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Effect of Human Factors in the Success of Agile Software Project: A Quantitative Study

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Abstract: The Agile methodology has been growing in the software industry, which means data showing people are slinging code more than ever before. This helped lead me to investigate how human factors are impacting the success of Agile software projects. The primary objective of this research was to determine the relationship between human factors and the success of Agile software projects. This research was based on a combination of systematic literature review and survey research techniques to conduct a tracking and a tracing of the elements of Agile that resulted in team performance. This research was conducted in two stages. For the first phase, performed a theoretical study of the factors and challenges influencing the successful completion of Agile software projects; and in the second phase, an exploratory research by conducting a survey of 120 software developers about their current practices. As a portion of the conclusion for the published paper (listed below), it went on to identify 15 human factors that significantly influenced team performance. Those human factors consisted of personality, leadership, motivation, cognitive style, emotion, professional knowledge, IQ, work experience, capability, trust, social sensitivity, respect, social skills and formal education.The findings of this study would significantly benefit several stakeholders, such as software developers, organizations, project managers and other stakeholders as it provides them with an understanding into potential cross-cultural challenges, to increase the likelihood of the success of their Agile development projects. Having known that, this can be a nice reason to give to a business sponsor while trying to determine the types of projects you might like to pursue for your portfolio as a young professional, or to bring to some smaller businesses in order to help them jumpstart their understanding of how human factors are impacting their surrounding software development wardrobe or adding some supports to a first ever fidelity investment in probing more deeply into how individuals that otherwise largely agree on entering software applications, might go on to evolve into disagreeing about working with each other.

Keywords: Agile Methodology; Success Factor; Team Performance; Human Factors; Cross-Cultural Collaboration.

1. Introduction

Businesses around the world are stepping away from traditional work practices in droves, demonstrating the widespread impact of Agile methodologies. The 10th Annual State of Agile Report in 2015 noted that 26% of European companies and 18% from South America, Asia, Africa and Oceania had implemented Agile practices [1]. Formulated in 2001, the Agile Manifesto — which laid the foundation for the Agile methodology — comprised 12 principles and four essential values for software development.

Agile has broadened its embrace to encompass a wide variety of businesses and industry sectors, endowing organizations with enhanced capability to manage ongoing change and meet the demands of an increasingly complex and dynamic marketplace [1]. Among a multitude of industries, the successful management of multicultural teams is often thwarted by cross-cultural complexities [2]. Where project team members are drawn from different cultural backgrounds, research warns that miscommunication, misunderstanding and conflict are endemic [3]. In a software development project for which a team was assembled from a range of cultures [3], for example, miscommunication and misperceptions common to cross-cultural differences eventuated in conflict. Similarly, a study of cultural variation within project teams [4] found differential interpretation among team members, culminating in a sequence of misunderstanding, ambiguity, and disagreement that undermined the team's performance. In a different study, [5] found that team members' opinions and approaches of task execution were affected by culture, and that this, in turn, had an impact on project team performance. Researchers suggest addressing the cultural gap by understanding each team member's culture in order to reduce the effects of cross-cultural challenges on project teams. It will help the project move forward and increase a greater awareness of work patterns.

From the late 1990s until the introduction of the Agile Software Development Manifesto in 2001 by a group of software professionals, the Agile movement has been constantly changing. This marked the genesis of the Agile movement in the industry and set the tone for its growth and adoption in the years to come. Agility, as per [6] refers to the Responsiveness of method of information system development to proactively and quickly respond to change. Agile principles prioritize value addition over following a rigid plan, by providing functional software to users at frequent intervals being one way to achieve this. Agile development expects teams to deliver early and gather feedback promptly, which allows for easier changes, better quality, and constant testing.

A significant emphasis is placed by the Agile Manifesto on the value of human interaction, with the 1st statement prioritizing "individuals and interactions over processes and tools", and the third statement emphasizing "customer collaboration over contract negotiation." Additionally, the 60 principle states that face to face conversations are the best way of exchanging information with the development team. [1] defines human factors as any issues that arise from the working of team members together in the agile development, this concept is especially relevant due to the focus on the human interaction. Sharp describes human factors as social factors that enable the flow of development process, which arise from various interactions between team members. [1] have stressed the significance of human elements such as cordiality, talent, skills and communication in agile development methods. These elements tend to surface when individuals work together as a team.[7], [8], [9] have noted the presence of social and human elements within conventional Agile environments and software development, particularly in extreme Programming. However, [9] points out that research on human elements in software development is restricted. Additional research is required to assess the impact of human factors on the software development process, especially in contexts of agile environments.

According to [1] in comparison to traditional development approaches, the Agile methodology places greater importance on the human aspect. The team's proficiency is critical, and every member contributes to the agility of the development process. This means that in addition to reducing the need for extensive documentation, Agile pays attention on creating a skilled team that can effectively leverage any tool and technique to achieve its objectives. The Critical Success Factor methodology for identifying and assessing an organization's performance was introduced by [10] in the beginning and subsequently refined and established [11]. CSF is defined by [11], CSFs are a small range of key areas which achieving desirable outcomes will lead to competitive success for individuals, departments, or organizations.

Agile software development methodologies are focused on teams that carry out knowledge-intensive work [12], [13], [14]. In order to transform complex requirements into software solutions, the expertise of team members and problem-solving abilities needed. Agile teams strive to be independent, self-organizing, introspective, and adaptable [15]. The discussed characteristics of the team are differ from those of teams that have coaches and leaders taking charge as the main controlling authority figures [16]. Hofstede's definition of culture as the shared mental programming that sets apart one group's members from another [17] Hofstede's cultural dimensions framework was developed for a business context and consists of five dimensions based on Kluckhohn and Strodtbeck's research, which has been expanded to include a sixth

dimension. The framework is used to assess how management is influenced by cultural differences among groups.

As [17] note, cultural orientation significantly impacts managerial practices, and cross-cultural management focuses on understanding how individuals with diverse cultural backgrounds behave within an organization. This includes understanding the behavior of organizations within different cultural contexts and comparing behavior across cultures and countries to improve interactions between workers and managers globally. As per [18] findings, people often rely on their before existing notions when encountering unfamiliar cultures. They project their generalized and stereotypical understanding of the other culture and resort to previously learned communication strategies. However, these projections may differ in complexity and accuracy. The individual's own culture also influences their perception of another culture, as it affects what they consider important. Thus, individuals tend to act based on their subjective and biased understanding of a culture, rather than the culture's true nature. However, [19] argues that with more information about another culture, people's perception tends to become closer to the actual culture. Effectively managing a diverse workforce requires managers to have the skills to manage workers from different cultural backgrounds. Therefore, as noted by [17], that is necessary for the managers to understand the conduction of cross cultural leadership to improve corporate performance. Additionally, the cultural challenges should be handle by managers by and they also have the ability of understanding what is and isn't effective in different cultures [20].

The primary goal of this research is to address the following questions:

RQ 1: What are the challenges in implementing agile software development projects with the human factor?

RQ 2: What are the perceived critical success factors for agile software development projects in the human factor?

RQ 3: What are the cross-cultural issues that arise when diverse software development teams collaborate to adopt and apply agile methodology?

The rest of the paper is organized as follows: Section 2 provides details on materials and methods. Section 3 presents the results of the research questions proposed for this study. Section 4 summarizes our discussions and future work.

2. Materials and Methods

In order to verify the LR and obtain current information about the topic, researchers use the survey method. Insights from data gathered from the literature are incorporated into the survey's design, along with additional questions about the elements that influence practitioners' perspectives. The primary goal is to guide the questions that represent the findings from the literature that will validate the knowledge gained from the literature, and the other questions may provide a more practical understanding of the issues. The purpose of this study's survey is to gather useful responses from software professionals, particularly those working on agile projects. In this research variety of participation will involve a range of team roles, experiences, and geographical locations. A survey is conducted using the Google online form.

The questionnaire's questions are created using the relevant data that the researchers gathered from the Literature Review (LR), and answers are given for any information that the participants would not be familiar with. In order to gain a general understanding of the participants, the first asked geographical questions about their job roles and experiences. Next, about individual human factors that was identified through literature. The questionnaire then proceeded on to ask more in-depth questions about the personality factor. Lastly, participants had to decide whether or not certain factors had an impact on the team's performance. The purpose of this research is to determine the point at which agile methods may be implemented in diverse cultural contexts. Successful implementation of agile techniques requires modifications in guiding concepts and values. At last, the majority of the questionnaires were distributed within Pakistan. Of course, our goal was to increase the number of respondents from different regions to our survey by using many platforms for publication and participant forwarding. A theoretical study and an analysis of the exploratory inquiry comprised the two stages of this project.

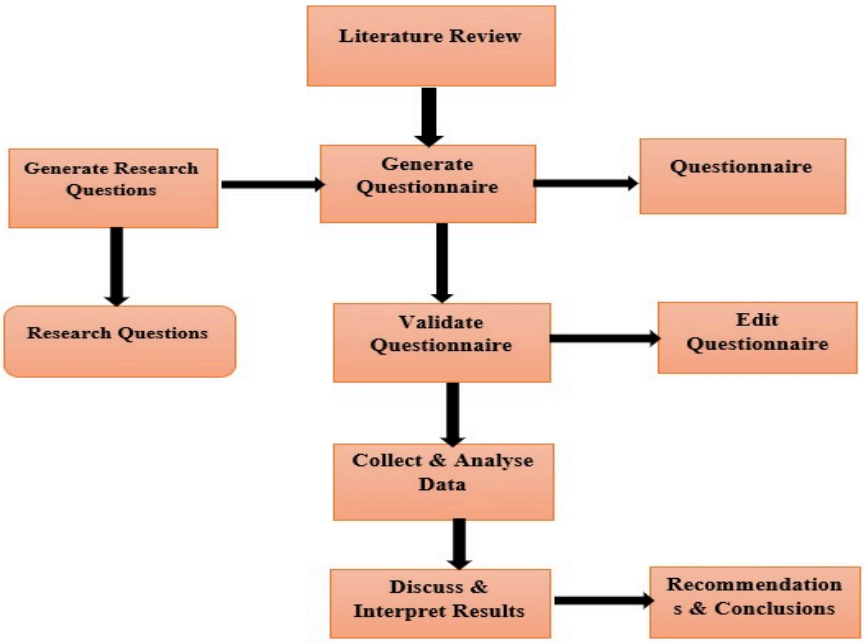

Figure 1. Illustrates complete theoretical foundation of this study

The aims of the theoretical study is to find the difficulties linked with implementing agile projects concerning human factors, conduct a survey to enhance perceived critical success factors, and evaluate cross-cultural issues that arise when diverse teams adopt agile methodology. An exploratory study was conducted using a survey research approach, with a focus on the use of a survey to collect quantitative data [21]. To ensure the survey objective's clarity, various factors were considered, including participant selection, response format standardization, and appropriate question quantity, following the general guidelines proposed by [22]. The survey design includes questions based on the relevant content obtained from the literature, with corresponding explanations offered for certain details that participants might not be familiar with. The data set included 250 participants, representing 100% of the population being researched.140 participants were willing to participate, representing 56% of the population. This indicates that just over half of the population agreed to take part in the study. 20 participants rejected or did not complete the online survey, representing 8% of the population. This suggests that there may have been some reluctance or difficulty in completing the survey for these individuals. the total number of usable responses was 120, representing 48% of the population. the majority of respondents (54.3%) were programmers, followed by project managers who made up 20.8% of the respondents. Quality assurance/tester/auditor and team leader positions each represented 7.5% of the respondents, respectively. System analysts accounted for 6.7% of the respondents, while IT service coordinators, UI/UX designers, intern full-stack developers, and product managers each represented 0.8% of the total respondents. This research employed a 5 point based Likert scale questions which ranges from "Strongly disagree" to "Strongly Agree" [23], [24], which is known for its reliability and validity in research [25].

3. Results

This research addressed numerous human factors challenges related to Agile and cross-cultural communication. Using the goals of the exploratory study as a guide, the following subsections examine the research findings.

3.1 RQ1: What are the challenges in implementing agile software development projects with the human factor?

The primary objective of the study was to examine the challenges and obstacles faced when carrying out Agile software projects, with a focus on the human element. The study revealed that challenges related to team collaboration, communication, individual and team psychology, resistance from team members, and remote work or distributed teams can comprise in Agile software development projects. Overcoming

these challenges requires effective communication and collaboration, involving team members in decision-making, using appropriate tools and technologies, and providing coaching and mentoring support.

3.2 Agile Issues and Challenges

The opinions of the respondents were measured using a 5-point Likert scale (Table 1), with 1 indicating "Never" and 5 indicating "Always." Following this, the scale was translated into equal intervals. The ranges for the intervals were determined using a formula [26]. The survey results suggest that challenges related to team collaboration, communication, individual and team psychology, resistance from team members, and remote work or distributed teams can occur in Agile software development projects, but their frequency and severity may vary depending on the specific project and team dynamics.

Table 1. Agile challenges

Challenges	Mean	DI
Have there been challenges working with others in the team?	4.05	Often
Improper communication may cause bigger challenges of agile methodology execution.	3.89	
In your opinion: how important is individual and team psychology in successfully implementing Agile software development projects?	4.06	
Have you ever faced resistance from team members when implementing Agile software development methodologies?	3.62	
Can Agile teams handle challenges related to remote work or distributed teams?	3.98	

According to the percentage of respondents who selected each option, achieving project success in agile development is heavily dependent on effective communication and collaboration. 70 respondents believe that effective communication and collaboration are "Very Important," 46 respondents believe it is "Important," and four respondents selected "Neither Important nor Unimportant." None of the respondents chose "Unimportant" or "Very Unimportant," indicating that All respondents believed that these elements were essential for Agile development projects to succeed. Overall, the survey's findings imply that cooperation and communication are widely seen as being crucial parts of Agile development projects that are highly appreciated.

3.3. RQ2: What are the perceived critical success factors for agile software development projects in the human factor?

The goal of the research was to explore the human-related elements that contribute to the Agile software development projects' success requires a comprehensive approach that considers the mindset, culture, skills, leadership, and empowerment of the team. By focusing on these factors, organizations can create an environment that fosters success and enables teams to deliver high-quality software quickly and efficiently. 76 respondents believe their organization always supports self-organizing teamwork (Figure 2), which is positive for innovation, collaboration, and productivity. The organization generally supports self-organizing teams, but there is still room for improvement to ensure all team members feel empowered and supported.

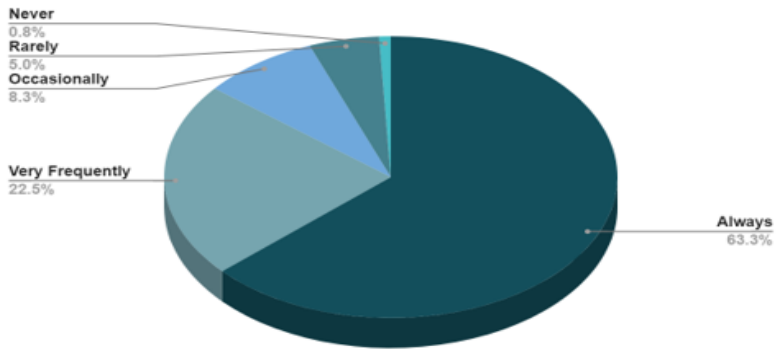

Figure 2. Organizational Support for teamwork

The majority of the team members (58) are very satisfied with their ability to manage and resolve conflicts, while 52 team members are somewhat satisfied, and only a few are dissatisfied (Figure. 3). Conflict resolution skills are crucial to project success, and the team's overall satisfaction is positive. However, it may be necessary to address the concerns of dissatisfied team members to prevent potential conflicts from escalating.

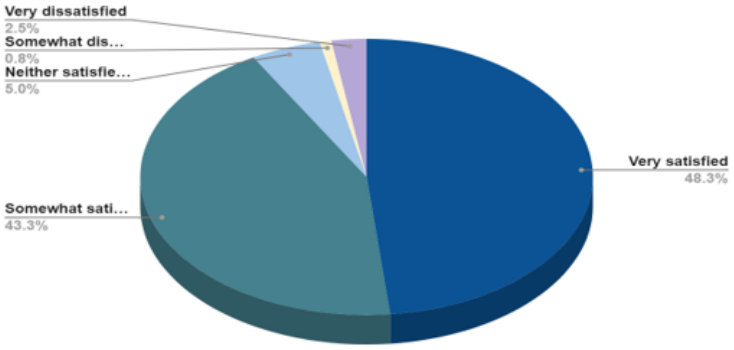

Figure 3. Conflict Management by Team

The second table presents a list of the human factors in individual-based TSNA and their mean Importance-level with respect to team performance. This table ranks the mean importance level of the human factors in individual-based TSNA with respect to team performance in descending order, so that the most important human factor listed is "1 and Ranked highest is listed highest. As shown, the most important element is "Personality," having a mean importance level of 4.52. This strongly suggests that team performance is greatly influenced by the personality of the other team members.

Table 2. Detailed evaluation of individual human factors

	Factors	Mean	DI
1.	Personality	4.52	Very Important
2.	Former Education	4.16	Important
3.	Work Experience	4.32	
4.	Professional Knowledge	4.35	Very Important
5.	Motivation Level	4.31	
6.	Social Skills (Communication, Empathy etc.)	4.33	
7.	Emotions	3.47	Important
8.	Leader's leadership Style	4.17	
9.	Intelligence (Ability to Learn and apply Knowledge and skills)	4.37	Very Important
10.	Age	3.23	Neither Important
11.	Gender	3.22	or Unimportant
12.	Ethnicity	3.48	
13.	Job Satisfaction	4.28	
14.	Mutual Trust and Respect	4.35	Very Important
15.	Cognitive Skills	4.33	

In the agile approach to software development, teams make decisions and are accountable for these decisions. Effective agile leadership comprises a leader providing a purpose, direction and having trust, trust and trust among the members of a team. Lastly critical, team members usually need high than average technical skills and interpersonal skills, so they know how to play their roles and they know when to simply back one another up.

3.4. RQ3: What are the cross-cultural issues that are raised when diverse software development teams partner to adopt and implement agile approaches to software development?

Agile leadership comprises a leader providing a purpose, direction and, finally, trust among the members of a team, and a leader providing a purpose. Cross-cultural communication Issues are becoming increasingly significant in the development of software projects. Reckoning of cross-cultural problems leads to an awareness of how work behaviours, communication styles, and cultural norms are influenced by cross-cultural differences of a wide variety. It investigates how development process and project management are affected by cross-cultural differences & plays down strategies for successfully adjusting for these differences.

In cross-cultural collaboration during agile methodology implementation and execution, punctuality, meeting deadlines, asking questions and disclosing issues as soon as possible to avoid wasting time were among the issues analyzed and the highest mean scores were 4.2, 3.86, 3.86 and 3.81 respectively. From the table it is observed that cross-cultural collaboration can be complicated by cultural differences in communication styles and work cultures and that effective collaboration could be hampered by one's confidence in their ability to give feedback or ask questions and local superiors respect. These issues need to be addressed by teams in order to create an environment or trust and openness which will foster effective execution of the agile methodology. In order to address these challenges, teams should set up clear communication procedures and offer cross-cultural collaboration and communication training. In addition, teams need to try to create a friendly and supportive environment in which all can work effectively, regardless of their culture background.

Table 3. Cross-Cultural Collaboration in Agile

Cross-Cultural Issues	Mean
Differences in punctuality (arriving late/on-time to meetings)	4.2
Reluctance to warn about non-feasible deadlines	3.86
Reluctance to reveal a lack of understanding and ask questions	3.86
Reluctance to expose problems at earliest convenience	3.81
Reluctance to discuss failure	3.81
Seeking immediate manager's approval for team tasks in deference to local superiors	3.77
Reluctance to voice criticism or propose alternatives to perceived directives from superiors	3.75
Differences in readiness to extend work hours in urgent situations	3.86
Taking days off/leaves of absence without or with a very short prior notice	3.88

Table 4. presents the survey results on cross-cultural communication in the context of globalization, which show its importance with a mean score of 4.46 out of 5. The respondents reported feeling reasonably at ease while collaborating with people from diverse cultural backgrounds and frequently encountering cultural disparities in their daily routines. However, the respondents are somewhat confident in their ability to navigate cross-cultural communication challenges. The respondents emphasize the importance of promoting cross-cultural understanding and communication among employees, with a mean score of 4.11 out of 5.

Table 4. Cross-Cultural Communication

Questions	Mean
To what extent do you believe cross-cultural communication is important in today's globalized world?	4.46
How comfortable are you with working with individuals from different cultures?	4.12
How confident are you in your ability to navigate cross-cultural communication challenges?	3.95
How often do you encounter cultural norms that are different from your own in your daily life?	4.1
How important do you believe it is for organizations to actively promote cross-cultural understanding and communication among their employees?	4.11

From the Figure. 4, it shows that 75 respondents believe that the correct use of body language is crucial in avoiding misunderstandings, as perceived by 82 respondents. Additionally, 62 respondents

consider the appropriate selection of words to be essential, while 34 respondents prioritize the proper use of voice. Only 2 respondents chose "None" as an answer, which means that they did not think any of the options presented were important in order not to cause misunderstandings in cross-cultural communication.

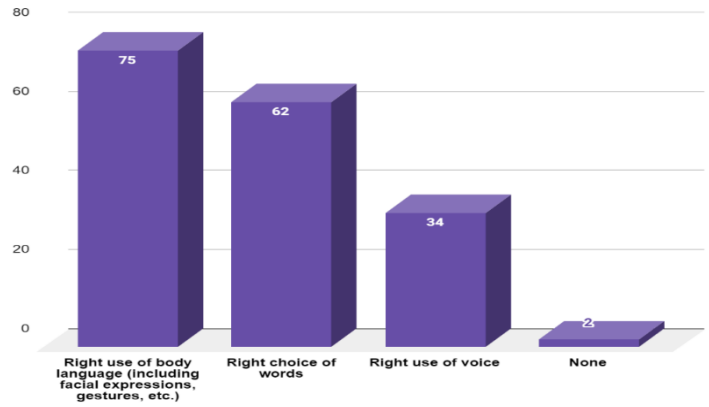

Figure 4. Cross-cultural communication strategies

Examining cross-cultural issues is essential for successful software development projects. By recognizing and managing differences in communication styles, work practices, and cultural values, project managers can ensure effective collaboration and maximize the productivity of the team. Overall, cultural diversity can be an asset in software development, bringing a range of perspectives and ideas to the table. However, effective cross-cultural communication and management strategies are necessary to leverage these benefits fully.

4. Discussion and Conclusion

The discussion of research goals focuses on evaluating the study results are presented, along with suggestions for addressing the challenges related to human elements in agile software development projects. The objective of this research is to find the specific human elements that effect team performance and investigate their effects. This research initially looked into and compiled the elements mentioned in the previous literature before talking about how these features impact team performance. This was done in order to see if these aspects may have an impact on performance in real-world scenarios. For this three corresponding research questions was created to achieve research objective. The LR and Survey two research methods were combined for this study. While Survey collects the scoring data for the variables looked at in context, LR is used to collect academic data relevant to our research. After that, a questionnaire was constructed and available online. With the information from the survey and the results of LR, this research compile a summary of the important effect on team performance.

RQ1 explores the challenges that arise when trying to implement agile software development projects with human factors in mind. This reseach identified some challenges such as collaborating across different cultures can pose challenges, as work cultures and communication styles may vary significantly. Additionally, factors such as reluctance to ask questions or give critical feedback, as well as deference to local authority figures, can further impede effective collaboration. To ensure successful adoption of agile methodology, it is crucial for teams to address these challenges by cultivating a culture of openness and trust. This can be achieved by establishing clear communication protocols and providing training on cross-cultural communication and collaboration. It's important for teams to strive towards creating an inclusive and supportive environment where every team member can work together effectively, irrespective of their cultural background.

RQ2 identified 15 distinct human factors using LR. Personality, leadership, social skills, emotion, work experience, professional knowledge, respect, motivation, trust, and capability are some of them. Others include cognitive style, social sensitivity, social sensitivity, ethnicity, formal education, gender, IQ, and age. The one that is most often mentioned is personality, hence it is crucial to match personality traits with professional duties. Organizations must set up corresponding personality assessments when hiring new

employees because it's difficult to alter someone's personality. The analysis of LR also allows us to draw the conclusion that all other parameters have an effect on team performance. A survey questionnaire available on several web platforms through the survey. Total 120 questionnaires were collected before the survey's deadline, and our manual data verification determined that each one had accurate information.

In RQ3 the cross-cultural issues that can arise when diverse software development teams work together to implement and utilize Agile methodology. By identifying the challenges associated with cross-cultural collaboration in Agile software development projects, this research provides valuable insights for project managers, software developers, and other stakeholders in the field. The results of this research can help project managers to anticipate and address potential cross-cultural challenges, ultimately increasing the likelihood of project success.

After analyzing the results from the LR and survey data, several elements that had no impact on the team's performance were able to be eliminated. Ultimately, 15 factors were identified that clearly demonstrated an influence on team performance. The research served as a means of better understanding the individual contributions to team performance. As has been mentioned repeatedly, the Agile development method emphasises that "people" rather than just "processes" contribute significantly to the development of software. Examining how human factors impact team performance can be accomplished through research. This research will help as a good place for firms to start and the many parts of them to understand these elements and their effects and use them to enhance software development and process improvement. Also, this research might contribute to future studies on how individuals affect teams. In future research, it's important to identify additional behaviors and characteristics that influence team performance to gain a more detailed understanding of how factors impact team performance.

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