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Investigating challenges in Agile software development: a cross-country comparative analysis

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ABSTRACT

Agile software development has been a significant methodology in software engineering for over two decades, offering enhanced adaptability to software requirement changes, improved delivery, and better quality. However, prevalent misunderstandings in Agile implementation have limited its benefits. Hence, this study investigates the challenges faced during Agile implementation. Initial analysis was carried out from cases in Indonesia, a leading country in the software industry within the Asia-Pacific region. Using Kitchenham's systematic literature review (SLR) methodology, fourteen distinct obstacles were identified from a database of research reports on Agile software development in Indonesia. Subsequent interviews with Agile experts in the country were conducted to validate the SLR findings. The results emphasize the critical need for a top-down strategic approach, the active participation of senior management, and the essential roles of competent scrum masters or Agile coaches. A comparative analysis with reports from other developing countries Saudi Arabia, India, Malaysia, Brazil and developed countries the UK, Belgium, Singapore, and the USA reveals common challenges. They highlight the imperative for proactive upper management leadership to steer successful Agile adoptions, particularly in organizations with entrenched top-down practices and complex hierarchical systems.

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1. INTRODUCTION

As the fourth most populous country, Indonesia strategically positions itself in the software industry. Boasting the most prominent digital economy in Southeast Asia (SEA), with a gross merchandise volume (GMV) reaching US $27 billion in 2018 and projected to surge to US $100 billion by 2050 [1]. By January 2023, Indonesia had 212.9 million internet users and 167.0 million social media users [2]. The flourishing software market, valued at 1.05 trillion USD in 2023, is primarily propelled by infrastructure, software development, and enterprise software [3]. Furthermore, 12 million new e-commerce users were onboarded [4]. Indonesia's internet traffic demonstrated a remarkable annual growth rate, escalating by 73% in the first quarter of 2020 compared to the previous year and surging to 139% in the second quarter. The e-commerce trend in Indonesia shows continuous growth from 2019 to 2023 [5]. It correlates with the increase in the volume of e-commerce markets in SEA countries from 2019 to 2022 [1]. It is estimated that the volume of the e-commerce markets in Indonesia, Vietnam, and Thailand will reach US $95 billion and US $32 billion, respectively, in 2025. Additionally, Indonesia ranked second in fintech among ASEAN countries in 2019,

following Singapore [6]. This growth suggests that studying software development implementation in Indonesia can provide valuable insights for other countries seeking to leverage a burgeoning digital economy.

Meanwhile, Agile is widely employed in business and research due to reduced time and costs in software development [7]–[11]. It has the potential to enhance customer satisfaction, accelerate software delivery, foster adaptability to changes, and maintain a low failure rate [9]–[12]. It revolutionizes software development with adaptive, iterative, and human-centric approaches, utilizing self-organized cross-functional teams [10], [12]–[14] and even outside technology projects [15].

Almost two decades have passed since the introduction of the Agile manifesto. Yet the challenges in this matter persist. And they are impeding the smooth implementation of Agile methodology. These challenges are restricting their potential benefits and overall effectiveness [8], [9], [16]. Organizations may overlook critical challenges, such as securing sponsorship and senior management involvement, transforming established team norms and practices, choosing appropriate Agile methods, and managing conflicting leadership approaches. Other challenges are managing industry-specific factors and promoting professional development. The 16th annual State of Agile report in 2022 highlights the top three challenges in Agile implementation. They are corporate culture 41%, insufficient leadership involvement 42%, and consistency 42% [17].

One challenge in adopting Agile is organizational culture [18]. Each region and country possess unique cultural nuances. Thus, specific challenges of Agile implementation across diverse national contexts warrant examination. Research on Agile implementation has predominantly focused on Western countries, with limited representation from Asia, particularly Indonesia. However, the report was based on a survey [17] with limited representation from the Asian continent, comprising only 11% of respondents. Furthermore, specific research on Agile implementation in Indonesia is lacking. The widespread adoption of Agile methodologies in software development has led organizations across countries to encounter varying challenges. These challenges affect the implementation and success of Agile practices. However, there is a lack of comprehensive comparative studies analyzing how these challenges manifest in different national contexts, most notably between developing and developed countries.

- RQ1: What challenges arise in implementing Agile software development in Indonesia?
- RQ2: How are the challenges in Indonesia compared with those in other developing countries?
- RQ3: How are the challenges in developing countries compared with those in developed countries?

The examination reveals common and unique challenges that impede Agile implementation across different regions. It offers insights that could facilitate better Agile practices globally. Understanding these differences in Agile implementation between countries is crucial for organizations aiming to optimize their Agile practices. Thus, this study provides a comprehensive comparative analysis. Organizations can also use it to tailor their Agile practices more effectively to their specific national contexts. They are also enhancing the overall benefits of Agile methodologies worldwide.

2. LITERATURE STUDY

2.1. Agile software development

Software development endeavors aim to deliver software products that effectively align with user needs while adhering to predetermined schedules and budgetary constraints [19]. Various methods, methodologies, and frameworks are employed to pursue this objective. Among these, methods grounded in Agile principles have emerged as the predominant choice on a global scale [20], [21].

Agile emerged to remedy shortcomings in traditional software engineering, bringing about significant shifts in work habits and ongoing project benefits [22]. In 2001, industry leaders formalized Agile through the Agile manifesto [13], [23], [24], encompassing 12 principles [13], [23], [25]. Various Agile approaches today share these foundational roots, as illustrated in Figure 1, placing Agile within a broader context of diverse frameworks, methods, and practices aligned with the Agile Manifesto's values and principles [23].

The Agile paradigm, derivative methods, and methodologies demonstrate notable efficacy in achieving shorter development cycles and adapting to dynamic user requirements [26]. Prominent methodologies rooted in Agile principles include scrum, extreme programming (XP), crystal, kanban, feature-driven development (FDD), and test-driven development [11]. According to findings outlined in research [27], the period spanning 1999 to 2009 witnessed the dominance of XP, succeeded by scrum's ascendancy from 2010 to 2016, as depicted in Figure 2. Moreover, a survey conducted in 2022 revealed that scrum stands as the most prevalently utilized methodology [17]. Despite its widespread adoption, Agile software development is not exempt from constraints. Scholarly investigations have elucidated that challenges in Agile implementation predominantly revolve around complexities inherent in managing large-scale projects involving numerous stakeholders and organizational intricacies [28]–[30].

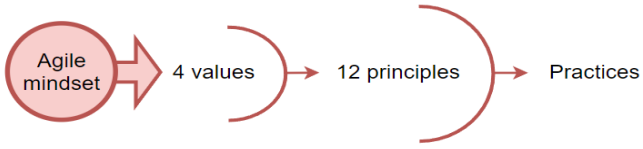

Figure 1. Relationship between Agile values, principles, and practices. Processed from [23]

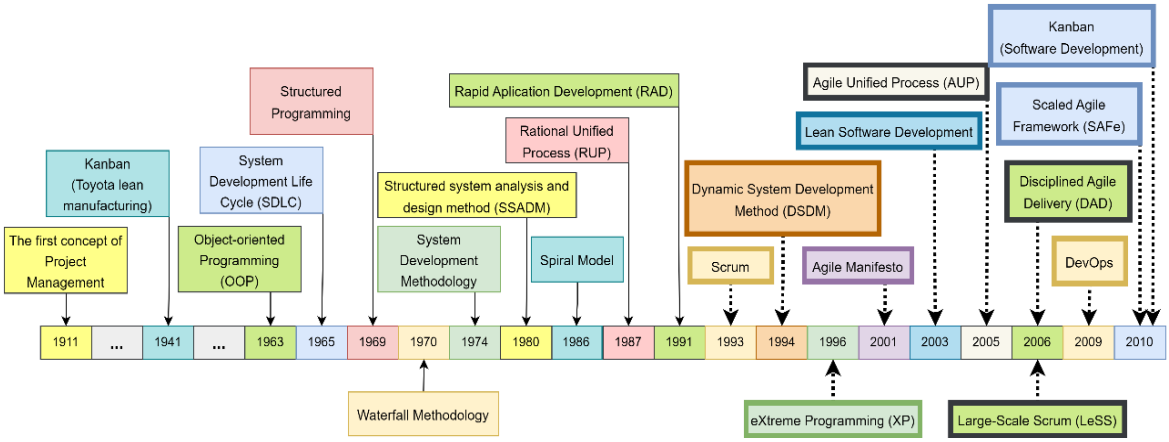

Figure 2. Software development methodology timeline. Processed from [31]

2.2. Systematic literature review

The research employed a systematic literature review (SLR) pioneered by Kitchenham and Brereton in software engineering [32]. The SLR method provides a good level of specificity and keeps the review activity within a scientific framework [33]. It offers relevant research results that can be processed or used for other activities [34]. It comprises three stages, i.e., planning, conducting, and reporting the review [32].

2.3. Content analysis

Content analysis encompasses a range of methodologies aimed at systematically analyzing textual information and data. It involves meticulous coding and categorizing textual data to discern prevailing trends and patterns, ascertain the frequency and interrelationships of specific terms, and scrutinize textual structures, among other objectives [35]. The implementation of content analysis entails distinct stages. The preparation consists of studying and understanding existing data and textual information. It is followed by organizing, which comprises conducting open coding, categorizing and sub-categorizing, and grouping existing textual data. Lastly, the final stage is reporting. It covers the preparation of the reports and reveals the stages and results of activities with an interpretation of the results.

Open coding is part of a qualitative research approach (qualitative research). It aims to understand and derive meaning (interpretation) from a set of data [36]. Data obtained from real-world sources encompasses a variety of modalities such as interviews, questionnaires, surveys, observations, or secondary data retrieved from scientific literature, publications, reports, and online resources. Subsequently, acquired data undergoes transcription into textual format, facilitating subsequent analysis. The textual data is scrutinized and compared during analysis to discern similarities, differences, or recurring patterns. Similar concepts or themes within the data are grouped into distinct categories, each assigned a descriptive label or code [36]. The coding process that has been carried out can be refined by conducting a review to eliminate duplication and minimize subjectivity and errors. And to further detail the definition of the code given [37].

3. RESEARCH METHOD

3.1. Research design

This study employs Kitchenham's systematic literature review (SLR) methodology. It also used qualitative interviews to investigate the challenges of Agile implementation in Indonesia. The literature review is based on a comprehensive database of research reports from Universitas Indonesia. Using Kitchenham's SLR methodology, the study systematically reviews and analyzes existing literature to identify obstacles encountered in Agile implementation within the Indonesian context. Next, the result of this

systematic literature review was validated by interviewing three Agile experts. These interviews are designed to validate the SLR findings and provide deeper insights into the challenges and strategic recommendations for effective Agile adoption.

3.2. Procedure

Figure 3 illustrates the research stages. Initially, the research questions were established. Subsequently, in step two, these questions guided the selection of keywords used to search the university's database for master's student research reports on Agile implementations. In step three, studies of lesser relevance were excluded. In step four, the challenges associated with Agile implementation in Indonesia were identified from the remaining manuscripts. It focused on fourteen challenges categorized into four groups, as discussed in [7].

In step five, interviews were conducted with three experts in Agile practices in Indonesia to validate and enrich the identification of these challenges [26]. Additional details on the experts are provided later in the text. The sixth research phase involved an expanded search across various international academic databases to uncover scholarly work on Agile implementation in developing and developed nations. Next, in steps seven and eight, the challenges identified in steps four and five were compared with those found in step six. The ninth step synthesized the challenges of Agile implementation in Indonesia against those in other developing and developed countries. The final phase compiled these insights into a comprehensive report detailed in step ten.

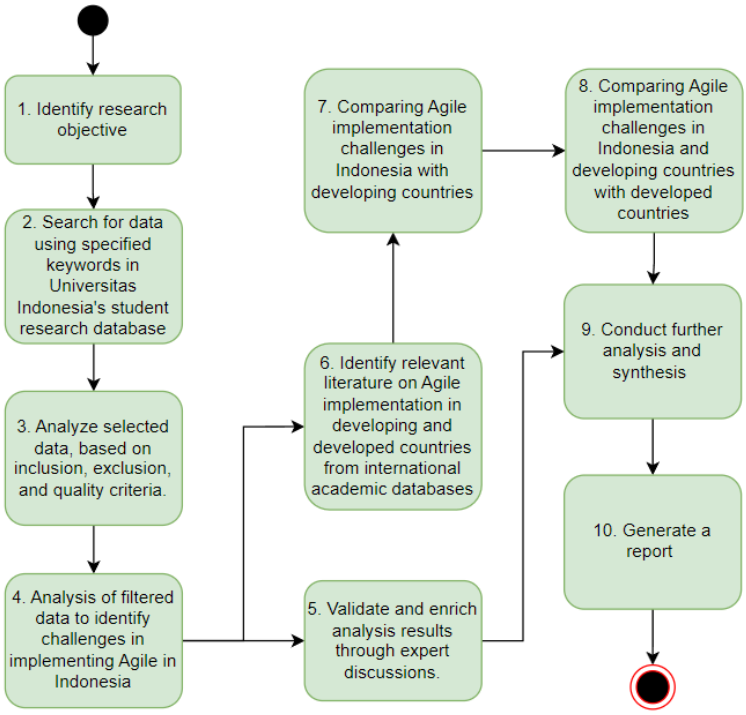

Figure 3. Research stages

3.3. Data collection

The study encompassed three phases of data collection. The initial data collection was depicted in steps two and three in Figure 3. Step two showed the search process for relevant references using keywords in Universitas Indonesia's research report database. Studies on Agile implementation in Indonesia are scarcely found in international databases. However, the Universitas Indonesia's Faculty of Computer Science hosts a substantial collection of master's student research manuscripts on Agile implementations in various companies. Apart from being master's students, they were software engineers investigating Agile implementations in their workplaces. Therefore, examining the research reports provides valuable insights into Agile implementation in the country. The keywords employed in the search included Agile, scrum, lean, kanban, extreme programming, and test driven development (TDD). Determining and forming appropriate keywords is essential to identify relevant literature to the research topic [33].

In step three as shown in Figure 3, the selection criteria were applied, which included master's student research reports from 2017 to 2023. Quality assurance criteria were established to ensure alignment with the research questions. Any reports that met all three criteria were marked as "Yes". The quality assurance standards are detailed in Table 1. Initially, 54 reports were identified through keyword searching. Next, 42 manuscripts were retained based on inclusion and exclusion criteria. After eliminating duplicate data, 30 reports remained. Subsequently, quality control measures were applied, resulting in a final set of 28 manuscripts on Agile implementation studies, as depicted in Figure 4.

Table 1. Quality assurance

Criteria	Yes	No
QA1: Does the student research incorporate pertinent studies on Agile implementation in team management?	If the primary study presents research related to Agile implementation in team management	If the primary study presents research related to Agile implementation but narrows the scope to sub-team management
QA2: Were the research data adequately presented?	If the primary study presents research data clearly and completely	If the primary study shows data clearly but lacks evidence, such as photos or attachments
QA3: Are the inclusion criteria in this report?	The inclusion criteria are shown explicitly	The inclusion criteria are shown implicitly

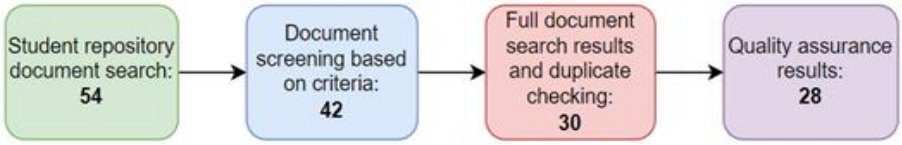

Figure 4. The flow of the selection process

The second data collection was indicated in step five as shown in Figure 3. It comprised interviews with three experts in Agile implementation in Indonesia to validate and explore the challenges previously identified in step four as shown in Figure 3. Each expert had at least five years of Agile experience. With seven years of experience, Expert "A" served as a Scrum Master in a healthcare technology company. Expert "B", with seven years of Scrum experience, worked as a Product Owner and occasionally as a Scrum Master in the software industry. Expert "C", a sponsor and CTO in software development consultancy, had ten years of Scrum experience. Insights from these interviews illuminated the challenges of Scrum implementation, subsequently analyzed using open coding based on recurring themes [36], [38], [39].

The third data collection was shown in step six as shown in Figure 3. It was a subsequent SLR searching for relevant papers on Agile implementation in the developed and developing world. It was conducted on the ACM Digital Library, Scopus, ScienceDirect, and IEEE Xplore. Keywords such as "Agile", "Scrum", "Lean", "Kanban", "eXtreme Programming", "Feature Driven Development", "Test Driven Development", "adoption", and "implementation" were employed. A total of ten papers covering Agile implementation challenges were identified. The UK, Belgium, Singapore, and the USA represented the developed world, while Saudi Arabia, India, Malaysia, and Brazil were representatives of developing nations. The selected papers underwent an in-depth review to comprehensively understand their topics, research questions, methodologies, and findings. The key points and conclusions from each paper were summarized. The analysis revealed nine studies on Agile implementation in developing countries [7], [16], [40]–[46] and six papers in developed countries [30], [40], [42], [43], [47], [48].

4. RESULT AND DISCUSSION

The data extraction results were then analyzed using content analysis methods [35] and open coding [36]. This approach allowed for identifying key themes and patterns in the data, providing a structured way to categorize findings. From this process, reports and conclusions can then be synthesized to answer the RQ as follows:

4.1. RQ1: what challenges arise in implementing Agile software development in Indonesia?

Data extraction from the SLR unveiled 14 challenges in Indonesian organizations. Figure 5 illustrates their distribution across different organizational fields, while Table 2 categorizes these challenges based on organizational, people, and technical similarities [7]. Here are the details:

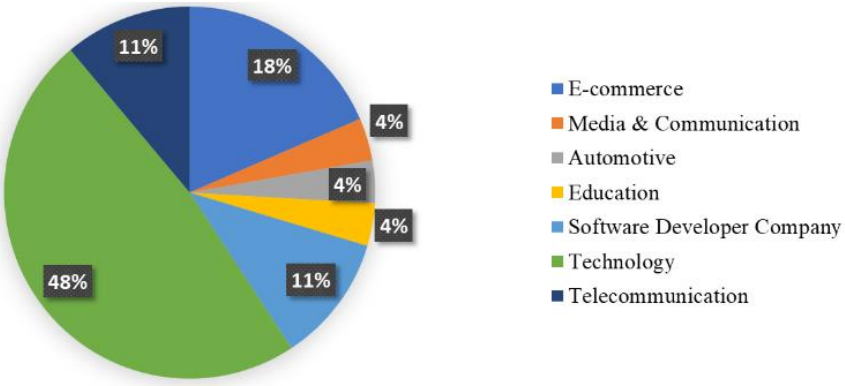

Figure 5. Distribution of organizational fields

4.1.1. Organizational

Conventional organization structure and mindsets often hinder the successful implementation of Agile methodology within an organization. This analysis explores the main obstacles across three essential dimensions: organizational culture, communication and collaboration, and top management support. These dimensions are key areas that can influence the success of Agile adoption:

a. Organizational culture

The sub-theme highlights traditional organizational culture as a root cause, influenced by management's limited understanding of Agile, continual interference hindering team self-organization, inconsistent time-boxing undermining Agile productivity, inadequate stakeholder support, and inexperienced Product Owners. These challenges were often a result of previous waterfall practices, newly established organizations inheriting waterfall culture, and the integration of Agile teams into predominantly traditional organizational contexts. Expert “A” emphasized the importance of agility through continuous personal development and cultivating a culture of ongoing improvement. Organizational adaptation to agility focused primarily on rapid responses to change and meeting customer needs. Meanwhile, resistance to agility could arise from both management and subordinates. Legacy companies grappled with outdated practices, whereas startups tended to be more adaptive. Expert “C” highlighted clients with fixed mindsets often perceived Agile solely as a methodology, neglecting cultural aspects. It led to a shift in focus towards scope, quality, time, and budget considerations.

b. Communication and collaboration

Poor communication among team members, especially between the Product Owner and the Developer team, resulted in disparate perceptions of product development, delays in product delivery, and unresolved discussions between business and technology stakeholders. Expert “B” underscored that deficient team communication and collaboration might originate from issues related to communication competence, such as passiveness, lack of initiative, unclear delivery methods, and misunderstandings in knowledge documentation among team members. Expert “C” added that the role of the Agile Coach in addressing team communication issues might lack influence. It was possibly due to an unfavorable organizational culture.

c. Support from top management

The absence of stakeholder support, primarily evident during sprint reviews, resulted in misaligned product expectations and potential delays in product delivery. This situation also reduced the product owner's involvement. Expert “B” highlighted a lack of support from other stakeholders, impacting client-side business operations and leading to potential misunderstandings of project details. Expert “C” noted its connection to the Agile coach's challenge in convincing stakeholders of the benefits of Agile. Moreover, team members' commitment to a single Agile team was compromised due to external work commitments. While Experts “A” and “C” disagreed with this challenge, Expert “B” suggested that dynamic team members could handle multiple projects to save on the budget. Expert “C” recommended gaining maturity in managing one product before tackling others.

Besides, inadequate management understanding of Agile resulted in ignorance and poor monitoring of its implementation. Expert “C” emphasized the organizational reluctance to commit to Agile, citing resistance to change, historical baggage, and a lack of individuals capable of convincing top management. Expert “A” suggested that this issue could also stem from a shortage of skilled change agents, specifically those introducing Agile. The lack of capability refers to concerns about organizational commitment and related factors, as stated by Expert “A”:

What works best in Agile is that the influence comes from top management. Why? Because they will incorporate every decision into the agreed policy implemented in the organization. If it does not come from there, all these challenges will arise because initiating change from the bottom first will take a long time. It is either impossible or difficult to deviate from the superiors' decisions, making it challenging.

Table 2. Challenge extraction result

Category	Sub-theme	Challenge	Total	Percentage	Percentage per sub-theme	Percentage per category
Organizational	Organizational culture	Organizational culture tends to be traditional	25	92.59%	19.23%	39.23%
	Communication and collaboration	Poor communication between team members	10	37.04%	9.23%	
		Poor teamwork	2	7.41%		
	Support from top management	Lack of support from relevant stakeholders	7	25.93%	10.77%	
		Dedicated commitment to one product	4	14.81%		
		Organizational/management commitment in implementing Agile culture	3	11.11%		
People	Team capability	Challenges to determining priorities and management requirements	19	70.37%	23.85%	46.92%
		Team capabilities that are not following the existing workload	12	44.44%		
	Awareness and knowledge	Team commitment in implementing the Scrum Event	14	51.85%	10.77%	
	Training and learning	Lack of knowledge of Scrum	10	37.04%	12.31%	
		Not self-organized team	6	22.22%		
Technical	Technic	No Scrum Master/Agile Coach	11	40.74%	13.85%	13.85%
		Inconsistent time-boxing	4	14.81%		
		A team larger than ten people	3	11.11%		

4.1.2. People

Effective implementation of Agile methodologies relies on several key factors. They are team capability, awareness, and training. Organizations may face significant challenges in adopting Agile principles and practices if these factors are not properly addressed. This analysis explores the three key areas:

a. Team capability

It occurred when additional tasks were introduced in mid-sprint, altering sprint goals due to frequent changes in requirements. Task accumulation extended into the next sprint, estimating task weights and priorities challenging, with stakeholders often rejecting estimates. These challenges may arise from mismatched team capabilities, incomplete requirements during initial weight assignment, mid-sprint task additions, an inexperienced team primarily comprising junior members, and sprint work estimates exceeding the team's capacity. Expert "A" clarified that late product delivery could be attributed to challenges in analyzing business opportunities and product research data. It was often compounded by agents of change introducing Agile culture in organizations lacking the necessary change capabilities. The capability was not necessarily linked to Agile implementation but depended on the company's expectations or the recruitment of individual team members. It involved the ability of all organization members to implement Agile effectively. Expert "B" added that late delivery could stem from the development team losing focus, prioritizing lower-priority tasks, or adopting an Agile framework with a fixed-scope mindset. Meanwhile, effective communication with the Agile coach could help address this issue, as stated by Practitioner "C":

If everything is deemed essential, nothing is vital. The mindset lacks a focus on value and revolves around scope, quality, time, and budget. Success in a project is defined by meeting the agreed-upon scope within the specified time, cost, and quality parameters.

b. Awareness and knowledge

The team considered these practices unnecessary and steered clear of Agile activities, resulting in ignorance and impeding progress tracking. Expert "A" pointed out that resistance from team members and leaders to adopting Agile could disrupt organizational workflows significantly when team leaders obstructed Agile event implementation. Given their more significant influence, team leaders might resort to coercive tactics, like threats of replacement, to enforce compliance. Expert "C" suggested that such behavior indicated the incompetence of the Agile coach.

c. Training and learning

Challenges include a lack of Agile understanding due to the absence or minimal involvement of a scrum master or Agile coach. Insufficient commitment to Agile implementation arises from culture shock while transitioning from traditional to Agile methodologies. The team's failure to self-organize results from a lack of commitment, compounded by inadequate scrum master or Agile coach involvement due to multiple organizational roles. Expert "B" highlighted a lack of Agile understanding stemming from limited implementation experience. Expert "A" emphasized insufficient support from change agents, and top management's influence on Agile implementation permeates every organizational policy. Additionally, Expert "B" attributed the issue to the team's inexperience, while Expert "C" identified an ineffective Agile coach as a contributing factor.

4.1.3. Technical

An effective implementation of Agile methodology is contingent upon several technical factors, including the role of the Scrum Master or Agile Coach, adherence to time-boxing practices, and team size. This analysis explores the three key technical areas:

a. Lack of scrum master or Agile coach: This problem arose from the absence of a dedicated scrum master, reliance on randomly chosen scrum masters per sprint round, and inadequate role understanding. Expert "C" emphasized the importance of having a capable scrum master or Agile coach who served as an agent of change within the organization. Expert "A" noted that recruiting a scrum master was costly, requiring not only familiarity with guidelines but also extensive experience. The Agile team should include an individual with a strong character capable of effectively explaining Agile usage. It should identify and address errors in cases of immature Agile implementation. It can prevent incomplete or inconsistent Agile practices. The Agile coach should maintain firmness, and if the team is unprepared or faces resistance, it may be better to postpone Agile implementation.
b. Inconsistent time-boxing: Teams frequently postpone time-boxing to adhere to stakeholder-driven product delivery schedules. Expert "B" attributed the issue to mid-sprint changes or additional tasks. Meanwhile, Expert "C" cited the ineffective role fulfillment of the Agile coach or scrum master. Expert "A" suggested the problems could be mitigated with a more substantial organizational commitment to Agile implementation and pressure from top-level stakeholders.
c. Large teams: Teams with more than 15 members violate optimal Agile team size recommendations. Expert "C" linked the presence of over ten members to the misconception that larger teams lead to faster work completion, potentially undermining the value of Agile events due to time constraints. Expert "B" emphasized the importance of maintaining an ideal team size within organizations.

The challenges in Agile implementation reveal several critical issues with varying degrees of impact. The most significant challenges, based on Figure 6, are rooted in organizational culture 19% and difficulties determining work priorities and management requirements 15%. In contrast, some challenges were less significant, including poor teamwork 2% and managing teams with more than ten people 2%. These findings suggest that while team size and internal collaboration issues are present, they are not as detrimental to Agile adoption as the broader organizational and management-related challenges. Other notable challenges include the lack of team commitment to Agile practices 11%, team capabilities that do not match the workload 9%, and the absence of a scrum master or Agile coach 8%. These insights highlight the importance of dedicated roles and appropriate skill sets for successful Agile implementation.

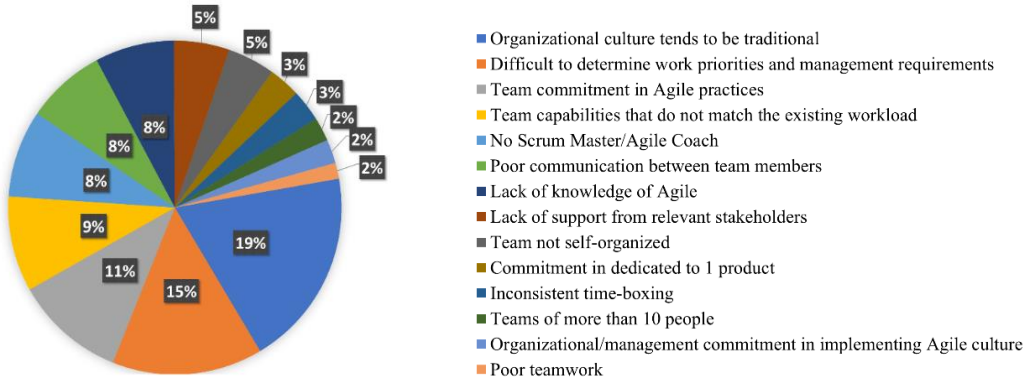

Figure 6. Chart of challenges extraction results

4.2. RQ2: how are the challenges in Indonesia compared with those in other developing countries?

This research identified nine papers [7], [16], [40]–[46] on Agile implementation from international academic databases. Common challenges were then mapped to those identified in the SLR.

a. Organizational culture tended to be traditional

In Indonesia, the challenges included management's limited understanding of Agile, inconsistent time management affecting productivity, insufficient stakeholder support, and inexperienced product owners. In Brazil, hindrances to change involved existing practices, incompatible methodology [16], lack of top management support, entrenched traditional mindset, and misconceptions about continuous delivery [42]. Malaysia faced difficulties adapting to Agile, including transparency issues [40], [43], while India demonstrated cultural adaptability supported by influential leaders [41], [44]. Conversely, Saudi Arabia encountered collaboration hurdles due to gender segregation, a lack of top management support, and a hierarchical system [7]. Asian and Middle Eastern traditional cultures have rigid hierarchical structures, respect for higher positions, and a top-down communication approach [16], potentially impeding Agile organizational change.

b. It was challenging to determine priorities and management requirements

Indonesia's challenges include incomplete initial load assignments and mid-sprint task additions. Malaysia and Saudi Arabia lack customer involvement due to early and specific customer requirements [7], [40]. Brazil faced issues from a lack of guidance and strategy in software development, governance, and Agile transformation [16]. It also encounters complex decision-making problems in delayed project schedules, unclear requirements, and insufficient change management [42]. India grapples with ambiguous requirements and incomplete information regarding problem context and client expectations [41], [44]. Developing countries struggle with communication in customer involvement, requirement prioritization with top management, expert recruitment, and inter-team problem-solving complexities.

c. Team capabilities did not meet the existing workload

Indonesia faced issues with team capabilities that misaligned with the workload. An inexperienced team primarily comprised junior members; sprint work estimation exceeded capacity. In Saudi Arabia, problems with team members were caused by a lack of collaboration skills, shared responsibility, and a willingness to learn [7], [40]. Brazil encountered difficulties due to insufficient team commitment to meeting predetermined product delivery targets [42]. India's issues arose from an incorrect development team recruitment process prioritizing career excellence over problem-solving and analytical thinking skills [41], [49]. In general, developing countries faced challenges related to individual commitment to task completion and recruitment processes that were not aligned with team needs.

d. There was poor team commitment in implementing the Agile practices

Indonesia avoided Agile activities, hindering progress tracking. Malaysia faced team demotivation for practices like retrospectives, which were considered time-consuming [40], [43], although they were highly motivated to adopt Agile practices. Brazil and Saudi Arabia lacked knowledge of Agile work processes [7], [16]. Developing countries generally encountered challenges related to Agile knowledge, team member commitment, and motivation in implementing Agile practices.

e. There was poor communication between team members

Indonesia faced issues, including differing perceptions of product development, delayed product delivery, and unresolved discussions between business and technology stakeholders. In Saudi Arabia, mixed-gender teams encountered communication challenges due to cultural restrictions [7]. India experienced inequality among senior and junior team members, limited two-way communication, and a hierarchical organization [41], [44], [45]. Malaysia noted a reluctance to raise issues like unmet deadlines or technical difficulties, potentially linked to a command-and-control mindset [40], [43]. Developing countries attributed communication problems to cultural factors, such as mixed-gender communication issues in Saudi Arabia and a lack of transparency and complex hierarchies.

f. The understanding of Agile was lacking

In Indonesia, a lack of Agile understanding existed due to the absence or minimal involvement of a scrum master or Agile coach, insufficient commitment to Agile implementation, and culture shock during the transition. Brazil's deficiency in Agile knowledge impeded its transformation process, leading to role confusion [16], [42]. In Saudi Arabia, there was a lack of Agile awareness among key stakeholders, including customers, senior management, and team members. The disparity between higher education and the labor market prompted universities to involve companies in skill-building initiatives [7].

g. There was a lack of support from relevant stakeholders

In Indonesia, the absence of relevant stakeholders posed a potential risk, leading to misaligned product expectations and delivery delays, ultimately reducing the product owner's involvement. Brazil encountered issues with insufficient product owner participation and a lack of top-level management support and understanding of the execution process [42]. In Saudi Arabia, there was a lack of awareness among key

stakeholders, including customers and managers, and a scarcity of learning resources regarding Agile for stakeholders [7].

h. The team was not self-organized

In Indonesia, there was a lack of commitment, internal collaboration, familiarity with Agile, and sufficient scrum master or Agile coach involvement due to multiple organizational roles. In India, senior team members were deficient in mentoring junior team members [41], [45].

i. There was a lack of organizational/management commitment to implementing Agile culture

In Indonesia, issues arose from management's lack of understanding of Agile, leading to neglect and inadequate monitoring of Agile implementation. Brazil grappled with limited trust and support from management in ongoing information technology (IT) projects, primarily prioritizing customer satisfaction to the detriment of progress [42]. In Saudi Arabia, Agile adoption was slow due to senior management's lack of awareness, a sluggish adoption pace, and poor Agile application. Management teams played a pivotal role in training and educating development team members [7]. In Malaysia, managers strongly supported implementing and improving Agile practices [40], [46].

Out of the fourteen challenges identified in RQ1, only nine were mentioned in published Agile research in developing countries. In these regions, the traditional hierarchical communication structure and top-down transformation methods can impede the successful implementation of Agile methodologies. This hierarchy often hinders effective communication between teams and other stakeholders, leading to challenges in Agile adoption. Therefore, it is crucial to carefully consider and address these issues to facilitate a smoother transition to Agile practices

4.3. RQ3: how are the challenges in developing countries compared with those in developed countries?

This research identified six published papers on Agile implementation [30], [40], [42], [43], [47], [48]. Specifically, research on Agile adoption in developed countries. Comparative analysis of these papers, emphasizing on core factors, including organizational culture, and communication, while also exploring the critical role of management.

a. Organizational culture posed challenges

Developing countries encountered difficulties with hierarchical systems and top-down approaches during Agile transformation. Likewise, in the UK and the US, resistance to Agile transformation was linked to traditional work-process thinking [42]. Additional challenges encompass inadequate change management, restricted access to experts and training, lack of commitment from product owners, insufficient documentation, and poor integration with standard processes [30]. In contrast, Singapore did not face these issues, as the transition process succeeded due to a top-down approach and the active involvement of top management [40], [48].

b. Determining priorities and management requirements presented a significant challenge

Developing countries faced communication challenges related to customer involvement, requirement prioritization with top management, expert recruitment, and complexities in inter-team problem-solving. This situation was further complicated by a lack of clear priorities and uncertainty about long-term research direction [47]. Relatedly, in the US, late project schedules, unclear requirements, poor change management, and ambiguous roles created minimal contributions and duplicated work [42]. Moreover, the UK encountered issues such as low team member commitment to delivering products as planned, alongside challenges with requirement quality [30].

c. Team capabilities did not align with the existing workload

Developing countries faced challenges related to individual commitment, and the recruitment processes did not align with team needs. This issue was also observed in Singapore, a developed country experiencing difficulties empowering the team [40], [43]. Consequently, it impeded efficient decision-making and creative thinking.

d. Team commitment to implementing Agile practices was inadequate

Developing countries faced challenges regarding Agile knowledge, team commitment, and motivation. Similarly, in a developed country like Belgium, there were process rule violations during project retrospectives, including extended daily stand-up meetings [40]. Furthermore, due to tight schedules, Singapore reported team fatigue and decreased motivation for certain practices, such as retrospectives.

e. There was an absence of a scrum master or Agile coach

Indonesia experienced this issue due to the absence of a dedicated Agile coach or scrum master, reliance on randomly chosen scrum masters per sprint round, and inadequate role understanding. Meanwhile, in some developed countries, the scrum master role is absent from scrum practices and processes [47].

f. There was poor communication between team members

Communication challenges rooted in cultural factors were prevalent in developing countries such as Saudi Arabia. It included mixed-gender communication issues, transparency challenges, and hierarchical

complexities. Besides, developed countries like the US and the UK faced fewer team meetings due to a lack of initiative in building effective relationships. Concerns in these countries revolved around effective communication, collaboration, and project task execution [42]. Furthermore, Singapore observed reluctance to address unmet deadlines or technical difficulties, possibly tied to a command-and-control mindset [40], [43].

g. There was a lack of knowledge of Agile

Developing countries faced challenges due to the absence or minimal involvement of a scrum master or Agile coach, insufficient commitment to Agile, and a lack of stakeholder awareness. Limited experience with Agile methodologies was also a hurdle [30]. Correspondingly, Singapore and Belgium encountered issues with the absence of customer representatives in iteration planning sessions, affecting team velocity and decision-making on business priorities [42].

h. There was a lack of support from relevant stakeholders

Developing countries met this challenge due to the absence of a product owner role providing feedback during development and a lack of top management awareness. In contrast, Belgium handled customer requests directly, maintaining customer closeness without interfering with teamwork during iterations [40]. Meanwhile, Singapore struggles to manage customer needs within tight schedules.

i. The teams were not self-organized

Developing countries underwent the issue due to insufficient senior guidance and training in Agile and a lack of commitment to implementation. Comparably, The UK grappled with a complex hierarchy, leading to communication challenges and inflexibility in self-organization [40]. Management frequently intervened, and the product owner occasionally assigned critical tasks without team consultation [47].

j. There was insufficient organizational/management commitment to implementing an Agile culture

Developing countries encountered this challenge due to a lack of awareness and an excessive focus on customer satisfaction. In the UK, the absence of top-level management support and understanding of the implementation process led to an emphasis on customer satisfaction without a clear understanding of the necessary steps. Additionally, there was a lack of organizational leadership and standardization in IT projects [42]. In contrast, Singapore benefitted from robust managerial support for deploying and enhancing Agile practices [40]. Belgium shared a similar commitment from management, even though the initiative originated at the team level.

Both developing and developed countries encountered comparable challenges. The initial challenge involved team member resistance, followed by difficulties related to complex hierarchical systems. These challenges impacted decision-making and hindered effective communication with stakeholders, impeding the facilitation of continuous feedback. Challenges also arose concerning commitment from both top management and team members. Additionally, the absence of crucial roles in the Agile methodology was noted. These challenges often stemmed from universal human behaviors, encompassing resistance, communication issues, reluctance to embrace change, misalignment among customers, stakeholders, and development team members, and bureaucratic decision-making processes. These factors collectively contributed to delays and inefficiencies.

In the globalized business landscape, companies in developing countries experience pressures and customer demands similar to those in developed countries. The widespread adoption of Agile has become a new global standard for software development and project management [50], [51]. Consequently, organizations in developing and developed countries often encounter similar challenges in Agile implementation caused by shared principles and practices [50], [52], [53]. However, addressing these challenges could require country-specific solutions due to cultural differences.

Anticipated changes were frequently viewed as significant disruptions involving transformations that elicited resistance from individuals who preferred focusing on new endeavors [54]. Based on discussions with Expert "A", it was suggested that senior leaders could function as agents of change, mediating between macro-level organizational shifts and micro-level behaviors. During the Agile transformation, they needed to embrace new mindsets and acquire new skills to design a new Agile corporate architecture and culture [50], [52], [53].

A gradual approach aligned with a more relaxed culture addressed team member resistance and commitment issues in developing countries. This approach involved team building and training [55]–[57]. While the team-building approach could foster bonding, it came with certain caveats. Its effectiveness was maximized when team members actively diagnosed their team's issues. Although external facilitation was often necessary, team members had to be willing and capable of expressing their needs [57].

However, team training also had caveats, particularly regarding the required effort. Identifying team-specific knowledge, skills, and attitudes and developing learning objectives and training strategies could be time-consuming and resource-intensive. Nevertheless, laying this groundwork was essential for a successful team training program with the desired outcomes [55], [56].

According to discussions with Expert "C", the implementation of Agile could commence with small-scale projects or a gradual introduction to the Agile culture. Expert "A" suggested that a more stringent

approach might be suitable for developed countries with stricter hierarchies, involving direct orders for Agile implementation and consequences for team members who resisted. Most team members and leaders in developing countries typically obeyed top-down management [7]. This cultural inclination was shaped by traditional education and upbringing. Overcoming complex hierarchies in developing countries required proactive team members to contribute input to the organization. In contrast, it was relatively more straightforward in developed countries due to their more open culture.

Conducting project demos and providing regular information updates on IT project developments was essential to enhance communication between customers and stakeholders [42]. Communication methods and channels tailored to stakeholders' preferences–including videos, emails, and presentations-were also crucial. However, it was necessary to consider the limitations of the Internet, hardware, and infrastructure in developing countries compared to developed countries [54]. Furthermore, Agile events such as sprint reviews and retrospectives could be leveraged for effective communication and feedback delivery. On the contrary, it was important that enhancing transparency in the culture required an understanding that developed countries generally possessed a more established culture of openness than developing countries [40].

The commitment of top management to Agile implementation was apparent in their role as initiators and agents of change. However, challenges could arise due to budget constraints and insufficient project funding [43], [58]. Experts "A" and "C" stated that resistance to change in well-established organizations with traditional practices made it difficult to secure top management commitment. In developing countries, the Agile initiator was required to persuade top management by aligning Agile's benefits with the organization's vision, facilitating smooth adoption. In contrast, the open culture in developed countries encourages bottom-up Agile implementation [40]. According to Expert "B", this approach could effectively address the absence of crucial Agile roles, such as scrum master or product owner, by securing top management's commitment to allocate the necessary funding.

Despite similarities in Agile implementation challenges between developing and developed countries, Singapore displayed unique characteristics. The transition to Agile in Singapore was notably smoother, attributed to leaders creating a collaborative environment that fostered independence and reduced excessive guidance [40]. This top-down approach transformed management roles into coaches, facilitators, and resource providers, supporting team self-organization decision-making and nurturing team members' sense of ownership and responsibility.

5. CONCLUSION

The most significant challenges identified include the persistence of traditional organizational culture, which impedes the adoption of Agile methodologies, and the difficulties encountered in determining work priorities and management requirements. In contrast, challenges such as having team members exceed ten individuals and experiencing poor teamwork were found to be less impactful. Of the fourteen identified challenges, only nine were mentioned in developing countries. These countries' traditional hierarchical communication structure and top-down transformation methods could hinder successful Agile implementation, primarily impeding effective team and stakeholder communication. These issues required careful attention to facilitate a smoother transition to Agile practices in developing countries.

The same ten challenges were prevalent in developed countries. These similarities suggest that challenges in both developing and developed countries often stem from universal human behavior. Additionally, companies in developing countries operate globally and encounter customer pressures and demands similar to those in developed countries. The widespread adoption of Agile as the global standard for software development and project management led to comparable challenges in organizations from developing and developed countries. It can be attributed to their shared adherence to Agile principles and practices.

In developing countries, a more relaxed and gradual approach proves beneficial. It includes team-building activities and training programs, which help foster team cohesion and diagnose issues with the aid of external facilitators. Conversely, a stricter and more direct approach is often necessary in developed countries. It involves issuing direct orders and implementing consequences for non-compliance, which aligns with their established hierarchical systems.

Enhancing communication between customers and stakeholders through tailored methods is essential for successful Agile implementation. However, it is imperative to consider the infrastructural limitations prevalent in developing countries. Securing top management commitment remains a significant challenge, often hindered by budget constraints and resistance inherent in traditional organizational structures. In developing countries, aligning Agile benefits with the organization's strategic vision is crucial to garner top management support. Conversely, a bottom-up implementation approach is often more effective in developed countries due to their open cultural environments. Additionally, addressing the absence of critical Agile roles requires securing top management's commitment to allocate the necessary funding.

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