Systematic Literature and Expert Review of Agile Methodology Usage in Business Intelligence Projects

Hapsari Wulandari[1]* ID, Teguh Raharjo[2]

[1)2)]*Faculty of Computer Science, University of Indonesia, Jakarta, Indonesia*

[1)]hapsari.wulandari@ui.ac.id, [2)]teguhr2000@gmail.com

Abstract

Background: Agile methodology is known for delivering effective projects with added value within a shorter timeframe, especially in Business Intelligence (BI) system which is a valuable tool for informed decision-making. However, identifying impactful elements for successful BI implementation is complex due to the wide range of Agile attributes.
Objective: This research aims to systematically review and analyze the integration of BI within Agile methodology, providing valuable guidance for future projects implementation, enhancing the understanding of effective application, and identifying influential factors.
Methods: Based on the Kitchenham method, 19 papers were analyzed from 288 papers, sourced from databases like Scopus, ACM, IEEE, and others published in 2016-2022. Meanwhile the extracted key factors impacting agile BI implementation were validated by qualified expert.
Results: Agile was discovered to provide numerous benefits to BI projects by promoting flexibility, collaboration, and rapid iteration for enhanced adaptability, while effectively addressing challenges including those related to technology, management, and skills gaps. In addition, Agile methods, including tasks such as calculating cycle time, measuring defect backlogs, mapping code ownership, and engaging end users, offered practical solutions. The advantages included adaptability, success, value enhancement, cost reduction, shortened timelines, and improved precision. The research additionally considered other critical Agile elements such as BI tools, Agile Practices, Manifesto, and Methods, thereby enhancing insights for successful implementation.
Conclusion: In conclusion, the research outlined Agile BI implementation into seven key factor groups, validated by qualified expert, providing guidance for BI integration and practices, and establishing a fundamental baseline for future applications.

Keywords: Agile Methodology, Business Intelligence (BI), Expert Judgement, Kitchenham, Systematic Literature Review (SLR)

Article history: Received 28 April 2023, first decision 16 June 2023, accepted 29 September 2023, available online 28 October 2023

I. INTRODUCTION

Business Intelligence (BI) is known to play a crucial role in the competitive business landscape, enabling informed decision-making by systematically collecting data on competitors, customers, and markets [1]. To stay competitive and effectively respond to shifts in market conditions, companies rely on valuable resources such as BI systems, providing quantifiable data for informed decision-making processes, by analyzing extensive datasets to identify trends and provide recommendations [2]. The need to build BI systems that can adapt to unforeseen or changing demands within a set timeframe is driven by the increasingly complex and dynamic nature of organizational environments [3]. Information Technology (IT) departments should regularize the quick delivery of high-quality technology solutions to maintain a competitive advantage.

However, conventional methodologies are frequently rigid and stringent, causing difficulties in adjusting to evolving business demands [4], as the implementation process is time-consuming, leading to a mismatch between the initial solution design and the final user requirements upon projects completion [5]. Agile methodology can enhance BI projects by delivering initial results and increasing value at a faster pace compared to traditional methods [5]. The complexity of BI systems, akin to enterprise or infrastructure projects [4], includes hardware, software, and resources used throughout their lifespan. Therefore, as the scope of BI system expands, the complexity of the infrastructure increases [4].

The existing literature on BI implementation and Agile methodology outlines the need for further research on the integration of these two concepts. However, the current literature lacks practical insights and guidance on the effective

---

* Corresponding author

integration of BI and Agile methods. Similar research has been conducted by Krawatzeck et al [3], which explored making BI more Agile by categorizing four fundamental key groups, namely 'principles', 'process models', 'techniques', and 'technologies'. Therefore, this research introduces additional groups of factors including obstacles, solutions, and the advantages derived from implementing BI within Agile framework [6]. It also provides a clear understanding of the benefits of using Agile for BI, enabling stakeholders to make well-informed decisions [7]. This research has quantified the most influential factors of BI system implementation through Agile, providing stakeholders insights that facilitate informed decision-making.

Successful BI projects tend to rely on a proficient Agile implementation, specifically during its initial stages, as it factors in critical elements essential for obtaining success [8]. This manuscript outlined the significance of integrating BI practices into Agile methodology, by categorizing Agile factors into several key groups that contribute to the success of BI development. Therefore, this research was conducted by applying the Systematic Literature Review (SLR) method following Kitchenham et al's guidelines. [9]. Following this, it comprehensively surveyed sources from Scopus, ACM, IEEE, Science Direct, Taylor & Francis, SAGE Journals, and ProQuest. The objective is to provide an optimal understanding of BI within the context of Agile methodology, including identifying areas where further research is needed or has already been extensively researched for both practitioners and research projects.

The results of SLR analysis obtained were validated by experienced practitioners further lending credibility and contributing to optimal understanding of how this integration can lead to more effective BI projects within the ever-evolving competitive business environment. This was performed to ensure the validity of the key factors that were obtained from SLR, including a summary of the ranking of factors in each key group.

II. LITERATURE REVIEW

A. Business Intelligence

Business Intelligence (BI) refers to a range of software tools used to analyze organizations data [10], including activities such as data mining, Online Analytical Processing (OLAP), querying, and reporting. Organizations use BI to enhance their decision-making processes, decrease expenses, and identify new opportunities [11]. BI typically includes the use of software applications to collect and analyze data from various sources within an organization, such as sales figures, customer data, and financial records [12]. It also provides organizations with insights and information that contribute to better decisions, identify new opportunities, and optimize their operations [13]. BI systems frequently comprise various features, such as data visualization, reporting, and dashboards, assisting in comprehending and analyzing the data. It is used in a wide range of industries, including finance, healthcare, retail, and manufacturing, to support decision-making at all levels of an organization [4].

B. Agile Methodology

In recent years, Agile methodology has gained significant popularity for its ability to manage software development projects in an adaptable and flexible manner. It is also a software development process that is based on incremental and iterative development, where requirements and solutions are determined through collaborative efforts among cross-functional and self-organizing teams [13]. In Agile methodology, there is continuous user interaction throughout projects, and requirements are subject to regular changes or adaptations, making it markedly distinct from other methodologies [11]. This methodology focuses on flexibility, customer collaboration, and the continuous delivery of functional software [12]. Therefore, adopting Agile methodology can help software development projects respond more efficiently to changing requirements and produce high-quality software that meets customer demands [13].

C. BI Implementation Using Agile Methodology

The use of Agile methodology in BI systems is becoming increasingly important to adapt to the rapidly changing requirements of business environment [14], enabling flexibility, collaboration, rapid iteration [12], and the ability to deliver value to stakeholders more quickly [5]. Therefore, Agile methodology typically includes breaking projects down into small, incremental stages, with each phase delivering a specific piece of functionality or value [13]. Through the adoption of this methodology, the team can offer value to stakeholders on a consistent and predictable basis, rather than waiting until project's completion to showcase the outcomes [15]. Agile methodology also encourages collaboration and communication among team members, which can be particularly important in BI projects where ~~multiple~~ departments or functions may be included [12]. Through iterative and incremental collaboration, team members can share ideas, offer feedback, and make necessary adjustments. Hence, Agile can be a useful methodology in BI projects because it enables greater flexibility, faster delivery of value, and improved collaboration among team members.

D. Related Secondary Research

The research is significant in aiming to bridge the gap between previous assays that discussed SLR of BI implementation using Agile methodology. Meanwhile, several SLRs of BI implementation have not discussed Agile methodology comprehensively. Similarly, some research has already performed SLR of Agile methodology, discussing data analytics in general, but they do not specifically explain BI implementation terms.

Bajaj et al. [7] conducted survey-based research of BI implementation on Agile practitioners, aiming to identify methodologies, gaps, and challenges faced in different organizations. The survey consisted of 24 matrices and 5 open-ended questions, with a total of 19 participants having experience in Agile BI implementation. The collected responses were analyzed using univariate analysis to gain overall insights. The primary reasons for opting for Agile method in BI implementation included its capability to meet demanding deadlines, improve output quality, and efficiently identify issues.

El-Adaileh et al. [16] conducted an SLR on factors affecting successful BI implementation, using keywords, such as "business," "intelligence," and "implementation," resulting in a preliminary review of relevant articles [16]. Furthermore, content analysis was used to gain a comprehensive understanding of these factors identified in previous research. A total of 38 articles compiled from 11 databases published between 1998 and 2018, resulting in 10 factors as the main impact for successful BI implementation, such as management support, data source systems, organizational resources, IT infrastructure, vision, projects advocate, team skills, projects management, user participation, and change management [16].

Yin et al. [17] also conducted an SLR of business analytics implementation, using 40 articles from two databases published between 2000 and 2018. Based on the bibliometric information of the papers selected, the research included an analysis of trends and patterns within literature [17]. Literature was reviewed and relevant sections were inductively coded using MAXQDA *(quantitative analysis software)*, enabling systematic analysis and organizing the results from the selected articles [17]. The research resulted in four results, such as the rapid growth of business analytics literature, how BI implementation supports organizational performance, and applications in various sectors, such as technical and business skills [17]. Neither El-Adaileh's nor Yin's research included Agile methodology in implementing BI but only conducted SLRs in general terms without any model specification.

Biesialska et al. [18] showed how data analytics (software analytics, data analytics, machine learning, and artificial intelligence) can support and improve Agile software development (ASD) using systematic mapping (SM) rather than SLR due to the broad research topic. A comprehensive manual search and snowballing method were performed on papers published between 2011 and 2019 from the IEEE database and 88 relevant articles were selected [18]. The research used a multi-stage selection process, initially based on title and abstract screening, followed by a quick read of papers to ensure relevance [18]. Subsequently, full-text reading was carried out for further refinement, and a 1st Round snowballing method was used by reviewing the references cited in the selected papers. In the 2nd Round, both forward and backward snowballing were performed, leading to the inclusion of additional relevant research in the analysis [18]. The results outlined three categories of Agile software development supported by data analytics, namely Agile practices, engineering, and methods [18].

Krasteva et al. [19] conducted SLR to explore the adoption of Agile methodologyin various data science contexts. Review included case research published between 2012 and 2017, with 14 identified relevant papers on the intersection of Agile methodology and large data from reputable sources such as ACM Digital Library, IEEEXplore, Scopus, and ScienceDirect [19]. The keywords used included "Agile," "scrum," "kanban," "extreme programming," "large data," and "data science" [19]. The research concluded that the dynamics of big data projects differ from traditional software engineering programs in terms of people, processes, and technologies [19]. However, recent evidence suggests that adopting Agile methods in large data projects can be beneficial and suitable, showcasing their potential to bring positive outcomes [19].

Saltz et al. [20] conducted an SLR using a manual literature review from 2014-2016, resulting in 42 works of literature from six conferences and 33 journals. The online search strategy was performed using several keywords such as "big data" and "data science". The data extraction process was assessed by their title and abstract manual from papers in the journals and conferences. The research outlined several key factors, such as data needed, governance activities, process, objectives, team, and tools needed for successful large data projects [20].

Mikalef et al. [21] conducted an SLR analyzing big data analytics capability using the resource-based view theory. A total of 84 pieces of literature were selected from 2010 onwards and various academic outlets, including journal articles, conference proceedings, and reports for business executives [21]. Therefore, to ensure comprehensive coverage, the research strategy included electronic databases, such as Scopus, Business Source Complete, Emerald, Taylor & Francis, Springer, Web of Knowledge, ABI/Inform Complete, IEEE Xplore, and the Association of Information Systems (AIS) library [21]. Meanwhile, to complement these efforts, the research used the search engine Google Scholar and explored the AIS basket of eight journals for further relevant sources [21]. The keywords used

included analytics capability, competitive performance, firm performance, organizational performance, dynamic capabilities, resource-based view, human skills, managerial skills, analytics ecosystems, data scientist, competencies, and resource management. The research proposed a framework based on prior literature in IT-business value, strategic management, and management IS literature, providing a reference for broader large data implementation in business context [21].

Despite the discussion of Agile methodology in the research conducted by Bajaj et al. [7], El-Adaileh et al. [16], Yin et al. [17], Biesialska et al. [18], Krasteva et al. [19], Saltz et al. [20] and Mikalef et al. [21], limited explanation was presented in the context of BI implementation. Therefore, this research focused on various aspects related to large data, Agile software development, and data analytics capability but did not directly address the combination of Agile methodology and BI implementation. Therefore, a gap remains in the existing literature regarding the investigation of Agile methodology in the context of BI implementation.

SLR was carried out to investigate Agile implementation of BI systems from an alternative perspective. While building on the foundational work by Bajaj et al. [7], a comprehensive method was used by analyzing existing literature, validated by qualified expert. This systematic review and validation ensure a strong exploration of the topic within a new framework.

III. METHOD

A. Protocol and Registration

This research followed the protocol outlined by Kitchenham et al. [9], including planning, implementation, and reporting steps. This comprehensive method ensures a systematic and thorough review process, enhancing the reliability of the results.

B. Eligibility Criteria

1) The need

The primary aim of the current research is to identify essential considerations for the successful application of Agile methodology. This was performed to address the increasing demand for insights into the best practices and challenges associated with integrating Agile principles into BI projects. The research aimed to explore the key factors influencing the effectiveness of Agile BI implementation and provide valuable guidance for organizations seeking to adopt this method. It also aimed to enhance the understanding of how Agile methodology can be customized and optimized to support BI initiatives, improving organizational performance and decision-making processes through analysis of existing literature. The results provided valuable insights for BI practitioners, projects manager, and stakeholders, assisting in navigating the complexities of Agile BI implementation and facilitating successful adoption in diverse business contexts.

2) Specifying the research question:

To meet the objective, seven research questions (RQs) have been identified as follows.

RQ1: What BI tools are commonly used for BI implementation using Agile methodology?

RQ2: What Agile methods are used in BI implementation using Agile methodology?

RQ3: What aspects of agile manifesto are used in BI implementation using Agile methodology?

RQ4: What Agile practices are applied in BI implementation using Agile methodology?

RQ5: What benefits prompted the adoption of Agile methodology in BI projects?

RQ6: What obstacles or potential issues hinder the adoption of Agile methodology in BI projects?

RQ7: What solutions are frequently used to address challenges and support the adoption of Agile methodology in BI projects?

C. Information Source and Search Strategies

This research focused on conducting metadata-based string searches in seven digital databases, such as Scopus, ACM, IEEE, Science Direct, Taylor & Francis, SAGE Journals, and ProQuest databases, processed using the Mendeley Desktop application. Scopus is renowned for its comprehensive database of peer-reviewed literature and is widely used in academic research. ACM and IEEE are reputable sources for computer science and technology-related publications, while Science Direct, Taylor & Francis, and SAGE Journals offer a vast collection of academic journals in various subjects, including information systems and data analytics. The articles collected in the ProQuest database have been through a quality control process and validated by qualified expert. ProQuest is a valuable source as it offers a rich selection of literature directly related to the topic, improving the quantity of relevant materials available.

Therefore, the criteria for inclusion and exclusion in this literature review were formulated based on the research questions, ensuring the reliability of the obtained results following Kitchenham's guidelines [9]. During the initiation

phase, paper selection was based on Boolean criteria. In Phase 1, research related to BI using Agile methodology were identified while excluding traditional methods. Moving to Phase 2, a full-text analysis was conducted, focusing on research discussing BI implementation with Agile methodology, examining advantages, issues, and providing solutions. Research not explicitly discussing Agile methodology were excluded to ensure targeted and relevant literature. Phase 3 involved assessing full-text and publication year, including only English research for consistency and accessibility.

The time frame was not arbitrarily defined but it was selected based on several factors. Firstly, focusing on recent publications allows the authors to capture the latest developments, advancements, and evolving trends in the field. Secondly, technological and industry changes occur rapidly in many research domains and limiting the scope to the last seven years ensures that the selected literature remains current and correlates with present practices. By setting a specific timeframe, the research's focus was maintained and a meaningful analysis of the most up-to-date and reliable research in the field was provided. The inclusion and exclusion criteria have already been established as outlined in Table 1.

TABLE 1
INCLUSION AND EXCLUSION CRITERIA USED IN EACH PHASE

Phase	Inclusion Criteria	Exclusion Criteria
Initiation Phase (selection based on Boolean search)	Boolean search string	-
Phase 1 (selection based on titles and abstracts)	Related to BI using Agile methodology	Related to BI that does not use traditional methodology
Phase 2 (selection based on full text)	o Discussing BI implementation using agile methodology o Discussing the advantages, issues, and solutions faced when implementing BI with agile methodology	Not discussing the use of Agile methodology in the research
Phase 3 (selection based on full-text and year of publication)	o Year of publication o Publication is in English The research used is from the last 7 years	Year of publication is more than 7 years old

To select relevant papers, the PICOC formula was adopted as the basis for the Boolean search string, as stated in Table 2, to ensure a well-defined and targeted inquiry. The selected population centers around BI, while the intervention focused on Agile methodology or software development. There was no specific comparison term, and the expected outcome was related to BI implementation. Lastly, the research context centers on BI implementation using Agile methods within organizations or enterprises, aiming for valid and applicable results. Based on the PICOC formula, the Boolean search string was "Business Intelligence" or "BI", "Agile Methodology" or "Agile Software Development", "Implementation" or "Method", and "Organization" or "Enterprise".

TABLE 2
PICOC FORMULA

Formula	Context
Population	Business Intelligence or BI
Intervention	Agile Methodology or Agile Software Development
Comparison	-
Outcome	Implementation or Method
Context	Organization or Enterprise

D. Selection of Research

The article selection process consisted of several steps, including the initiation, exclusion, and final phase, as shown in Table 3. The objective of annotating Table 3 was to assess the relevance, accuracy, and quality of the cited sources.

Among the 288 articles obtained through Boolean searches, filtered based on inclusion and exclusion, and checked for full articles, 19 met the criteria. These 19 articles included 1 from Scopus, 1 ACM, 9 IEEE, 4 ScienceDirect, 3 Taylor & Francis, and 1 ProQuest. Table 3 shows the process for reviewing articles, which included several stages, such as searching for relevant literature, screening for inclusion and exclusion criteria, and assessing the quality of selected papers.

TABLE 3
SELECTION OF RESEARCH

Phase	Total Articles	The Number of Articles for Each Database
Initiation Phase (based on Boolean search)	288 Articles	Scopus (25 articles) ACM (75 articles) IEEE (71 articles) Science Direct (63 articles) Taylor & Francis (31 articles) SAGE Journals (90 articles) ProQuest (85 articles)
Exclusion Phase (based on title & abstract)	42 Articles	Scopus (4 articles) ACM (5 articles) IEEE (16 articles) Science Direct (7 articles) Taylor & Francis (6 articles) SAGE Journals (1 articles) ProQuest (3 articles)
Exclusion Phase (based on scanning full text)	35 Articles	Scopus (2 articles) ACM (2 articles) IEEE (16 articles) Science Direct (6 articles) Taylor & Francis (6 articles) SAGE Journals (0 articles) ProQuest (3 articles)
Final Phase (based on release year)	19 Articles	Scopus (1 articles) ACM (1 articles) IEEE (9 articles) Science Direct (4 articles) Taylor & Francis (3 articles) SAGE Journals (0 articles) ProQuest (1 articles)

E. Data Extraction & Synthesis of Result

After selecting the papers in the previous process, each was carefully read, and relevant information was extracted and summarized based on the research questions. There was a total of seven research questions (RQs), and the authors filtered the answers for each RQ. Each RQ became a category of topics to be discussed in the results section, referred to as "key groups". The answers from each RQ were then extracted as items for each key group, namely BI Tools, Agile Methods, Manifesto, Practices, Advantages, Issues, and Solutions.

F. Expert Judgment Validation

The process of validation was an additional step in evaluating and improving the outcomes. This procedure included assessing significant factors through a comprehensive online questionnaire, designed to collect insights about the most important components within the key groups. Therefore, expert judgment, in this situation, was obtained from individuals who have substantial experience as projects manager (PM) in the field of BI.

The selection of this expert was done carefully, primarily based on their certifications and practical experience. Specifically, Individuals holding Project Management Office certifications, such as Project Management Professional (PMP), and possessing prior experience in managing BI projects using Agile methods, were eligible for participation. The criteria for selection were based on a requirement of 4-5 years of hands-on experience in the implementation and leadership of BI projects using Agile methodology. This expert was selected from diverse sectors within Indonesia, including IT consulting, banking, e-commerce, insurance, automotive, and manufacturing, as well as

telecommunications industries. This varied industry representation ensured a comprehensive and well-rounded perspective during the judgment process.

Expert judgment phase included administering a structured online questionnaire to the qualified participants, to fill in a series of probing questions, carefully designed to the identified categories. Through this comprehensive method, experts were encouraged to assess and rank the significance of various items within each key group. The combination of responses from these experienced stakeholders provided a diverse perspective on the essential aspects that contributed to successful BI implementation within Agile framework. It's important to note that all respondents provided explicit consent to participate in this study, and their privacy and confidentiality were rigorously upheld throughout the data collection and analysis process. The insights obtained from expert judgment validation process served to confirm, enhance, and support the results derived from SLR.

IV. RESULTS

A. Overview of Research

Fig. 1 shows that the number of papers on Agile methodology in BI has been a subject of discussion in recent years, as reflected in the number of articles published. This trend may indicate a growing interest among practitioners and research in adopting and documenting Agile methodology for their projects.
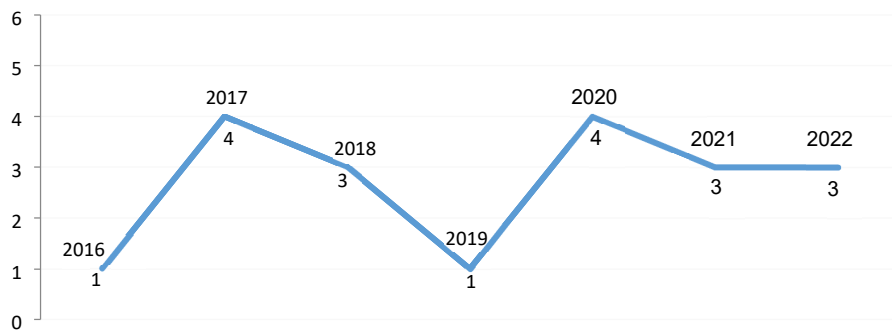

Fig. 1 Selected papers by year interval

Table 4 shows that among the 19 research examined in this SLR, only 4 (21%) were based on empirical evidence and they all focused on case research from industry. The remaining 15 (79%) were categorized as either "lessons learned" or reports of industrial experience. It can be deduced that there is a scarcity of empirical research on the application of Agile methodology in BI setting. This indicated limited empirical research available regarding the implementation of Agile methodology in the context of BI.

B. Results Related to Research Questions

This section involved analyzing how the data collected from reviewed literature correlated with the research questions. The purpose of this survey is to provide a comprehensive overview of literature on the usage of Agile methodology in different distributed BI projects by addressing various research questions. Based on the results of SLR, a detailed implementation of BI using Agile methodology can be observed in Table 5. To compile the criteria, this work used categorization to select key groups based on the research questions that have already been defined from the 19 articles in full paper format.

Furthermore, all items were classified into their respective key groups, and the assessments provided by 12 project managers for each item were consolidated and then ranked accordingly. The percentage score for each item in various key groups was calculated by dividing the total score for the selected items by the total number of managers. The analysis indicated that when the score was 83%, it means 10 out of 12 projects manager agreed on the contribution of items to the key group. From the criteria analyzed on the results of SLR, it can be divided into 7 key groups, namely BI Tools, Agile Practices, Manifesto, Methods, Advantages, Issues, and Solutions that were explained in the discussion chapter.

C. BI Tools in the Implementation of BI

BI tools are software used to collect, organize, visualize, and analyze data from business operations, enabling data-driven decision-making [18]. The purpose of using criteria for BI tools was to evaluate and offer insights on those frequently used for developing BI projects, thereby enabling the instruments to be considered as potential options for

future research and selection. The graph on the key group of BI tools can be seen in Table 4. Among 19 articles, PowerBI was the most widely used tool for implementation, followed by Tableau, Google Data Studio, MSTR, Looker, and QlikSense. Evaluating these tools enabled better selection in future BI projects [18].

TABLE 4
BI TOOLS ASSESSED BY EXPERT JUDGMENT

BI Tool	Validation Percentage
PowerBI	83%
Tableau	58%
Google Data Studio	25%
MSTR	16.7%
Looker, QlikSense	8.3%

D. Agile Practices in the Implementation of BI

Agile practices include a collection of principles and methodologies that prioritize flexibility, collaboration, and iterative development in software projects. [22]. Several Agile practices can be implemented in BI implementation, including Scrum, which all stakeholders agreed was used in all BI projects, followed by Kanban, ScrumBan, Scaled Agile, and Lean-Agile based on SLR. Therefore, Agile practices can serve as a reference for research on implementing BI using Agile methodology. The graph of the practices commonly used in BI projects implementation can be seen in Table 5, where Scrum was the practice used throughout BI projects based on expert judgment.

TABLE 5
AGILE PRACTICES IN BI PROJECTS ASSESSED BY EXPERT JUDGMENT

Agile Practice	Validation Percentage
Scrum	100%
Kanban	41.7%
ScrumBan	41.7%
Scaled Agile	8.3%
Lean Agile	8.3%

E. Agile Manifesto in the Implementation of BI

Agile Manifesto influence on the software community has resulted in extensive publications and research on Agile development, initiating discussions and debates on Agile principle implementation, human engagement, and software advancement [23]. In addition to other considerations, the Agile Manifesto [24], served as a crucial criterion for implementing BI. It outlined 12 principles, 8 of which were relevant to BI implementation, including delivering work frequently, having a motivated team, prioritizing working software over comprehensive documentation, continuous integration, deployment, shared understanding between sponsors, developers, and users, team commitment, and reflection. These principles can enhance the efficiency and sustainability of BI development. Table 6 shows Agile manifesto's impact on BI projects implementation, with "deliver work frequently" being the most widely practiced principle for ensuring the success of projects.

TABLE 6
AGILE MANIFESTO IN BI PROJECTS ASSESSED BY EXPERT JUDGMENT

Agile Manifesto	Validation Percentage
Deliver work frequently	83.3%
Continuous integration & deployment	66.7%
Shared understanding between sponsors, developers, and users	66.7%
Team commitment and reflection	66.7%
Motivated team	50%
Working software over comprehensive documentation	25%

F. Agile Methods in the Implementation of BI

BI systems were not simply purchased or leased as complete solutions, however, were customized to meet the specific needs and capabilities of the buyer. It was important to optimize the development of Agile methodology and processes to reduce the risk of failure. Based on research from 19 articles, there were 9 Agile methods to implementing BI, including separation of Agile (Scrum) information collection layer (ETL, DW), business analysis (BA), Kanban Board, Design Science Research (DSR) Method, Knowledge Discovery in Databases (KDD), Cross Industry Standard Process for Data Mining (CRISP-DM), service-oriented architecture, Decisional Big Data Methodology (DECIDE), and iteration design. The technique currently being used can serve as a reference for implementing BI in various

projects. Table 7 shows the model used, where the iteration method and the use of the Kanban board were the most practiced forms.

TABLE 7
AGILE METHODS IN BI PROJECTS ASSESSED BY EXPERT JUDGMENT

Agile Method	Validation Percentage
Iteration Method	83.3%
Kanban Board	83.3%
Separation of Agile Information Collection Layer and Business Analysis (BA) layer	66.7%
Cross Industry Standard Process for Data Mining (CRISP-DM)	50%
Design Science Research (DSR) Method	50%
Knowledge Discovery in Databases (KDD)	50%
Service-Oriented Architecture	50%
DECisional BIg Data Methodology (DECIDE)	25%

G. Agile Advantages in the Implementation of BI

Several advantages of using Agile in BI projects include the ability to easily adapt to changes, higher success rates, added value, cost reduction, shorter projects timeline, and improved accuracy. Table 8 shows Agile advantages in BI projects implementation, where the most agreed-upon was an increase in success rate and added value.

TABLE 8
AGILE ADVANTAGES IN BI PROJECTS ASSESSED BY EXPERT JUDGMENT

Agile Advantage	Validation Percentage
Increase success rate and added value	91.7%
Improve accuracy	58.3%
Less time spent	50%
Easy to adapt	41.7%
Cost reduction	16.7%
Improving engagement by continuously involving users and stakeholders in the process	8.3%

H. Agile Issues in the Implementation of BI

While Agile has several advantages, it can also present some challenges, such as technological and managerial, a lack of discipline, inadequate technical skills, difficulty in value delivery and managing tasks that are hard to estimate, increasingly ambiguous, as well as hard-to-verify requirements. Agile challenges in BI projects implementation can be seen in Table 9, where the most frequently encountered problems were increasingly ambiguous and hard to verify. Based on Ain et al.'s research, the most influential problems were resistance to the use of BI systems, lack of motivation, system challenges and errors, and inadequate communication between IT staff and business users. It can be concluded that two main reasons why BI implementation may fail using Agile were demotivation of the working team and challenges in system development [25].

TABLE 9
AGILE ISSUES IN BI PROJECTS ASSESSED BY EXPERT JUDGMENT

Agile Issue	Validation Percentage
Requirements are increasingly ambiguous and hard to verify	91.7%
Inability to react to tasks which are not estimable	50%
Fail to deliver expected value	41.7%
Lack of discipline	41.7%
Managerial obstacles	41.7%
Technical skill	33.3%
Technological obstacles	16.7%

I. Agile Solutions in the Implementation of BI

The challenges mentioned above can be addressed with various Agile solutions, such as calculating cycle time, measuring the backlog of defects, creating a code ownership map and artifact, establishing a framework for evaluation in design science (FEDS), securing management support, implementing structured Kanban iteration (SKI), using Scrum-DS to more flexibly handle tasks that were difficult to estimate, and properly sizing the team. It was imperative to include end users in the development process, conduct prototype experiments before immediate task implementation, establish clear objectives, and adhere to a structured project definition process. A visual

representation of Agile solutions addressing challenges can be found in Table 10. The most frequent solution for overcoming BI projects problem was collaborating with the end user.

TABLE 10
AGILE SOLUTIONS BI PROJECTS ASSESSED BY EXPERT JUDGMENT

Agile Solution	Validation Percentage
End user collaboration	75%
Calculate cycle time	66.7%
Follow up clear goal	50%
Management support	50%
Prototype experiments over implementing tasks	41.7%
Create FEDS	41.7%
Scrum-DS (flexible reaction to tasks which hard to estimate)	33.3%
Measure defect backlog count	25%
Creating an artefact	25%
Methodical projects definition process	25%
Code ownership map	8.3%
SKI	8.3%
Sizing the team	8.3%

V. DISCUSSION

A. Frequently Used BI Tool

In correlation with the result obtained, Saabith et al. (2022) [26] also confirmed that Power BI was the most popular tool, followed by Oracle Analytics Cloud, MSTR, TIBCO Spotfire, QlikSense, and Tableau. Power BI was found to be the preferred choice for BI implementation due to its user-friendly interface that accommodates beginners. This tool enabled business to effortlessly connect with diverse data sources and created personalized dashboards. Organizations selected specific tools based on factors such as maintenance feasibility, correlation with other tools or their environment, availability of forums, community support, as well as cost considerations [7].

B. Scrum: The Most Widely Used Agile Practice in BI Implementation

Scrum was the most widely used Agile method in both software development and BI [27]. It included key concepts such as user stories, sprint and product backlog, sprints, as well as daily scrum. In BI, requirements were divided into small stories and assembled into projects, with each story passing through design, development, testing, and release within one to two-week sprints [27]. Biesialska et al. [18] also concluded that Scrum practices were the most used in BI implementation, followed by Kanban, Xtreme Programming (XP), Custom Hybrid Multiple Programming, and Rational Unified Process (RUP). The research included systematic mapping, indicating that various types of organizations contributed to determining popular agile practices.

Despite the introduction of recent Agile practices, such as SAFe [28] and Disciplined Agile Delivery (DAD) [29], Scrum introduced in 1993 [30], continues to maintain its dominant presence in Agile practices, spanning across software development, including BI implementation. This consistency showed that BI implementation followed the broader software development trend. Scrum offered substantial benefits in BI implementation, particularly in fostering improved collaboration and knowledge sharing among team members [31]. This research indicated Scrum's positive impact on knowledge sharing and collaboration scores [31]. These outcomes were relevant in BI projects where cross-functional teams collaboratively analyze data to drive informed decision-making.

C. Significant Impact of Agile Manifesto

This research identified certain factors, such as "continuous integration" or change management, "user participation" or shared understanding among sponsors, developers, and users, as well as "motivated team" or organizational resources. In correlation with the survey of El-Adaileh et al., this suggests that the impact of BI implementation on the use of Agile manifesto remains significant. The prominence of delivering work frequently and the prevalence of continuous integration as an influential Agile manifesto factor arises from its ability to facilitate the seamless consolidation of various components and modules in BI systems [32]. This was crucial in BI implementation as it included the integration of multiple data sources, analytics tools, and visualization components.

In contrast to El-Adaileh et al.'s research [16], the most influential implementation factors were management support, followed by data sources systems, organizational resources, IT infrastructure, projects advocate, team skills, user participation, and change management. The results showed the use of Agile manifesto by professionals across

various companies and fields in Indonesia. El-Adaileh et al. used sources from several countries for compiling manuscript, including the USA, Australia, the European Union, and Asian nations such as Malaysia, Vietnam, and Korea [16], spanning the last five years (2017-2023). In contrast, El-Adaileh et al.'s research included literature from 1998 to 2018, sourcing from various journals, including Elsevier's, ProQuest, and Emerald Insight [16].

D. Iteration Method

Iteration Method is the most influential, validated based on the research of Biesialska et al. [18]. This method in the context of Agile methodology was crucial, enabling continuous feedback and adaptation throughout the development process. In BI projects, requirements, and data sources can be complex and dynamic, requiring frequent adjustments and refinements [33]. Organizations can obtain feedback from stakeholders and users at regular intervals by dividing projects into smaller iterations, each with a defined set of deliverables [33]. Since BI implementation frequently yields value, organizations can prioritize and provide the most critical and valuable features early in the process [33].

Organizations can identify and address potential risks and challenges early, since this method enabled the discovery of issues [34], fostered collaboration, engagement of team members, and stakeholders [33]. Working in short iterations enabled teams to foster close collaboration, share knowledge, and channeled their efforts towards shared objectives. The use of Kanban boards within the scope of Agile methodology was also important since these boards provide a visual representation of work in progress, ensuring that the entire team shared a common view of ongoing tasks [35]. The visual presentation promoted transparency and collaborative efforts among team members, leading to improved efficiency and productivity levels.

E. Benefit of BI Implementation Using Agile Methodology

The benefits of Agile methodology can enhance success rates, improve accuracy, and reduce time consumption. It also provide a monitoring and implementation process, ensuring the minimization of risks and liabilities, which, in turn, contributes to the accuracy of decision-making [37]. Agile methodology can lower costs due to the speed of projects implementation [38]. Kisielnicki et al. conducted interviews with seven users and five participants from a company that boasted a workforce of 12,000 employees [36]. The results indicated several influential benefits, including the seamless adaptability to changes, frequent delivery of functionalities, rapid ROI, and cost-effective maintenance following BI implementation [36]. These conclusions corresponded with earlier research, which identified factors ranked fourth and fifth in importance, further enhancing the overall validity of the results.

F. Failure and Agile Issue

Team demotivation can be a critical factor in the failure of BI implementation. As discussed by Black et al. [39], the absence of team cooperation can lead to reduced motivation. Furthermore, the lack of a clear vision and management support may divert team members from the project's purpose. Inadequate training and skills, as well as a lack of recognition and rewards, can also contribute to the demotivating effect [39]. The absence of extrinsic motivation factors, as mentioned by Kaur [40], can further contribute to declining motivation levels. Addressing these factors was crucial for maintaining a motivated team and increasing the chances of successful BI implementation.

Implementing BI projects successfully can also encounter obstacles during system development due to a combination of factors. The significant concerns were the inherent complexity and concealed intricacies in system development [41], which can introduce uncertainties and complications in BI implementation. Moreover, system failures, including issues like data loss and technical problems can significantly hinder the overall success of the implementation [42]. Another crucial aspect was the limited critical success factors (CSFs) that influenced BI implementation outcomes [43]. The inability to fully comprehend the CSFs, which included management support, resource integration, and adequate training, can lead to setbacks in the execution of BI systems [43]. In essence, these diverse challenges indicated the necessity for meticulous planning and consideration to ensure the effective implementation of BI initiatives.

G. Solutions for Addressing Agile Issues

The most influential solutions to address agile issues in BI implementation were collaboration and communication of the team, dynamic product definition, effort estimation, as well as management dimension. The expert judgments were consistent with the findings of Noteboom et al. [44] indicating that effective collaboration and communication are vital for successful BI implementation. Collaboration encouraged knowledge-sharing, problem-solving, and collective decision-making, leading to improved outcomes [44]. Meanwhile, clear communication ensured that team members possessed a shared comprehension of projects goal, requirements, and progress, thereby minimizing misunderstandings and enhancing overall coordination [44]. In the context of BI implementation, where requirements and data sources can evolve, a dynamic method to product definition becomes crucial. This method provided the

flexibility needed to define and refine the product scope in response to changing business needs, incorporating new insights and data sources to ensure that BI solution continued with relevance and value [45].

Accurate effort estimation played a significant role in effective projects planning and resource allocation, correlating with Agile principles that emphasized iterative development and frequent value delivery [45]. Furthermore, gaining management support, symbolizing organizational leaders' approval of Agile BI project implementation,, fostered a positive culture that placed value on adaptability, collaboration, and continuous improvement [45]. This support assisted in overcoming resistance to change, ensured necessary resource provision, and cultivated a climate of innovation and adaptability. Organizations can promote collaborative success in Agile BI implementation by effectively addressing these dimensions and navigating associated challenges.

VI. Conclusions

In conclusion, this research has conducted a comprehensive assessment and evaluation of various aspects of BI implementation within the context of Agile methodology. It has gained valuable insights from 12 experienced project managers representing diverse industries in Indonesia. The results showed the key elements essential for successful BI projects and contributed to the field's understanding of BI tools, Agile practices, manifestos, methods, advantages, issues, and solutions.

The benefits of Agile methodology in BI projects were evident through enhanced adaptability to changes, higher success rates, added value, cost reduction, and shorter projects timeline. Agile practices, particularly Scrum, were found to be the preferred method among experts, with its iterative and collaborative nature promoting efficient BI development. The 12 principles of the Agile Manifesto, particularly those pertinent to BI implementation, indicated the significance of continuous delivery, motivated teams, and shared understanding among stakeholders. These principles, when applied collectively, significantly boosted the efficiency and sustainability of BI development teams.

Agile implementation in BI projects also presented challenges, such as technological and managerial problems, lack of discipline, and difficulty in handling ambiguous and hard-to-verify requirements. These challenges may lead to demotivated teams and hinder effective system development. However, this research identified various Agile solutions, including calculating cycle time, creating code ownership maps, securing management support, and end users in the development process. Collaboration and communication from the team dimension, dynamic product definition, and management buy-in were identified as influential solutions in overcoming Agile issues in BI implementation.

Although, several key groups were obtained from multiple relevant literature sources and validated by 12 BI project managers, the results were constrained by the limited number of experts involved. Therefore, a broader inclusion of experts in the judgment process is likely to yield a more accurate overview. The summary for each key group was based on comparisons with just one or two previous similar or related literature sources, suggesting potential for improvement in the future through a more comprehensive literature review. To enhance future research, a larger pool of expert judgments and more comprehensive literature reviews are recommended to provide a better understanding of Agile BI implementation and its impact across various industries and contexts.

In summary, this research shows the significance of Agile methodology in driving successful BI projects, fostering adaptability, and delivering added value. It also indicates the importance of Scrum as a preferred Agile practice, correlating with the Manifesto's principles relevant to BI implementation. Meanwhile, challenges may arise, adopting Agile solutions can help mitigate obstacles and ensure the effective and efficient development of BI systems. This research contributes valuable insights for BI practitioners, decision-makers, and research seeking to optimize BI projects through Agile methodology.

Informed Consent: Informed consent was obtained from all human subjects participating in this study. A detailed explanation of the consent process can be found in the Methods section.

Animal Subjects: There were no animal subjects.

ORCID:
Hapsari Wulandari: https://orcid.org/0000-0002-8220-364X
Teguh Raharjo: N/A

REFERENCES

[1] V. H. Pirttimäki, "Conceptual Analysis of Business Intelligence," *S Afr J Inf Manag*, vol. 9, no. 2, Aug. 2007, doi: 10.4102/sajim.v9i2.24.

[2] K. K. Ramachandran, A. Apsara Saleth Mary, S. Hawladar, D. Asokk, B. Bhaskar, and J. R. Pitroda, "Machine Learning and Role of Artificial Intelligence in Optimizing Work Performance and Employee Behavior," in *Materials Today: Proceedings*, 2022. doi: 10.1016/j.matpr.2021.11.544.

[3] R. Krawatzeck, B. Dinter, and D. A. P. Thi, "How to Make Business Intelligence Agile: The Agile BI Actions Catalog," in *Proceedings of the Annual Hawaii International Conference on System Sciences*, IEEE Computer Society, Mar. 2015, pp. 4762–4771. doi: 10.1109/HICSS.2015.566.

[4] D. Larson and V. Chang, "A Review and Future Direction of Agile, Business Intelligence, Analytics and Data Science," *Int J Inf Manage*, vol. 36, no. 5, pp. 700–710, Oct. 2016, doi: 10.1016/j.ijinfomgt.2016.04.013.

[5] J. Kisielnicki and A. M. Misiak, "Effectiveness of Agile Compared to Waterfall Implementation Methods in IT Projects: Analysis Based on Business Intelligence Projects," *Foundations of Management*, vol. 9, no. 1, pp. 273–286, Oct. 2017, doi: 10.1515/fman-2017-0021.

[6] S. Rezaie, S. J. Mirabedini, and A. Abtahi, "Identifying key effective factors on the implementation process of business intelligence in the banking industry of Iran," *Journal of intelligence studies in business*, vol. 7, no. 3, 2017.

[7] S. Bajaj and T. Rai, "Survey on Agile Implementation of The BI Systems," *International Journal of Engineering & Technology*, vol. 7, p. 898, Aug. 2018, doi: 10.14419/ijet.v7i4.38.27604.

[8] M. Prouza, S. Brodinová, and A. M. Tjoa, "Towards an Agile Framework for Business Intelligence Projects," in *2020 43rd International Convention on Information, Communication and Electronic Technology (MIPRO)*, 2020, pp. 1280–1285. doi: 10.23919/MIPRO48935.2020.9245166.

[9] B. Kitchenham, O. Pearl Brereton, D. Budgen, M. Turner, J. Bailey, and S. Linkman, "Systematic Literature Reviews in Software Engineering - A Systematic Literature Review," *Information and Software Technology*, vol. 51, no. 1. pp. 7–15, Jan. 2009. doi: 10.1016/j.infsof.2008.09.009.

[10] C. A. Tavera Romero, J. H. Ortiz, O. I. Khalaf, and A. R. Prado, "Business Intelligence: Business Evolution After Industry 4.0," *Sustainability (Switzerland)*, vol. 13, no. 18. MDPI, Sep. 01, 2021. doi: 10.3390/su131810026.

[11] M. Williams, T. Ariyachandra, and M. Frolick, "Business Intelligence - Success Through Agile Implementation," *Journal of Management & Engineering Integration*, vol. 10, no. 1, pp. 14–21, 2017.

[12] L. Rao, M. McNaughton, and G. Mansingh, "An Agile Integrated Methodology for Strategic Business Intelligence (AimS-BI)," in *Americas Conference on Information Systems 2018: Digital Disruption, AMCIS 2018*, 2018. [Online]. Available: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85054214653&partnerID=40&md5=9952865df3550e1cd340ce9c929c38f6

[13] D. Batra, "Agile Values or Plan-Driven Aspects: Which Factor Contributes More Toward The Success of Data Warehousing, Business Intelligence, and Analytics Project Development?," *Journal of Systems and Software*, vol. 146, pp. 249–262, 2018, doi: 10.1016/j.jss.2018.09.081.

[14] R. Krawatzeck and B. Dinter, "Agile Business Intelligence: Collection and Classification of Agile Business Intelligence Actions by Means of a Catalog and a Selection Guide," *Information Systems Management*, vol. 32, no. 3, pp. 177–191, Jul. 2015, doi: 10.1080/10580530.2015.1044336.

[15] M. Al-Hasan and M. S. Hossain, "Adapting SCRUM in Data Analytics Solution Development for Telecom Operators in Bangladesh," in *2019 International Conference on Electrical, Computer and Communication Engineering (ECCE)*, 2019, pp. 1–5. doi: 10.1109/ECACE.2019.8679124.

[16] N. A. El-Adaileh and S. Foster, "Successful Business Intelligence Implementation: A Systematic Literature Review," *Journal of Work-Applied Management*, vol. 11, no. 2. Emerald Group Holdings Ltd., pp. 121–132, Nov. 14, 2019. doi: 10.1108/JWAM-09-2019-0027.

[17] J. Yin and V. Fernandez, "A Systematic Review on Business Analytics," *Journal of Industrial Engineering and Management*, vol. 13, no. 2. Universitat Politecnica de Catalunya, pp. 283–295, 2020. doi: 10.3926/jiem.3030.

[18] K. Biesialska, X. Franch, and V. Muntés-Mulero, "Big Data analytics in Agile Software Development: A Systematic Mapping Study," *Information and Software Technology*, vol. 132. Elsevier B.V., Apr. 01, 2021. doi: 10.1016/j.infsof.2020.106448.

[19] I. Krasteva and S. Ilieva, "Adopting Agile Software Development Methodologies in Big Data Projects - A Systematic Literature Review of Experience Reports," in *Proceedings - 2020 IEEE International Conference on Big Data, Big Data 2020*, Institute of Electrical and Electronics Engineers Inc., Dec. 2020, pp. 2028–2033. doi: 10.1109/BigData50022.2020.9378118.

[20] J. S. Saltz and I. Shamshurin, "Big Data Team Process Methodologies: A Literature Review and The Identification of Key Factors for A Project's Success," in *Proceedings - 2016 IEEE International Conference on Big Data, Big Data 2016*, Institute of Electrical and Electronics Engineers Inc., 2016, pp. 2872–2879. doi: 10.1109/BigData.2016.7840936.

[21] P. Mikalef, I. O. Pappas, J. Krogstie, and M. Giannakos, "Big Data Analytics Capabilities: A Systematic Literature Review and Research Agenda," *Information Systems and e-Business Management*, vol. 16, no. 3, pp. 547–578, Aug. 2018, doi: 10.1007/s10257-017-0362-y.

[22] R. Sandstø and C. Reme-Ness, "Agile Practices and Impacts on Project Success," *Journal of Engineering, Project, and Production Management*, vol. 11, no. 3, pp. 255–262, Sep. 2021, doi: 10.2478/jeppm-2021-0024.

[23] P. q Hohl *et al.*, "Back to The Future: Origins and Directions of The 'Agile Manifesto' – Views of The Originators," *Journal of Software Engineering Research and Development*, vol. 6, no. 1, Dec. 2018, doi: 10.1186/s40411-018-0059-z.

[24] B. Gina and A. Budree, "A Review of Literature on Critical Factors that Drive the Selection of Business Intelligence Tools," in *2020 International Conference on Artificial Intelligence, Big Data, Computing and Data Communication Systems (icABCD)*, 2020, pp. 1–7. doi: 10.1109/icABCD49160.2020.9183852.

[25] N. U. Ain, G. Vaia, W. H. DeLone, and M. Waheed, "Two Decades of Research on Business Intelligence System Adoption, Utilization and Success – A Systematic Literature Review," *Decis Support Syst*, vol. 125, Oct. 2019, doi: 10.1016/j.dss.2019.113113.

[26] A. S. Saabith, T. Vinothraj, and M. Fareez, "Business Intelligence Tools-Systematic Review," 2022. [Online]. Available: www.ijres.org394|

[27] M. Muntean and T. Surcel, "Agile BI - The Future of BI," *Informatica Economica*, vol. 17, no. 3/2013, pp. 114–124, Sep. 2013, doi: 10.12948/issn14531305/17.3.2013.10.

[28] S. Theobald, A. Schmitt, and P. Diebold, "Comparing Scaling Agile Frameworks Based on Underlying Practices," in *Lecture Notes in Business Information Processing*, Springer Verlag, 2019, pp. 88–96. doi: 10.1007/978-3-030-30126-2_11.

[29] S. Beecham, T. Clear, R. Lal, and J. Noll, "Do Scaling Agile Frameworks Address Global Software Development Risks? An Empirical Study." 2020. doi: 10.48550/arxiv.2009.08193.

[30] D. K. Rigby, J. Sutherland, and H. Takeuchi, "The Secret History of Agile Innovation," *Harv Bus Rev*, vol. 4, 2016.

[31] K. Bhavsar, V. Shah, and Dr. S. Gopalan, "Scrum: An Agile Process Reengineering in Software Engineering," *International Journal of Innovative Technology and Exploring Engineering*. 2020. doi: 10.35940/ijitee.c8545.019320.

[32] A. Zaid, "Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation." 2023. doi: 10.31219/osf.io/ksj5q.

[33] D. Greer and Y. Hamon, "Agile Software Development," *Softw Pract Exp*, vol. 41, no. 9, pp. 943–944, Aug. 2011, doi: 10.1002/spe.1100.

[34] R. Srivastava, "Iterative Minimum Viable Product Approach to Implementing AI, RPA, and BI Solutions," *Westcliff International Journal of Applied Research*, vol. 5, no. 1, pp. 44–50, Nov. 2021, doi: 10.47670/wuwijar202151rs.

[35] J. McLean and R. Canham, "Managing the electronic resources lifecycle with kanban," *Open Information Science*, vol. 2, no. 1, pp. 34–43, 2018.

[36] J. Kisielnicki and A. M. Misiak, "Effectiveness of Agile Compared to Waterfall Implementation Methods in IT Projects: Analysis Based on Business Intelligence Projects," *Foundations of Management*, vol. 9, no. 1, pp. 273–286, Oct. 2017, doi: 10.1515/fman-2017-0021.

[37] L. Mathiassen and J. Pries-Heje, "Business Agility and Diffusion of Information Technology," *European Journal of Information Systems*, vol. 15, no. 2, pp. 116–119, Apr. 2006, doi: 10.1057/palgrave.ejis.3000610.

[38] D. Mishra and A. Mishra, "Complex software project development: agile methods adoption," *Journal of Software Maintenance and Evolution: Research and Practice*, vol. 23, no. 8, pp. 549–564, Dec. 2011, doi: https://doi.org/10.1002/smr.528.

[39] J. Black, K. Kim, S. Rhee, K. Wang, and S. Sakchutchawan, "Self-Efficacy and Emotional Intelligence," *Team Performance Management*, 2019, doi: 10.1108/tpm-01-2018-0005.

[40] K. Kaur, "Business Intelligence on Supply Chain Responsiveness and Agile Performance: Empirical Evidence from Malaysian Logistics Industry," *International Journal of Supply Chain Management*, vol. 6, no. 3, pp. 31–63, 2021, [Online]. Available: www.iprjb.orgwww.iprjb.org

[41] C. Caserio, "IT Governance in Enterprise Resource Planning and Business Intelligence Systems Environment: A Conceptual Framework," *International Journal of Management & Information Technology*, 2017, doi: 10.24297/ijmit.v12i1.5915.

[42] K. C. Moke, T. J. Low, and D. Khan, "IoT Blockchain Data Veracity with Data Loss Tolerance," *Applied Sciences*, 2021, doi: 10.3390/app11219978.

[43] N. S. Mosavi and M. F. Santos, "Implementation Considerations for the Applied Business Intelligence in Health Care," 2021, doi: 10.1007/978-981-16-2502-2_19.

[44] Noteboom Cherie, Ofori Martinson, Sutrave Kruttika, and El-Gayar Omar, *Agile Project Management: A Systematic Literature Review of Adoption Drivers and Critical Success Factors*. Proceedings of the 54th Hawaii International Conference on System Sciences, 2021.