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Facilitators and inhibitors of Agile methods adoption: Practitioners view

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Abstract

This study provides empirical evidence to the body of knowledge in Agile methods adoption in small, medium, and large organizations in the global context. This research explores facilitators and inhibitors of Agile methods adoption in software development organizations. A survey was conducted among Agile professionals to gather survey data from 52 software organizations in seven countries across the world. This study found many facilitators of Agile adoption to be significant such as customers' dominant issues, encouragement, project champion, highly competent team, use of tools, etc. Similarly a correlation analysis revealed multiple inhibitors as significant: absence of a full set of right Agile practices, absence of customer presence, absence of tracking mechanisms during Agile progress, and failure to determine the role of the client. The present study identifies that an Agile team with high expertise and competence leads to higher quality in software, customer satisfaction along with return on investment (ROI) while a small Agile team increases ease in handling changing requirements, customer satisfaction, reduced delivery time, and increased ROI. Frequent delivery accelerates better control over work, adds to software quality, customer satisfaction, and in shortening delivery time along with increase ROI. It has also been observed that providing essential features early leads to increase in software quality and customer satisfaction. This study confirms that active customer focus leads to better control over work. Further, absence of customer decreases dealing with changing requirements, and customer satisfaction while absence of progress tracking lowers customer satisfaction.

KEYWORDS
Agile methods, facilitators, failure factors, inhibitors, system development, success factors

1 | INTRODUCTION

The software industry is one of the most rapidly growing sectors and small software development companies play an important role in this trend.[1] Agile methods are being embraced widely by various software development organizations[2] and they are also getting acceptance in small scale organizations.[3] It has been reported that 94% of companies have been practicing Agile methods for 1–5 years where 33% have used Agile methods for 3–5 years and 52% of companies use Agile methods for more than 1/2 of their projects.[4] The wide distribution is related with the count on advantages of adopting Agile methods, such as a reduced time to market or a better customer satisfaction.[5]

Agile methods are considered flexible and pertinent methods for problem-solving, since they involve the end user in the entire process.[6,7] It is an excellent software development paradigm to advance a better understanding of requirements elicitation. The constant feedback from stakeholders is one of the main advantages of Agile methods principles.[7] Agile methods involve developing software/information systems in an iterative manner by providing priority to the end-users needs to deliver the product to customers in a short interval of time. Each iteration involves development and testing in parallel in contrast to conventional methods where the testing often takes place at the end of development.[8] Further, by using adaptable strategies, Agile methods facilitate the development of a range of systems starting from traditional business software, mobile, web-based, and e-commerce applications to complex information systems, as supported by Govil et al.[9] The assumption that systems are becoming larger, more complex, and more software-based again reinforces the use of Agile development.[10]

Research has been largely carried out to identify productivity impact factors in traditional software development. There are four main factors generally discussed[11]: the product being developed (characterization of the specific software), people (team members, capabilities, experience, and motivation), project (management and resourcing), and processes (tools and software methods).[12] Wagener[13] divided critical success factors (CSFs) in four classes, that is, process, organizational, technical, and people classes. Aldahmash et al.[14] selected eight CSFs of Agile development and presented a taxonomy to map with technical, organizational, people, and process categories. Fuchs[15] found that the interaction of Agile methods and organizational features shows a process of mutual transformation that creates the organizational change in terms of Agile methods' implementation.

Even though there exists many guidelines and frameworks for Agile methods adoption, organizations still have problems with the selection of the most suitable Agile method and with the general initiation of the Agile transformation process.[16] According to Sjoberg et al.[17] software engineering research should focus more on empirical studies in the future. Such empirical research will likely lead to established scientific knowledge regarding how the different software engineering methods, tools, and techniques are being used. Trip et al.[18] argued that in order for the study of Agile development and methods to progress, more empirical studies are required. Empirical studies should enable a better understanding of how Agile principles and practices are adopted and their impact on project success.[14] Even though 64% of organizations have reported improved software delivery by using the Agile method, 34% of organizations reported facing resistance to Agile adoption.[4] Campanelli et al.,[6] presents an assessment of the organizational environment including the company's goals and the perception of the team members to provide awareness of how the organization should prepare for the next steps in the Agile adoption and a case study for the assessment validation. Hanslo et al.[19] also stressed the need for quantitative study on Agile acceptance.

The critical success factor (CSF) approach to identifying and measuring an organization's performance was first introduced in the late 1970s[20] and later refined and established in the early 1980s.[21,22] CSF is defined as "the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department, or organization.[21] CSF's are the few key areas where 'things must go right' for the business to flourish and for the managers goal to be attained."[21] In the context of Agile software development, CSFs are factors that must be present for an Agile project to be successful.[23] Critical failure factors (CFFs) are defined as the key aspects (areas) where "things must go wrong" in order for the process to achieve a high level of failure.[24]

Recently, Dingsoyr et al.[25] urged researchers to conduct empirical studies and combine lessons with previous research from relevant fields such as project management, organizational psychology, and management science. Aldahmash et al.,[14] further argued that important factors associated with agility, such as people, process, and organizational culture, are unlikely to be addressed without solid empirical research. What are the success factors for an organization and their teams in preparation for the Agile adoption process.[6] Research on facilitators of Agile adoption is not conclusive and there is still need for guidelines to help in this process considering the organizational context in terms of culture, values, needs, reality, and goals.[6,26] The recent annual state of Agile report also observed that culture, leadership, and consistency are three key challenges to successful Agile adoption in an organization.[27] Therefore, in this backdrop it would be worthwhile to study it further in small and medium sized enterprises (SMEs) in empirical manner towards advancement of knowledge in this direction.

The rest of the paper is structured as follows: Section 2 presents related work on four dimensions (people, technical, project, and process). Section 3 describes research methodology followed by data analysis and results in the Section 4. A discussion is provided in Section 5 and this paper concludes with future research directions, implications of the study for practitioners and researchers in Section 6.

2 | BACKGROUND

During Agile transition initiatives, organizations go through important transformations that impact its culture, hierarchy, management, environment, and people.[26,28–31] Nerur et al.[31] studied this from the administrative perspective as well as people, process, and technology aspects of the transition to Agile ventures. Chow and Cao[23] identified a preliminary list of potential CSFs and CFFs of Agile projects and categorized them into the following dimensions: organizational, people, process, and technical. Challenges in Agile acceptance process can be related to the organizational issues, technical issues, customer issues, development process, and people issues.[32,33] In light of the previously mentioned literature, CSFs and CFFs related with Agile adoption can be classified into four groups: organizational, individuals, procedural (process), and technical.

2.1 | People dimension

Agile methods emphasize on the people factors and strength of teamwork that simplify the development process. In a review by Asnawi et al.,[34] of 13 members, including CEOs, ventures managers, originators, and engineers involved in Agile adoption, showed that social and human viewpoints are critical when Agile strategies are to be utilized. Given that human factors affect the success of a project, it is important that a quality model comprehensively include this aspect, as well as practices related to the Agile process. Trendowicz and Münch[11] concluded that their biggest result is to observe that the success of the software project still depends on the people involved. The following factors related with people dimension are found to be significant in the adoption of Agile methods. The people factor, such as team capability, was observed to be an important one as far as the use of Agile methods is concerned.[23] Ignoring team in the software development process or managing them in an inappropriate way can have a high impact on their productivity and team effectiveness.[35] Greater importance should be given to collaboration with the client. A highly productive team throughout an Agile software development process is very instrumental in achieving project success[12] whereas a project champion akin project manager drives the team to stay true to Agile principles.[36] Furthermore, gradual adoption of Agile practices according to needs and gaining experience with those Agile practices lead to team members' becoming more receptive to further changes and more capable of contributing to and driving those changes.[37] While the success of any process is largely dependent on the people, the ability of the people to achieve their goals is dependent on the level of support they receive from users, customers, and management.[38] Similarly, perceptions that the project had sufficient resources, such as people, budget, and time, should give team members a positive expectation about the possibility of project success.[39]

2.2 | Technical dimension

Technical aspects have been mentioned as the most significant[23] dimension in Agile transformation. Technical factors include: delivery strategy, Agile programming engineering methods, and group ability. Williams[40] realized practices critical for teams to be considered Agile being related to their capability to satisfy the customer through early, continuous, and frequent delivery of valuable, working software. Requirement's prioritization is crucial for satisfying the time-to-market and budgetary constraints as well as to meet customer needs effectively.[41] Kasauli et al.,[42] found that frequent demos, testing, integration, and retrospectives are at the heart of Agile methods because they provide additional opportunities for the coordination among development teams and across areas of specialization. They further suggested the need of an appropriate tool chain that better supports Agile development process. Recently Barroca et al.,[43] also supported in their study that many positive elements of an Agile culture includes being competent, collaborative, feedback and learning, innovative, and risk taking among others.

2.3 | Project dimension

Project success has been measured in a variety of ways. Early measures of project success focused on meeting the "triple constraint"[44,45] of time, budget, and scope. However, current thinking expands these success criteria. Various studies indicate that the success of an Agile project may vary according to cost, delivery time, scope, and quality.[23,46] A guide to the Project Management Body of Knowledge now includes project constraints such as scope, quality, schedule, budget, resources, and risks.[45] Agile is best suited for small size development teams in projects under vague and changing requirements.[47] Agile project management supports concepts of flexibility and continuous improvements which help to keep an organization's workforce efficient and motivated,[48] however, project management-related issues such as poor change control, scope creep, etc. when not managed properly may lead to increased time and cost. Further, Berntzen et al.,[49] supported a need to increase the focus on a clear agenda for the weekly product owner meeting to ensure effective use of time and resources in large scale Agile software development.

2.4 | Process dimension

Iterative and incremental development processes have gained strength in the industry with the adoption of Agile project management and system development methodologies. The main gains of these methodologies are the ability to deliver continuous value, flexibility to change, increased confidence in code through automated testing, among others.[50] The transition to Agile methodologies creates additonal challenges such as management style, software development process, and software developer resistance.[51] Cao et al.,[32] recommended framework for Agile development that focuses on specific context of the project, organization, and development process. Agile processes are effective and flexible as they result in minimal documentations.[52] However, this means an active communication and collaboration is necessary among the development teams' member along with product owners and customers. Customers should be involved in the process of development which can be an issue by itself in some cases.[3] In Agile software development, high-quality adaptive software is developed by small teams using the principles of continuous design improvement and testing based on rapid feedback and change from the customers.[31] In addition, it is vital at any rate for the developers to react to the changeable environment, and to understand that the process of developing software is now a changeable subject itself.[53]

3 | RESEARCH METHODOLOGY

The aim of this research study is to identify organizational facilitators and inhibitors that can help the adoption of Agile methods easier and more productive in small- and medium-scale software development organizations. However, to define the research hypotheses of success factors, certain related attributes are needed to delineate the general

TABLE 1 Benefits of Agile methods.

Benefits	Supporting studies
The use of Agile provides better control over the work	Bambauer-Sachse and Helbling,[58] Terblanche and Nkukwana,[60] Jørgensen[73]
Agile methods help to cope with changing user requirements in a better way	Inayat et al.,[7] Roy et al.,[41] Perera and Fernando,[47] Jørgensen,[73] Krancher,[82] Highsmith and Cockburn,[84] Daneva et al.,[85] Mishra and Mishra[92]
Agile adoption allows to achieve better quality	Chow and Cao,[23] Shastri et al.,[36] Kasauli et al.,[42] Agarwal and Rathod,[46] Bishop et al.,[63] Putta et al.,[65] Mishra and Mishra[92]
Agile is used because it helps in effort estimation (cost, schedule)	Chow and Cao,[23] Agarwal and Rathod,[46] Tyagi et al.,[69]
Agile methods are used because they lead to customer satisfaction	Olsson et al.,[5] Oprins et al.,[87] Mishra et al.,[93]
Using Agile methods help to reduce the delivery schedules	Akiwatkar,[4] Williams,[40] Kasauli et al.,[42] Bishop et al.[63]
The Agile methods are used in order to increase the return on investment	Misra et al.,[56] Schwaber,[67] Tyagi et al.,[69] Laanti et al.,[79]

view of success for a specific venture. In this respect, Cohn and Ford[54] and Lindvall et al.,[55] recommend these criteria: quality (i.e., providing a working item), scope (meeting all prerequisites set by the client), timeliness, and cost. In addition, Misra et al.,[56] identified decreased delivery agenda and increased return on investment (ROI) as success attributes, adding that output, functionality, and client satisfaction can also be seen as quality criteria. Considering the aforementioned studies, following benefits (Table 1) gained by adopting Agile methods (success attributes/dependent variables) are selected for consideration.

The success factors (independent variables) were identified and categorized into four dimensions based on an extensive literature survey: people, technical, project, and process. The research model related with people, technical, poject, and process dimensions are shown in Figures 1–4 respectively followed by related hypothesis.

In terms of success factors, the relationship between success factors and success attributes is positive, meaning that when the independent variable X_i (success factors) increases, the dependent variable Y_i (success attributes) increases, and vice versa.

Hypothesis 1. Customers dominant issues (CDI) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 2. Highly capable team (HCT) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 3. Practice and learning (PL) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 4. Communication and arbitration (CA) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 5. Encouragement (E) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 6. Project champion (PC) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 7. Assigning essential features first (EFF) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 8. Frequent delivery (FD) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 9. High competent team (HTT) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 10. Use of tools (UT) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 11. Integration testing (IT) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 12. Project category (PG) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 13. Small team (ST) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 14. Agenda (AG) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 15. Fewer requirements change (FRC) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 16. Hazard analysis (HA) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 17. Clarity (CL) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 18. Customer participation (CP) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 19. Efficient requirements gathering (ERG) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

The failure factors were categorized into three dimensions: people, technical, and process. The related research models are shown in Figures 5–7, respectively, followed by related hypothesis. In terms of failure factors, the relationship between failure factors and success

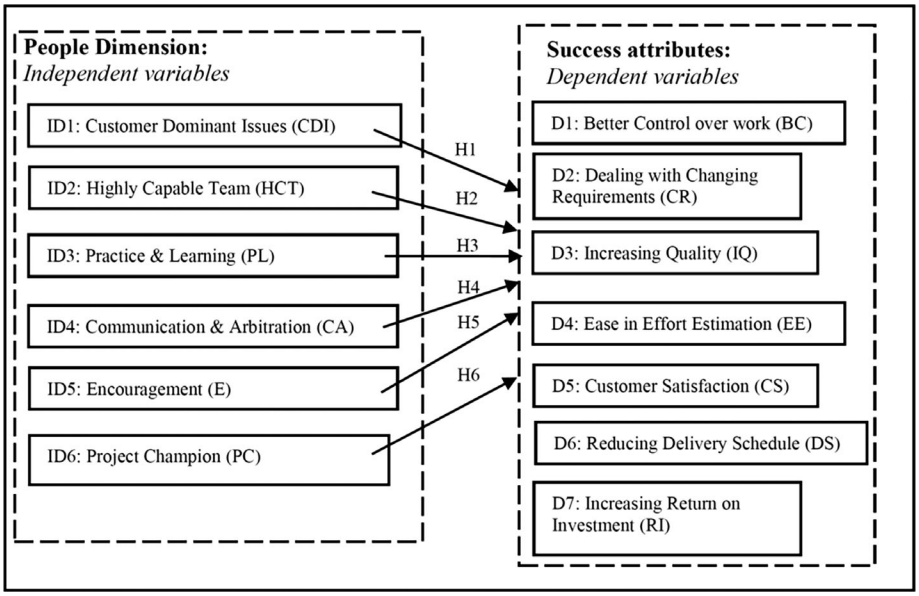

FIGURE 1 Research model of success factors related with people dimension.

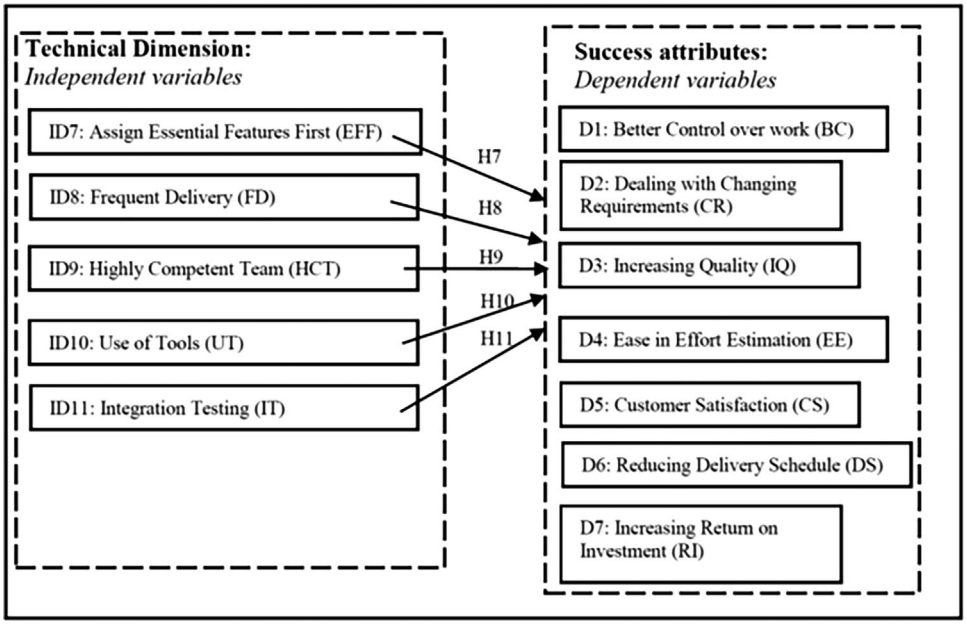

FIGURE 2 Research model of success factors related with technical dimension.

attributes is negative because when the independent variable X_i (failure factors) increases, the dependent variable Y_i (success attributes) decreases, and vice versa.

Hypothesis 20. Negative relationship with customer (NRC) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 21. Absence of cooperation (AC) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 22. Absence of essential skill-set (AES) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 23. Absence of Agile practices (AAP) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 24. Inadequate technology and tools (ITT) have a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

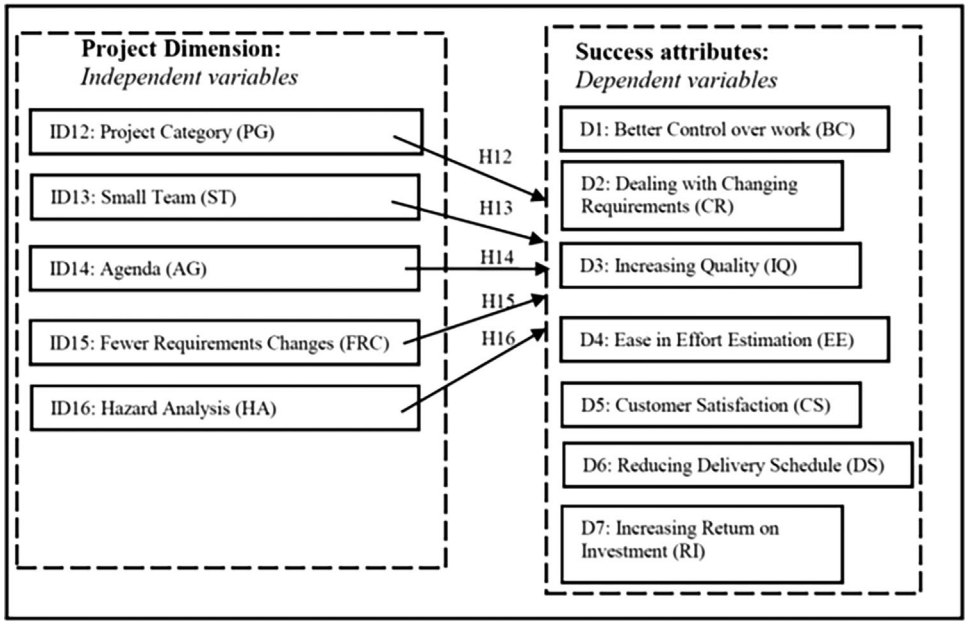

FIGURE 3 Research model of success factors related with project dimension.

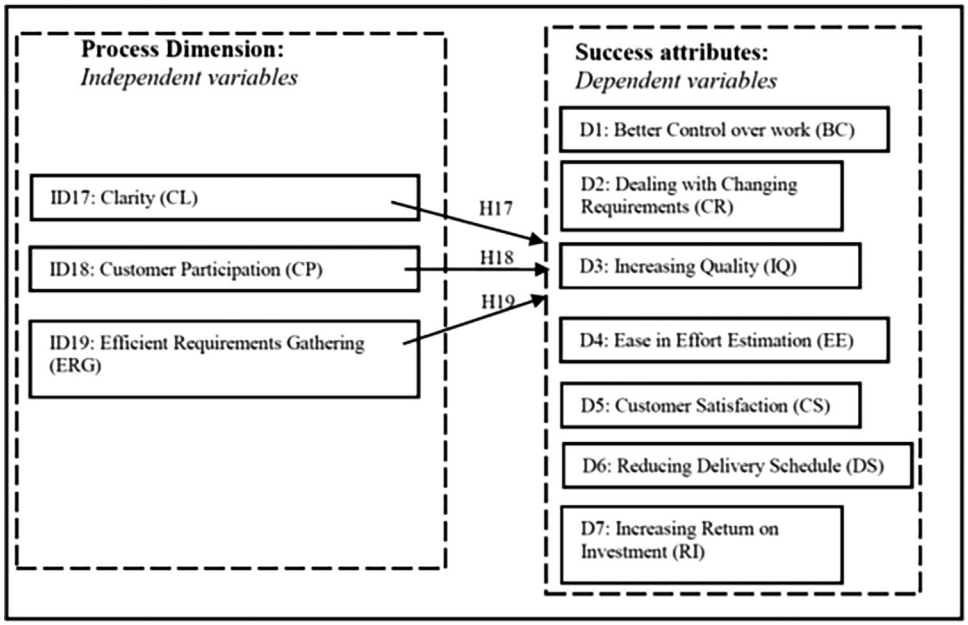

FIGURE 4 Research model of success factors related with process dimension.

Hypothesis 25. Absence of customer (AC) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 26. Absence of progress tracking (APT) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

Hypothesis 27. Determining customer role (DCR) has a significant impact on the adoption of Agile methods in terms of BC, CR, IQ, EE, CS, DS, RI.

4 | DATA ANALYSIS AND RESULTS

The Google form was used to gather the data. The target audiences are individuals from companies that have adopted Agile methods in software development. The questionnaire was filled by 52 software development companies from 7 different countries, but most of the responses are from Turkey (30), followed by India, Brazil, and Malta as 8, 7, and 4, respectively. Also, Finland, Saudi Arabia, and U.A.E. are represented by one company from each country. In terms

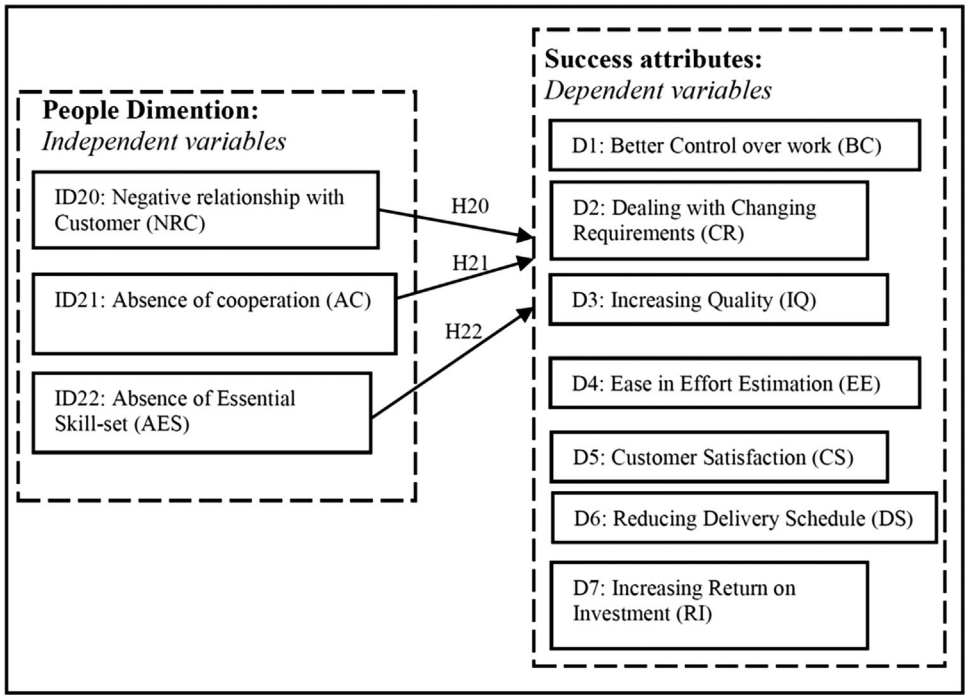

FIGURE 5 Research model of failure factors related with people dimension.

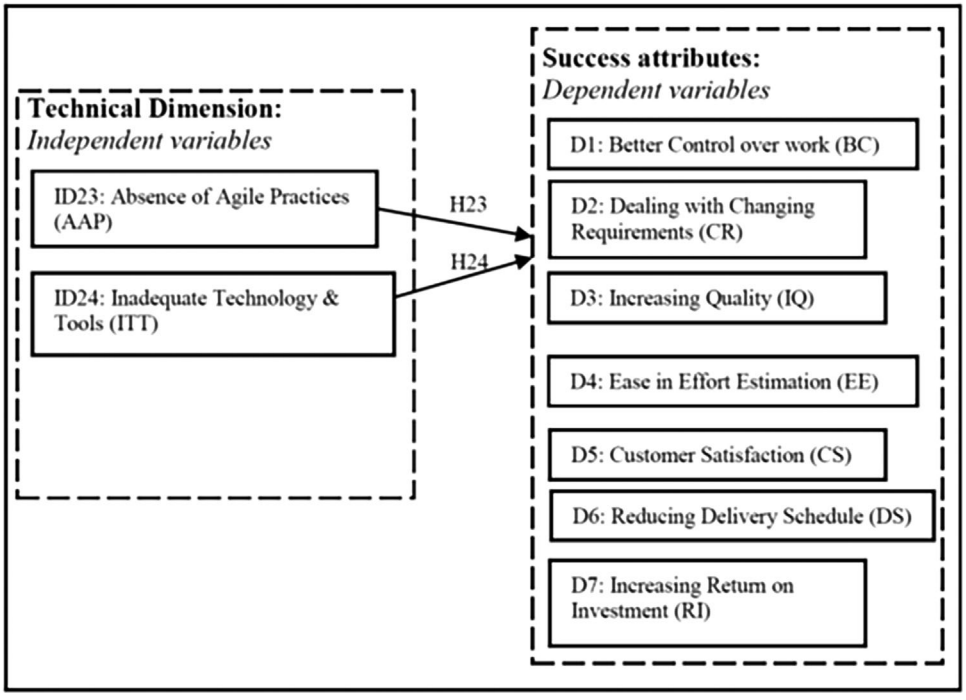

FIGURE 6 Research model of failure factors related with technical dimension.

of respondent's job profile, participants have varied roles such as Project/product/senior manager, developers, Scrum master etc. To analyze the data, a statistical approach is adopted and, for this purpose, the IBM SPSS version 20 program is used.

4.1 | Reliability and validity test

Since this study is of exploratory nature, there is a need for a reliability analysis, for which purpose the Cronbach's alpha is used as it is the most

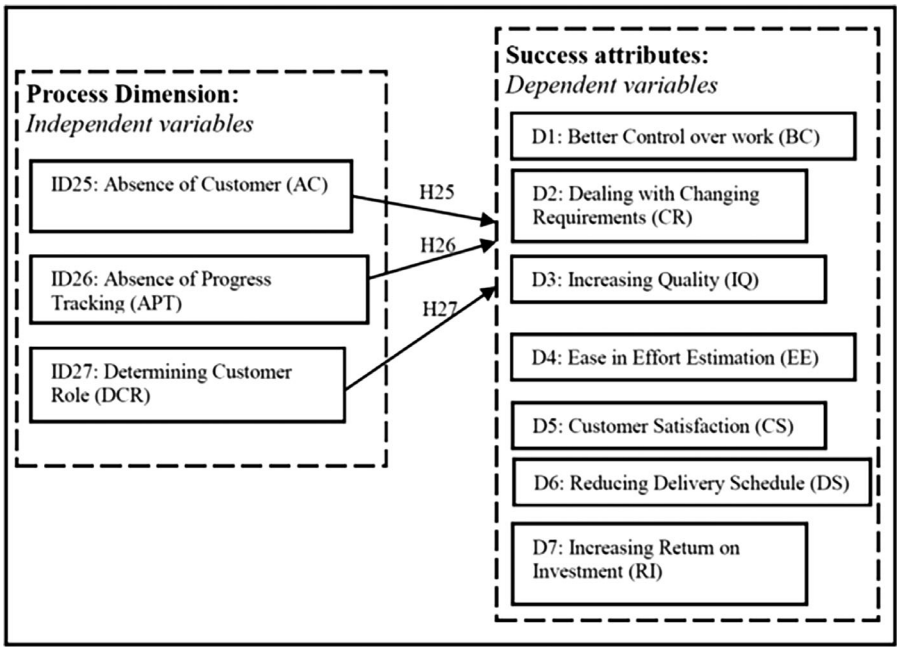

FIGURE 7 Research model of failure factors related with process dimension.

TABLE 2 Reliability statistics summary.

Items in	Chronbach's alpha
Facilitators (success factors)	0.913
Inhibitors (failure factors)	0.895

well-known and efficient technique today to calculate inner consistency reliability.[57] Higher estimations of Cronbach's alpha respectively demonstrate more noteworthy consistency in variance of the specimen test scores when the value exceeds 0.7 as the standard in a survey study.

Cronbach's alpha for a set of test scores in this research yield 0.8 for the failure factors, while for success factors this value stands at 0.9 (Table 2). According to these results, there is an indication of clear accuracy of the statistical deductions from the information; that is, there are no issues with the inner consistency reliability tests.

4.2 | Results of success factors

The Pearson correlation coefficient r_{ij}, is computed with the help of the SPSS software for each success factor X_i and each quality attribute Y_j. From the observed value of the test statistic, the p-value is obtained and the null hypothesis is rejected if and only if $p < .05$. The following Table 3 shows which of the correlation coefficients appear to be significant (in bold). By looking at the table, one can notice that five success factors do not demonstrate any noticeable relation to the considered success attributes, namely ID3, ID4, ID15, ID16, and ID19. On the whole, we assume that 19 success factors are all essential to achieve each and every one of the success attributes D1:D7. After conducting 19×7 tests as described earlier, five of the factors were found to be unessential. In addition, it is observed that the remaining factors are important only for some, and not all, attributes. Further going into details, we can see that the most effective factor is ID10 with a positive relationship with six attributes, followed by ID5, ID8, and ID11, all of which have positive relationships with five attributes.

However, depending on the significance values and the values of correlation coefficients, we either accept or reject our 19 hypotheses introduced in the previous section as tested with seven attributes (a–g). This means that there are 133 tests or hypotheses to test, out of which 42 hypotheses are accepted and 91 rejected. The results of the acceptance/rejection of these hypotheses are shown in Table 4 and Figure 8.

4.3 | Results of failure factors using correlation analysis

Table 5 shows which of the correlations coefficients appear to be significant (in bold). We assumed that eight failure factors can cause failure for each and every quality attributes D1–D7. After conducting 8×7 tests as described before, four of the factors are considered as unessential which are ID20, ID21, ID22, and ID24. In addition, it has been found that the remains factors are important only for some rather than all attributes. Going in details the most effective factor is ID27 which has negative relationships with three attributes followed by ID23 and ID25 with each having negative relationship with two attributes.

However, depending on the significance values and the values of correlation coefficients, we either accept or reject eight hypotheses that we have introduced in the previous section as tested with seven

TABLE 3 Results of correlation test for success factors.

SF/SA	D1:BC	D2:CR	D3:IQ	D4:EE	D5:CS	D6:DS	D7:RI
ID1:CDI	$r = 0.360$	$r = 0.152$	$r = 0.078$	$r = -0.120$	$r = 0.207$	$r = -0.025$	$r = 0.079$
	$p = .009$	$p = .282$	$p = .583$	$p = .395$	$p = .141$	$p = .863$	$p = .576$
ID2:HCT	$r = 0.208$	$r = 0.181$	$r = 0.296$	$r = -0.131$	$r = 0.170$	$r = 0.309$	$r = 0.218$
	$p = .138$	$p = .199$	$p = .033$	$p = .356$	$p = .277$	$p = .062$	$p = .121$
ID3:PL	$r = 0.043$	$r = 0.043$	$r = 0.102$	$r = 0.073$	$r = 0.074$	$r = 0.030$	$r = 0.022$
	$p = .760$	$p = .764$	$p = .473$	$p = .604$	$p = .603$	$p = .835$	$p = .879$
ID4:CA	$r = 0.141$	$r = 0.173$	$r = 0.036$	$r = -0.027$	$r = 0.080$	$r = 0.030$	$r = 0.148$
	$p = .318$	$p = .220$	$p = .799$	$p = .850$	$p = .572$	$p = .833$	$p = .295$
ID5:E	$r = 0.349$	$r = 0.281$	$r = 0.301$	$r = 0.106$	$r = 0.303$	$r = 0.297$	$r = 0.273$
	$p = .011$	$p = .044$	$p = .030$	$p = .454$	$p = .029$	$p = .032$	$p = .051$
ID6:PC	$r = 0.133$	$r = 0.204$	$r = 0.211$	$r = 0.014$	$r = 0.313$	$r = 0.322$	$r = 0.214$
	$p = .349$	$p = .146$	$p = .133$	$p = .919$	$p = .024$	$p = .020$	$p = .129$
ID7:EFF	$r = 0.037$	$r = 0.219$	$r = 0.383$	$r = 0.123$	$r = -0.007$	$r = 0.255$	$r = 0.374$
	$p = .793$	$p = .118$	$p = .005$	$p = .385$	$p = .005$	$p = .069$	$p = .006$
ID8:FD	$r = 0.372$	$r = 0.173$	$r = 0.437$	$r = 0.040$	$r = 0.441$	$r = 0.398$	$r = 0.447$
	$p = .007$	$p = .220$	$p = .001$	$p = .776$	$p = .001$	$p = .003$	$p = .001$
ID9:HCT	$r = 0.167$	$r = 0.271$	$r = 0.415$	$r = 0.018$	$r = 0.424$	$r = 0.244$	$r = 0.424$
	$p = .235$	$p = .052$	$p = .002$	$p = .898$	$p = .002$	$p = .081$	$p = .002$
ID10:UT	$r = 0.082$	$r = 0.313$	$r = 0.382$	$r = 0.378$	$r = 0.535$	$r = 0.432$	$r = 0.308$
	$p = .565$	$p = .024$	$p = .005$	$p = .006$	$p = .000$	$p = .001$	$p = .026$
ID11:IT	$r = 0.187$	$r = 0.312$	$r = 0.365$	$r = 0.106$	$r = 0.349$	$r = 0.278$	$r = 0.343$
	$p = .185$	$p = .024$	$p = .008$	$p = .453$	$p = .011$	$p = .046$	$p = .013$
ID12:PG	$r = 0.321$	$r = 0.174$	$r = 0.154$	$r = 0.063$	$r = 0.151$	$r = 0.156$	$r = 0.165$
	$p = .020$	$P = .218$	$p = .275$	$p = .659$	$p = .286$	$p = .286$	$p = .242$
ID13:ST	$r = 0.129$	$r = 0.383$	$r = 0.246$	$r = 0.033$	$r = 0.512$	$r = 0.381$	$r = 0.385$
	$p = .362$	$p = .005$	$p = .079$	$p = .818$	$p = .000$	$p = .005$	$p = .005$
ID14:AG	$r = 0.250$	$r = 0.167$	$r = 0.158$	$r = 0.125$	$r = 0.210$	$r = 0.177$	$r = 0.318$
	$p = .073$	$p = .237$	$p = .263$	$p = .379$	$p = .135$	$p = .211$	$p = .021$
ID15:FRC	$r = 0.083$	$r = 0.125$	$r = 0.036$	$r = 0.084$	$r = 0.134$	$r = 0.094$	$r = 0.100$
	$p = .559$	$p = .379$	$p = .800$	$p = .555$	$p = .344$	$p = .507$	$p = .482$
ID16:HA	$r = 0.109$	$r = 0.110$	$r = 0.071$	$r = 0.019$	$r = 0.110$	$r = 0.115$	$r = 0.264$
	$p = .440$	$p = .439$	$p = .617$	$p = .893$	$p = .438$	$p = .418$	$p = .059$
ID17:CL	$r = 0.272$	$r = 0.098$	$r = 0.099$	$r = 0.069$	$r = 0.098$	$r = 0.232$	$r = 0.378$
	$p = .051$	$p = .530$	$p = 0.483$	$p = 0.627$	$p = 0.490$	$p = 0.098$	$p = 0.006$
ID18:CP	$r = 0.300$	$r = 0.402$	$r = 0.117$	$r = 0.021$	$r = 0.356$	$r = 0.217$	$r = 0.297$
	$p = .030$	$p = .003$	$p = .410$	$p = .844$	$p = .010$	$p = .122$	$p = .032$
ID19:ERG	$r = 0.174$	$r = 0.233$	$r = 0.134$	$r = 0.000$	$r = 0.263$	$r = 0.259$	$r = 0.140$
	$p = .217$	$p = .096$	$p = .344$	$p = 1.000$	$p = .060$	$p = .064$	$p = .323$

attributes (a–g). Thus, there are 56 tests or hypotheses to test, out of which 8 hypotheses are accepted whereas 48 hypotheses are rejected. The results of acceptance/rejection of hypotheses are shown in Table 6 and Figure 9.

5 | DISCUSSION

This study explores the facilitators and inhibitors of Agile methods' adoption in small and medium enterprises. In all, 52 respondents

TABLE 4 Summary of hypothesis testing results of success factors using correlation analysis.

SF/SA	D1:BC	D2:CR	D3:IQ	D4:EE	D5:CS	D6:DS	D7:RI
ID1:CDI	H1a √	H1b	H1c	H1d	H1e	H1f	H1g
ID2:HCT	H2a	H2b	H2c √	H2d	H2e	H2f	H2g
ID3:PL	H3a	H3b	H3c	H3d	H3e	H3f	H3g
ID4:CA	H4a	H4b	H4c	H4d	H4e	H4f	H4g
ID5:E	H5a √	H5b √	H5c √	H5d	H5e √	H5f √	H5g
ID6:PC	H6a	H6b	H6c	H6d	H6e √	H6f √	H6g
ID7:EFF	H7a	H7b	H7c √	H7d	H7e √	H7f	H7g √
ID8:FD	H8a √	H8b	H8c √	H8d	H8e √	H8f √	H8g √
ID9:HCT	H9a	H9b	H9c √	H9d	H9e √	H9f	H9g √
ID10:UT	H10a	H10b √	H10c √	H10d √	H10e √	H10f √	H10g √
ID11:IT	H11a	H11b √	H11c √	H11d	H11e √	H11f √	H11g √
ID12:PG	H12a √	H12b	H12c	H12d	H12e	H12f	H12g
ID13:ST	H13a	H13b √	H13c	H13d	H13e √	H13f √	H13g √
ID14:AG	H14a	H14b	H14c	H14d	H14e	H14f	H14g √
ID15:FRC	H15a	H15b	H15c	H15d	H15e	H15f	H15g
ID16:HA	H16a	H16b	H16c	H16d	H16e	H16f	H16g
ID17:CL	H17a	H17b	H17c	H17d	H17e	H17f	H17g √
ID18:CP	H18a √	H18b √	H18c	H18d	H18e √	H18f	H18g √
ID19:ERG	H19a	H19b	H19c	H19d	H19e	H19f	H19g

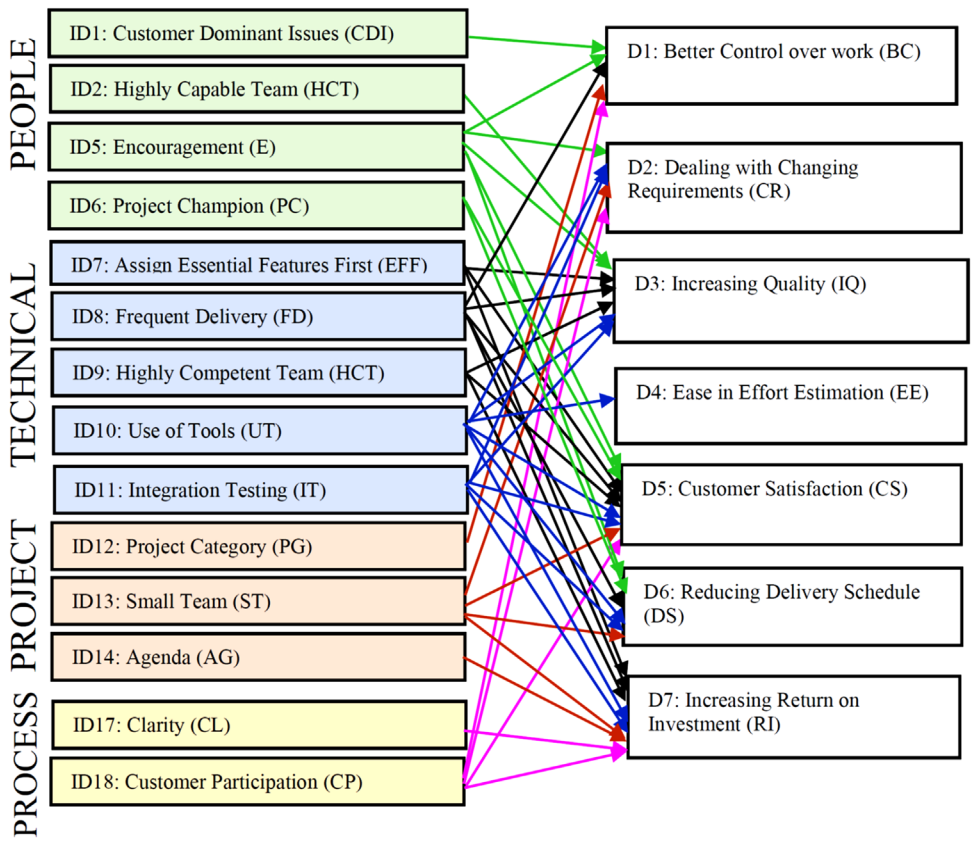

FIGURE 8 Agile success factors.

TABLE 5 Results of correlation test for failure factors.

FF/SA	D1:BC	D2:CR	D3:IQ	D4:EE	D5:CS	D6:DS	D7:RI
ID20:NRC	$r = -0.199$	$r = -0.027$	$r = 0.094$	$r = 0.252$	$r = -0.170$	$r = 0.158$	$r = 0.198$
	$p = .157$	$p = .850$	$p = .509$	$p = .072$	$p = .228$	$p = .263$	$p = .159$
ID21:AC	$r = -0.157$	$r = -0.113$	$r = 0.083$	$r = 0.228$	$r = -0.120$	$r = 0.122$	$r = 0.039$
	$p = .265$	$p = .424$	$p = .557$	$p = .104$	$p = .397$	$p = .389$	$p = .781$
ID22:AES	$r = -0.057$	$r = -0.206$	$r = -0.102$	$r = 0.193$	$r = -0.074$	$r = 0.028$	$r = 0.031$
	$p = .686$	$p = .142$	$p = .474$	$p = .171$	$p = .604$	$p = .844$	$p = .826$
ID23:AAP	$r = -0.052$	$r = -0.306$	$r = 0.054$	$r = 0.119$	$r = -0.287$	$r = -0.059$	$r = -0.226$
	$p = .714$	$p = .027$	$p = .706$	$p = .402$	$p = .039$	$p = -.677$	$p = .108$
ID24:ITT	$r = -0.104$	$r = -0.168$	$r = -0.171$	$r = -0.053$	$r = -0.222$	$r = -0.118$	$r = -0.095$
	$p = .463$	$p = .235$	$p = .266$	$p = -.711$	$p = .144$	$p = -.405$	$p = .501$
ID25:AC	$r = -0.222$	$r = -0.381$	$r = -0.096$	$r = 0.215$	$r = -0.409$	$r = 0.052$	$r = 0.023$
	$p = .113$	$p = .005$	$p = .498$	$p = .125$	$p = .003$	$p = .713$	$p = .871$
ID26:APT	$r = -0.173$	$r = -0.113$	$r = 0.014$	$r = 0.200$	$r = -0.348$	$r = 0.000$	$r = 0.003$
	$p = .220$	$p = .426$	$p = .922$	$p = .156$	$p = .011$	$p = 1.000$	$p = .983$
ID27:DCR	$r = -0.327$	$r = -0.329$	$r = -0.106$	$r = 0.068$	$r = -0.324$	$r = -0.127$	$r = -0.203$
	$p = .018$	$p = .017$	$p = .455$	$p = .633$	$p = .019$	$p = -.371$	$p = .149$

TABLE 6 Summary of hypothesis testing results of failure factors using correlation analysis.

FF/SA	D1:BC	D2:CR	D3:IQ	D4:EE	D5:CS	D6:DS	D7:RI
ID20:NRC	H20a	H20b	H20c	H20d	H20e	H20f	H20g
ID21:AC	H21a	H21b	H21c	H21d	H21e	H21f	H21g
ID22:AES	H22a	H22b	H22c	H22d	H22e	H22f	H22g
ID23:AAP	H23a	H23b √	H23c	H23d	H23e √	H23f	H23g
ID24:ITT	H24a	H24b	H24c	H24d	H24e	H24f	H24g
ID25:AC	H25a	H25b √	H25c	H25d	H25e √	H25f	H25g
ID26:APT	H26a	H26b	H26c	H26d	H26e √	H26f	H26g
ID27:DCR	H27a √	H27b √	H27c	H27d	H27e √	H27f	H27g

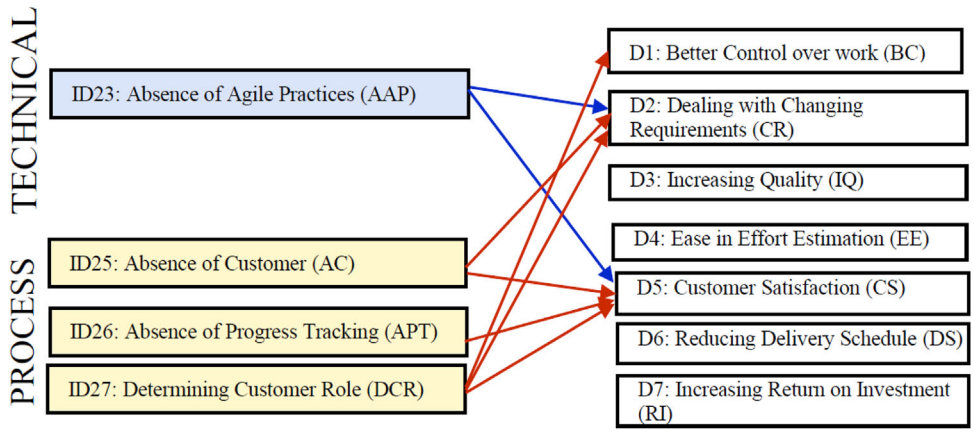

FIGURE 9 Agile failure factors.

participated from around the world from which, 35 belonged to small and medium companies and the rest to large enterprises.

As mentioned in Section 3, seven success attributes (Agile benefits) were identified which are: better control over work, dealing with changing requirements, quality, customer satisfaction scope, effort estimation, reducing the delivery schedules, and increasing ROI. A statistical test was conducted to study the correlation between the success factors (under people, technical, project, and process dimensions) and success attributes. The following success factors are found to be significant: customers' dominant issues, high capable team, encouragement, project champion, assigning essential features first, frequent delivery of software, highly competent team, use of tools, correct integration testing, project category, smaller-size team, agenda, clarity, and strong customer participation. Similarly, a correlation analysis revealed the following failure factors as significant: absence of a full set of right Agile practices, absence of customer presence, absence of tracking mechanisms during Agile progress, and failure to determine the role of the client.

5.1 | Success factors related with the people dimension

People involved in the Agile development starting from customers, development team members, team leader to project champion play an important role in successful Agile adoption. In a recent study by Bambauer-Sachse and Helbling[58] it was found that Agile Methods have significantly transformed project management and leads to higher customer satisfaction than plan-driven approaches. This study confirms that active customer focus leads to better control over work.

Also, high competent teams in terms of technology and domain experience augment the quality of the software. As team members gain more experience with their practices, they become more receptive to further changes and more capable of contributing to and driving those changes[37] which leads to the increasing quality of the software.

The project manager facilitates the project teams functioning, increasing process efficiency, and ensuring quality control. Therefore, the leader's encouragement towards team members extends better control in handling changing requirements along with better quality, customer satisfaction, and in reducing delivery time of software. Han and Anantatmula[59] model for knowledge sharing in large IT organizations identifies leadership as an important component and their suggestions for leadership highlights the importance of aspects such as a management help with knowledge partaking, verbal compliment, encouragement, and career promotion. Project champions also boost customer satisfaction and help in shortening software delivery time to customers. The senior management expects the project champion akin project manager to take responsibility for project delivery and adopts a controlling approach if necessary, while teams expect a light touch "servant leader" type approach.[60] In a recent study, Shastri et al.,[36] noted in one advertisement "The PM should be the grease that drives the team machine as it sets new benchmarks in quality and delivery while staying true to Agile principles." Skilling the development teams to be Agile is easy, the difficulty is getting the software organizations at large to adopt agility across value streams, as senior management lack the skills and understanding to embrace agility.[61] They also observed it as major challenge in Scaled Agile adoption.

5.2 | Agile facilitators related with the technical dimension

To overcome the various challenges encountered during Agile methods adoption in traditional plan-driven organizations, the literature suggests customizing Agile methods to the technical, cultural, and social environment and the reality of the traditional organization. This is known as Agile method tailoring.[62] In Agile software development, requirement's gathering, prioritization, and validation are jointly done by the development team and clients. It has been identified that providing essential features early on leads to an increase in quality and customer satisfaction. Bishop et al.,[63] study observed that project managers appreciated the practical benefits of Agile adoption such as adaptability, increased efficiency, and faster delivery of features. Frequent delivery accelerates better control over work, adds to quality, customer satisfaction, and in shortening delivery time along with increase ROI. Williams[40] realizes practices critical for teams to be considered Agile being related to their capability to satisfy the customer through early, continuous, and frequent delivery of valuable, working software based on two large surveys of Agile teams. Further, frequent delivery of tested, working, and customer-approved software at the end of each iteration is an important aspect of Agile quality assurance.[64] Putta et al.,[65] also observed that in the front-end area, it was viewed to be easy to unveil results and business value with help of short iterations and frequent deliveries.

The present study identifies that an Agile team with high expertise and competence leads to higher quality in software, customer satisfaction along with ROI. Literature reveals that Agile managers are responsible to promote agility, eliminating the obstacles threatening the team, Agile team formation, budget control, ensuring return of investment, etc.[66] If the product is not ready to deliver to the customer on time due to poor planning, Agile managers are required to help the business party to re-prioritize feature lists to improve ROI and create innovative product.[67] Requirements prioritization is crucial for satisfying the time-to-market and budgetary constraints as well as to meet customer needs effectively.[41]

An Agile project management tool will facilitate software developers to plan their work and assist project managers to get the desired results in terms of team communication and resource allocation when required.[68] Moreover, the application of tools increment in handling changing requirements, better quality, facilitate in effort estimation, reduced delivery time, and hike in ROI. Kasauli et al.,[42] reported the need for an appropriate toolchain that better supports Agile information flows in their four case studies of large-scale Agile system development in automative, telecom, and technology companies. In an

interview with the telecom sector they asserted the need for more efficient tool solutions, so engineers could potentially be more motivated to make changes to requirements and thus narrow the gap between Agile user stories and requirements. In an automative sector interview they reported use of traditional tools of Agile development JIRA but they felt that in order to be able to perform RE in a more Agile way, they would need an appropriate tool chain in an integrated manner as they operate in a multi-disciplinary, regulated environment. The senior management should provide the required infrastructure and environment to facilitate effective test automation practices.

ROI evaluation is a common method to achieve this based on evaluating the benefits of test automation regarding its implementation costs in terms of tool cost, manpower cost, time to set up required infrastructure for automation.[69]

Integration testing integrates components with each other and tests as a subsystem which is not completed as a system. The current study also found that integration testing adds to handling in changing requirements, increased quality, customer satisfaction, reduces delivery, and increment in ROI. A study of large scale Agile system development observed that in system development, integration testing often depends on a strong laboratory setup that allows testing hardware, software, and potentially mechanics together.[42] Hobbs and Petit[70] in their study found that the project teams in the case study organizations are organized to deal with the integration issue. The primary strategy is to have human resources available to the team that are experts in the integration with the other systems. This reduces the impact of testing and integration with other systems somewhat but, despite these measures, the delays in delivery remain significant. They further suggested that frequent demos, testing, integration, and retrospectives are at the heart of Agile methods because they provide additional opportunities for the coordination among development teams and across areas of specialization. On the other hand, Kasauli et al.[42] argued the integration and testing domain is struggling to generate and maintain traces and with the fact that user stories and tests are not adequate to build and maintain sufficient system understanding.

5.3 | Success factors related with the project dimension

The most important success factor in safeguarding Agile Project Management acceptance over the conventional project management is to ensure that there is management support.[71,72] It has been revealed that project classification helps in extending better control over work. Jørgensen[73] observed that it is reasonable to categorize the projects as "agile," "partly agile," and "not agile" based on responses. There were, however, no simple links between the self-assessed degree of agility (using the scale from 1 to 5) and the implemented Agile practices. He further argued that this forms the development classification boundaries, specifically the boundary between Agile and partly Agile, to certain extent fuzzy and subjective.

Small team increase facilitates handling changing requirements, customer satisfaction, reduced delivery time, and increased ROI. Since Agile method is a customer oriented, light-weight software development paradigm, it is best suited for small size development teams in projects under vague and changing requirements.[47] Better alignment of a holistic requirements model with Agile development practice promises rich gains in development speed, flexibility, and overall quality of software and systems.[42] In Agile software development: high-quality adaptive software is developed by small teams using the principles of continuous design improvement and testing based on rapid feedback and change.[31] In one case study it has been observed that in addition to documentation practices, the small team itself facilitates to keep track of the actions of individual developers even in an ad hoc manner.[74]

Agile teams having a clear agenda augments ROI. Recently Berntzen et al.,[49] supported the need to increase the focus on a clearer agenda for the weekly product owner meeting in large scale Agile software development. Thus, communication at this meeting might have become more accurate, and facilitate towards reinforcing shared knowledge and goals. They further suggested such meetings should have a clear, predefined agenda to assure effective use of time and resources.

5.4 | Success factors related with the process dimension

Process-related challenges often stem from the inconsistency of the organizational and management theories underlying plan-driven and Agile software development processes.[75] Non-functional requirements testing is challenging due its cross functional views and lack of clarity of their needs by businesses in the most part of projects,[76] thus, although significant, the non-functional requirements are often neglected in Agile testing for many reasons, such as experience, culture, awareness, priority, cost, and time pressure.[77] Masood et al.,[78] also found that in Agile methods task allocation is impacted by many factors including mainly requirements clarity. This study also identified that clarity leads to increased ROI. Agile is a community of project leaders that are highly successful at delivering results in software development. To achieve these results, they increase return on investment by making continuous flow of value addition in software product development.[79]

Customer participation raises better control over work, changing requirements handling, customer satisfaction, and increased ROI. Customers appreciate active participation in projects as it allows them to control the project and software development process is more visible to them, and can be aware of recent updates in project.[80] A study by Siddique and Hussein[81] observed a lack of experience of the project manager, lack of customer involvement, budgetary issues, and ego conflicts within teams can contribute to a drop in productivity, lowering of motivation, and poor decision making.

5.5 | Inhibitors related with the technical dimension

Absence of Agile practices reduces customer satisfaction and increases difficulty in dealing with changing requirements. Recently, Krancher[82] in his study empirically supports that Agile practices help cope with changing requirements. Agile practices, including concepts such as iterative requirements engineering,[7,83] dynamic prioritization[7,84,85] which helps in dealing with changing requirements.

5.6 | Inhibitors related with the process dimension

It has been found that the absence of customer participation makes it difficult to deal with changing requirements and decreases customer satisfaction. Jørgensen et al.,[86] noticed that external factors complicate the use of good Agile practices, for instance the lack of involvement by the customer. Team-based work, continuous improvement, learning, organization, and customer involvement are main enablers in Agile practices.[87] However, it is interesting to note that despite the many benefits of Agile methods adoption still there is a lack of user involvement and participation.[88]

Further results reveal that the absence of progress tracking reduces customer satisfaction. Therefore, it is important to track progress not only for the customer but for the development team itself in order to have a shared understanding of the project and information visualization is practical in tracking the project's progress. Paredes et al.,[89] conducted a survey of existing literature on information visualization techniques used by Agile software development teams and found that information radiators and card walls are most frequently used for Agile teams in communication and progress tracking. However, when the team is distributed and does not have access to the physical board, using the digital solution Jira suits their purposes better than their previous on-paper solution.[90]

This research study recognizes that it is crucial to formalize the customer role in Agile software development in order to enhance control over work, dealing with changing requirements, and customer satisfaction. Hoda et al.,[91] found in their study that in the absence of specific formal role keepers some aspects of Agile working lost the team's attention, such as the retrospective. Masood et al.,[78] also observed that in Agile methods task allocation is affected by many factors including mainly requirements clarity.

6 | CONCLUSION, IMPLICATIONS, LIMITATIONS, AND FUTURE WORK

Applying an empirical approach, this study used survey data to examine Agile methods acceptance in software development organizations. The data gathered from 52 respondents from different-size Agile software development organizations and geographical areas provided sufficient data for statistical analysis to address core issues and arrive at the conclusions.

6.1 | Implications of the study for professionals/practitioners

The following success factors are found to be significant facilitators for the adoption of Agile methods: customers' dominant issues, encouragement, project champion, assigning essential features first, frequent delivery of software, highly competent team, use of tools, correct integration testing, project category, smaller-size team, agenda, clarity, and strong customer participation.

Similarly, correlation analysis revealed the following inhibitors as important: absence of a full set of right Agile practices, absence of customer presence, absence of tracking mechanisms during Agile progress, and failure to determine the role of the client.

- The current study found that integration testing adds to handling in changing requirements, increases quality, customer satisfaction, reduces delivery time, and increment in ROI.
- It has been identified that providing essential features early on leads to an increase in product quality and customer satisfaction.
- Frequent delivery accelerates better control over work, adds to product quality, customer satisfaction, and in shortening delivery time along with increased ROI.
- Further, a highly competent team in terms of technology and domain experience augments quality of the software.
- This research study confirms that an active customer focus leads to better control over work.
- The presence of customer feedback facilitates in changing requirements and increased customer satisfaction whereas lack of progress tracking lowers customer satisfaction.
- Project champions also boost customer satisfaction and helps in shortening software delivery time to customer.

Therefore, software development organizations and professionals should consider the above significant issues as a way towards successful Agile methods adoption, productivity, quality, delivery time, and increased customer satisfaction along with ROI.

6.2 | Implication of the study for researchers

Despite the fact that this research study achieved its objectives, there are still certain limitations that should be taken into account by researchers in future studies. These limitations are reflected in what follows. To begin with, this study is constrained by the presumption limits that the information acquired across various work functions are equally critical. It would have been more interesting to explore if there are any differences in terms of the outcomes in light of the work elements of the respondents. Nevertheless, this ambition requires a change in the design of the original survey and instruments of research and, as such, shall be left to future initiatives. Scaled Agile adoption and hybrid approaches (Agile Methods and Structured/Plan-driven

combined) of software development can be included by researchers in the future studies.

As future research it would be interesting to include more respondents from different countries to compare Agile methods acceptance, success, and failure factors in different sizes of organizations. Further focus on identification of inhibitors by researchers may also lead to new insights for practitioners and enterprises in Agile methods adoption.

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CONFLICTS OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Not Applicable.

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