Analyst's Perception on the Use of AI-based Tools in the Software Development Life Cycle

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Abstract

Artificial Intelligence (AI) integration has been the goal in many industries, including in the software development industry. One example of this integration comes in the form of integrating AI in the Software Development Lifecycle (SDLC). To date, the difficulties of incorporating AI-based tools into particular phases of SDLC have not received much attention in research. Using qualitative approach, this study aims to discover the perception on the use of AI-based tools and challenges in integrating them in the analysis phase of SDLC. The study finds out that analyst have positive perception about integrating this technology in their field of work but there are some challenges while integrating this technology such as familiarity of the tools, output quality, dependency, and data security and privacy concern. This study also discovers some key factors of why some analysts adopt or refuse this technology namely related to time, urgency, and budget.

Keywords: artificial intelligence, sdlc, integration, challenge, key factor

Introduction

Software engineers have been creating techniques and standards since the beginning of software development to turn the process into a methodical one that can guarantee particular standards of quality. The rules outlined in the Software Development Lifecycle (SDLC) have been the appropriate methodology to follow by the practitioners since these rules guide them in developing a high quality of software products (Acharya and Sahu 2020; Moreschini et al. 2023; Pargaonkar 2023). Due to the ever-

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changing development of technology and demands from the market, this methodology is adapted to the changes that occur, resulting in breakthroughs in the use of the technology as well as action taken in the process (Adanna and Nonyelum 2020; Banerjee et al. 2020). An example of the changes that are occurring is the application of technology, including artificial intelligence, or AI. AI technology is well known to have a significant impact on a variety of industries, including transportation, agriculture, health, and others, in addition to the technological sectors (Kuang et al. 2021; Panda et al. 2019). This phenomenon triggered researchers to conduct studies to explore this technology.

There are several studies related to the integration of AI in the technology industry, specifically related to SDLC. A notable study examines how AI techniques can be used in software development (Stavridis and Drugge 2023). The study's primary findings include the possibility that AI tools could offer developers intelligent assistance in the form of innovative feedback and task automation. Concerns were raised, meanwhile, regarding the organization's potential impacts as well as the requirement to adjust to AI tools. The study highlights how crucial it is to consider how the introduction of AI may alter system development processes and how crucial it is for developers to successfully work with and adjust to AI tools.

Another study investigates the use of ChatGPT and other AI tools in different stages of software development (Waseem et al. 2023). According to the study, ChatGPT is helpful in expediting the initial stages of software development, enhancing accuracy and efficiency. ChatGPT remained a useful tool during development, optimizing workflows and offering insightful data. The study also emphasizes how AI technologies may be used to simulate the function of an architect in Architectural Collaborative Software Engineering (ACSE) by efficiently and effectively producing software requirements. To improve requirement quality, the research also highlights the importance of human oversight and the value of human feedback.

Another study explaining the challenges of integrating AI (in this case ML) (Laato, Mäntymäki et al. 2022). The study examines the challenges of incorporating SDLC concepts with machine learning (ML) development. To investigate how four distinct archetypal SDLC models promote ML development, the study performed a series of expert interviews. Redefining the prescribed roles and responsibilities within development work, using the SDLC as a framework for management, customers, and software development teams to commit to a common understanding, and method tailoring are the three high-level trends in ML systems development that the research found to emerge from the analysis. The study emphasizes the issues associated with managing the development of ML models as part of the full SDLC and the need for additional research on whether and how to incorporate data scientists' work into SDLC models.

There are also similar studies that try to explore the integration of AI in other fields of studies, such as pathology (Drogt et al. 2022). The study aims to learn about the views of experts on the shift to digital pathology and the possible benefits of AI-based image analysis, the researchers conducted interviews with 24 professionals (15 pathologists, 7 lab workers, and 2 computer scientists). The advantages and difficulties of digital pathology were spoken about, along with the aspirations and expectations of the respondents regarding AI in pathology. The Researchers thought AI may help with more sophisticated diagnoses and improve the efficiency of their workflows, especially for repetitive and routine chores. The significance of keeping a realistic perspective on AI's prospective benefits and the necessity of practical viability for successful AI research were other topics covered by the respondents. Lastly, the respondents also saw AI fulfilling a variety of roles and duties in the diagnostic process, such as advisor, instructor, and additional expert.

Another study comes from the agricultural industry, which explains the possible benefits and challenges of using smart farming technologies in the agricultural industry (Jerhamre et al. 2022). According to the study, farmers are generally in favor of smart farming and think it will save money and time on tasks like fertilizing and irrigation, which will benefit workers' working conditions. Farmers, on the other hand, might not always see the need for investments in smart farming and instead think of them as something stylish and modern.

Based on the literature research conducted by own researcher, many AI integration processes have been incorporated into the SDLC phases, but there has not been much focus on the analysis phase of software

development, specifically related to the challenges of this integration. Therefore, qualitative study is required to explore the challenges in integrating AI into the SDLC's analysis phase. The objective of this study is to learn what analysts think about integrating AI into the analysis phase of the software development life cycle (SDLC) and what obstacles they may encounter while integrating this technology. Thus, several questions arise from the objectives of this research: (1) What is the analyst's perception of using AI-based tools in the analysis phase of the SDLC? (2) What are the main challenges that analysts may face regarding the use of AI-based tools to support the analysis stage of the SDLC? (3) What are the key factors that influence an analyst's decision regarding the use of AI-based tools in the analysis phase of the SDLC?

The remainder of this paper is structured as follows. The next section provides a brief description of related literatures and followed by the methodology used in this study. Then, we present the result of this study as well as the discussion, conclusion, implication, limitation, and suggestion for further research.

Literature Review

Artificial Intelligence

The terms Artificial Intelligence, or known as AI, is used to describe how a system or machine can imitate human intelligence. The system that builds by the principal of AI is capable of various cognitive processes such as understanding, thinking, learning, predicting, planning, and others (Xu et al. 2021). The main idea of AI is to create a smart machine that can provide solutions and solve problems related to human intelligence (Goralski and Tan 2020). According to (Sarker 2022), techniques in the field of AI potentially can be divided into 10 major parts: (1) machine learning; (2) neural networks and deep learning; (3) data mining, knowledge discovery and advanced analytics; (4) rule-based modeling and decision-making; (5) fuzzy logic-based approach; (6) knowledge representation, uncertainty reasoning, and expert system modeling; (7) case-based reasoning; (8) text mining and natural language processing; (9) visual analytics, computer vision and pattern recognition; (10) hybrid approach, searching and optimization.

In industry 4.0, AI is recognized as the key driver behind the technological advancements. AI is transforming various industries, which is causing the existing industry to grow very swiftly (Cioffi et al. 2020; Mohammed et al. 2021; Nortje and Grobbelaar 2020). Many companies invest in AI because they perceive it as an opportunity in the current industrial competition. However, many of them still find it difficult to take advantage of its benefits (Enholm et al. 2022). Although AI technology has the potential to greatly benefit humanity and society, some people are concerned about the possibility that AI will eventually replace human labor in the workforce (Vorobeva et al. 2022; Vrontis et al. 2022).

Software Development Life Cycle

The term Software Development Life Cycle (SDLC) refers to a set of organized tasks that are used as a guide for developing information systems. This methodology helps the development team to control every activity that occurs in the software development cycle, which makes this methodology essential for software development (Okesola et al. 2020). SDLC consists of several primary phases in its application, namely requirement analysis, design, implementation, testing, and maintenance (Saravanan et al. 2020). In another study, the phases in SDLC are divided into six phases consisting of planning, defining requirements (requirement analysis and software requirement specification), designing and software architecture, building or developing the product, testing, and deployment as well as maintenance (Gupta et al. 2021). Although some researchers may explain the SDLC phases different from the others, the overall explanation still revolves around the same main idea.

There are two primary categories of SDLC methodology, namely heavy-weight methodology and light-weight methodology (Ben-Zahia and Jaluta 2014; Yas et al. 2023). In the heavy-weight methodology, prior to beginning the development process, this approach greatly emphasis on documentation, long-term planning, and design. In contrast to the heavy-weight methodology, the light-weight methodology, also referred as agile development, prioritize more on the user involvement during the cycle as well as

shorter and more efficient process (Al-Saqqa et al. 2020; Ben-Zahia and Jaluta 2014). Both approaches have different SDLC models. Some examples of SDLC models that are categorized as heavy include waterfall, spiral, and incremental models. Meanwhile, SDLC models such as prototyping, Rapid Application Development (RAD), and Agile (Scrum, Lean, and Extreme Programming) are categorized as the lightweight (Ben-Zahia and Jaluta 2014). Each of these models certainly has its own advantages and disadvantages and given the growth of the technology and current industries, it is not completely ruled out that the number of SDLC models might keep increasing in the future.

The Current State of AI Technique Application in SDLC

Prior to conducting this study, researchers conducted a literature review to gain a broad understanding of the phenomenon of utilizing AI technology in SDLC. This is brought about by circumstances where advancements in technology keep evolving and their applications continue to be utilized in various industrial sectors. From this phenomenon, the literature review study aims to gain a comprehensive understanding of the trends in the application of AI technology in assisting the development of a software system as well as the challenges or obstacles encountered while doing so. The literature review study was carried out systematically by adopting the Kitchenham method (Kitchenham and Charters, 2007). From the systematic literature review, researchers were able to comprehend the trends and challenges of using AI technology related to each phase of the SDLC which helps the work of the software development team.

The findings of the literature review demonstrate that, among the many techniques falling under the scope of AI, ML, deep learning (DL), and natural language processing (NLP) methods are the ones most frequently employed to assist software system development activities. AI techniques such as DL can be used in the planning phase of SDLC to help predict which SDLC models are suitable for usage (Dhami et al. 2021) and to improve function Point-Based Software Size estimation (Zhang et al. 2021). Related to the analysis phase, ML techniques can help with software requirement specifications (Akshatha Nayak et al. 2022; Quba et al. 2021) and can also be used to predict software vulnerabilities (Imtiaz et al., 2021). Related to the design phase, various AI techniques can be used, such as ML which is used to assist in predicting software bug (Delphine Immaculate et al. 2019) and automate the assumption identification process (Li et al. 2019), NLP to create DFDs (Cheema et al. 2023) and used for voice-driven modeling software (Black et al. 2021), Artificial Neural Network (ANN) for software bug prediction (P and Kambli 2020), as well as the use of tools based on intelligence decision support systems used in risk management software (Asif and Ahmed 2020). Related to the fourth phase of SDLC, implementation, ML techniques can be u can be applied for a variety of purposes. these include assisting in the identification of weak points in source code (Sonnekalb 2019) and helping to predict defects in software (Ahmed et al. 2020; Pradhan and Nanniyur 2021; Shrimankar et al. 2022), generating code using generative AI (Sun et al. 2022), and other techniques such as NLP which is used to classifying bugs (Picus and Serban 2022) and the use of tools such as ChatGPT which helps in code analysis (Ozturk et al. 2023). Regarding the testing phase, several forms of this application are the use of DL techniques which are used to automate the process of generating test case scenarios (Roy et al. 2021), the test case classification process by utilizing a combination of NLP and ML techniques (Tahvili et al. 2020), as well as the use of NLP to provide solutions and automate fixing in the source code (Chi et al. 2023). Related to the last SDLC phase, maintenance, ML techniques can be used to assist the development team in detecting and analyzing technical debt (Khan and Uddin 2022; Tsoukalas et al. 2022) and DL techniques are used to assist in Software Maintainability Metrics Prediction (Jha et al. 2019).

The application of AI to fulfill different requirements for software system development activities is undoubtedly related to potential challenges. Prior study has focused more on the difficulties experienced by researchers testing AI techniques than by real users of these tools. These difficulties are related to the requirement for tools that are helpful in the development of software systems. In general, the challenges faced in most SDLC phases are related to the datasets used to test these AI techniques, such as limited dataset availability and low dataset quality (Chi et al. 2023; Dhami et al. 2021; Laato, Birkstedt et al. 2022; Sonnekalb 2019). Apart from that, several challenges were also identified in various cases which may be related to certain phases in the SDLC such as chances of error (Sun et al.

2022), high costs (Sonnekalb 2019), security concerns (Ozturk et al. 2023; Sonnekalb 2019), inconsistent results (Ozturk et al. 2023), and inaccurate result (Malhotra et al. 2022) which is related to the implementation phase, there is concern about human error and the complexity of the model used (Chi et al. 2023), which is related to the testing phase, as well as challenges related to the maintenance phase such as imbalance class in determining the model used to test the equipment (Tsoukalas et al. 2022). Even though the study to examine the current condition of the use of AI in SDLC has been carried out, challenges, especially in the analysis phase related to the use of AI in SDLC, still remain unexplored.

Methodology

This study uses a qualitative approach, which is an approach that aims to study and understand the meaning given by a particular individual or group regarding specific problems (Creswell and Creswell 2018). The qualitative approach was chosen because this approach allows researchers to have in-depth information regarding how an analyst perceives the use of AI-based tools, especially for the requirement analysis phase in SDLC.

Data Collection

In the process of data collection, this study used a semi-structured interview method. This method allows researchers to delve into a particular topic through the opinions of informants related to the topics being asked. The data collection process was carried out from December 4, 2023, to December 11, 2023. For the method of determining the study sample, this study adopted a purposive sampling method with selection criteria, namely people who have worked or are still working as an analyst, whether as business analysts, system analysts, or others and have been involved in the development cycle of a software system, especially involved in the analysis phase. The use of this sampling method allows researchers to explore the perceptions of a particular group on a particular research topic, which is in accordance with the initial objectives of this research. Apart from that, the sample selection was also carried out only on people who have worked or are still working as an analyst because the researchers assumes that they are the people who have experience in the field related to the development of a software system, especially at the analysis stage.

In the data collection process, interviews were conducted with five participants with each role as business analyst and system analyst. This research only involved five participants because the results obtained already addressed previously formulated research questions by providing several important insights related to the use of AI-based tools in the analysis phase in SDLC. The diversity of roles allows researchers to obtain more varied information related to an analyst's perception of the use of AI-based tools at the analysis stage in the SDLC phase. Apart from that, the variety of industries sectors of each participant also allows this research to gain a broader understanding, especially regarding the background, regulations, and culture of each company. The profiles of the participant of the interview from this study can be seen in Table 1.

Table 1. Profile of the Interview Participant

No.	Role	Age (years)	Working Experience (years)	Industry Sector
1.	Assistant Manager of Business Analyst	27	5+	Finance and Insurance
2.	Business Analyst	24	3	Information Technology
3.	System Analyst	31	5+	Government and Public Administration
4.	System Analyst	23	2	Education
5.	Business Analyst	26	3	Finance and Insurance

Interviews were carried out online via the Microsoft Teams platform and recorded via the same platform and recording tools from the local computer. Based on the literature research conducted by the researchers, these interview questions consist of open-ended questions which are intended to explore the answers from the informant. The interview questions are divided into several parts: to find out the informant's background, to find out the informant's personal opinions regarding the use of AI-based tools, to find out the positive and negative points of view of the informant regarding the use of AI-based tools, and to find out their opinion regarding the development of the analyst role in the AI development.

Data Analysis

In this study, data analysis was carried out by adopting the thematic analysis method. Thematic analysis is a technique used to evaluate qualitative data which involves searching for recurring patterns in a dataset and reporting the results. This method is a way to explain data, where in the process of code selection and theme creation, interpretation is also used (Kiger and Varpio 2020).

In this study, the steps for conducting the thematic analysis consist of six parts (Kiger and Varpio 2020). In the first step, the researchers transcribed the audio interviews that had been conducted previously. This process was carried out to help the researcher to see all the data that had been collected. In addition, in this first step, the process of data translation to English was also carried out because the interviews were conducted using Indonesian. The next step continues with the initial coding process. The initial code was formed to facilitate the process of compiling and collecting similar data. Then, in the third step, the theme searching process is carried out. In this process, data that has been grouped based on its code is re-evaluated to look for potential themes that can be developed. Next, in the fourth step, the potential themes that have been formed are reviewed again to see their suitability to the codes they describe. Next, in the fifth step, the names of the themes are determined, where in this research the themes are adjusted to the research questions. Finally, in the sixth step, the results of the findings that have been analyzed are presented in sentence. The entire thematic analysis process in this research was carried out manually using Microsoft Word and Microsoft Excel tools. In addition, this process also uses the researcher's personal interpretation skills.

Results

Analysts Perception Regarding the Use of AI-based Tools in the Analysis Phase of SDLC

Convenience and Efficiency of the Work Processes

It is well-recognized that the use of AI-based tools can facilitate human work. These tools can be used to do a variety of tasks, from easy ones to time-consuming, complex ones. As a result, new opportunities can be created to improve the convenience and efficiency of the job to be done, such as in software development projects. This AI-based tool's fast data processing and analysis capabilities may provide users valuable insight that helps them work better, particularly when it relates to the requirements analysis process that analysts carry out when creating a software system. Some analysts argue:

(*"When it comes to using AI when designing a system, for example requirements analysis, I think it's quite helpful, because first it can simplify the requirements gathering process, so the assumption is that general or minor requirements can already be provided with AI. So, from our side, we only need to be concerned with the deeper, or more technical parts"* – Participant 1)

(*"So, my current project has various modules. When I am assigned to a module, before I carry out requirements gathering with users and stakeholders, first I need to understand what the best practices that are likely to be obtained from that module are. That's why AI really helps me to keep me on the right track, so I don't need to be confused about determining best practice."* – Participant 2)

Increased Productivity and Time Savings

Undoubtedly, it is hard to separate the efficiency that AI-based products provide to work from productivity. When using AI-based tools, particularly during requirements analysis in the software system development cycle, employees can work more productively because some of these tools can provide suggestions, which allows them to make decisions more quickly and eventually complete their tasks. As mentioned by several analysts:

(*"While there are a few teams who have already started using AI, such as OCR or optical character recognition, it's most likely that the technology is still in its early stages of implementation at my workplace. This is useful during the requirements stage because the user provides data in the form of files (PDF files, maybe) or images. It might take a while to manually convert it to text, so perhaps we can use the OCR feature to extract the text data from, like, an image or a PDF file so that it can be processed again for the requirements process."* – Participant 4)

(*"…but from my personal side, I feel that, if for example there were AI tools that could help with every SDLC process from planning, collection, requirements, etc., so that every design already had a to-do list, we could calculate how much manpower it would have, and estimate the time based on the requirements with just one or two statements of our needs until finally it can also suggest the type of database to use, that's actually quite helpful."* – Participant 3)

Enthusiasm

The presence of new technology in a company is often a topic that sparks enthusiasm among employees, especially if the technology provides ease in employee tasks, where employees can directly feel the impact of using the technology. one analyst said:

(*"Maybe it hasn't been used in our company now, but in my own opinion, maybe later it will be needed for the data analysis process, because if we use AI, maybe the data source will be completer and more varied. But for the moment, because we haven't used it yet, we haven't tried it or applied it."* – Participant 5)

Possible Challenges in Using AI-Based Tools to Support Analysis in SDLC

Familiarity and Training for Using the Tools

Using new tools or technology, such as AI, often requires adequate training because not everyone is familiar with the technology. This is necessary to understand how the technology works effectively to maximize the potential of the tool in supporting the work being undertaken. As the analysts said:

(*"Maybe for the start, because I have never used AI tools before, the first thing that I must do is to adapt and learn more to understand the AI tools that I will use if I must use them."* – Participant 1)

(*"... maybe the first thing is how to use it, because I've never tried it directly, I'm only used to seeing on share screens how to use it and from the information I know, for example, to use OCR, it requires quite a long training, and some training may not be free."* – Participant 4)

(*"Because I'm not very familiar with it, I've never used it. so, training or knowledge transfer is needed first for things like this So I can get used to it and maybe understand better how to use it."* – Participant 5)

Quality and Credibility of the Data Produced

Feelings of anxiety and doubt are common reactions that some people may feel when they are faced with something new. Similarly, with AI technology, some people who are not familiar with the innovation of the technology, especially in their working environment, will certainly have some questions such as how credible and accurate the results given from the technology are.

(*"As for the risks themselves, what I can think of now is that maybe the results are invalid. I mean like, it's human-made too. Maybe when it's used for the first time, it might produce data that doesn't match*

what we want. So, maybe my concern is more about the results that don't match what we need." – Participant 1)

(*"... what I'm more worried about is the result of AI. If it is wrong, if we are not aware, it can have quite fatal consequences. So, the humans themselves must be smarter in filtering the results generated by AI."* – Participant 2)

(*"So first, it's the credibility of the AI because there are many new AIs operating, the data dictionary from AI may be limited. So, the accuracy of the information we need may not be what we expect."* – Participant 3)

Excessive Tool Dependency

The excessive use of technology is one of the things that needs to be considered in this continuously evolving digital era. The advancement of technology such as AI can lead to over-dependence on the technology given the many things that can be solved using AI-based tools. This may indirectly affect the abilities of its users, such as the decay of critical thinking skills and adaptability when faced with new or unexpected situations, as stated by one of the following analysts:

(*"... So, when we encounter problems with different users or for example with different systems, we are worried that if we depend too much on AI, AI will not be a supporting tool, but instead will be the main character. In our system, if in the future we were transferred to another office, we might be unable to adapt to the standards of the new office."* – Participant 3).

Data Security and Privacy

Concerns about data security and privacy are something that needs to be underlined especially when using AI-based tools. Some users feel anxious when they process data on these tools because it is possible that the tools they use are vulnerable to misuse or privacy violations which will have a negative impact on the company where they work. This was stated by several analysts:

(*"... maybe for the paid tools it is safe because maybe when purchasing the license there is a statement that the data will be safe. Now maybe for the tools that are used for free, we don't know whether the data can also be accessed by other people who use the same tools."* – Participant 4).

(*"the biggest risk is probably back to data security. So, if for example, when we collect from various sources using AI, if the security is not secure, it could turn back to the company."* – Participant 5)

Key Factors that Influence Analysts Decisions in Using AI-Based Tools in the Analysis Phase in SDLC

Time Efficiency

AI-based tools are known to be able to create efficiency in various work processes. For example, some AI-based tools can be used to process and analyze a large number of text documents in a short time, which previously would have taken a long time if done manually. Another example, some AI tools can be utilized for faster decision-making due to their ability to provide suggestions that may be valuable to the user. Several analysts explained their needs in using these AI-based tools, especially when it comes to time issues:

(*"Why do I use the tools themselves because it can cut quite a lot of time. So, for example, in analogy, I usually need 4 hours to determine the best practice, but with a matter of minutes or seconds, depending on how fast I click, I can get the best practice."* – Participant 2)

(*"... we are racing against time while the requests from users are many and sometimes change."* – Participant 3).

No Requirement from the Company

The use of a new technology or breakthrough within the company often requires a strict approval process. Generally, when a company is going to adopt new technology, the company needs to first evaluate both the urgency or need from internal and external sides, the benefits obtained, the risks of implementing the technology, the availability of resources, and other factors. This time-consuming process can make some companies reluctant to adopt new technology. One analyst explained:

(*"Until now, we haven't, because our company itself does not require us to use AI. It seems that there are no decisions or others related to AI, so now we are still manual. Personally, I want to try it, it's just because in a professional environment, we must raise the issue if we want to propose a new method for using AI and it must be approved by many parties. So, from my own side, it is constrained because the IT department itself has no intention of using AI."* – Participant 1).

Inadequate Budget

Adequate budget allocation is necessary for the successful implementation or use of new technologies, including AI, in companies and organizations. However, each team and division within the Company may not be provided with an adequate budget to adopt these technologies. This can be a roadblock for teams and divisions in implementing such technologies that enable improvements in the effectiveness, efficiency, and productivity of their work, as explained by one of the analysts:

(*"... each division and team are given a budget. Well, maybe it's not enough to include the budget for implementing AI."* – Participant 4).

Not required by the users and internal

The use of technology such as AI is not always an absolute necessity for users or internal parties of a company. Any decision to adopt something that may affect operations or projects needs to be evaluated first. Sometimes, a simpler solution may be enough to meet the user's needs and expected goals. Some analysts argue:

(*"My team has never used it, because maybe my users are more internal, so it doesn't need much analysis, because it just affects the internal parties. Maybe if it's for another team that goes to students, maybe it is necessary to use Ai."* – Participant 4).

("*At the moment, maybe our company does not need it and the requirements of the users themselves do not need it. And for data analysis our company also has another team such as data analytics which usually handles data needs. For example, for certain needs, they who usually collect data and those who are the ones who handle the analysis*" – Participant 5).

Discussion

The results of this study show that most analysts see a positive impact of using AI-based tools, especially in the analysis stage of software development activities. The benefits identified include an increase in efficiency as well as ease in the work process. In addition, an increase in productivity and savings in time to complete a task were also advantages highlighted by analysts. For some analysts who have never used these tools, the adoption of these tools in their work process, especially for the analysis process in software development activities is something to look forward to in the future given some of the advantages offered by the tool. The results of this study are similar to study conducted (Job 2021) which shows that the application of AI techniques has a significant impact on various stages in software development activities, especially in the testing stage. The study states that the use of AI tools allows automation in the software testing process which helps to increase the overall scope of testing and ensure the quality produced through the testing process and error detection with a relatively faster time when compared to the testing process carried out manually. In addition, AI tools are also expected to be able to test with fewer possible errors so that the results provided can be more accurate.

Although the use of AI tools is considered to have a positive influence on software system development activities, this is certainly inseparable from the obstacles and challenges that may be faced by users of

these tools. The first possible challenge faced from the use of AI-based tools for analysis needs in software development relates to the familiarity of the tools used. Some companies or organizations that have been running for a long time may see AI-based tools as something new to be adopted in their environment. This leads to a lack of familiarity with and understanding of how to use these tools among their employees. In addition, adequate training is also required for companies that intend to adopt such technology. This finding is in line with the result of other study (Shang et al. 2023) which explains that lack of knowledge on AI technologies and applications and lack of skilled and trained employees are two of several other barriers to the adoption of AI in the scope of project management. This is due to the use of AI systems that are still relatively new in their industry where familiarity with the use of AI itself is still lacking. Then, the next possible challenge relates to the results provided by these tools. Although AI is considered capable of completing a variety of tasks, some analysts think that the results provided by these tools are not 100% accurate and credible, which hinders the use of these tools in supporting their work. This finding is in line with the results obtained in other study (Fui-Hoon Nah et al. 2023) which explains that there are several challenges in using generative AI-based tools, specifically regarding to the output produced. The obstacles referred to in the study are the accuracy of the results generated and the explainability of the results provided which may make it difficult for users to understand the results they get which can lead to a sense of distrust of the tools. The third possible challenge identified in this research is over-reliance. The growing capabilities of AI-based tools cause some people to focus too much on using the tools, rather than their "real" work. This result is in line with the findings of study conducted (Bird et al. 2022) which explains that the use of AI-based tools involved in software development tasks makes developers spend too much time focusing on the results obtained from these tools compared to the completion of the tasks they should be doing. The last possible challenge identified in this research relates to data security and privacy. Data processed through AI-based tools raises concerns for some parties regarding the risk of misuse and violation of the privacy of the data they provide. Similar findings were also presented in the study (Murdoch 2021) which highlighted concerns about the misuse of personal data that needs to be protected, such as medical information. In the context of software development activities, especially when conducting analysis, some analysts share the same concerns about the misuse of company data provided when they use AI-based tools.

With some consideration of the positive and negative impacts, as well as the possible challenges faced in its implementation, this study successfully identified several key factors that influence the use of AI-based tools, especially during the analysis phase of a software system development activity. These factors are divided into two main aspects, namely internal and external considerations. From the internal perspective, the time factor was identified to encourage the use of AI technology. This is due to the ability of AI that can complete complex and dynamic tasks in a relatively faster time when compared to completing these tasks manually. This finding is consistent with the results of other study conducted (Barenkamp et al. 2020) which explains that the use of AI in various phases of the SDLC allows time savings in these phases and can help improve the quality of the output provided. This is possible with AI's ability to provide valuable suggestions and automate the work of certain tasks.

From the external side, the key factors identified are more directed towards the factors that influence analysts' decisions not to use the tools. The first factor relates to the absence of Company requirements to use the technology. Adopting a new technology that has never been used in the operational activities certainly requires many considerations. The lack of support from top management makes the adoption of these technologies low. Then, the second factor that influences the analyst's decision not to use this technology is that there is no urgency either from the user or internal side to use this technology. This is due to the requirement of each of these parties, which does not require complex technology and is sufficient to be completed with existing technological resources. These two factors are in line with the findings of a study (Shang et al. 2023) where the study showed that the lack of need for adoption and lack of support from project stakeholders are several things that become obstacles in the adoption of AI technology in the scope of project management. The last factor influencing the decision to use this technology is the limited resources available, specifically financial resources. This result is consistent with the findings in the study (Alsheiabni et al. 2019) which shows that lack of funding is one of the hindrances faced in the adoption of AI within the organizational scope. Lack of funding is one of the crucial factors in the successful implementation of new technologies in companies and organizations.

However, in many cases, each team or division is not necessarily provided with an adequate budget to adopt the technology.

Conclusion

This research was conducted to explore the understanding regarding the use of AI-based tools in the context of SDLC, particularly in the analysis process. To support the objectives of this study, the researchers conducted qualitative study by exploring the perceptions of analysts through semi-structured interviews. Based on the results of the interviews conducted, there were several findings related to the research questions.

First, all analysts have a positive perception of the use of AI-based tools in the analysis process in SDLC. This is supported by the availability of various AI tools such as Chat GPT or other AI-based tools that can summarize PDF files and provide valuable suggestions for analysts. Additionally, several benefits of integrating AI-based tools in the analysis process, particularly in requirements gathering, have been identified, including that AI-based tools can simplify the requirements gathering process, especially for general or small requirements, thereby allowing analysts to focus on more important things, such as technical aspect. AI can also help the analysis process become faster and more efficient because it can save time in the requirements gathering process. For analysts who have never directly used these tools, this is something they are enthusiastic about and hope to use in the future.

For the second finding, it can be concluded that some of the main challenges that an analyst may face when using AI-based tools are related to familiarity and how to use the tools, the quality and credibility of the data produced, dependence on tools that can reduce user skills, and there are concerns about data security and privacy.

For the latest findings, there are several factors that influence analysts' decisions in using AI-based tools, especially for conducting analysis. The time factor is known to be the main factor influencing analysts' decisions in using the help of this AI-based tool. This is because these tools can help cut a lot of time from the process carried out. In addition to the factors that influence use, there are also factors that influence an analyst's decision not to use these tools. Some of these factors include the absence of company necessity for adopting these technologies, insufficient funding for their adoption, and lack of need from users or internal parties for their use.

Implication

This study makes several contributions, both theoretically and practically. From a theoretical perspective, this study contributes to the literature in the context of AI integration in SDLC, specifically highlighting the analysis phase. This study shed lights on the perceptions, possible challenges, and key factors that influence the adoption of AI-based tools by analysts in software development activities. The insights provided broaden the understanding of the SDLC by incorporating the potential role and impact of AI technologies and offer a different perspective on how AI can enhance software development practices. In addition, this study also provides a strong foundation for future research in technology adoption, particularly in the fields of AI and software development by highlighting the theoretical discourse on technological resistance and facilitation in organizational settings.

From a practical perspective, this study contributes by providing insights to software development teams, organizational and project leaders, and AI-based tool developers on what can be addressed to emphasize the use of AI in the SDLC. By understanding user perceptions, benefits, challenges, and key factors affecting the adoption of AI-based tools in organizations, stakeholders can create appropriate strategies regarding the adoption and use of AI in software development. This study emphasizes the importance of a comprehensive training program to address the issues of employee familiarity and adaptation to AI-based tools if companies want to adopt AI technology in their work process. Furthermore, the study also underscores the need for a strategic approach to resource allocation and policy design to encourage the integration of AI in software development activities.

Limitation and Future Work

Although this study provides valuable insights into how analysts perceive the use of AI-based tools in SDLC, this study has certain limitations. This study only focused on a relatively small group of participants, involving only business and system analysts, thus limiting the generalizability of the findings to the various roles involved in SDLC and various industry sectors. Future research can broaden the scope of roles of participants and industries represented to ensure that the findings can be more generalized to the population studied. Furthermore, this study only involved qualitative methods in the process. Future research is expected to conduct quantitative research to complement and validate the findings in this study. In addition, longitudinal studies can be carried out to observe how the perception and development of integrating AI-based tools in the SDLC change over time.

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