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Artificial Intelligence Implementation in Agile Project Management Addressing Challenges and Maximizing Impact

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Abstract

The Agile methodology, with an 80% adoption rate, often faces challenges leading to project failures. This study investigates using artificial intelligence (AI) to overcome these challenges through a systematic literature review of 44 papers. It examines AI's impact on key Agile phases: envision, speculate, explore, adapt, and close. Findings highlight AI's critical role in improving project outcomes by addressing implementation challenges. AI tools aid in risk assessment and project selection during planning, enhance effort estimation and task allocation in speculation, improve team communication and technical issue resolution in exploration, optimize systems in adaptation, and provide valuable insights in closure. The paper offers guidance on effective AI integration to enhance Agile Project Management success.

A. Introduction

The introduction includes background problems related to supporting theories (literature review) or previous studies (both from journals, as well as current phenomena/issues) as the basis for conducting research. The presentation of the introductory part that contains the background of the problem, theoretical basis, or related research does not have to be subtitled, but is integrated into a unified paragraph, and is presented in narrative form. At the end of the introduction, the purpose and usefulness of the research results are also explained. The 16th Annual State of Agile Report reveals that 80% of respondents adopt Agile as their primary approach in their companies [1]. Agile methodologies are increasingly popular due to their ability to stay aligned with customer needs and rapidly adapt to changing business conditions. Research spanning over 200 organizations indicates that companies fostering an adaptive Agile culture experience four times faster revenue growth [2].

However, implementing agile project management poses challenges despite its potential benefits. These challenges include communicating and changing culture and mindset, gaining buy-in from management, customers, and team members, addressing day-to-day operational issues, and drawing from experience to make it work [3].

Stoneseed's Scrum 2021 report reveals that 47% of Agile projects experience delays, budget overruns, or dissatisfied customers, with an additional 11% failing outright [4]. Importantly, the primary cause of these failures lies in the implementation and application of Agile methodologies, rather than the methodologies themselves [5]. For instance, Lalsing found that budget increase of up to 66% due to communication between teams, rework in testing, a high defect rate and unclear requirements clarification and on time [6].

The integration of Artificial Intelligence (AI) into various domains has significant implications for agile project management. The Project Management Institute foresees a future where AI complements human ingenuity, thereby enhancing productivity and project success [4]. Agile project management, with its emphasis on flexibility and collaboration, is well-positioned to leverage AI tools to manage risk, scope, budget, and schedule effectively [7].

This paper aims to conduct a systematic literature review (SLR) to investigate the challenges faced and impacts observed during the implementation of AI in project management, specifically mapping them into Agile Project Management phases. The research questions derived from this objective are as follows:

RQ1: What are the challenges and impacts observed during the implementation of AI in agile project management?

RQ2: How does AI implementation in project management align with Agile Project Management phases?

Through a comprehensive review of existing literature, this study seeks to provide insights into addressing these challenges and harnessing the potential benefits of AI in agile project management effectively.

The paper follows a systematic approach, beginning with a Literature Review section that evaluates existing studies on AI implementation and Agile Project Management phases. The Methodology section comprises three phases:

planning, executing, and presenting the SLR findings. The Results and Analysis section includes two subsections: the first maps AI tools, implementation challenges, and impacts based on prior research, while the second aligns AI tools, challenges, and impacts with Agile Project Management phases (envision, speculate, explore, adapt, closing) [8]. Lastly, the paper concludes by summarizing key findings and discussing their implications for agile project management.

B. Research Method

This section provides detailed information about the SLR's design and execution. The main motivation for conducting an SLR is that it provides an unbiased view and synthesizes the reported work about a particular research area. In this work, we have followed the widely adopted SLR's guidelines as suggested by kitchenham [9].

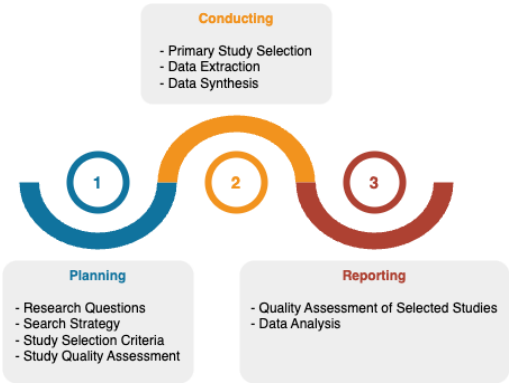

Figure 1. The core phases of SLR

According to kitchenham [9], a SLR comprises three core phases: (i) planning, (ii) conducting, and (iii) reporting the review. Figure 1 highlights the core phases and sub-phases of a SLR. The main motif of the performed SLR was on evaluates existing studies on AI implementation and Agile Project Management phases.

1) Planning

In this stage of the research, keywords are defined by combining main keywords and their synonyms. The main keywords, "Artificial Intelligence" and "Agile Project Management" are connected using "AND" while synonyms or simpler words are connected using "OR." The keywords and their synonyms or equivalents include "Agile Project Management," with synonyms such as "Scrum," "Kanban," "Lean," "Extreme Programming," and "Test-Driven Development," and "Artificial Intelligence," with the synonym "Machine Learning".

The search keywords are created by combining the main keywords and their synonyms, resulting in: ("Agile Project Management" OR "Scrum" OR "Kanban" OR "Lean" OR "Extreme Programming" OR "XP" OR "Test-Driven Development" OR "TDD") AND ("Artificial Intelligence" OR "AI" OR "Machine Learning").

For this research, various digital source repositories were selected to locate relevant articles. The study accessed potential publications from widely used repositories, including the ACM Digital Library, Science Direct, Scopus, IEEE, and Emerald Insight.

After determining which databases to use for the search, the researcher proceeds with the study selection process. A criteria to select the relevant studies was identified in this step. It includes two types of criteria, specifically inclusion and exclusion criteria which can be seen in Figure 2.

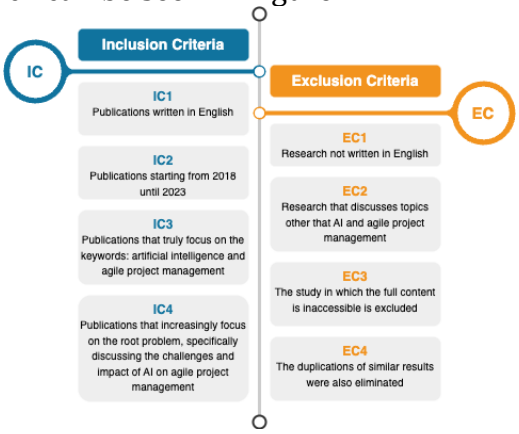

Figure 2. Criteria for Study Selection

2) Implementation

In this stage the focus will be on conducting an extensive search and selecting relevant literature. This involves identifying related studies, extracting relevant information, and synthesizing findings to gain a comprehensive understanding of the research topic.

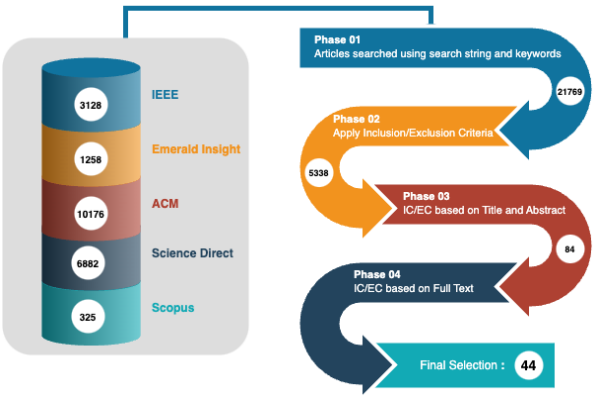

Figure 3. Selection Process

Figure 3 represents the flow that illustrating the selection process conducted from the initial data collection in various databases using the inclusion and exclusion criterias specified in Figure 2.

3) Reporting

The final step of the Systematic Literature Review (SLR) is reporting the results. Table 1 presents a summary of all relevant article titles aligned with the research objectives, including information on the year and reference citation coding.

Table 1. Summary of All Relevant Articles

No	Title	Year	Code

1	A Comparative Study of Machine Learning Algorithm for Predicting Project Management Methodology	2023	[10]
2	A Conceptual Framework for Applying Artificial Intelligence in Project Management	2021	[11]
3	A proposed model for eliminating nonfunctional requirements in Agile Methods using natural language processes	2022	[12]
4	A Review of Effort Estimation in Agile Software Development using Machine Learning Techniques	2022	[13]
5	A TDD Framework for Automated Monitoring in Internet of Things with Machine Learning	2022	[14]
6	Agile Development Methodologies and Natural Language Processing: A Mapping Review	2022	[15]
7	Agile Software and Business Development Using Artificial Intelligence	2022	[16]
8	Agile Technology and Artificial Intelligent Systems in Business Development	2022	[17]
9	AI Desicion Assistant ChatBot for Software Release Planning and Optimized Resource Allocation	2023	[18]
10	AI-Powered Conceptual Model for Scrum Framework	2023	[19]
11	Artificial Intelligence and Agility-Based Model for Successful Project Implementation and Company Competitiveness	2023	[20]
12	Artificial intelligence and resource optimization: A study of Fintech start-ups	2023	[21]
13	Artificial Intelligence based Risk Management Framework for Distributed Agile Software Development	2021	[22]
14	Artificial Intelligence for Technical Debt Management in Software Development	2023	[23]
15	Artificial Intelligence in Project Management: Systematic Literature Review	2022	[24]
16	Artificial Intelligence in Software Test Automation: A Systematic Literature Review	2019	[25]
17	Assessing the Risk of Software Development in Agile Methodologies Using Simulation	2021	[26]
18	Automated Feature Document Review via Interpretable Deep Learning	2023	[27]
19	Automatically Tagging the “AAA" Pattern in Unit Test Cases Using Machine Learning Models	202 2	[28]
20	Automating Root Cause Analysis via Machine Learning in Agile Software Testing Environments	2019	[29]
21	Combination of Scrum Lean-UX-based AI UX Design	2023	[30]
22	Data-driven effort estimation techniques of agile user stories: a systematic literature review	2022	[31]
23	Effort and Cost Estimation Using Decision Tree Techniques and Story Points in Agile Software Development	2023	[32]
24	Effort Estimation using Bayesian Networks for Agile Development	2019	[33]
25	Exploring the Challenges and Impacts of Artificial Intelligence Implementation in Project Management: A Systematic Literature Review	2023	[34]
26	Fuzzy Logic-based Expert System for Effort Estimation in Scrum Projects	2021	[35]
27	Information Technology (IT) Governance Framework with Artificial Neural Network and Balance Scorecard to Improve the Success Rate of Software Projects	2022	[36]
28	Integrating Interactive Detection of Code Smells into Scrum: Feasibility, Benefits, and Challenges	2023	[37]
29	Interplay of Machine Learning and Software Engineering for Quality Estimations	2020	[38]
30	Machine Learning models to predict Agile Methodology adoption	2020	[39]
31	Machine Learning-based Estimation of Story Points in Agile Development: Industrial Experience and Lessons Learned	2021	[40]
32	Managing Risks in Agile Methods: a Systematic Literature Mapping	2022	[41]

33	Predictive Analysis of Manpower Requirements in Scrum Projects Using Regression Techniques	2020	[42]
34	Project Management Effort Estimation Using Agile Manager game platform	2022	[43]
35	Project management: openings for disruption from AI and advanced analytics	2021	[44]
36	Scaled Agile Framework Implementation in Organizations', its Shortcomings and an AI Based Solution to Track Team's Performance	2022	[45]
37	Software Effort Estimation for Agile Software Development Using a Strategy Based on k-Nearest Neighbors Algorithm	2022	[46]
38	Task Allocation in Distributed Agile Software Development using Machine Learning Approach	2021	[47]
39	TaskAllocator: A Recommendation Approach for Role-based Tasks Allocation in Agile Software Development	2021	[48]
40	Intelligent software engineering in the context of agile software development: A systematic literature review	2020	[49]
41	Towards Challenges Faced in Agile Risk Management Practices	2023	[50]
42	Towards Effective AI-powered Agile Project Management	2019	[51]
43	User Story Splitting in Agile Software Development using Machine Learning Approach	2022	[52]
44	Using Machine Learning to Prioritize Automated Testing in an Agile Environment	2019	[53]

Furthermore, the distribution of the scientific articles based on their publication years is presented in Figure 4.

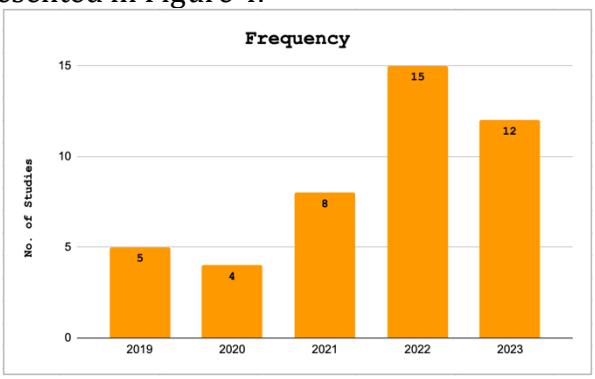

Figure 4. Selection Process

C. Result and Discussion

In accordance with the objective of this research, a thorough mapping and analysis of the literature obtained will be conducted using the Systematic Literature Review (SLR) method described in the previous chapter. The outcomes obtained from this process will be divided into the mapping of AI tools used, challenges, and the impact of AI implementation on each article, as well as their summaries.

1) Mapping the AI tools, Implementation Challenges and Impacts based on Related Studies

Table 2 presents the analysis results of the articles obtained through the systematic literature review (SLR), focusing on the AI tools used, implementation challenges, and impacts identified in the referenced studies. These AI tools cover algorithms, software, models, and other relevant methodologies.

Table 1. Summary of All Relevant Articles

Ref	AI Tools	Challenge	Impact
[10]	Machine learning algorithms (Decision Tree, K-Nearest Neighbors, Gradient Boosting, Neural Network, Naive Bayes, Support Vector Machine and Bayesian Network)	Selecting the appropriate project management methodology is one of the challenges faced by project managers. Predicting the adoption of agile or traditional methodology during the early stage of the project could contribute to its success.	AI help project managers make the right decisions and select the most suitable project management approach.
[11]	AI techniques/functions	Most AI methods, especially machine learning, require comprehensive sets of historical data, the benefits of applying AI to project management (PM) seem to be hardly worthwhile.	AI provides benefits towards efficiency goals (time, cost, quality), effectiveness goals (product quality, stakeholder satisfaction, business impact).
[12]	Natural Language Processing	An important step in software creation is the elicitation of requirements where poor elicitation choices cause the system to not function properly.	AI can be used to elicit Functional Requirement and Non-Functional Requirement in early phases of agile projects to reduce time, effort, and risk.
[13]	Machine Learning Techniques (Random Forest, Decision Tree, SGB and Neural Network Models, DBN-ALO)	Estimation of time, effort, and size of a project is a challenging task in agile software development due to the changing requirement during development.	Machine Learning Techniques (DBN-ALO) provides better effort estimation accuracy as compared to other techniques.
[14]	K-Means algorithm	The IoT infrastructure is often used to collect a large amount of data to meet the business demands of Smart Cities, Industry 4.0, and Smart Home, but there is an opportunity to use these data to intrinsically monitor an IoT system in an autonomous way.	AI was applied to free memory available, internal temperature and Wi-Fi level metrics to automatically monitor the IoT devices under development to identify device constraints violation and provide insights for monitoring frequency configuration of different firmware versions.
[15]	Natural Language Processing	Utilizing NLP to reduce problems during the documentation process in agile software development.	AI can help improve requirements engineering, transform artifacts such as user stories, improve one or many elements of the agile development process such as time estimation, cost, acceptance tests and code generation of unit tests. On the other hand, it can also improve communication within the team.
[16]	Simple Reflex Agent, Goal-Based Agents	How quality is maintained while sending products to customers as soon as possible.	The use of artificial intelligence (AI) technology is beneficial for farmers in analyzing their land, soil, health, and plants to produce

			good quality products.
[17]	AI techniques, machine learning algorithms	Examines how Agile methodology and concepts are used to the delivery of artificial intelligence as well as how Agile has transformed over time.	AI can assist in automating tactical procedures like the classification of marketing data, responding to frequent consumer inquiries, and performing security authorizations.
[18]	Machine learning algorithms (Extreme gradient boosting (XGBoost), K-nearest neighbors (K-NN))	Presents a web-based artificial intelligence (AI) chatbot that designed to facilitate Agile software release planning by using two machine learning (ML) models to estimate the time for each task selected by the project managers and recommend the optimal resource to be assigned to each task.	AI techniques provide all the needed tools to the managers to help them in release planning and in assessing the expected risks by allowing them to foresee the expected time estimates of the whole release.
[19]	Machine learning algorithms (Logistic Regression, Naive Byes, Decision Tree, Random Forest, K-Nearest Neighbors)	Although many organizations are adopting Scrum, it is still following the traditional manual approaches. Even though many tools are available in the market to facilitate project management and Scrum master tasks, the support is still limited and lacks the utilization of Artificial Intelligence science.	Machine Learning Techniques (Random Forest) had the best accuracy among all the algorithms to predict the total achieved story points for scrum teams.
[20]	AI techniques, machine learning algorithms, data analysis methods	Presents a model of factors influencing the successful implementation of projects by introducing agility and artificial intelligence to increase the competitiveness of companies.	Using AI solutions in a project, which have a positive effect on successful project implementation to increase company competitiveness. This presents vast opportunities for new products and services, significant improvements in productivity and efficiency, and the potential for increased revenue and competitive advantage.
[21]	AI techniques, machine learning algorithms	Very few studies have focused on examining how implementing disruptive technologies such as AI can affect FinTech start-ups' internal organizational resources and external natural resources including minerals and the allied industries.	AI has affected internal and external organizational resources.
[22]	Artificial Intelligence based Risk Management Framework (AIRMF) for DASD	Identifying and managing risk on time improves the quality of the software product and reduces the overall development cost.	AI based Risk Management Framework will reduce the time in managing risks, thereby reducing the overall cost of the project.
[23]	Natural Language Processing, Static Analysis, Deep Learning, Cognitive	Presents a comprehensive literature review of existing research on the use of AI-powered tools to avoid technical debt in	AI has proven to be a promising approach to help manage technical debt that negatively impacts software

	Biasing, SonarQube, CAST, CodeInspector, NDepend, Squore, Symfony Insight	software development.	quality, maintainability, and performance.
[24]	AI techniques, machine learning algorithms, data analysis methods	Although artificial intelligence applied to the field of project management is not new, some evidence shows that there is still a lack of knowledge about artificial intelligence in project management.	Automated staff assignment for building maintenance using natural language processing. AI is used in estimating and planning, scheduling, adjusting estimates, and maintaining baselines.
[25]	AI techniques, machine learning algorithms	Review how artificial intelligence works in software test automation.	AI enhanced precision, reduced defects, improved accuracy, better test coverage. Time and money saved equates to a quicker time to market.
[26]	Machine learning algorithms (Bayesian networks, Rough Set, Multi-layer-perceptron, Fuzzy comprehensive evaluation)	The risk of project failure or time and budget overruns is still a relevant problem.	AI can predict the number of residual defects of a system, selecting and prioritizing a set of critical threats in a software development project to minimize risks, generate risk prompts, assess the risk level of a software project, estimate a project's risk level.
[27]	Neural networks, Interpretable Deep Learning	Feature documents play a critical role in controlling software development at a macro level. It is therefore important to ensure the quality of feature documents so that defects are not introduced at the outset.	AI can help reduce the workload of the reviewers along with decreasing the overall time of feature review and assist engineers to write better quality feature documents.
[28]	Machine learning algorithms	The Arrangement, Action, and Assertion is a common and nature layout to create a test case. Following this pattern in test cases may benefit comprehension, debugging, and maintenance. The AAA structure of real-life test cases may not be explicit due to its high complexity. Manually labelling AAA statements in test cases is tedious. Thus, an automated approach for labelling AAA statements in existing test cases could benefit new developers and projects that practice collective code ownership and test-driven development.	AI able to identify Arrangement, Action, and Assertion statements with a precision upwards of 92% and recall up to 74% in Unit Test Cases
[29]	Artificial Neural Networks	The large amounts of raw diagnostics (log data) that test engineers need to analyze to retrieve failed tests and trace their RCA still done manually, with test engineers generally relying on their accumulated experience to	AI classifies data or preprocesses it for grouping.

		examine what they consider to be suspicious log files, often by asking for predefined keywords	
[30]	Machine learning algorithms and techniques	The combination of Agile UX, e-commerce, and AI creates an app that delivers personalized product recommendations to users. This app allows users to browse and purchase products from the company's online store. To develop this app, the company would use a combination of Scrum and Lean UX methodologies.	AI improves the user experience by providing personalized recommendations and enhancing the overall usability of the app.
[31]	Machine learning algorithms	Research regarding a comprehensive overview of data-driven techniques for user story effort estimation is still very limited.	Data-driven techniques have proven effective in estimating agile user story effort estimates.
[32]	Machine learning algorithms (Decision tree, random forest and AdaBoost)	Early effort estimation is important for efficiently planning the use of resources in an Information Technology (IT) project. However, limited research has been conducted on the topic of effort estimation in agile software development using artificial intelligence.	AI can generalize information and provide reliable results for project planning using story points, from product backlogs and team features such as velocity.
[33]	Bayesian Networks	Proposed an automated method for estimating development effort based on narrative text.	AI estimates story points with 83% accuracy.
[34]	Machine learning algorithms	Presents a systematic literature review (SLR) investigating the challenges and impacts of implementing artificial intelligence (AI) in project management, specifically mapping them into the process groups defined in the Project Management Body of Knowledge (PMBOK).	AI improves initiating, planning, execution, monitoring, controlling, and closing to the Process Groups in PMBOK.
[35]	Fuzzy Logic	Estimating effort is crucial for planning and managing software projects. The accuracy of the effort estimate directly impacts the success of a software project, underestimating the work can result in cost overruns while overestimating the effort can harm the organization’s competitiveness.	AI can improve effort estimation in the scrum process.
[36]	Artificial Neural Network (ANN) method, Balanced Score Card framework	Top management commitment, solution finding, and data availability.	AI integration in software project management enables informed decision-making and better outcomes, leading to the development of new project life-cycle solutions.
[37]	AI techniques, machine learning algorithms	Code smells indicate poor coding practices or design flaws, suggesting deeper software quality	AI assist in detecting code smells.

		issues. While addressing code smells promptly improves software quality, traditional detection techniques often fail in continuous detection during software development.	
[38]	Machine learning algorithms and techniques	The CI/CD integration requires manual code-revisions and refactoring at large scales.	AI helps in automating and optimizing SE processes, whereas SE helps in developing proper ML- based systems with appropriate integration and maintenance.
[39]	Machine learning algorithms	The success of software projects has significantly improved while using Agile methodologies in comparison to the Waterfall methodology, a large proportion of projects continue to be challenged or fails.	AI can predict the accuracy of Scrum adoption based on a feature set derived from a survey questionnaire's response data.
[40]	Deep-SE	Estimating story points is an important activity in agile software engineering. Story-point estimation enables software development teams to, among other things, better scope products, prioritize requirements, allocate resources, and measure progress.	AI achieved a mean absolute error of 1.46, significantly better than three different baselines for estimating story points.
[41]	Machine learning algorithms	Explicit risk management is often ignored as agile methods deal with risk intrinsically and focus on rapid value delivery.	AI estimates the impact of risks and converts them into risk detection and control actions. Risk management in software projects has even attracted the application of Machine Learning (ML) which aims to identify or predict risks before project development begins.
[42]	Machine learning algorithms (Linear Regression models, Support Vector Machine models, Tree models, Ensemble models and Gaussian Process)	Agile projects work in self-organizing small collaborative teams. Team size varies according to the project requirement however, agile development focus on smaller team size. Supervised learning is applied to provide optimum prediction model.	AI predicts the number of team members for a Scrum project.
[43]	Machine learning algorithms (Naïve bayes, IBK, Decision tree J48 and AdaBoostM)	Effort estimation research studied the effort spent in direct software project development. While the effort involved in indirect software project development increased, management is considered as an indirect effort, but it influenced the overall effort since many foundations prefer buying software rather than building it.	AI determines the impact of the manager's personality and the nature of the task on management efforts.
[44]	Software tools with AI and analytics features	Project managers adapting to software features.	AI and analytics tools enhance project management with

			increased support, automation, and adaptive practices, emphasizing stakeholder relations and risk management.
[45]	Machine learning algorithms	The traditional Software Development Life Cycle (SDLC) created models like Waterfall Model, RAD model, etc. But this approach required extensive documentation, lacked customer involvement, and could not develop responsive software.	AI predict the mean percentage probability of whether the features of a particular sprint in a release will be completed in the remaining time or not.
[46]	k-Nearest Neighbors Algorithm	Enterprises need to respond quickly to the needs of their customers and stakeholders and by adopting agile practices in IT teams, business value is raised in both performance and quality, so it is important to adopt practices and models that ensure the time, scope and cost of a project are achieved successfully.	AI build effort estimation model that uses a story point to estimate completion time and total cost of a project that is developed with agile methods like Scrum.
[47]	Ontologies and Bayesian network	To design and implement a method for job allocation in distributed Agile software development that is based on machine learning.	AI helping on decision making for task assignment/allocation in distributed agile software development.
[48]	Natural Languange Processing	Approach, identifying team roles rather than individual persons, allows project managers to perform better tasks allocation in case the individual developers are over-utilized or moved on to different roles/projects.	AI is useful when developers are either over-committed or have already changed the team/role, or when the manager wants to distribute the task knowledge among multiple team members.
[49]	Bayesian networks	Synthesize and analyze the state of the art of the field of applying intelligent techniques to Agile Software Development (ASD).	AI helps on software engineering management, more specifically, effort estimation, requirements prioritization, resource allocation, requirements selection for a release or sprint and requirements management.
[50]	Machine learning algorithms	Potential problems that occur could also have a bad impact on the technical success, project's budget, timetable the product's quality, or the team's morale. The process of recognizing, addressing, and removing these issues before they affect the project is known as risk management.	AI improves the use of data generated during software development processes. To improve current risk modelling techniques, a lot of industry knowledge about security vulnerabilities can be used.
[51]	Machine learning algorithms (Natural Language Processing)	Propose a framework where AI technologies can be leveraged to offer support for managing agile projects, which have become increasingly popular in the	AI assist project managers and team members by automating repetitive, high-volume tasks to enable project analytics for estimation and risk prediction,

		industry.	providing actionable recommendations, and even making decisions. AI can serve as a distinctive accelerator for agile teams and thus help increase project success rates.
[52]	Machine learning algorithms (K-medoids and K- means clustering)	The quality of the user story should also be maintained semantically. As semantics gives meaningful artifacts about the customer requirements. User stories can be written easily, if there is complexity then need attention to make it easy. As user story splitting techniques are available to split various user stories.	AI reduces the software development time of requirements and also improves performance.
[53]	Machine learning algorithms	The number of tests increases to such a point that the time required to run all the tests often hinders the speed in which artifacts can be deployed.	AI can predict where defects might be in the source files and then prioritize testing appropriately.

2) Mapping the AI tools, Implementation Challenges and Impacts based on Related Studies

Table 3 presents the further analysis results of the articles obtained in the previous SLR process, where the analysis is conducted regarding the AI tools used in the referenced studies, as well as the challenges and impacts of implementation in those studies. These AI tools can include algorithms, software, models, or others.

Table 3. Summary of All Relevant Articles

No	APM Phases	Reference	Client
1	Envision	[10], [11], [12], [15], [21], [22], [34], [39], [42], [43], [44].	11
2	Speculate	[13], [15], [18], [19], [24], [31], [32], [33], [34], [35], [40], [41], [46], [47], [48], [49], [50], [51], [52].	19
3	Explore	[15], [16], [17], [18], [19], [20], [26], [27], [28], [29], [30], [34], [36], [37], [38], [53].	16
4	Adapt	[14], [15], [34].	3
5	Close	[23], [25], [34], [45].	4

In the envision phase, 11 scientific papers were found that have significant impacts and helps project managers in many ways, especially in the initial planning process. AI help project managers make the right decisions and select the most

suitable project management approach [10] and predict the accuracy of project management methodology [39]. AI provides benefits towards efficiency goals (time, cost, quality), effectiveness goals (product quality, stakeholder satisfaction, business impact), risk [11] [22] [34] [44]. Which can then be derived to obtain functional and non-functional requirements [12] [15]. PM will also be able to assist with internal and external organizational resources in initial project discussions [21] and predict the number of team members for a project [45]. In summary, the 11 scientific papers examined showcase a wide range of tools and methodologies that address various challenges in the envision phase. The application of these tools has a profound impact on risk assessment, project selection, cost estimation and overall project success rates. Additionally, the integration of AI and agile project management can predict several aspects in terms of adoption of agile methodology and team member allocation.

In the speculate phase, 19 scientific papers were found that show how important this phase needs to be focused on or improved. AI provides better effort estimation accuracy depicted in artifact user stories [13][15][24][31-35][40][46] [49-51]. AI helps PM in release planning and in assessing the expected risks by allowing them to foresee the expected time estimates of the whole release [18]. AI can also be used to predict the total story points achieved by the scrum team so that sprint goals can be achieved [19] [52]. AI estimates the impact of risks and turns them into risk detection and control actions outlined in user stories [41]. Task allocation for each team member can also take advantage of AI to be more effective in the work process [47][48][49][52]. In summary, the 19 scientific papers examined showcase a wide range of tools and methodologies that address various challenges in the speculate phase. The application of these tools has a profound impact on effort estimation, assessing the expected risks, and resource allocation. Additionally, the integration of AI and agile project management can predict total story points achieved by the scrum team to make sure the sprint goals can be achieved.

The explore phase found 16 scientific papers focuses on how to complete and implement features for every defined iteration with a high-quality testing. During the work process, intense communication is needed to ensure the process runs smoothly. AI can improve communication within the team [15]. Technical aspects also benefit from AI. AI can help on the analysis process [16], classification of data, responding to consumer inquiries, automating development process, detecting code smells and performing security authorizations [17][29][30][34] [36][37][38], covering the unit test [28]. AI also can be used to predict the number of residual defects of a system that has been developed [26][53]. In summary, the 16 scientific papers examined showcase a wide range of tools and methodologies that address various challenges in the explore phase. The application of these tools has a profound impact on improving communication within the team during the development process, few technical aspects also benefit from AI and AI can be used to predict the residual defects.

The adapt phase found 3 scientific papers which provided the right time for the team to compare results on features outlined during the Explore section with the plans first defined during the Speculate phase if the feature still need some modifications or has meet expectations. In summary, the 3 scientific papers

examined showcase that AI was applied to improve the existing system and agile process [14][15][34].

The close phase found 4 scientific papers that provides time for the teams to compile lessons learned throughout the project that they can apply on future engagements. AI has proven to be a promising approach to help manage technical debt that negatively impacts software quality, maintainability and performance, improved accuracy and closing that can be used as learning material in the future [23][25][34]. Additionally, the integration of AI and agile project management can predict the probability of whether a particular sprint feature in a release will be completed in the remaining time or not [45].

The findings from this systematic literature review hold significant implications for professionals engaged in Agile Project Management. As the adoption of Agile methodologies continues to rise, and organizations increasingly leverage the power of Artificial Intelligence (AI), understanding the intersection between AI implementation and Agile methodologies becomes paramount for achieving effective and efficient project management practices.

D. Conclusion

The results of the systematic literature review (SLR) provide significant insights into the application of AI in Agile Project Management. Despite the challenges and associated risks, the findings underscore the importance of leveraging advanced tools and techniques in each phase of Agile Project Management for successful AI implementation.

In the envision phase, AI application enhances risk assessment, project selection, cost estimation, and overall project success rates. The speculate phase benefits from improved effort estimation accuracy and the ability to predict total story points, aiding in achieving sprint goals and optimizing task allocation. Additionally, AI contributes to improved communication within teams and addresses technical challenges in the explore phase. The adapt phase sees the application of AI to improve existing systems and Agile processes, facilitating better decision-making and adaptation. Finally, in the close phase, AI assists in compiling project lessons learned, enhancing accuracy, and guiding future engagements.

Overall, these SLRs offer valuable insights for organizations seeking to integrate AI into their Agile Project Management practices. By aligning challenges and impacts with Agile Project Management phases, this research provides a structured framework for effectively leveraging AI applications to improve project outcomes and increase productivity.

E. References

Articles must refer to at least 10 primary references published in the last 5 years. Writing a reference list must use the IEEE Mendeley style tool with the following conditions. [Cambria 12, space single]

Journal Article

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