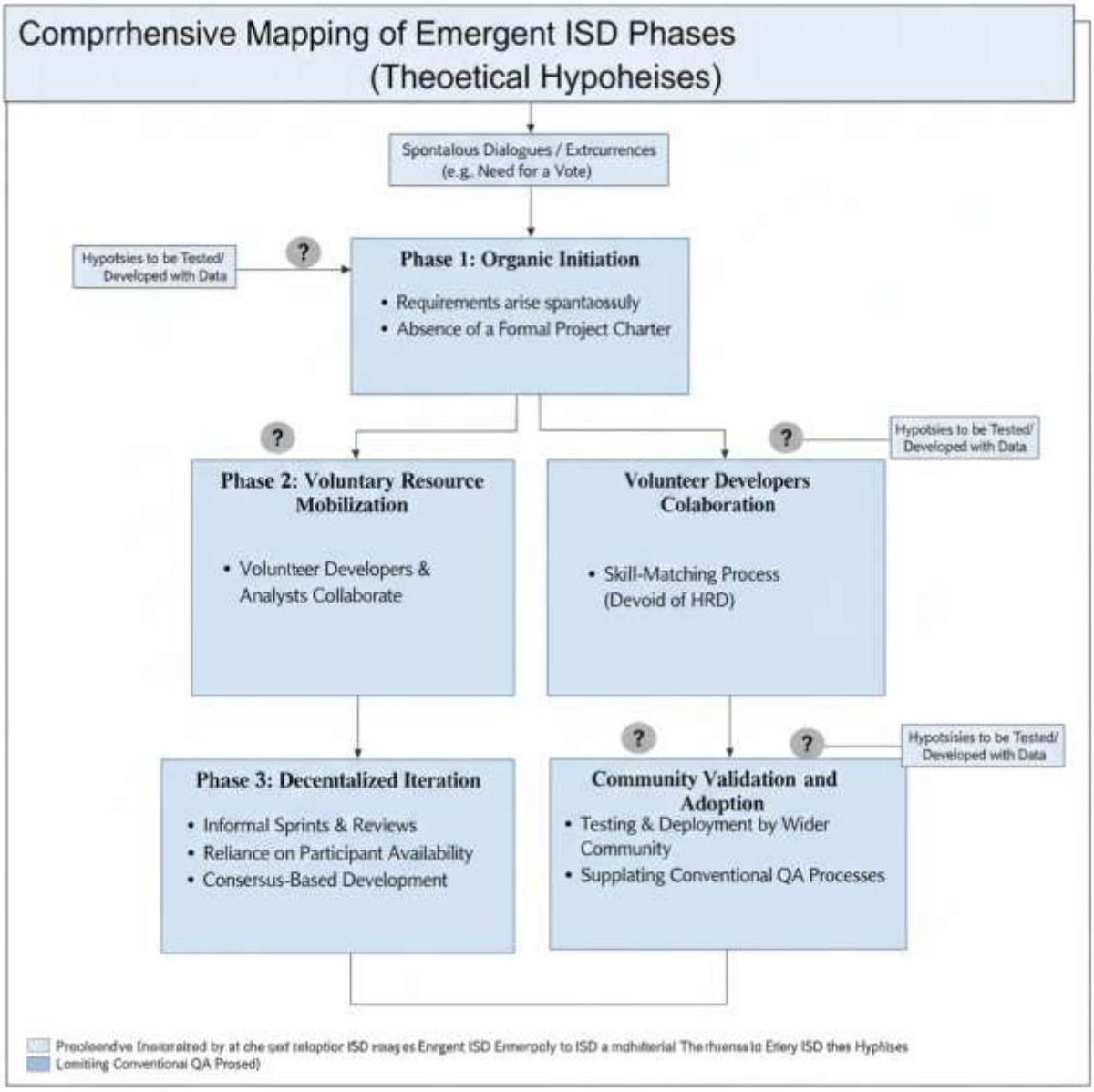

Figure 2. Comprehensive Mapping of Emergent ISD Phases

In this section, delineate the steps of the ISD process that you anticipate will be identified according to your methodological design, framed as theoretical hypotheses to be tested or developed with data.

Phase 1: Organic Initiation: The stage in which requirements arise from spontaneous dialogues or external occurrences (e.g., the necessity for a vote). A formal project charter is absent.

Phase 2: Voluntary Resource Mobilization: The phase in which volunteer developers and analysts collaborate. Our model delineates the process of skill-matching in an environment devoid of Human Resource Development (HRD).

Phase 3: Decentralized Iteration: The principal development stage, characterized by informal sprints and reviews, reliant on participants' availability and consensus.

Phase 4: Community Validation and Adoption: This stage involves the transfer of testing and deployment responsibilities to the wider community, supplanting conventional Quality Assurance (QA) processes.

4.3 Contribution to Methodological Precision

This framework additionally functions as a methodological outcome by offering a mapping tool for other scholars. Our proposed coding methodology, based on Grounded Theory, facilitates the mapping of non-linear process flows. This methodology guarantees that the resultant process map will:

1. Illustrate Bottom-Up Reality: Each phase in the model is associated with qualitative data (e.g., interview excerpts or Discord transcripts).
2. Address Data Heterogeneity: The framework offers direction on integrating disparate data (documents, conversations, code) to authenticate a singular process.

Conclusion

This research has effectively developed a Qualitative Case Study Methodological Framework essential for delineating the Information Systems Development (ISD) process within a Distributed Digital Community context. This research is predicated on the assertion that traditional Information Systems Development approaches (SDLC, Agile) inadequately address the voluntary, non-hierarchical, and emergent dynamics inherent in community-based systems development.

The proposed framework seamlessly combines a Qualitative Case Study design with the analytical capabilities of Grounded Theory. This methodological framework systematically delineates precise procedures for data collecting in online contexts—utilizing triangulation among in-depth interviews, digital artifact analysis, and virtual observation—thereby ensuring data rigor and validity in challenging circumstances. The result of this methodological framework is a Conceptual Model of the ISD Process that will be constructed inductively from empirical facts, rather than being deductively derived from established theory.

The principal contribution of this study is methodological. We offer a comprehensive and reproducible framework for scholars seeking to examine or develop theories on informal digital groups. This approach broadens the scope of ISD research, transitioning the emphasis from prescriptive actions to the descriptive and theoretical examination of organic processes inside emerging digital ecosystems.

Subsequent investigations will concentrate on the empirical validation of this paradigm. Subsequent research will entail the actual application of this methodological framework in a case study of the BTS Fandom Community to conclusively develop and exhibit the resultant conceptual model of ISD.

References

[1] K. Beck et al., Manifesto for Agile Software Development. Agile Alliance, 2001.
[2] Y. Benkler, The wealth of networks: How social production transforms markets and freedom. Yale University Press, 2006.
[3] T. Dingsøyr, T. E. Fægri, and D. Smite, "Agile development: A literature review of empirical studies," Journal of Systems and Software, vol. 156, pp. 125-142, 2019.
[4] H. Hermansyah, Dr. R. F. Wijaya, and R. B. Utomo, "Metode Waterfall Dalam Rancang Bangun Sistem Informasi Manajemen Kegiatan Masjid Berbasis Web," KLIK: Kajian Ilmiah Informatika dan Komputer, vol. 3, no. 5, pp. 563-571, 2023.
[5] T. Dingsøyr, T. E. Fægri, and D. Smite, "Agile development: A literature review of empirical studies," Journal of Systems and Software, vol. 156, pp. 125-142, 2019.

[6] S. Wahyuni, B. Mesra, and A. Lubis, "Implementation of the IMAKOM Organization Presence (Computer Student Association) Panca Budi Medan Development University Using QR Code-Based ID Cards," Jurnal Mantik, vol. 6, no. 3, pp. 2781-2788, 2022.
[7] S. Suherman and A. Maulana, "Recent Advances in Deep Learning for MRI-Based Brain Tumor Identification: A Systematic Review (2020 - 2025)," Komputasi: Jurnal Ilmiah Ilmu Komputer dan Matematika, pp. 75-82.
[8] A. Sutanto, S. Lee, and H. Kim, "Unraveling the dynamics of digital collaboration in volunteer communities," Journal of Management Information Systems, vol. 39, no. 1, pp. 1-28, 2022.
[9] R. S. Hardinata, I. Sulistianingsih, R. F. Wijaya, and A. M. Rahma, "Perancangan Sistem Informasi Pelayanan Rekam Medis Menggunakan Metode Design Thinking (Studi Kasus: Puskesmas Simeulue Tengah)," INTECOMS: Journal of Information Technology and Computer Science, vol. 5, no. 2, pp. 112-118, 2022. (Relevansi: Perancangan Sistem & Metode Design Thinking).
[10] A. Lubis, S. Wahyuni, B. Mesra, and S. Batubara, "Penjualan Online Ikan Asin sebagai salah satu Usaha Meningkatkan Pendapatan Masyarakat Nelayan Bagan Deli," ETHOS: Jurnal Penelitian dan Pengabdian kepada Masyarakat, vol. 8, no. 1, 2020.

[11] Z. Ramadhan, "PEMAHAMAN MASYARAKAT DESA KOTA PARI MENGENAI PENGGUNAAN APLIKASI E`SPT DAN DJP ONLINE TERHADAP PELAPORAN PAJAK PENGHASILAN PERORANGAN MASYARAKAT DESA KOTA PARI KECAMATAN PANTAI CERMIN KABUPATEN SERDANG BEDAGAI," Laporan Pengabdian Masyarakat, UNPAB, 2022.
[12] M. D. Lesmana Siahaan, A. Arpan, and I. Ismaidar, "PELATIHAN/WORKSHOP PERANCANGAN APLIKASI PEMINJAMAN ALAT KONTRUKSI BERBASIS ANDROID PADA DINAS PEKERJAAN UMUM DAN PENATAAN RUANG KOTA BINJAI DENGAN MENGGUNAKAN METODE USER CENTERED DESIGN (UCD)
[13] K. Tauscher and J. H. Kietzmann, "The new collective: Exploring the collaborative behavior in digital ecosystems," Academy of Management Review, vol. 42, no. 3, pp. 441-460, 2017.
[14] R. W. Royce, "Managing the development of large software systems," Proceedings of IEEE WESCON, vol. 26, no. 8, pp. 1-9, 1970.
[15] B. G. Glaser and A. L. Strauss, The discovery of grounded theory: Strategies for qualitative research. Aldine Publishing Company, 1967.
[16] T. Pikkarainen, M. Hyry, and V. Vartiainen, "SDLC in a dynamic business environment," Information Systems Frontiers, vol. 22, no. 4, pp. 883-901, 2020.
[17] B. Wellman and C. Haythornthwaite, The Internet in Everyday Life. Blackwell Publishing, 2002.
[18] V. Filippi, M. Ratto, and M. Manzo, "Decentralized development in digital ecosystems: A systematic literature review," Information Systems Journal, vol. 31, no. 5, pp. 754-780, 2021
[19] W. W. Royce, "Managing the development of large software systems," Proceedings of IEEE WESCON, vol. 26, no. 8, pp. 1-9, 1970.

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