Analysis of Information Systems Development Methods: A Literature Review

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Abstract - The development of information systems involves various methods and platforms, including web-based, desktop, and mobile platforms. This development process is guided by the Software Development Life Cycle (SDLC), a cycle used to create high-quality information systems according to customer needs or the system's objectives. This research aims to identify and determine the most commonly used and beneficial models for information system development, with data obtained from relevant literature from 2019 to 2023. The method employed in this study is Systematic Literature Review (SLR), used to identify, review, evaluate, and interpret all research in a specific subject area. The research results indicate that the most dominant method for information system development is the waterfall method. The effectiveness of the waterfall model lies in its sequential approach, ensuring that the project is executed in stages from beginning to end. The impact includes more structured planning, detailed documentation, and gradual issue resolution. The waterfall model can also be well-applied in the development of small-scale information systems or individual projects, particularly focusing on the education and business sectors. In summary, the key findings of this research demonstrate a high preference for the waterfall method in information system development, providing significant implications for project planning and implementation in the education and business sectors.

Keywords - Information Systems Development, System Literature Review (SLR), Software Development Life Cycle (SDLC), Waterfall.

I. INTRODUCTION

Information systems play a crucial role, and their significance grows in tandem with the rapid expansion of companies and organizations. The ever-increasing demand for superior information systems is driven by technological advancements, corporate progress, procedural alterations, government regulations, and the need for information access. The process of creating information systems is commonly known as information system development. This development involves the creation of computer-based systems designed to address organizational challenges or capitalize on emerging opportunities. System development can encompass the development of entirely new systems to replace outdated ones or the enhancement of existing systems, typically undertaken when the previous system's efficiency is compromised or it faces various issues.

Information system development is closely linked to the System Development Life Cycle, commonly referred to as SDLC, which serves as the fundamental methodology for creating information systems. SDLC encompasses several phases, commencing with planning, followed by analysis, design, implementation, and concluding with system maintenance. This SDLC concept draws from a variety of software development models to establish a structured framework for planning and managing the development of information systems. SDLC is a process that entails transforming or advancing software systems using tried-and-tested methodologies and practices from previous software development experiences. There are several implementation approaches within the process stages of SDLC, including the Parallel Model, Sequential Model (Waterfall), Iterative Model, RAD (Rapid Application Development) Model, Prototyping Model, V-shaped Model, Spiral Model, and Agile Development. In essence, system development involves revitalizing an older system, either by reconfiguring it

or replacing it with a new system that aligns with improved and more beneficial directions. The decision to revamp or replace an old system is driven by various factors, such as the emergence of issues, or the pursuit of key opportunities and directives from leadership.

The development of information systems plays a crucial role in supporting and optimizing organizational operations, especially in the rapidly evolving technological era. Firstly, information systems provide the foundation for efficient information management and access. With the implementation of a well-designed information system, organizations can enhance productivity by streamlining business processes and ensuring that necessary data can be accessed quickly and accurately.

Secondly, information system development provides the necessary capability for data integration in the current digital environment. Data has become a valuable asset, and sophisticated information systems enable organizations to integrate and manage data effectively. This not only improves internal information management but also establishes a basis for in-depth data analysis, predictive modeling, and the implementation of artificial intelligence to support better decision-making.

As a case in point reinforcing the urgency of information system development, we can refer to research on the implementation of hospital information systems. In this study, the focus on the development of health information systems involves an analysis of the Software Development Life Cycle (SDLC) methodology to understand how the implementation of health information systems can enhance patient data management, ensure accurate medical records, and facilitate interdepartmental coordination for improved healthcare.

Literature review research on SDLC is crucial in this context as it allows for a deep understanding of how software development methodologies can impact the success of information system implementations. By analyzing various SDLC methods, this research can explore how different approaches affect the quality, reliability, and sustainability of the developed information systems, especially in the healthcare context within hospitals. This understanding can provide valuable insights for the development of more effective and responsive information systems to meet organizational needs.

Due to the significance of information system development methods that offer numerous benefits, such as addressing issues from legacy systems, supporting organizational growth, facilitating decision-making processes by relevant parties, and providing clear guidance. In the context of this research, data is collected from previous studies up to the present regarding information systems to identify various information system development methods that have been utilized. The upcoming research adopts a systematic literature review method, aiming to interpret and evaluate the entirety of existing studies with a focus on predetermined research questions, topic areas, and relevant phenomena. This literature review is expected to provide a holistic overview of various types of information system development that frequently appear in articles within journal databases from 2019 to 2023, offering a more up-to-date perspective compared to previous research.

II. LITERATURE STUDIES

A. Systematic Literature Reviews (SLR)

A Systematic Review is a term employed in research methodology to describe a methodical process used to gather and assess research relevant to a specific topic of interest. Several researchers have provided various definitions of Systematic Literature Reviews (SLR) as follows:[1]

a) A Systematic Literature Review (SLR) is a methodology used to systematically identify, interpret, and assess all the available research pertaining to a specific topic, research question, or area of interest.

b) SLR, an evidence-based approach, is employed to systematically search for studies that align with predefined research questions. It involves assessing, synthesizing, and evaluating findings to address those research inquiries.
c) SLR is a research method for comprehensively analyzing the current state of knowledge in a particular field. This involves formally defining the research problem, constructing search criteria, specifying information sources, outlining inclusion and exclusion criteria for identified papers, determining any necessary analysis techniques, and establishing templates for organizing the collected information from the papers.
d) SLR is a research method utilized to investigate issues within the realm of Software Engineering.

B. Research Question

Research questions are created according to the requirements of the selected topic. The following are the research questions used in this research:
RQ1: What website-based information system development methods are most frequently used in 2019-2023?
RQ2: Is the implementation of the SDLC model effective?
RQ3: What are the fields that implement the SDLC model for information system development?

C. Search Process

The search process for research journals was obtained from Google Scholar which were published in 2019-2023. This process is carried out to find relevant sources that can answer the Research Question.

D. Inclusion and Exclusion Criteria

The stages of Inclusion and Exclusion Criteria were conducted to identify data that met the requirements for use in this research.

E. Quality Assessment

Quality Assessment or QA is formed according to a list of problem formulations. QA must contain an assessment to answer all existing problem formulations. In this research, the data found will then be evaluated according to the following quality assessment criteria questions:
QA1   : Is literature regarding the application of the SDLC method in system development published in 2019-2023?
QA2   : Does the literature describe the platform used in the research?
QA3   : Is the literature written about fields that apply the SDLC method?
Based on each literature, the answer values will be given below for each question above.
Y (Yes): literature that matches the questions in the quality assessment.
N (No): literature that does not match the quality assessment questions

III. RESULT AND ANALYSIS

Journals are grouped according to journal type. This is done to make it easier to view journals obtained through the search process. Journal grouping according to Table 1:

TABLE I
GROUPING JOURNALS BASED ON JOURNAL TYPE

No.	Journals	Quantity
1.	Education Sciences	2
2.	Procedia CIRP	1
3.	International Journal of Advances in Data and Information Systems	2
4.	E3S Web of Conferences	1

5.	International Journal of Teaching, Education and Learning	1
6.	Applied Engineering and Technology	1
7.	International Conference on Applied Science and Technology on Engineering Science	1
8.	Dinasti International Journal of Management Science (DIJMS)	1
9.	Jurnal Sisfokom (sistem informasi dan komputer)	12
10.	Jurnal Penelitian Ilmu Komputer, System Embedded & Logic	1
11.	Jurnal Ilmu Komputer-Agri Informatika	3
12.	Jurnal Teknoinfo	1
13.	Jurnal Manajemen Informatika & Komputerisasi Akuntasi (METHOMIKA)	1
14.	Jurnal Teknologi Informasi dan Ilmu Komputer (JTIIK)	2
15.	Jurnal Paradigma	1
16.	Jurnal Manajemen dan Bisnis	1
17.	Jurnal Testing dan Implementasi Sistem Informasi	1
	Total	**33**

A. *Inclusion and Exclusion Criteria Selection Results*

The selection results based on the Inclusion and Exclusion Criteria have yielded 33 journals from the search process. The next step involves scanning the data.

B. *Quality Assessment Results*

Table II, presented below, will display the outcomes of the quality assessment, indicating which data is suitable for utilization in this research.

TABLE II
QUALITY ASSESSMENT RESULTS

No.	Authors	Journal Title	Year	Q1	Q2	Q3	Result
1.	[2]	Factors Associated With Students' Performance In English In The Implementation Of Spiral Progression	2019	Y	Y	Y	✓
2.	[3]	Pengembangan Fitur E-Matur Dengan V-Model Sebagai Alat Pengaduan Publik Untuk Website Badan Kepegawaian Negara	2019	Y	Y	Y	✓
3.	[4]	Implementasi Metode Extreme Programming Pengembangan Sistem Informasi Izin Produk Makanan	2019	Y	Y	Y	✓
4.	[5]	Consumer Satisfaction of Sorabel Applications Using The Delone and Mclean Method	2020	Y	Y	Y	✓
5.	[6]	Pengembangan Aplikasi Android Patriot Pangan sebagai Sarana *e-Particiation* untuk Sistem Ketahanan Pangan Nasional	2020	Y	Y	Y	✓
6.	[7]	Sistem Informasi Penjualan Pada TB Harmonis Menggunakan Metode FAST	2020	Y	Y	Y	✓
7.	[8]	Implementation of Agile Methodologies in an Engineering Course	2020	Y	Y	Y	✓
8.	[9]	Metode Exteme Programming Dalam Pengembangan Aplikasi Legalisir Online Berbasis Web Service	2020	Y	Y	Y	✓
9.	[10]	Aplikasi Pengelolaan Data Kepegawaian Berbasis Web Pada PT. Pelayaran Sakti Inti Makmur Palembang	2020	Y	Y	Y	✓
10.	[11]	Improving The Performance of Student Teams in Project-Based Learning With Scum	2021	Y	Y	ISY	✓
11.	[12]	A Framework For Generating Agile Methods For Product Development	2021	Y	Y	Y	✓

12.	[13]	Application of the Waterfall Method on a Web-Based Job Training Management Information System at Trunojoyo University Madura.	2021	Y	Y	Y	✓
13.	[14]	Android Trainer Wawancara Pekerjaan Dalam Bahasa Inggris menggunakan Audio Visual Dengan Metode Prototype	2021	Y	Y	Y	✓
14.	[15]	Sistem Informasi Setoran Wajib Jemaat Menggunakan Framework Codeigniter	2021	Y	Y	Y	✓
15.	[16]	Application of Simple Additive Weighting (SAW) Method and Decision Table in Decision Support System Determines the Level of Problem Student Punishment Levels.	2021	Y	Y	Y	✓
16.	[17]	Website-Based E-Pharmacy Application Development to Improve Sales Services Using Waterfall Method	2021	Y	Y	Y	✓
17.	[18]	Aplikasi Monitoring Data Imunisasi Berkala Untuk Meningkatkan Pelayanan Posyandu Menggunakan Metode RAD Berbasis Android	2021	Y	Y	Y	✓
18.	[19]	Penerapan Metode Prototype Pada Perancangan Sistem Informasi Penggajian Karyawan (Persis Gawan) Berbasis Web	2022	Y	Y	Y	✓
19.	[20]	Aplikasi Satu Pintu Penerimaan Siswa Baru Pada Sekolah Menengah Atas.	2022	Y	Y	Y	✓
20.	[21]	Kombinasi Metode Waspas dan Moora Dalam Menentukan Calon Kepala Desa Hiteurat Padang Lawas Utara.	2022	Y	Y	Y	✓
21.	[22]	Pengembangan Aplikasi Sistem Informasi Pendataan Bangunan (SIPBANG) Pada Dinas Pekerjaan Umum Dan Penataan Ruang (DPUPR) Kota Malang Menggunakan *Framework* Scrum	2022	Y	Y	Y	✓
22.	[23]	Perancangan Arsitektur Sistem Pemesan Tiket Wisata Online Menggunakan Framework Zachman.	2022	Y	Y	Y	✓
23.	[24]	Pengembangan Sistem Layanan SPAB (Sarana Penyedia Air Bersih) Berbasis Web.	2022	Y	Y	Y	✓
24.	[25]	Payroll Information System Design Using Waterfall Method	2022	Y	Y	Y	✓
25.	[26]	Perancangan Aplikasi Helpdesk Ticketing System Pada PT. Indonesia Nippon Seiki.	2022	Y	Y	Y	✓
26.	[27]	Pengembangan Aplikasi Penggajian Karyawan Dengan Menggunakan Metode Agile Berbasis Mobile Android.	2023	Y	Y	Y	✓
27.	[28]	Implementation of simple additive weighting (SAW) in determining nutrition in toddlers.	2023	Y	Y	Y	✓
28.	[29]	Perancangan Sistem Informasi Inventory Barang Berbasis Web Menggunakan Metode Agile Software Development	2023	Y	Y	Y	✓
29.	[30]	Marketplace Selection Based on Product, Price, and Promotion Using the Simple Additive Weighting (SAW) Method.	2023	Y	Y	Y	✓

30.	[31]	Implementation of Performance Assessment Of Indragiri Institute Of Technology And Business Using The Simple Additive Weighting (SAW) Method	2023	Y	Y	Y	✓
31.	[32]	Analisis Kepuasan Pengguna E-Learning SMA Xaverius 1 Palembang menggunakan Metode End User Computing Satisfaction	2023	Y	Y	Y	✓
32.	[33]	Implementation Of The Simple Additive Weighting (SAW) Method For Selection Of Salesperson	2023	Y	Y	Y	✓
33.	[34]	Perancangan Sistem Informasi Kas Berbasis Web Dengan Menggunakan Metode Waterfall.	2023	Y	Y	Y	✓

Note:
✓ : Journals were selected because they have problems, approaches and information related to data selection.
✕ : Journals were not selected because of a lack of information to support data selection.

C. RQ1: What SDLC models are used to develop information systems in 2019-2023?
RQ1 shows the results of grouping the SDLC method used in developing information systems, namely waterfall. The results are shown in Table III:

TABLE III
SDLC METHOD MODEL GROUPING

No.	Information Systems Development Methods	Journal Number	Total
1.	Waterfall	[3], [13], [15], [17], [25], [34]	6
2.	Iteration (Iterative)	[10]	1
3.	*Rapid Application Development (RAD)*	[18], [24]	2
4.	*Extreme Programming*	[4], [21]	2
5.	FAST	[7]	1
7.	Prototype	[14], [19], [26]	3
8.	Spiral	[2], [20]	2
9.	*Framework Zachman*	[23]	1
10.	*End User Computing Satisfaction*	[32]	1
11.	*Simple Additive Weighting (SAW)*	[16], [28], [30], [31], [33]	5
12.	*The Delone and Mclean methods*	[5]	1
13.	Scrum	[6], [11], [22]	2
14.	Agile	[8], [12], [27], [29]	4
15.	V-Model	[3]	1
	Total	**-**	**33**

The SDLC method is a method that has been widely used in developing information systems. Below are some of the models in the SDLC method:
a. Waterfall: A software development model involves the systematic progression of tasks, including the analysis of software requirements, code creation, design, testing, maintenance, and system support. These tasks are executed sequentially, from the initial stages to the final ones, ensuring thorough planning, detailed documentation, and a step-by-step implementation of the project. The advantage of using the waterfall method is that this method allows for departmentalization and control. one by one phase model development process, thereby minimizing errors that might occur.
b. Iteration (Iterative): combining processes in the waterfall model (Waterfall) and iteratively in the prototype model.[10] Some benefits of using an iterative development approach include enhanced development speed in the early lifecycle stages, gradual attainment of

results, the ability to plan development in parallel, measurable progress at regular intervals, and the capability to modify scope or requirements at a lower cost. Additionally, testing and issue resolution can be performed more easily during smaller iterations. Risks can be identified and resolved incrementally throughout each iteration, allowing for better management of achievements. Risk management becomes more effective as higher-risk components can be addressed first. With each iteration, operable products can be delivered, and issues, challenges, and identified risks can serve as material for improvements in subsequent iterations. Risk analysis improves, and this approach supports changing requirements. Early operation time is also reduced, making it more suitable for larger and critical projects. Moreover, by producing software earlier in the lifecycle, gathering customer evaluations and feedback becomes more feasible.

c. Rapid Application Development (RAD): A software development model that focuses on incremental progress, particularly within tight timeframes.[18] RAD method enhances productivity by enabling swift and efficient application development through team-based prototype creation, expediting the overall process. Collaboration among developers, users, and project managers minimizes errors and accelerates development stages. By creating and testing prototypes upfront, RAD mitigates risks by identifying and rectifying issues early. Active user involvement ensures applications align with user expectations, enhancing overall quality and user satisfaction.

d. *Extreme Programming*: a development method derived from agile development. The main focus is on teams with the motto "technical how to" adhering to the principles of agile methodology.[4] Extreme Programming (XP) presents a multitude of advantages in software development. Firstly, it champions time and cost efficiency, trimming down expenses and project timelines by excising unproductive tasks, thereby allowing focused efforts on coding. Another significant benefit is its ability to curtail risk, ensuring minimal chances of programming or project failures and guaranteeing clients obtain desired outcomes. Moreover, XP's simplicity empowers development teams to craft easily improvable code. Its transparent and accountable process involves developers making clear commitments, fostering a genuine development progression. Constant feedback mechanisms facilitate ongoing improvements and help teams maintain their direction. XP's rigorous testing protocols ensure faster software production while meeting customer expectations. Additionally, its teamwork ethos encourages collective involvement in all project aspects, nurturing collaboration from requirements to code. Finally, XP's value-driven approach ensures fixed working hours, reduces overtime, divides projects into manageable components, and prioritizes constant customer feedback, preventing excessive work accumulation before deadlines and ultimately boosting team satisfaction.

e. FAST: An frequently employed system development approach that is characterized by its adaptable structure and can be integrated with other methods. This approach is capable of delivering a high-quality system in a relatively short timeframe.[7]

f. Prototype : supports software development so that it can practice its functionality in order to reduce the risk of failure when creating information systems.[35] When utilizing this model, errors are typically identified faster, allowing for rapid user feedback to generate improved solutions. This approach involves presenting a functional system model, enhancing the user's comprehension of the evolving system. Developers can effectively ascertain client requirements, resulting in increased efficiency in system development and simplified implementation due to the clear understanding of client needs.

g. Spiral: The spiral model is a software development approach that merges the iterative qualities of prototyping with the disciplined and methodical aspects of linear sequential models. It offers the advantage of swiftly generating new software versions. Under the spiral model, software is developed through a sequence of incremental stages.[20]

h. *Framework Zachman*: The prevailing architectural framework, well-recognized by enterprise data architects, has gained widespread acceptance and utilization since its inception by John A. Zachman in the IBM System Journal in 1987.[23]
i. *End User Computing Satisfaction* (EUCS) : useful for calculating people's satisfaction levels directly using a system.[32]
j. *Simple Additive Weighting (SAW)*: weighted sum method. The SAW method seeks to calculate the combined score by assigning weights to performance ratings for each alternative across all attributes.[30]
k. *The Delone and Mclean methods*: This approach encompasses two key contributions in the comprehension of information system success. It involves creating a system for categorizing the phases of success that has been applied in diverse studies and illustrates the interrelated nature of these models.[5]
l. Scrum: A flexible software development method that is easy to update and can make regular changes. This model is not suitable for small-scale projects.[35]
m. Agile : an information system development method that is more collaborative and open to change, closer to the user and therefore requires a larger team.[35]
n. The V-Model: is an expansion of the waterfall model tailored for software development procedures. The V-Model describes the relationship between quality assurance actions with communication, modeling and construction activities in the first stage.[3]

In research on the Software Development Life Cycle (SDLC), the Waterfall method stands out as a dominant subject, garnering a larger share of attention and exploration compared to other software development methods. Supporting factors for the dominance of the Waterfall method include its longstanding resilience, promotion of extensive documentation from the planning phase to maintenance, ease of comparison with alternative SDLC models, and the stability and clarity of its concepts, facilitating researchers in discussing and analyzing each stage of the development process.

The uniqueness of the literature supporting the Waterfall method lies in the depth and richness of the information it provides, granting researchers access to abundant references and case studies for analysis. The use of Waterfall as a benchmark for comparing other software development methods demonstrates its popularity and its role as the starting point for evaluating the strengths, weaknesses, and applicability of alternative SDLC models. The stability and clarity of concepts offered by the Waterfall method serve as a strong foundation for discussion and analysis in the framework of journal reviews, especially for readers less familiar with software development models.

While the Waterfall method dominates SDLC literature, awareness of the potential mismatch of this method with every software development context is crucial. Therefore, further research in the field of SDLC should involve exploring alternative models and considering specific contexts to understand when and where a method may be more relevant or effective.

D. RQ2: Is the Implementation of The SDLC model effective?

In accordance with 33 journals, it shows that the application of the waterfall model is very effective in developing information systems because it is carried out sequentially according to the initial stages to the end, so that the projects carried out have more careful planning, more detailed documentation and sequential elimination. The waterfall model can also be used in developing information systems on a small scale or for individual projects.

E. RQ3: What are the fields that implement the SDLC model in information system development?

The results of RQ3 show that the results of grouping fields that implement the SDLC method in developing information systems are as follows:

TABLE IV
GROUPING SDLC METHOD IMPLEMENTATIONS

No.	Area/Sector	Journal Number	Quantity
1.	Government	[3], [6], [21], [22], [24], [25]	6
2.	Health	[17], [18], [28]	3
3.	Education	[2], [8], [9], [11], [13], [16], [20], [32]	8
4.	Finance	[34]	1
5.	Religious	[15]	1
6.	Business	[4], [5], [7], [12], [23], [29], [30], [33]	8
7.	Employment	[10], [14], [19], [26], [27], [31]	6

Based on Table 4 above, the focus areas that are widely used in research are the education sector such as student performance in English, technical courses, online legalization applications, student groups based on projects, job training management, student problem levels based on punishment levels, new student admissions in High School, analysis of e-learning user satisfaction at SMA Xavier 1 Palembang. Then in business fields such as developing a food product licensing information system, consumer satisfaction with the Sorabel application, book sales business, physical product development, online tourist ticket ordering, inventory/supply of goods, selecting marketplaces based on products, prices and promotions as well as calculating the selection of salespeople The best as well as the fields of Government, Work, Health, Finance and Religion also use the SDLC method in developing information systems.

IV. CONCLUSION

This study encounters potential biases in selecting literature, notably due to its emphasis on Systems Development Life Cycle (SDLC) methods. Subjective decisions in literature selection, such as favoring renowned sources and defining keywords and inclusion/exclusion criteria, can influence how SDLC methods are portrayed. Employing the Systematic Literature Review (SLR) method imposes limitations in temporal coverage, a critical factor in this research context. Restricting the research's timeframe choice can significantly impact the comprehensive understanding of a particular topic's evolution. In this investigation, these limitations stem from a deliberate decision to confine the analysis within a specific time frame.

Based on research that has been carried out with a Systematic Literature Review (SLR) on several literature that has been researched and published in 2019-2023, namely the Software Development Life Cycle (SDLC) model that is often and most widely used is the waterfall method, especially in the educational sector such as student performance in English, engineering courses, online legalization applications, student groups based on projects, job training management, level of student problems based on level of punishment, acceptance of new students at high schools, analysis of e-learning user satisfaction at SMA Xaverius 1 Palembang. Then in business fields such as developing a food product licensing information system, consumer satisfaction with the Sorabel application, book sales business, physical product development, online tourist ticket ordering, inventory/supply of goods, selecting marketplaces based on products, prices and promotions as well as calculating the selection of salespeople The best as well as the fields of Government, Work, Health, Finance and Religion also use the SDLC method in developing information systems.

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