

Global Research Landscape of Hybrid Agile-Lean Methodologies in Information Systems Development

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ABSTRACT

The rapid expansion of the global digital economy necessitated high operational efficiency and structural flexibility in information systems development (ISD). Traditional software engineering methodologies frequently failed to cope with volatile market demands, leading to elevated project failure rates in organizational and institutional ecosystems. Although hybrid agile-lean frameworks emerged as a promising integration to balance market responsiveness and resource waste elimination, a comprehensive structural mapping of this domain remained scarce. This study investigated the global research trends, core thematic clusters, and evolutionary trajectories of hybrid agile-lean adoption in ISD. A bibliometric analysis was conducted using the Scopus database to retrieve relevant peer-reviewed literature published between 2010 and 2023. VOSviewer software was applied to analyze key performance indicators, keyword co-occurrences, network densities, and chronological overlay visualizations. The empirical results mapped the domain into four primary thematic networks: technology and development, innovation performance, methodology adoption, and entrepreneurship education. The chronological trend revealed a massive shift from traditional rekayasa software structures toward contemporary digital transformation capabilities and research commercialization. Most importantly, the density visualization exposed a significant literature gap regarding hybrid methodological adoption inside highly bureaucratic environments, academic institutions, and developing regions like Indonesia. These findings provided a systematic justification and roadmap for future studies to engineer adaptive system architectures within non-traditional business settings.

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1. INTRODUCTION

The swift expansion of the digital economy compels commercial enterprises and educational institutions to systematically transform their technological infrastructures. Within higher education settings, universities are increasingly required to commercialize scientific research breakthroughs through campus-based digital business spin-offs. However, matching the dynamic tempo of the contemporary software industry remains a major obstacle for these units, resulting in high information systems development (ISD) failure rates [7]

Recent reports indicate that approximately 75% to 80% of digital tech ventures fail during their initial growth phases due to operational inefficiencies, bureaucratic friction, and structural rigidity.

To mitigate these challenges, the integration of Agile and Lean paradigms has emerged as a key strategic mechanism [1]. The Hybrid Agile-Lean approach effectively combines the adaptability and customer-centric loop of Agile with the rigorous resource optimization and waste elimination principles of Lean. While the global industrial sector has reported up to a 50% increase in product delivery speed through this hybrid strategy, its structural diffusion into heavily bureaucratic or academic settings faces massive resistance. According to the Diffusion of Innovations (DOI) theory, the rate of methodological uptake is significantly governed by how stakeholders perceive the relative advantage, compatibility, and complexity of the innovation [2].

Despite the growing body of literature on software engineering methods, there is a lack of comprehensive empirical mapping that delineates how hybrid agile-lean adoption has evolved globally. Indexing services and research communities require a clear bird's-eye view to navigate the intersection of process optimization and institutional governance. Therefore, this article presents a systematic bibliometric analysis utilizing data from the Scopus database from 2010 to 2023 [8]. The new value and innovation of this research lie in its empirical identification of global literature gaps, specifically highlighting the severe scarcity of hybrid ISD deployment within regional university spin-offs in developing nations like Indonesia [4].

2. RESEARCH METHOD

This research adopted a quantitative bibliometric approach using visual network modeling to chronologically map the domain of hybrid agile-lean adoption. The research procedure was executed in a three-stage workflow: data acquisition, data filtering, and network visualization mapping. Literature search was conducted through the Scopus database covering the publication window from 2010 to 2023 to capture a decade of methodological evolution. The search syntax relied on a combinations of primary boolean parameters: TITLE-ABS-KEY("Hybrid Agile-Lean" OR "Agile-Lean adoption") AND "Information Systems".

The data acquisition process applied strict inclusion criteria, limiting the final dataset to peer-reviewed international journal articles and high-impact conference proceedings written in English. Document metadata, including citation frequencies, keyword indices, and institutional affiliations, were exported into unified Comma-Separated Value (.csv) formats. For the computational analysis phase, VOSviewer software was utilized to build keyword co-occurrence models, network weight relationships, and timeline density maps. This automated network extraction ensured that the identification of literature clusters was scientifically validated and free from personal subjective bias [6].

3. RESULTS AND DISCUSSION

The structural extraction of Scopus metadata generated clear performance parameters regarding the global expansion of hybrid software framework literature.

3.1. Evaluation of Keyword Frequency and Link Strength

The computational density of terms was measured using total co-occurrence weights and total link strength indicators. This indicator evaluates how tightly interconnected different research themes are within the global ISD ecosystem [9].

Table 1. The performance of primary keyword occurrences and connection weights

Variable	Frequency of Occurrence	Link Strength	Color Cluster Alignment
Innovation	120	350	Blue Cluster
Adoption	110	305	Yellow Cluster
Performance	98	290	Blue Cluster
System	105	270	Red Cluster
Efficiency	90	250	Yellow Cluster
Relationship	75	230	Green Cluster
Entrepreneurship	65	210	Green Cluster
Agility	60	180	Yellow Cluster
Integration	65	175	Yellow Cluster

3.2. Network, Density, and Overlay Visualization Analysis

The network visualization mapped the global literature into four highly distinct color-coded clusters. The Red Cluster specifically focused on the technical dimensions of software development, anchoring nodes like system, software, machine learning, and accuracy. The Blue Cluster aggregated concepts surrounding organizational innovation and performance validation. The Yellow Cluster mapped the operational adoption processes, linking adoption, efficiency, integration, and agility. Lastly, the Green Cluster mapped the higher education and entrepreneurship domain, grouping keywords like higher education, student, and academia.

The density map highlighted that while keywords like innovation, performance, and efficiency occupied the dense, high-frequency yellow zones, nodes reflecting local contexts were completely scattered. Terms like university spin-off, bureaucracy, and developing nations like Indonesia or North Sumatra exhibited extremely low frequencies and isolated linkages.

Furthermore, the chronological overlay visualization displayed a critical temporal shift. Traditional, isolated rekayasa software topics dominated the earlier timeline (purple spectrum), whereas contemporary trends (bright yellow-green) shifted heavily toward digital transformation, capability maturity, and the commercialization of digital research products. This structural gap strongly justifies the urgent necessity of engineering a custom hybrid agile-lean framework tailored specifically to mitigate birokrasi constraints within regional educational business setups [10]

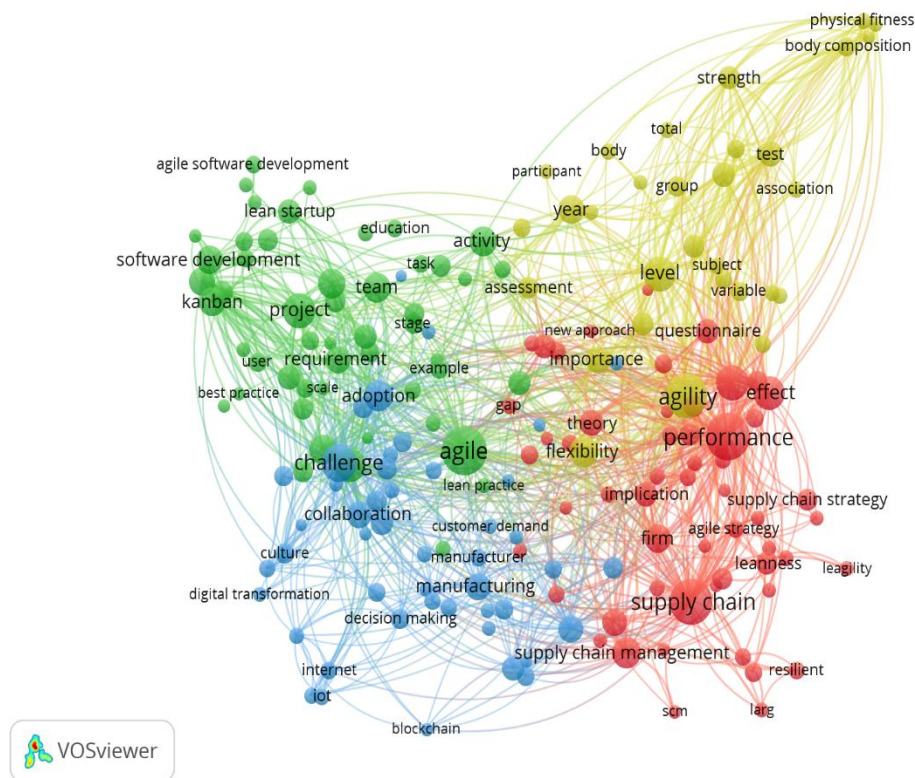


Figure 1. Bibliometric Analysis Result

4. CONCLUSION

This bibliometric study successfully mapped the global landscape of hybrid agile-lean adoption within information systems development from 2010 to 2023. The empirical findings via VOSviewer confirmed that while hybrid integration significantly optimizes development efficiency and organizational performance globally, its implementation models remain heavily skewed toward purely commercial software corporations. A profound literature gap exists concerning its structural adoption within bureaucratic academic institutions and developing digital markets. Future research directions should leverage these structural insights to build empirically validated, multi-site frameworks that can help university digital spin-offs eliminate activity waste and maximize research commercialisation.

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