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Systematic Literature Reviews on Rapid Application Development Information System

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ABSTRACT

Rapid Application Development (RAD) is one of the Software Development Cycle (SDLC) methodologies that are often used by development teams that prioritize time efficiency. The RAD methodology is considered as one of the methodologies that has the shortest completion time compared to other SDLC methodologies. This study aims to validate, update, and expand the previous discussion regarding the universal conditions of RAD model research in the world of software feature development. Objectives can be obtained using a narrative review procedure, which is applied to previously collected literature. This study aims to make conclusions about the model of the RAD methodology which is very effective, supports and constrains the RAD model, and is efficient compared to other development models. Not only that, this research also guides the universal stages in SDLC and the RAD methodology used to integrate these stages.

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1. INTRODUCTION

Technology from software has penetrated various fields such as health, learning, business, and politics. This technological advancement provides convenience in terms of efficiency, accuracy, and data innovation resulting from various types of software that exist today [1]. As software technology advances, so do the various methodologies used to develop software.

Barriers in the form of time and cost are often a challenge in software development projects [2]. Therefore, we need a model for the process of developing software features. This software development model aims to provide a clear and structured workflow in its development. With a clear workflow, it is hoped that the products produced from development projects will have good quality with short development times and lower costs. Along with the growth of technology, there are many software development models that can be selected to do the development way. One of the well-known and considered effective software development models is RAD [3].

RAD is a software development methodology that prioritizes rapid prototyping and minimizes planning [4]. RAD implementation aims to speed up the software development process and produce higher-quality products. The RAD model can be considered as an adaptation of the

traditional model (waterfall) which is faster and more effective [5]. The development stage takes precedence over the planning stage in Rapid Application Development. The RAD methodology is suitable for projects that can be divided into several modules, be it small, medium or large scale [6].

This analytical research has the objective of evaluating the effectiveness of the RAD model compared to other development models. Based on research journal articles collected, this research studies the RAD model more time-effectively compared to other development models in software development.

2. RESEARCH METHOD

James Martin introduced the term "Rapid Application Development (RAD)" in his book entitled "Rapid Application Development" in 1991, RAD is a software development philosophy that aims to produce fast and quality results [7]. Martin also emphasized that there are eight main principles in business negotiations consisting of law, methodology, people, and contracts that must be considered in software development [8].

There are several studies on the development of information systems using the RAD approach. For example, conducted an empirical study and found that RAD can increase the efficiency and quality of information system development [9], also reported that RAD allows developers to be more responsive to user needs and speeds up the development cycle [10]. However, several studies also found deficiencies in the development of information systems using RAD [11], such as a lack of planning and documentation which can cause problems in managing information systems in the future.

In an SLR conducted found that RAD can increase development efficiency and produce information systems that are easier to integrate with other systems [12]. However, the SLR also found deficiencies in terms of project documentation and management. Therefore, even though RAD has advantages in information system development, it still needs good supervision and planning to ensure successful information system development [13].

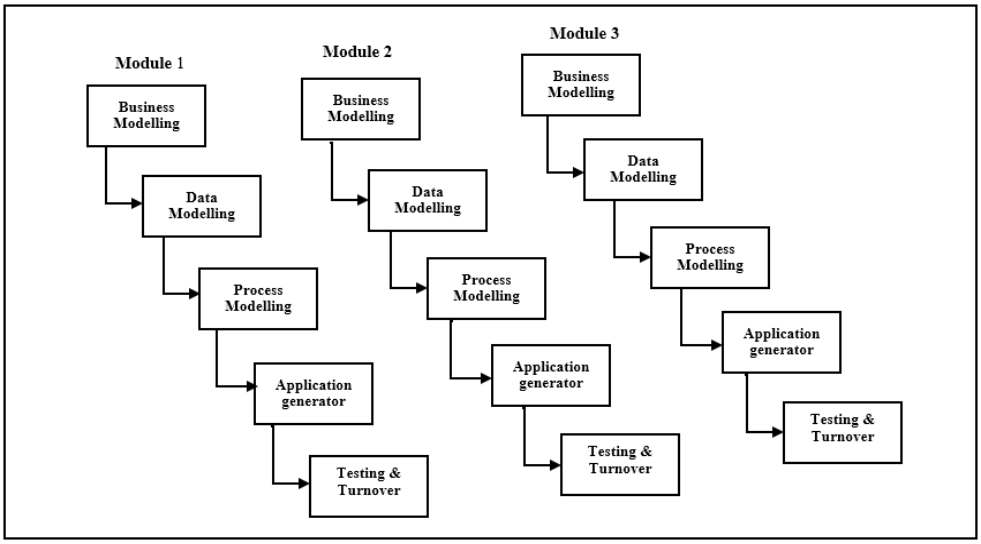

Figure 1. RAD method

The advantages of using the RAD method (Figure 1) in information system development speed up development time: with the RAD method, the development team can produce ready-to-use software products in a faster time compared to traditional software development methods [14]. Improve user communication and participation: The RAD method involves both the client and the user in the development process, which allows the developer to understand user needs and improve communication between them [15]. Produces more accurate software products: RAD methods allow developers to quickly identify and fix problems. Increases flexibility: The RAD method allows development teams to update and improve software products easily.

However, there are some drawbacks to using the RAD method, namely the use of RAD on large projects may not be effective because it requires complex coordination between developers and users. The quality of the resulting software may be unstable if the development process is not well managed and requires greater resources: The RAD method requires greater human and financial resources because it involves both developers and users in the development process [16].

Some of the challenges in developing information systems using the RAD method are complex coordination and communication because the RAD method involves users and developers in the development process which can be complex, especially on large projects. Difficulty in maintaining product quality, the RAD method allows developers to update and improve software products easily, but this can also affect product stability and quality. Functional limitations, the RAD method may not be effective in software development with very complex features.

Challenges in the development of information systems using the RAD method, identifying some of the challenges that may be encountered, such as difficulties in managing dependencies between modules, problems in integrating systems developed using RAD with other existing systems, and difficulties in meeting non-functional requirements such as security and performance [17]. Apart from that, there are also challenges in terms of maintenance and further development of systems that have been developed using RAD [18]. Systematic research conducted shows that the development of information systems using the RAD method can increase development efficiency and product quality, and can reduce development costs and time [19]. However, this research also shows that successful development with the RAD method depends on factors such as choosing the right RAD method, good risk management, and a good understanding of the characteristics and needs of system users [20].

RAD development stages require an information system is a system within an organization that meets the needs of daily transaction processing, supports operations, is managerial and strategic activities of an organization, and provides certain external parties with the necessary reports [21]. The RAD development information system follow in Figure 2 consists of components, each of which is named using an icon for a building block with the aim that the information obtained is of high quality [22].

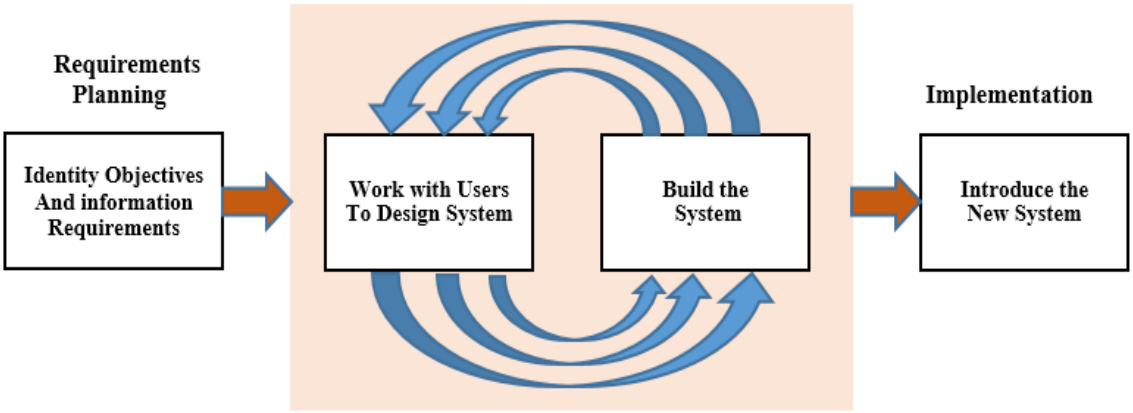

Figure 2. Stages of RAD

According to Kendal [23] Development Phases and Stages, there are three phases of RAD that allow analysis and implementation to be carried out in the assessment, design, and implementation phases [24]. Although the fourth phase is also known as requirements planning, RAD design workshop, and implementation. The implementation of the RAD model has three stages, the first is in the form of requirements planning from system analysts, customers, and users who will collaborate in formulating the objectives of the software to be developed. The second stage of the RAD design workshop with sketches and diagrams will be made as a guide in developing the software. In this stage, system analysts and programmers will design ERD, UML, and other diagrams and design the interface of the software. Finally, in the implementation or implementation stage, the code of the software will be created and tested by QA and users to ensure that the system is fit for

use [25]. This stage is also the stage of introducing the system to the user interface and users will be more frequently involved in the software development process.

3. RESULTS AND DISCUSSION

In reviewing the design to be implemented, the researcher used the design with the approach taken by Brocke et al in an article [26]. The process that will be carried out in the initial SLR is to determine the scope of the review; topic conceptualization; search literature; analyze and synthesize literature; and develop a research agenda. What can be achieved in the implementation of information systems using the RAD method such as in the academic field, marketplace, and in addition, what is the application of the RAD method. In the design review stage that will be carried out, the researcher applies the process as in the article with the methodology used, namely RAD.

3.1. Formulate research questions

This study focuses on identifying the application of the Rapid Application Development (RAD) methodology to various information systems, namely:

a. What information systems are suitable for the RAD methodology, with regard to identifying information systems that can utilize the RAD method.
b. The main factors that determine the feasibility of RAD in an information system, are the key factors that make an information system suitable for RAD.

3.2. Search Strategy

Search for articles from various journals such as IEEE Xplore, IOP Science, and several journals from Indonesia from 2018 to 2023, using a keyword-based search structure and logical connectors that process the following search strings: (Rapid Application Development Method OR Rapid Application Development Application OR Rapid Application Development OR Rapid Development Comparison OR Rapid Application Development Analysis OR Rapid Application Development Information System)

The researcher searches for this search string in three parts of the document: Keywords, abstract, and full text (main body of work). The procedure used to identify the most relevant studies for this SLR:

a. Define research topics and choose the right keywords.
b. Search for relevant studies in digital libraries using predetermined inclusion and exclusion criteria.
c. Evaluate the suitability of each study based on the title and associated abstract.
d. Download selected articles that match the search criteria for further analysis.
e. Carefully review the introduction and conclusion of the article, and take a quick look at the rest of the sections to get a general understanding.

3.3. Criteria Boundary

Selected papers must be published between January 2018 and May 2023 and consider papers using keywords such as “Rapid Application Development Method”, “Rapid Application Development Application”, “Rapid Application Development Analysis”, and “Rapid Application Development Information System”.

3.4. Measuring the Quality of the Review Strategy

To measure reviewer quality, research is done by making questions that include aspects such as the relevance and accuracy of the article's contribution to the research objectives. Here are some examples:

a. The article discusses the use of the Rapid Application Development (RAD) methodology in information systems.
b. The article provides insight into the determinants of RAD feasibility in information systems.

3.5. Search results used keywords

Search results used keywords such as "Analysis", "Application", "Application", "Comparison", and "Rapid Application Development" which resulted in a total of 64 papers. Then it was further reviewed with abstracts, bringing the number down to 25. After examining the full papers, 15 were identified as relevant to the research topic. More details can be seen in Table 1 to see the total count when selecting articles and Table 2, which is a collection of lists of articles that have been selected from the title, author, database, and year.

Table 1. Selection of Relevant Articles

Databases	From Title	Abstract reading	Chosen
IOP Science	6	4	3
IEEE	10	6	4
Indonesian Journal	48	15	8
Total	64	25	14

Table 2. List of Selected Articles

Article Title	Author	Databases	Year
Perancangan Sistem Informasi Helpdesk Ticketing Berbasis Web Pada PT. HFSA Tangerang (Hariyanto et al., 2020)	Hariyanto, M., Kholiq, M., Yani, A., & Narti, N	Indonesian Journal	2020
Pengembangan Aplikasi E-Marketplace UMKM Sektor Perikanan Menggunakan Metode Rapid Application Development (Ramadhan et al, 2022)	Ramadhan, M. R. H., Rohmani, A., Budiman, F., & Sugiarto, E.	Indonesian Journal	2022
Perbandingan Metode Pengembangan Perangkat Lunak (Waterfall, Prototype, RAD) (Pricillia & Zulfachmi, 2021)	Pricillia T, & Zulfachmi	Indonesian Journal	2021
Rancang Bangun Sistem Pendataan Jual Beli Tanah Menggunakan Metode Rapid Application Development (Alam et al. 2023)	Alam, A. R. S., Putri, W., R, N. I., Pratama, M. R., Syaifullah, A., Ratullah, E. I., & Hamzah, M. L.	Indonesian Journal	2023
Perancangan Aplikasi Kamus Bahasa Daerah Nias Berbasis Android dengan Metode Rapid Application Development (RAD) Menggunakan Android Studio (Zalukhu et al, 2023)	Zalukhu, D. J., Karo, P. K., & Faizah, N.	Indonesian Journal	2023
Penerapan Metode Rapid Application Development (RAD) dalam Rancang Bangun Sistem Informasi Rapor Online (SIRALINE) (Hidayat & Hati, 2021)	Hidayat, N., & Hati, K.	Indonesian Journal	2021
Model Rapid Application Development Dalam Pengembangan Sistem Reservasi dan Penyewaan Kamar Hotel (Fadli, 2018)	Fadli, S.	Indonesian Journal	2018
Penerapan Metode Rapid Application Development Dalam Pengembangan Sistem Informasi Akademik Berbasis Web (Aryanti et al., 2021)	Aryanti, R., Fitriani, E., Ardiansyah, D., & Saepudin, A.	Indonesia Journal	2021
Information system design of data bank population using Rapid Application Development. IOP Conference Series: Materials Science and Engineering (Fitriani et al., 2021)	Fitriani, L., Berlianti, N. E., Cahyana, R., & Baswardono, W.	IOP Science	2021

Rapid Application Development (RAD) model method for creating an agricultural irrigation system based on internet of things (Nalendra, 2021)	Nalendra, A. R. A.	IOP Science	2021
RAD Design and Data Management Systems of Natural Resources and Local Wisdom (Tongkaw et al., 2019)	Tongkaw, S., Inkaew, W., & Tongkaw, A.	IOP Science	2019
Design of learning applications using the Rapid Application Development method (Maulany et al., 2021)	Maulany, R., Hasan, B., Abdullah, A. G., & Rohendi, D.	IOP Science	2021
Islamic Calendar: Prototype of Hijri Calendar Application using Rapid Application Development Method (Qodim et al., 2019)	Qodim, H., Busro, & Rahim, R.	IEEE	2019
Multimedia Prayer Application for Education with Rapid Application Development Method (Rosyad et al., 2019)	Rosyad, R., Syukur, A., Busro, & Rahim, R.	IEEE	2019
Developing Suicide Risk Idea Identification for Teenager (SERIINA) Mobile Apps Prototype using Extended Rapid Application Development (Wahyuningrum et al., 2021)	Wahyuningrum, T., Fitriana, G. F., Wardhana, A. C., Sidiq, M. F., & Wahyuningsih, D.	IEEE	2021
"A Lone Burglar" Stealth Game Development Using Rapid Application Development (Gananjaya et al., 2022)	Gananjaya, I., Chandra, J. O. T., Christanto, J. F. A., Widianto, M. H., & Audrey, J.	IEEE	2022

The results of the reviewed articles can be seen that there are information systems in several fields that can apply RAD, namely services, marketplaces, utilities, society, games, agriculture, and education. Table 3 explains which articles are in the several fields mentioned.

Table 3. Fields that can implement RAD

Fields	Article
Service	(Hariyanto et al., 2020), (Fadli, 2018)
Marketplaces	(Ramadhan et al, 2022), (Alam et al. 2023),
Utility	(Qodim et al., 2019)
Public	(Fitriani et al., 2021), (Nalendra, 2021), (Wahyuningrum et al., 2021)
Game	(Gananjaya et al., 2022)
Agriculture	(Nalendra, 2021)
Education	(Zalukhu et al, 2023), (Hidayat & Hati, 2021), (Aryanti et al., 2021), (Maulany et al., 2021), (Rosyad et al., 2019)

From the results in Table 3, it can be concluded that the articles that apply RAD are mostly in the field of education where in this field of education there are information systems such as learning (Zalukhu et al, 2023) (Maulany et al., 2021) (Rosyad et al., 2019) and data collection in the education sector (Hidayat & Hati, 2021) (Aryanti et al., 2021). Most of the selected articles apply

RAD to information systems that are small to medium scale, such as the one in the article Qodim et al. (2019) made an Islamic calendar application. So that the application of RAD, namely:

a. Has the ability to reuse existing components so that developers don't have to build them from scratch. (Pricillia & Zulfachmi, 2021)
b. How good is the application of RAD in information systems on a small to medium scale (Qodim et al., 2019)
c. Does not have a high technical risk. (Pricillia & Zulfachmi, 2021)
d. Using RAD to save time, and if possible can save costs and produce quality products. (Fitriani et al., 2021)

CONCLUSION

The conclusion obtained from the RAD model is proven to be more efficient in terms of time for software development. Compared to other models, the RAD model can save anywhere from 21 to 120 days depending on the scale and type of project. The RAD model also facilitates system development because the stages are systematic and fast. However, several aspects can affect the successful implementation of the RAD model in software development. Although the RAD model has weaknesses, the advantages are far greater, especially in terms of time efficiency. In comparison with other models, the RAD model has more significant advantages and relatively small disadvantages, this can be seen from several articles that have been reviewed, most of the fields that apply RAD are in the education sector. This also led the researcher to conclude that the right conditions for implementing RAD were the ability to reuse existing components and to save time and effort in making new components. The application of RAD is very suitable for small to medium-scale information systems and does not have high technical risks, to minimize the possibility of errors or failures in development. RAD can save time and costs in development, and produce quality products.

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