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Research Article

Object-Oriented Analysis in Software Engineering: A Systematic Review of the Literature

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Abstract
This study examines the impact of the application of Object-Oriented Analysis (OOA) in software development on software quality improvement. Using the Systematic Literature Review (SLR) method covering the period from 2019 to 2024, this study identifies key methodologies and practices that contribute to improved software design, component reutilization, flexibility, and scalability. The research methodology involved collecting and evaluating relevant journal articles, with a focus on the use of Unified Modeling Language (UML), design patterns, and refactoring techniques in software development. The results show that the implementation of the OOA significantly improves the modularity of the software, allows for component reutilization, and improves the flexibility and scalability of the system. These findings highlight that the main success factors in the implementation of OO include competence of the development team, effective project management, adequate availability of tools and technology, and good communication and collaboration within the team.

Keywords: Object-Oriented Analysis, Software Development, Systematic Literature Review, Design Patterns, Refactoring

Abstrak
Penelitian ini bertujuan untuk mengkaji dampak penerapan analisis berorientasi objek (Object-Oriented Analysis/OOA) dalam pengembangan perangkat lunak terhadap peningkatan kualitas perangkat lunak. Dengan menggunakan metode tinjauan pustaka sistematis (Systematic Literature Review/SLR) yang mencakup periode 2019 hingga 2024, penelitian ini mengidentifikasi metodologi dan praktik kunci yang berkontribusi terhadap peningkatan desain perangkat lunak, reutilisasi komponen, fleksibilitas, dan skalabilitas. Metodologi penelitian melibatkan pengumpulan dan evaluasi artikel jurnal yang relevan, dengan fokus pada penggunaan Unified Modeling Language (UML), pola desain, dan teknik refaktoring dalam pengembangan perangkat lunak. Hasil penelitian menunjukkan bahwa penerapan OOA secara signifikan meningkatkan modularitas perangkat lunak, memungkinkan reutilisasi komponen, serta meningkatkan fleksibilitas dan skalabilitas sistem. Temuan ini menyoroti bahwa faktor kesuksesan utama dalam penerapan OOA meliputi kompetensi tim pengembang, manajemen proyek yang efektif, ketersediaan alat dan teknologi yang memadai, serta komunikasi dan kolaborasi yang baik dalam tim.

Kata Kunci : Analisis Berorientasi Objek, Pengembangan Perangkat Lunak, Tinjauan Pustaka Sistematis, Pola Desain, Refaktoring

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1. Introduction

Information systems should be developed by focusing on various aspects such as scalability, security, and robust execution, even in difficult circumstances. In addition, we must also pay attention to the clearly defined architecture so that the weaknesses or shortcomings of the designed system are easy to find and fix. Therefore, to obtain a good system design, it is necessary to perform modeling. Modeling is the process of describing the results of the analysis and design of an information system before coding using certain tools. The modeling carried out to build an information system can be analogous to making a blueprint in a building; thus, by using the model, the development of the system can meet or in accordance with the needs of the user.

The object-oriented method is a system development strategy that organizes system components as a collection of objects that contain data and the operations applied to it. Object-oriented methods involve various activities, including object-oriented analysis. The object-oriented analysis stage conducts a problem investigation to find (identify) and define the objects or concepts that exist in the scope of the problem, determine the needs of the system, determine the potential objects that exist in the system, and describe their characteristics and relationships formally. The object-oriented concept focuses on the creation of a class that is the blueprint of an object. This concept divides software into several interconnected objects that interact with each other (Aman et al., 2021).

Requirements are not only found and written by builders but previously written by customers or users who order information system products. Customers write system needs in an abstract form about their various system needs. These needs were then handed over to the construction team. When approval is obtained, the builder writes down the capabilities of the system that can be understood by customers or users (Pelawi, n.d.-a). Therefore, this study aims to conduct a comprehensive Object-Oriented Analysis using the Systematic Literature Review (SLR) method, which will collect related journals or articles from 2019 to 2024 to gain a deeper understanding of Object-Oriented Analysis.

2. Literature Review

2.1 Software

Software (Software engineering) is a computer program connected to software documentation such as requirements, system models, and how to use them. Software engineering is the design of software with the goal of building software of economic value that also works efficiently using machines. Software processes also include technologies that populate technical methods, automated tools, and procedures, which are often referred to as processes.

2.2 Object-Oriented Analysis

Object-oriented analysis, also known as Object Oriented Analysis (OOA), is a stage of analysis used to analyze the specifications or requirements for a system to be built with an object-oriented concept. The purpose of this analysis is to ensure that the existing needs can be implemented in a realistic and effective object-oriented system. In object-oriented analysis, several steps are performed, such as problem investigation to study the domain of the business problem and determine the need for the system to solve the problem. Next, objects or concepts that exist within the scope of the problem are identified and defined. Object-oriented analysis also involves determining the capabilities or functional requirements that the system must meet, describing the characteristics and relationships between objects, and determining the potential objects that exist in the system. To represent the needs model and explain what activities the system should perform, object-oriented analysis uses a variety of tools, such as Use Cases. In object-oriented analysis, these objects are considered sets of data and operations that can interact in a specific and structured manner. This analysis helps in identifying and defining relevant objects and determining the system needs that must be met (Astuti, 2009).

2.3 Systematic Literature Review

One of the procedures for carrying out literature discussion (SLR) is a systematic discussion. The SLR procedure is used to analyze and take into account research on phenomena that are systematic, clear, and repeatable by other scientists. An SLR post in the leading medical journal Nature Review Immunology, which published more than 40% of SLRs in 2016, reports that SLRs were first used in the healthcare field and have become very famous there. Several fields, such as management, data systems, and informatics, use SLRs. Allowing a transparent bibliographic search process, which allows for evaluation of the caliber and scope of discovery and allows other scholars to explore uniform methodologies, is one of the main alibis why SLRs continue to be famous (Wahyudi, 2022).

3. Methods

3.1. Systematic Literature Review

Systematic Literature Review is a term used to refer to a specific research or research methodology and development carried out to collect and evaluate research related to the focus of a particular topic. The term Systematic Literature Review (SLR) is used to refer to research methodologies or certain research as well as developments that are attempted to collect and evaluate research that is linked to a certain topic that is the focus of research. Initially, the Harzings Publish, or Perish application was used to conduct literature searches using Google Scholar. Second, the criteria used to find the research title were those related to customer bond management and customer loyalty in the banking industry in Indonesia that have been published. Third, literature that can be selected and studied must be sourced from the criteria mentioned earlier. Fourth, the researchers reviewed and pursued posts evenly throughout the research section. Fifth, at the end of the research, the researcher concluded from the research.

3.2 Research Object

This study aims to analyze the relationship between the software development process and the quality of products produced in the context of the information technology industry. The main focus of this study is to understand how different methods, practices, and approaches in software engineering affect the quality of the final product. This research identifies key factors in the software development process that contribute to product quality, such as requirements management, project planning, testing, and risk management. In addition, the study also explores the impact of the adoption of certain software development methodologies, such as Agile, Waterfall, and DevOps, on the quality of the resulting products.

3.3 Research Methods

In this study, a systematic literature review (SLR) method was used, which followed the following process flow:

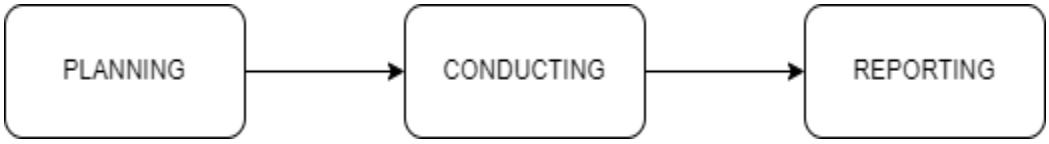

Figure 1. Research Stages

The flow diagram in Figure 1 consists of three sessions. The initial session is planning, which is meaningful because it shares directions for systematic literature review procedures (SLR). The second session is conducted, where research attempts to match the plan made in the planning session (Sudarsono et al., 2021). The last step is reporting. After the research ended, notes were made in the form of research reports (Isa Wibisono et al., 2020).

3.4 Research Question

In this session, the questions were made to fulfill the research topic. The following are some of the problems that are made from the requirements of the research topic at this time:

1. RQ1: How does the application of object-oriented analysis methods affect the quality of software design in the development of information systems?
2. RQ2: What are the techniques and tools used in object-oriented analysis to improve the efficiency and

effectiveness of software development?
3. RQ3: What are the key factors that influence the successful implementation of object-oriented analysis and its impact on the final quality of software in different types of development projects?

3.5 Search Process

After confirming the topic and formulation of the research problem, the next step is to create a relevant research post to share bonus information. Not only that, literature research is used to summarize findings from various relevant sources of information. Researchers used secondary information, which came from literature searches used through the Harzing Publish or Perish application. This search process aims to find information that is relevant to research at this time and can be used to respond to the formulation of problems or research problems (RQ) and the need for field proof. Publish, or Perish Search Engine Harzing application is used to complete the search process. To conduct a research data search, here are the steps to follow:

1. Opening the Harzing Publish or Perish App

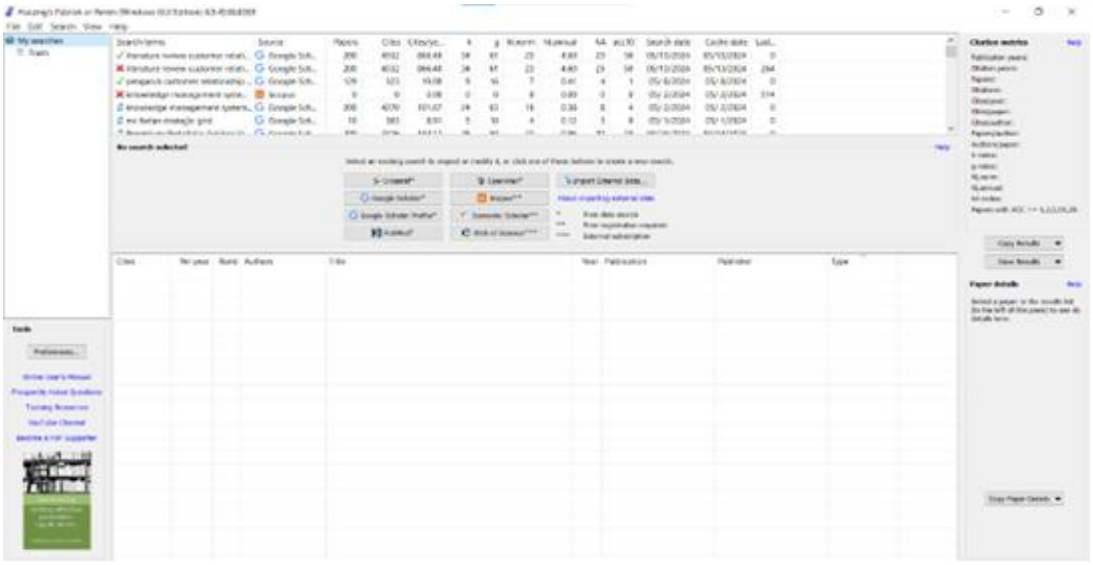

Figure 1. Harzing's Publish or Perish App View

2. Select the "Google Scholar" button, then enter the keywords section "object-oriented analysis."

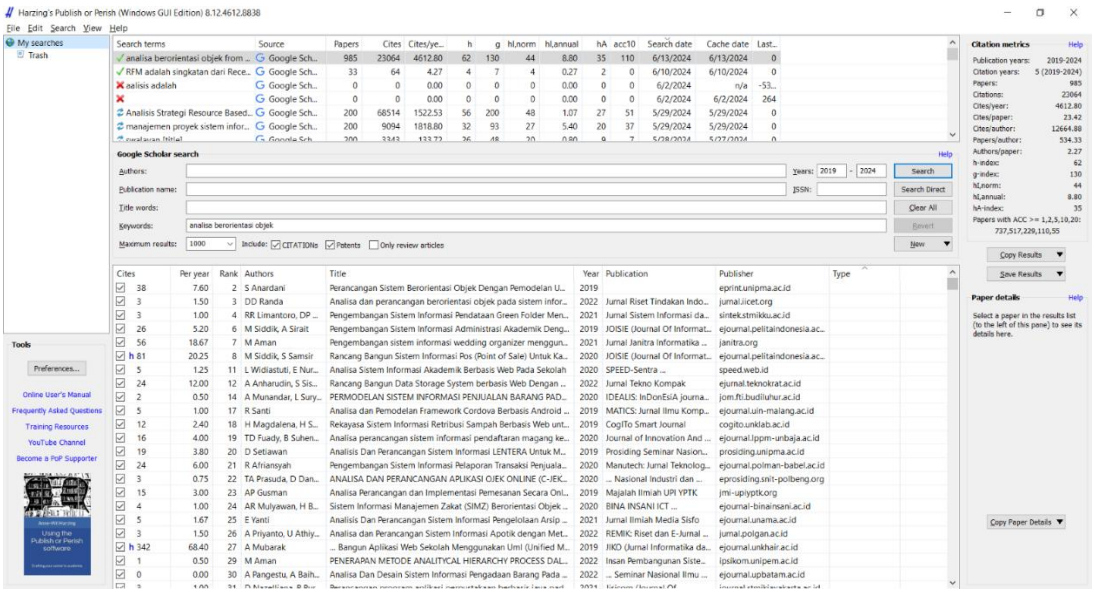

Figure 2. Keyword Search Results Display

3. After searching, close to 985 relevant posts were found. In this session, the data found is to be viewed using the following questions:

1) Does the journal article discuss the application of object-oriented analysis methods in the development of information systems?
2) Does the journal article cover the research period between 2019 and 2024?
3) Does the journal article specifically highlight the impact of object-oriented analysis on the quality of software design in different types of development projects?

Furthermore, journal articles will be evaluated based on the following questions:
• Yes: Journal articles according to the given quality evaluation questions.
• No: Journal articles do not match the given quality evaluation questions.

Table 1. The journals obtained will be evaluated using these questions.

No.	Article Title	Authors	QA			Information	
			Q1	Q2	Q3	Yes	No
1	"Pengembangan Sistem Evaluasi Nilai Mahasiswa Berorientasi Objek Menggunakan Metode Nisbi"	(Septiyanda et al., 2020)	√	√	√	√	
2	"Pengembangan Sistem Informasi Wedding Organizer Menggunakan Pendekatan Sistem Berorientasi Objek Pada CV Pesta"	(Aman & Suroso, 2021)	√	√	√	√	
3	"Hubungan Nilai Matematika Dengan Prestasi Belajar Pemrograman Berorientasi Objek Pada Siswa Kelas XII Jurusan RPL SMK Ibu Kartini Semarang"	(Adi Firdaus et al., n.d.)	√	√	√	√	
4	"Pengembangan Sistem Informasi Pendataan Green Folder Menggunakan Metode Berorientasi Objek Dan UML Berbasis Web Pada TK Harvest Christian School"	(Limantoro & Kristiadi, 2021)	√	√	√	√	
5	"Pemodelan Sistem Informasi Penjualan Baranag Pada CV. Clever Kids Dengan Menggunakan Metode Berorientasi"	(Munandar & Suryadi, n.d.)	√	√	√	√	
6	"Implementasi Sistem Informasi Pemasaran Rumah Dengan Pendekatan Sistem Berorientasi Objek Pada Developer Property"	(Aman et al., 2021)	√	√	√	√	
7	"Analisa Dan Perancangan Sistem Informasi Penerimaan Peserta Didik Baru Pada SMA Sumpah Pemuda Jakarta Barat Dengan Menggunakan Metodologi Berorientasi Objek"	(Wastiani et al., n.d.)	√	√	√	√	
8	"Analisa dan perancangan berorientasi objek pada sistem informasi geografis untuk menentukan lokasi irigasi sungai"	(Randa, 2022)	√	√	√	√	
9	"Pembuatan Sistem Informasi Dengan Analisis dan Perancangan Berorientasi Objek"	(Pelawi, n.d.-b)	√	√	√	√	
10	"Pemodelan Analisis Berorientasi Objek Dengan Use Case"	(Astuti, 2009)	√	√	√	√	
11	"Perancangan Sistem Monitoring Gangguan Akses Wifi.Id PT	(Mamusung et al., 2020)	√	√	√	√	

No.	Article Title	Authors	QA			Information	
			Q1	Q2	Q3	Yes	No
	Telkom Wilayah Jakarta Timur Berbasis Netbeans"						
12	"Analisa dan Perancangan Aplikasi Sistem Penyewaan Kendaraan berbasis Java"	(Putri et al., 2021)	√	√	√	√	
13	"Pemodelan Design Sistem Informasi Berorientasi Objek Pada E- Guest Book Menggunakan Unified Modelling Language"	(Asrin, 2023)	√	√	√	√	
14	"Implementasi Object Oriented Metodologi dan UML pada Pengembangan Sistem Informasi Keuangan Organisasi"	(Putra & Haryono, n.d.)	√	√	√	√	
15	"Rancang Bangun Sistem Informasi (Poins Of Sale) Untuk Kasir Menggunakan Konsep Bahasa Pemrograman Orientasi Objek"	(Siddik, 2020)	√	√	√	√	

3.6. Data Analysis
To answer the previous research question, data analysis was conducted to collect the results of fifteen articles that investigated the influence of customer relationship management on customer loyalty to pre-selected banking companies in Indonesia.

3.7. Documentation
In this session, the research results will be published in a journal according to the format that has been set previously.

4. Results

4.1 Search Process Results and Inclusion and Exclusion Criteria
The results of the search process, along with inclusion and exclusion criteria, selected 15 journal articles relevant to the research topic and will be published from 2019-2024 with topics related to "object-oriented analysis." The results of this process will be grouped into several types of journals as follows:

Table 2. Search Process Results and Inclusion and Exclusion Criteria

No	Journal Type	Year
1	"Jurnal Rekursif"	2020
2	"Jurnal Janitra Informatika dan Sistem Informasi"	2021
3	"Jurnal Nasional Pendidikan Teknik Informatika : JANAPATI"	2020
4	"Pengembangan Sistem Informasi Pendataan Green Folder Menggunakan Metode Berorientasi Objek Dan UML Berbasis Web Pada TK Harvest Christian School"	2021
5	"Jurnal IDEALIS"	2020
6	"Jurnal ICT : Information Communication & Technology"	2021
7	"Jurnal IDEALIS"	2020
8	"JRTI (Jurnal Riset Tindakan Indonesia)"	2022
9	"ComTech"	2020
10	"Media Informatika"	2020
11	"Jurnal Nasional Komputasi dan Teknologi Informasi"	2020
12	"Jurnal Teknologi Sistem Informasi dan Aplikasi"	2021
13	"Journal of Computer Science and Information Systems"	2023

No	Journal Type	Year
14	"Jurnal Rekayasa Perangkat Lunak"	2020
15	"JOISIE Journal of Information System and Informatics Engineering"	2020

The results of the quality assessment of the 15 articles are presented in the following Table 3.

Table 3. The results of the quality assessment

No	Authors	Year	Q1	Q2	Q3	Result
1	"Muhammad Irfan Septiyanda, Asahar Johar, Yudi Setiawan"	2020	√	√	√	Accepted
2	"Agung Adi Firdaus, Putri Khoirin Nashiroh, Djuniadi"	2021	√	√	√	Accepted
3	"Petrina Ayu Wulandini"	2020	√	√	√	Accepted
4	"Nabila Salma Khairunnisaa, Alim Murtani"	2021	√	√	√	Accepted
5	"Rio Rafel Limantoro,Dedy Prasetya Kristiadi"	2020	√	√	√	Accepted
6	"Mustar Aman, Riyanto, Suroso, Ipang Sasono, Yunianto Agung Nugroho"	2021	√	√	√	Accepted
7	"Ririn Wastiani, Bruri Trya Sartana"	2020	√	√	√	Accepted
8	"Dimas Dwi Randa"	2022	√	√	√	Accepted
9	"Pelawi D"	2020	√	√	√	Accepted
10	"Rini Astuti"	2020	√	√	√	Accepted
11	"Anzar Aggassi Mamusung, Nico Bustanul Anshary, Ria Asep Sumarni"	2020	√	√	√	Accepted
12	"Septi Nur Ilmi Putri, Mohammad Zaeni, Desi Jasmiati, Endar Nirmala, Irpan Kusyadi"	2021	√	√	√	Accepted
13	"Asrin"	2023	√	√	√	Accepted
14	"Ari Satrio Putra, Kholid Haryono"	2020	√	√	√	Accepted
15	"Siddik"	2020	√	√	√	Accepted

4.2 Data Analysis

In this session, the collected data will be processed and analyzed to answer previous research questions (RQ) and to analyze object-oriented analysis in software engineering.

1) RQ1 Results: How does the application of object-oriented analysis methods affect the quality of software design in information system development?

Table 4. RQ1 Results

No	Aspects	Research Paper	Quantity
1	Modularity Design	[1],[2],[3],[4],[5],[6],[8],[9],[10],[12],[13],[15]	12
2	Component Reusability	[2],[3],[4],[6],[7],[8],[11],[13],[14]	9
3	Flexibility and Scalability	[2],[3],[4],[5],[6],[12],[13],[14]	8
4	More Realistic Modeling	[4],[5],[13]	3

2) RQ2 Results: What are the techniques and tools used in object-oriented analysis to improve the efficiency and effectiveness of software development?

As shown in Table 5, 15 journal papers were collected by various methods based on Research Question 2 or RQ2.

Table 5. RQ2 Results

No	Measurement Method	Research Paper	Quantity
1	UML (Unified Modeling Language)	[1],[2],[3],[5],[6],[7],[8],[9],[10],[11],[13]	11
2	Design Patterns	[4],[6],[7],[10],[13],[14],[15]	7
3	Refactoring	[12]	1

3) RQ3 Results: What are the main factors that affect the successful implementation of object-oriented analysis and its impact on the final quality of software in different types of development projects?

Based on Research Question 3 or RQ3, Table 6 shows the main factors that affect the success of implementing object-oriented analysis, which is sampled here from several studies.

No	Key Factor	Research Paper	Quantity
1	Developer Team Competencies	[1],[2],[3],[4],[5],[6],[8],[9],[10],[12],[13],[15]	12
2	Effective Project Management	[2],[3],[4],[6],[7],[8],[11],[13],[14]	9
3	Availability of the Right Tools and Technology	[2],[3],[4],[5],[6],[12],[13],[14]	8
4	Quality of Communication and Team Collaboration	[4],[5],	2

4.3 Summary of Data Analysis Results

The facts about how customer relationship management affects customer loyalty to banking companies in Indonesia have been discovered through the results of an analysis of fifteen articles that have relevant research topics. The current method of collecting factor analysis data can be analyzed and used as an additional source of information for the public with reference to the 2019-2024 paper.

5. Discussion

In this discussion, it is important to highlight that the application of object-oriented analysis in software development is not only about choosing the right methods and tools but also about ensuring strong synergies among the various elements involved. The competence of the development team and effective project management are two key factors that greatly influence the successful implementation of this method. In addition, the availability of appropriate tools and technology, as well as the quality of communication and team collaboration, also play an important role. While object-oriented analytics offers many benefits in terms of modularity, reusability, flexibility, and scalability, challenges remain in terms of team adaptation and training, as well as integration with other development methodologies such as Agile or DevOps. Therefore, the successful implementation of object-oriented analysis requires a holistic approach that includes ongoing training, change management, and adequate technology support.

6. Conclusion

The conclusion of this study shows that the application of object-oriented analysis in information system development is essential for achieving high-quality software design. This method, with its structured approach to organizing system components as objects, helps to identify and define system requirements in detail before the coding stage. Research results from a systematic literature review (SLR) conducted in journals from 2019 to 2024 show that object-oriented analysis can improve design modularity, component reusability, flexibility, and software scalability. Techniques such as UML, design patterns, and refactoring have proven to be effective in improving the efficiency and effectiveness of software development.

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