Journal of Infrastructure, Policy and Development 2024, 8(1), 2621.
https://doi.org/10.24294/jipd.v8i1.2621

Article

The nexus between success factors and adoption of Agile project management framework: A moderated perceived compatibility paradox from the Omani oil and gas industry

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CITATION

Al Jabri AK, Islam MK, Daud SB. (2024). The nexus between success factors and adoption of Agile project management framework: A moderated perceived compatibility paradox from the Omani oil and gas industry. Journal of Infrastructure, Policy and Development. 8(1): 2621. https://doi.org/10.24294/jipd.v8i1.2621

ARTICLE INFO

Received: 21 August 2023
Accepted: 17 November 2023
Available online: 12 December 2023

Abstract: Recently, Agile project management has received significant academic and industry attention from due to its advantages, such as decreased costs and time, increased effectiveness, and adaptiveness towards challenging business environments. This study primarily aims to investigate the relationship between the success factors and Agile project management methodology adoption and examine the moderating effect of perceived compatibility. The technology-organization-environment (TOE) framework and technology acceptance theories (UTAUT, IDT, and TAM) were applied as the theoretical foundation of the current study. A survey questionnaire method was employed to achieve the study objectives, while quantitative primary data were gathered using a carefully designed methodological approach focusing on Omani oil and gas industry. The PLS-SEM technique and SmartPLS software were used for hypotheses testing and data analysis. Resultantly, readiness, technology utilization, organizational factors, and perceived compatibility were the significant factors that promoted Agile methodology adoption in the oil and gas industry. Perceived compatibility moderated the relationship between success factors and Agile methodology. The findings suggested that people, technology, and organizational factors facilitate the Agile methodology under the technology acceptance theories and frameworks. Relevant stakeholders should adopt the study outcomes to improve Agile methodology adoption.

Keywords: Agile project management; methodology; success factors; perceived compatibility; structural equation modelling; Omani oil and gas industry

1. Introduction

Recently, the advantages of Agile project management, such as lower costs and times, increased efficiency, and flexibility in challenging work situations, have attracted a lot of attention from academia and industry. The McKinsey Global Survey (2018) reported that incredibly rewarding Agile transformations often improve organisational efficiency by 5% and 10% and gains of approximately 30% in operational performance, customer satisfaction, and employee engagement and efficiency (Barton, 2018). Furthermore, approximately 71% of American businesses currently use Agile (Barton, 2018). Projects under the competing approach known as waterfall only demonstrate a 49% success rate, while Agile projects have a 64% success rate. Companies have experienced an average of 60% revenue and profit increase since using Agile (Barton, 2018). The most popular Agile framework is Scrum, which is utilised by 61% of respondents from 76 countries (Barton, 2018).

The core objective of this study is to investigate the relationship between the success factors and Agile project management methodology adoption and the moderating effect of perceived compatibility. However, the three study rationales are presented as follows. Firstly, Agile delivers excellent work in smaller quantities, solicits input from customers often, and adjusts its approach when companies learn new details about their customers' requirements (Noteboom et al., 2021; Tsoy and Staples, 2021). If the company intends to give its clients the products and requirements, then deliveries must be made on time. Secondly, when a company grows, it might occasionally lose its capacity for innovation. However, researchers found that Agile techniques to using volatility could be advantageous for well-organized teams operating in the right market and organizational environment. Finally, data on Agile adoption showed that a large number of fortune 500 companies had adopted this strategy. This procedure is one of the most widely used project management techniques in the world. Given that some of the top businesses implementing Agile include Cisco, Microsoft, and IBM, it stands to reason that the oil and gas sector benefits from Agile adoption.

Agility is a philosophy of production or management approach that can be integrated into existing technology, people, production strategies, and organization management systems to leverage performance and enable organizational global competitiveness (Piwowar-Sulej et al., 2022; Waszkiewicz, 2022). All Agile methodologies share common principles, such as satisfying customers, welcoming changes, delivering frequently, collaborating, building projects alongside motivated individuals, developing efficient communications, frequent measures of progress, sustainable development, continuous attention to technical excellence, simplicity, a well-organized team, and reflecting effectiveness. Intrinsic and extrinsic factors were associated with Agile methodology adoption. Individual and team readiness are intrinsic factors that determine the degree to which a person or team is ready to participate in alternate organizational activities (Farahat and Defina, 2022; Koch and Schermuly, 2021; Otero et al., 2020). Beliefs, attitudes, and intentions are the predictors of readiness where the readiness level varies based on workers' perception of the balance between behavioral maintenance and the benefits and costs of change. Changing recipients' acceptance or support is partially determined by how the change influences their teams or organizational routines and results. **Table 1** illustrates the most recent study on Agile project management methodology.

Table 1. Recent literature on Agile project management methodology.

Authors	Year	Study findings
(Almeida and Espinheira, 2022)	2022	The study investigated how the 10 practices based on the LeSS framework may be applied to the Management 3.0 principles. Thus, the function of Management 3.0 in software development and management processes based on the Agile paradigm was identified and explored using a qualitative research technique based on four case studies.
(Waszkiewicz, 2022)	2022	Components were selected from Agile approaches to simplify a design project team work. Section 1 examined various project management approaches with an emphasis on Agile.

Table 1. (*Continued*).

Authors	Year	Study findings
(Farahat and Defina, 2022)	2022	The article outlined effective methods for integrating the structured waterfall methodology with the Agile approach in oil and gas projects. A unique application of the Agile framework and predictive methodology for oil and gas projects was provided, which identified the critical custom process with a direct bearing on the success of the project.
(Miller and Núñez, 2022)	2022	Agile project management methodologies have gained popularity in the past decade. The study highlighted Project Win Game, which is a serious game designed to illustrate the distinctions between traditional or waterfall and Agile project decision-making processes.
(Pedrosa et al., 2022)	2022	The study aimed to apply absorptive capacity (ACAP) in projects created by information technology (IT) departments at four Brazilian telecommunications companies [hence referred to as telecom(s)].
(Bushuyev et al., 2021)	2021	The article examined contemporary information models that altered project managers' competency systems, approximations, and decision-making processes. Project managers' behavioural patterns were analysed in project product development and project management. The study also identified barriers to using Agile project management techniques in the fusion of popular information models and technologies based on the patterns.
(Koch and Schermuly, 2021)	2021	Discovering efficient techniques to attract and keep employees is challenging for businesses during market turbulence and uncertainty. The paper investigated whether Agile project management may functions in such situations. The predictive power of Agile project management was tested for luring people into the company in two separate experiments involving students ($N = 121$) and a field research with workers ($N = 229$). The findings revealed an indirect link between Agile project management and attractiveness to the organisation using psychological empowerment and SEM.
(Tsoy and Staples, 2021)	2021	Although Agile project management approaches have been extensively used in the 1990s, few studies or theoretical advancements highlight this topic. The paper examined the elements of Agile capacity and how they affect project performance based on the capacity theory. This proposed online survey assessed the impact of Agile capacity on project performance and designed an instrument to quantify Agile capacity. The outcomes evaluate and modify project agility.
(Otero et al., 2020)	2020	The study provided a thorough analysis of Agile approaches in classroom learning. In addition to that this study has claimed that Agile project management approaches, including Scrum and Extreme Programming, have recently been available as a possible teaching strategy with the goal of enhancing student learning. These approaches have emerged as an intriguing choice in education due to their capacity to modify student self-regulation, which outlines their high adaptability to required changes that may arise over time.

(Source: Author's accumulation).

The adoption of a new methodology is affected by extrinsic factors, such as organisational factors, technology utilisation, and perceived compatibility. Organisational factors include positive attitudes, such as active and enthusiastic approval, participation, and opinions or desires to embrace new methodology or technology (Farahat and Defina, 2022; Koch and Schermuly, 2021; Otero et al., 2020; Waszkiewicz, 2022). Employees perceive that the crucial organisational priorities align with the changes in methodologies and they believe that effective communication exists. Traditional methodology requires upfront planning, scheduling, and budgeting. Hence, employees trust the ability of their organisation to change and the leaders as a model while receiving all the necessary information about the newly adopted methodology. Perceived compatibility is an extrinsic factor that examines users' adoption of new methodologies or systems. In oil and gas companies, staff are used to traditional methodology and have a "not invented here syndrome." Rogers (1995) defined perceived compatibility and stated that a new methodology or technology is created based on users' supporting tasks and lifestyles. Low incompatibility increases the probability of rejecting methodology adoption as users will not accept a new method that contradicts their work.

Globalisation has evolved rapidly with rapid invention diffusion, increased financial market integration, and decreased information and communication costs. The emphasis on financial and operational performance has grown due to deregulation and privatisation in various industries, including oil and gas. The global oil and gas industry has migrated from consistency and stability to uncertainty and continuous change over the last 15 years. Globalisation has advanced immensely along with rapid diffusion of innovation, widening financial market integration, and lower costs (Carneiro et al., 2019; Goodison et al., 2019). Deregulation and privatisation have increased the focus on budgetary and operational efficiency. Although the oil and gas sector has experienced steady progress in the past 20 years, competition between oil companies worldwide for more inadequate assets has grown (Carneiro et al., 2019; Goodison et al., 2019).

Oman has experienced severe power interruptions due to limited oil and gas assets and resources. The country has begun to examine the use of renewable resources as an effort to diversify, such as the solar system and the need to invest a large amount of modal. The Agile methodology was suggested as an effective approach in the UAE to achieve the project goal. Hamilton et al. (2019) proposed that the Agile methodology can be applied from project planning until project delivery with comprehensive structured planning.

The adoption of Agile methodology remains at the concept stage as some oil and gas industries experience limited time and costs. Meanwhile, project management in several organisations with a strong centralised system needs to be upgraded. Agile methodology implementation in project management remains uncommon in oil and gas companies compared to other sectors, such as banking and IT (Abdulla and Al-Hashimi, 2019). Although other factors influence the usage of Agile methodology in project management, individual and team readiness, technology utilisation, organisational factors, and perceived compatibility have not been examined in terms of Agile methodology adoption in the oil and gas sector. Therefore, the current study investigated the relationship between the success factors

and Agile project management methodology adoption and the moderating effect of perceived compatibility. The technology-organization-environment (TOE) framework and technology acceptance theories, namely the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the Technology Acceptance Model (TAM), and the Innovation Diffusion Theory (IDT) were applied as the theoretical foundation.

Considering the aforementioned facts and theories, the oil and gas industry is the primary contributor to the overall revenue in Oman. Therefore, it's crucial to increase the urge to use this strategy in project management and the overall effectiveness of Omani oil and gas firms. The aforementioned theories were employed in this study to broaden perceptions of Agile methods in the Oman oil and gas industry. The literature review highlighted that implementing Agile methodologies in project management could enhance organisational performance. Previous research on the Agile method in the oil and gas industry did not address the direction and intensity of the relationship with the characteristics, which prevented generalisation. Therefore, this study used SmartPLS 3.0 to enhance data analysis to produce generalisable results and enhance research on the topic. Furthermore, the results confirmed past findings by examining how the influencing and moderating factors affect the acceptance of Agile methodology in the oil and gas industry.

The structure of the study is as follows: Section 1 includes the introduction followed by literature and theoretical perspective, hypothesis development, and conceptual model in section 2. Section 3 discusses the study methodology followed by data collection and analysis. Discussions and findings are explained in section 4 followed by section 5, which includes conclusions, recommendations and study contributions.

2. Literature and theoretical perspective, hypothesis development, and conceptual model

Firstly, this section will discuss about literature with their theoretical perspective. In addition to that relevant hypothesis was developed towards the research objectives of this study. Finally, research model was illustrated along with hypothesis sign.

2.1. Literature and theoretical perspective

The oil industry has experienced numerous developmental stages and conceptual changes. Organisations have reformed and reengineered to address the challenges of the 21st century. Agile methodology in the oil industry is defined as the ability to survive and thrive in a competitive atmosphere of constant and variable change (Waszkiewicz, 2022). Oil companies must be able to instantly deliver crude oil to customers and maintain a stable oil price.

The prerequisites for economies of scale in oil exploration contradict financial and economic development requirements and oil demand. This situation resulted from the BRIC countries interest in oil and gas to manage their economies, where the global oil demand was more robust between 2011 and 2013. The Agile framework does not represent several methods and techniques but rather a significant change

within production and management areas. This study outlined the factors influencing Agility adoption within the oil industry in the Sultanate of Oman. Organisations, such as British Petroleum (BP) have opted for rapid development following Gulf of Mexico issues to restructure the company and develop a safety division (Matriano, 2021). Introducing the new concept of "agility" into these organisations is required to upgrade global competition and modernisation among oil firms. This update will bring changes and new procedures for oil firms to instantly react to client requests and reduce production time. The four related theories are the TOE framework, UTAUT, TAM, and IDT. Meanwhile, the factors associated with Agile methodology adoption are individuals readiness, team readiness, technology utilisation, organisational factors, and perceived compatibility.

Firstly, the UTAUT model is a valuable starting point for studying technology adoption to identify variables that affect organisational intention to utilise IT to be adopted (Ayaz and Yanartaş, 2020; Rejali et al., 2023). Hence, this study adopted this model to examine Agile methodology adoption in oil and gas companies. Seven constructs were the major determinants of purpose or usage: performance expectation, expectation of effort, social impact, and conditions of facilitation. Performance expectations are the degree to which a person assumes that using a specific technology will enable them to achieve job performance gains (Ayaz and Yanartaş, 2020; Rejali et al., 2023). Perceived usefulness has been significantly linked to use intentions in numerous studies.

Secondly, TAM is a theory that explains why people decide to embrace or not receive a specific innovation or technology when performing a task (Assaker and Management, 2020). The concept suggests that two factors influence adoption: perceived usefulness (PU) and perceived ease of use (PEOU). The legitimacy and unwavering quality of the PU and PEOU in TAM have been emphasised in numerous research. The TAM is also an essential theory to assess IT method adoption (Assaker and Management, 2020). This theory explains that people might choose this method when they accept that utilising a specific method or system will improve the quality of the IT system development practice or the "perceived usefulness" system itself. Perceived usefulness is the particular perception of users wherever they have faith in that using particular technologies can accelerate the performance of their work. Perceived usefulness is a one-dimensional variable that few researchers have explored. Sub-measurements of perceived usefulness could be distinguished from the "usefulness" of IT solution measures.

Thirdly, the IDT explores the variables affecting people to receive or utilise another innovation or a development (Al-Rahmi et al., 2021; Al-Rahmi et al., 2019). The concept projects five principal convictions that influence the adoption of any development: relative advantage, compatibility, complexity, observability, and trialability. A recent study used compatibility (an element of IDT) as a moderating variable to assess the relationship between individual readiness, team readiness, technology utilisation, and organisational factors with Agile service management adoption.

Finally, the TOE framework was developed by Tornatzky and Fleischer in 1990 to explain the process of technological innovation (Tornatzky et al., 1990). This model is an organisation-level theory explaining that three elements of organisational

context influence adoption decisions: technological, organisational, and environmental. This idea aligns with IDT in terms of individual leader characteristics and internal characteristics of the organisational structure (Ullah et al., 2021). Rogers' highlighted that technological innovation features are similar to the TOE "technological context."

2.2. Hypothesis development

2.2.1. Individual readiness

Individual readiness for adaptation describes the level of readiness towards organisational members' attitudes, beliefs, and intentions (Mahendrati et al., 2020). This notion supports TAM where adoption depends significantly on belief. Al-Maamari and Raju (2020) added that a person's readiness depends on their job satisfaction level, commitment to their jobs, and whether they intend to leave their current jobs or make a change.

According to Blackman et al. (2013), organizational innovation and employee motivation for change can also boost a person's readiness for possible change and adaption to cutting-edge approaches, such as Agile. Given that the adoption of Agile methodology could improve oil and gas industry performance, staff members involved in project management possess individual readiness to make this strategy more successful. Therefore, the following hypothesis was proposed:

H1: There is a significant positive relationship between an individual's readiness towards change and Agile methodology adoption in oil and gas companies.

2.2.2. Team readiness

Agile development considers project management in the oil and gas industry as unpredictable, innovative, and unorthodox. Groups whose team members could sense the change in a situation were perceived to be more adaptable when responding to unfamiliar conditions (Ajmal et al., 2017). Al-Maamari and Raju (2020) interpreted readiness as organisational employees' state of mind while implementing an organisational change. The target team members' beliefs, attitudes, and intentions on the necessity and feasibility of implementing an organisational change are included in team readiness.

Studies proposed that the issue of completing tasks occurs when the team members are not working together. Considering that every organisational unit must collaborate to effectively complete a project, evaluating the team's readiness and ability to embrace the Agile approach is critical (Ajmal et al., 2017; Al-Maamari and Raju, 2020). Thus, the study suggested the following hypothesis:

H2: There is a positive relationship between team readiness towards change and Agile methodology adoption in oil and gas companies.

2.2.3. Technology utilisation

Technology use is based on the TOE framework, which explains that the technological component of the model includes "the full technologies that are relevant to the firm: both technologies that are available in the market but not currently in use." Furthermore, the concept highlights that present technological capabilities "are significant in the adoption process because they impose a broad

limit on the extent and pace of technological change that a corporation can undertake" (Collins et al., 1988).

Existing innovations that are not yet used at the company impact innovation by defining the boundaries of what is feasible and demonstrating how technology can facilitate them to change and adapt. Although numerous oil and gas organisations use the traditional project management technique, Agility requires multiple abilities to manage the technological advancements demonstrated by the methodology. Individuals who adopt technology poorly tend to embrace new technologies inefficiently (Faisal and Kisman, 2020; Ghapanchi and Talaei-Khoei, 2018). Thus, the following hypothesis was presented:

H3: There is a significant positive relationship between technology utilisation and Agile methodology adoption in oil and gas companies.

2.2.4. Organisational factors

The organisational component of TOE is described as "the characteristics and resources of the firm, including linking structures between employees, intra-firm communication channels, firm size, top management support, and the quantity of slack resources (Ullah et al., 2021)." This setting impacts the adoption and implementation decisions in several ways. First, methods that connect company submissions within or cross "internal borders" promote innovation (Adeleke et al., 2016). Adoption is correlated with variables, including strong lines of communication between managers and staff and gatekeepers and product champions. Nonetheless, additional examples of such systems include cross-functional teams and staff members with formal or informal affiliations to various departments. Generally, organisational elements and structure have been investigated to comprehend their relationship with the innovation adoption process. Burns and Stalker (1962) and Daft and Becker (1978) mentioned that adoption is linked to simple and decentralised structures.

Teams are prioritised in businesses with this type of structure or environment along with a degree of flexibility or autonomy in terms of employee tasks and encouragement of Agile communication outside traditional communication channels. These organisational cultures influence employees' autonomy and willingness to adopt new technologies. Few studies analysed the relationship between organisational culture and its ability to adopt the Agile methodology or other new approaches despite the relationship between corporate industries and IT. Production companies, such as oils and gas firms fall under this category. Hence, the following hypothesis was proposed:

H4: There is a significant positive relationship between organisational culture and Agile methodology adoption in oil and gas companies.

2.2.5. Perceived compatibility

The concept of perceived compatibility is based on Rogers' (1995) IDT, which asserts that one could evaluate the adoption of computing or technology resources using IDT variables or beliefs. This study applied perceived compatibility as a moderating variable to control the link between the independent and dependent variables, considering that adopting the Agile technique in project management is also technological innovation. Although perceived compatibility could theoretically

influence team readiness, individual readiness, technology utilisation, organisational variables, and acceptance of new technology, its impact on the oil and gas industry remains unstudied. Therefore, the following hypotheses were suggested:

H5: There is a significant positive relationship between perceived compatibility and Agile methodology adoption in oil and gas companies.

H6: There is a moderating effect of perceived compatibility between team readiness, individual readiness, technology utilisation, organisational factors, and Agile methodology adoption in oil and gas companies.

2.3. Conceptual model

The proposed model outlined four variables, namely the independent variable (success factors), the dependent variable (agile methodology adoption in project management), and the moderating variable (perceived compatibility). The TOE framework and the technology acceptance theories were the theoretical foundation for the suggested relationships in this study. The following **Figure 1** represents conceptual model of this study.

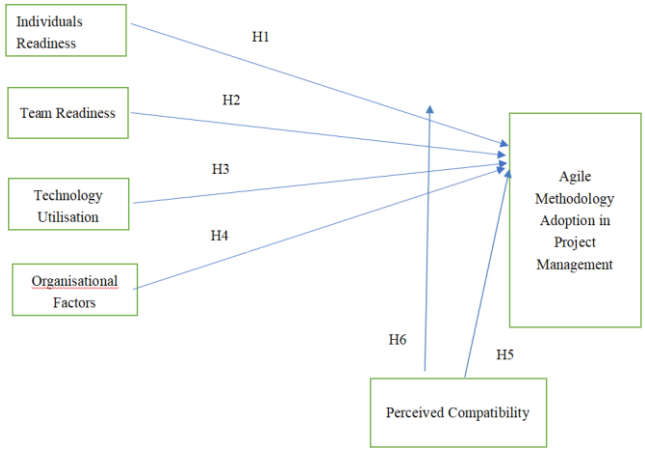

Figure 1. Conceptual framework.

3. Methodology

This study is based on the positivism paradigm and quantitative research design focusing on Omani oil and gas industry using a survey questionnaire. Overall, 73 oil and gas companies exist in Oman (69 in Muscat, 4 in Sohar). Company selection was made using a multi-stage sampling method. Employers from the management and administrative sectors were randomly selected from each company and all consented employers were included in this study. The respondents were employees (management and administrative sector employers who are Omani, experienced in project management, and permanent employers) in the oil and gas industry. The primary technique for data analysis was PLS-SEM, which integrated unobservable variables measured indirectly through indicator variables and enabled the accounting of measurement errors within latent variables. PLS-SEM assesses how well the model describes the target constructs of interest and calculates the connections between the latent variables. PLS-SEM is becoming more and more popular due to

its ease of use with data requirements and its capacity to estimate complicated models. **Table 2** illustrates the survey questionnaire (measurement instruments).

Table 2. Development of instruments.

Section	Name	Responses	No. of items	Sources
A	Respondents' characteristics	Multiple choice and open ended	5	(Chang et al., 2004)
B	Team Readiness (TR)-Independent Variable	5-point Likert scale	8	(Chang et al., 2004)
C	Individual Readiness-(IR)-Independent Variable	5-point Likert scale	5	(Chang et al., 2004)
D	Technology Utilisation-(TU)-Independent Variable	5-point Likert scale	5	(Premkumar and Ramamurthy, 1995)
E	Perceived Compatibility (PC)-Moderating Variable	5-point Likert scale	5	(Kanchanatanee et al., 2014)
F	Organisational Factors (OF)-Independent Variable	5-point Likert scale	4	(Donate and Guadamillas, 2011)
G	Agile Method Adoption (AMA)-Dependent Variable	5-point Likert scale	5	(Al-Jabri and Sohail, 2012)

4. Data collection and analysis

4.1. Data screening and statistical assumptions

Data screening is the first step in data analysis to clean up the dataset. A total of 1220 prospective respondents received the survey questionnaire via email. Overall, 370 completed surveys were received with a first response percentage of 30.33%. A final response rate of 28.52% was gained upon removing 22 out of 370 responses. The removed responses included respondents who were on a temporary or contract basis, which was a total of 15. Therefore, the total number of valid analysable questionnaires was 333. After initial screening, the study tested underlying assumptions for multivariate analysis. Hair et al. (2010; 2020) suggested examining statistical assumptions that might be present, which could affect the univariate and multivariate analysis. This study examined univariate and multivariate outliers, normality, and multicollinearity assumptions (see Appendix).

4.2. Demographic characteristics

Descriptive statistic was used to report respondents' demographic analysis, including gender, age, position, education, and computer proficiency in their current organization. Most respondents were male (n = 180), while female participation was slightly lower (n = 135), and 18 respondents fell under the other category. Most

respondents were under the 18 to 23 years category (n = 154) followed by the 24 to 29 age group (n = 143). Meanwhile, the least participative age group is 30 and above (n = 36).

The respondents were also analyzed based on their workplace position, namely managerial, executive, administrative, and other categories. The majority of respondents were in managerial positions (n = 159) followed by administrative (n = 79), and other positions (n = 59). Meanwhile, only 10.8% (n = 36) of the respondents were in the executive category. Most respondents (43.2%) had a Bachelor's degree (n = 144), while only 3.3% were Ph.D. graduates (n = 11). **Table 3** demonstrates that 31.5% of the respondents had diplomas (n = 105) and 21.9% had a Master's degree (n = 73).

Three categories indicated the respondents' computer proficiency: basic, intermediary, and expert. Most respondents (46.2%) possessed basic computer proficiency (n = 154) followed by 42.9% intermediary level (n = 143). Only 10.8% of respondents were experts in computer technologies.

4.3. descriptive and correlation statistics

Table 3 indicates that the TR items generated a mean score of 3.450 (SD = 1.264) with an IR mean score of 3.445 (SD = 1.211), TU mean score of 3.403 (SD = 1.314), PC mean score of 4.043 (SD = 1.063), OF mean score of 3.719 (1.147), and AMA mean score of 3.387 (1.269).

Table 3. Descriptive statistics.

Constructs	N	Min.	Max.	Mean	SD
TR	333	1.00	5.00	3.450	1.264
IR	333	1.00	5.00	3.445	1.211
TU	333	1.00	5.00	3.403	1.314
PC	333	1.00	5.00	4.043	1.063
OF	333	1.00	5.00	3.719	1.147
AMA	333	1.00	5.00	3.387	1.269

Table 4 suggested the correlation among all study variables. The IR indicated a moderate level of correlation with TR (0.295). Meanwhile, TU demonstrated a moderate correlation with TR (0.455) and IR (0.344). The PC indicated a weak correlation with TR (0.277), IR (0.139), and TU (0.131). Furthermore, OF construct has a moderate correlation with TR (0.296), IR (0.279), and TU (0.232). The OF outlined an insignificant and negative correlation with PC (−0.063, $p > 0.05$). Finally, AMA presented a moderate level of correlation with TR (0.412), TU (0.412) and OF (0.318), and a weak correlation with IR (0.223) and PC (0.194).

Table 4. Correlation analysis.

	1	2	3	4	5	6
TR (1)	1					
IR (2)	0.295	1				
TU (3)	0.455	0.344	1			
PC (4)	0.277	0.139	0.131	1		
OF (5)	0.296	0.279	0.232	−0.063	1	
AMA (6)	0.412	0.223	0.412	0.194	0.318	1

**. Correlation is significant at the 0.01 level (1-tailed).

4.4. Structural equation modelling and hypothesis testing

Hair et al. (2014; 2020) suggested a two-step SEM procedure. The first stage involved testing the measurement model (internal consistency reliability and validity of the scales), while the second stage involved examining the structural model (hypotheses testing). SmartPLS 3.0 (version 3.3.3) was used for data analysis (Ringle et al., 2015). Appendix lists the measurement model statistics, which were tested to assess the internal consistency reliability, convergent validity (factor loadings and average variance extracted), and discriminant validity of the study constructs. The following **Figure 2** is measurement model of this study.

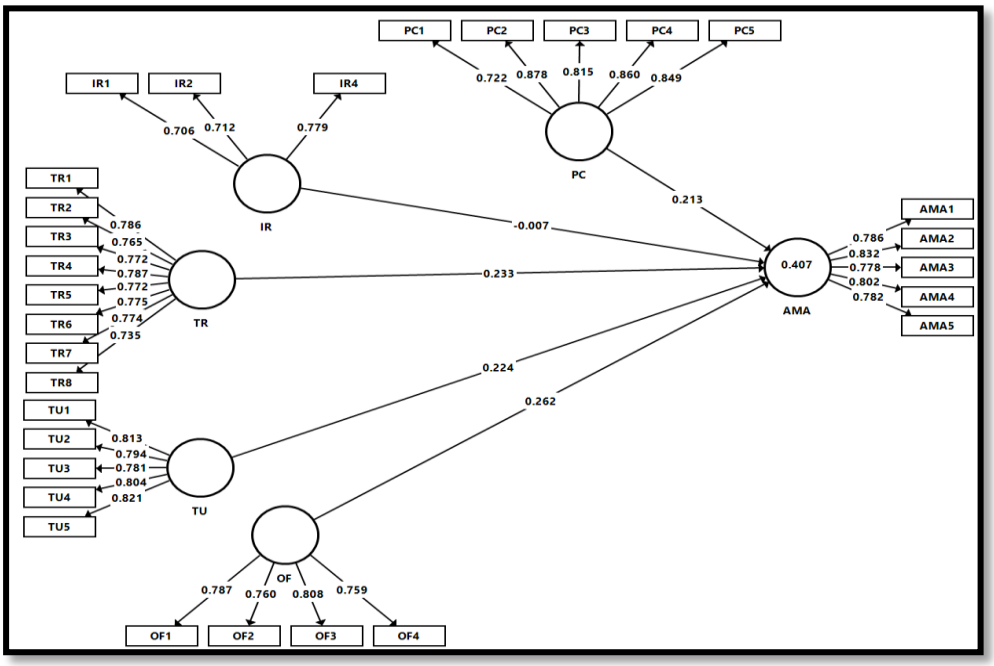

Figure 2. Measurement model.

The hypothesised relationships among study variables were examined using several structural models. First, the direct effect between exogenous and endogenous variables (H1 to H5) were examined. Subsequently, the moderating (H6) role of perceived capability was investigated between exogenous and endogenous variables.

SmartPLS 3.3 version examined the path models. Prior literature emphasised several criteria, such as the estimation of path coefficient, coefficient of

determinations (R^2), predictive relevance (Q^2), and effect size (f^2) (Hair et al., 2014). Based on Hair et al.'s (2014) recommendation, bootstrapping technique with a resampling method (5000 resamples, one-tailed significance) was adopted to estimate the path coefficient at $p < 0.05$. Thus, the rejection or acceptance of hypotheses in this study was based on a *p*-value (<0.05). **Table 5** indicates the path model statistics. The results revealed that the relationship between IR → AMA is not significant ($\beta = -0.007$, $p = 0.896$), hence, not supporting H1. Meanwhile, the relationships between TR → AMA ($\beta = 0.233$, $p = 0.000$), TU → AMA ($\beta = 0.224$, $p = 0.000$), OF → AMA ($\beta = 0.262$, $p = 0.000$), and PC → AMA ($\beta = 0.213$, $p = 0.001$) were positive and significant, therefore supporting H2, H3, H4, and H5.

Table 5. Path model statistics and hypotheses.

Relationship	*β*-value	*T*-statistics	*P*-value	Decision
H1: IR → AMA	−0.007	0.131	0.896	Rejected
H2: TR → AMA	0.233	3.758	0.000	Accepted
H3: TU → AMA	0.224	3.875	0.000	Accepted
H4: OF → AMA	0.262	4.820	0.000	Accepted
H5: PC →AMA	0.213	3.609	0.001	Accepted

Other essential elements of PLS-SEM are coefficient of determination (R2) and predictive relevance (Q^2). Hair et al. (2019) mentioned that the coefficient of determination (R^2) measures the proportion of dependent variable variance. The value of R^2 determines the model explanatory power regarding a specific dependent variable. According to Falk and Miller (1992), the R^2 value should be ≥0.10 for the variance of particular endogenous constructs to be deemed adequate. Hair et al. (2019) proposed that the value of $0.02 > R^2 < 0.12$ is considered small, $0.13 > R^2 < 0.25$ is considered moderate, and ≥0.26 is considered large. Researchers also recommended that Stone-Geisser's Q^2 (Geisser, 1974; Stone, 1974) value should be reported as predictive relevance (Hair et al., 2019). As suggested by Hair et al. (2014), the value of Q^2 exceeding zero ($Q^2 > 0$) indicated that the path model has predictive relevance. The study revealed that R2 of AMA is considered large (0.407) with Q^2 being 0.250.

4.5. Moderation analysis

Hypothesis 6 suggested that perceived compatibility plays a moderating role between exogenous and endogenous variables. Researchers adopted various approaches to examine the moderating effect, such as product-indicator (Chin et al., 2003), orthogonalising (Lance, 1988), and two-stage approach (Henseler and Fassott, 2010). Becker et al. (2018) suggested that the two-stage approach is the preferred technique compared to others. Furthermore, Hair et al. (2019) stated that researchers should use a two-stage approach for moderation analysis as the method excels more statistical power. Therefore, this study performed moderation analysis on a two-stage approach. As the change of R^2 in moderation analysis is vital, Hair et al. (2014) suggested a formula to measure the moderating effect.

Table 6 outlines the moderation analysis. The PC indicates a positive moderating effect between IR and AMA (β = 0.159, p = 0.001). Furthermore, PC positively moderates OF and AMA (β = 0.164, p = 0.016). The PC demonstrated no moderating effect on the relationship between TR and AMA (β = 0.020, p = 0.368). Meanwhile, PC indicated a significant and positive moderating role in the relationship between TU and AMA (β = 0.088, p = 0.051). Hence, the findings revealed that PC partially moderates the relationships between exogenous (IR, OF, and TU) and AMA. The following **Figure 3** is the PLS path model for this study.

Table 6. Moderation analysis.

Relationship	β-value	T-statistics	P-values	Decision
IR*PC ≥ AMA	0.159	3.225	0.001	Accepted
OF*PC ≥ AMA	0.164	2.142	0.016	Accepted
TR*PC ≥ AMA	0.020	0.339	0.368	Rejected
TU*PC ≥ AMA	0.088	1.638	0.051	Accepted

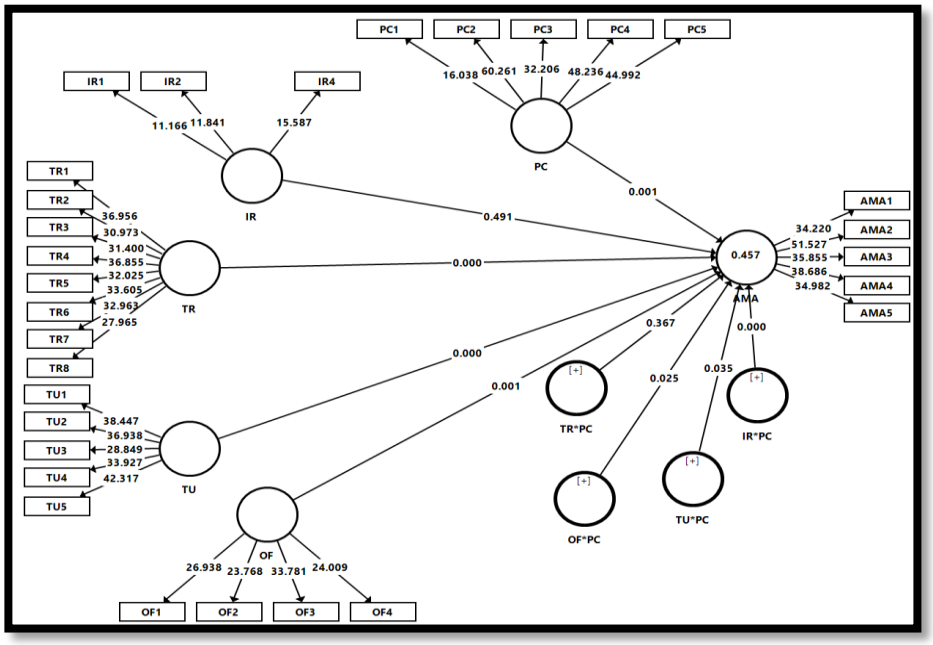

Figure 3. The PLS path model.

5. Discussion and findings

5.1. Effect of individual readiness on Agile methodology adoption (H1)

Although H1 proposed that individual readiness demonstrates a positive and significant relationship with AMA, the findings indicated a negative and insignificant effect on AMA. Previous literature emphasised that people-related factors are more critical than others as they start with human perceptions and lack the necessary skills in project management competence and teamwork. Chita (2018) outlined that individual characteristics, such as unsociability, clumsy, and non-interactivity are common factors that hinder Agile methodology adoption. The

current findings aligned with past studies (Chita, 2018, Dingsoyr et al., 2012), thus H1 was not supported.

5.2. Effect of team readiness on Agile methodology adoption (H2)

Hypothesis 2 indicated that team readiness positively and significantly affects Agile methodology adoption in Oman based on past literature. Altuwaijri and Ferrario (2022) underlined that self-organised teams are essential to adopt higher agility in software SMEs. Meanwhile, Handscomb et al. (2018) suggested that the digital transformation limited the impact of the team in other sections of the organisation and applied the Agile methodology to varying degrees. Ghimire and Charters (2022) also proposed that team readiness is essential to achieve Agile development practices in project-based organisations. Therefore, H2 was supported.

5.3. Effect of technology utilization on Agile methodology adoption (H3)

Hypothesis 3 proposed that technology utilisation has a positive and significant relationship with AMA. The current findings aligned with past studies, which indicated that technical factors (technology) are a crucial indicator to achieving agility in software development in Saudi software SMEs. Parsons et al. (2007) stated that technological utilisation significantly affects Agile methodology adoption in software development firms. Zain et al. (2005) added that external factors influence technology acceptance that further enhances firm agility. Technology is also a multi-dimensional construct, which impacts Agile methodology differently. Therefore, H3 was accepted.

5.4. Effect of organisational factors on Agile methodology adoption (H4)

The H4 stated that organisational factors have a positive and significant relationship with AMA. Past studies have argued that organisational factors (culture, management support, and communication) are vital to adopt Agile methodology in software SMEs and large software organisations. Khan et al. (2021) mentioned that organisational culture and management support are the vital sub-dimensions of organisational factors. Leso et al. (2022) and Chan and Thong (2009) summarised that organisational factors are the vital exogenous constructs to promote Agile adoption in system development methodologies of software firms. Past studies confirmed that organisational factors support Agile methodology adoption.

5.5. Effect of perceived compatibility on Agile methodology adoption (H5)

Hypothesis 5 suggested that perceived compatibility reflects a positive and significant relationship with AMA. Past studies outlined perceived compatibility as a significant predictor of Agile methodology adoption in software development firms. Hanslo and Mnkandla (2018) and Bawack and Ahmad (2021) confirmed that compatibility is the most silent construct that affects Agile methodology adoption in IT firms. Based on the technology acceptance framework, perceived compatibility is a vital factor in Agile methodology adoption, thus accepting H5.

5.6. Moderating effect of perceived compatibility (H6)

Hypothesis 6 proposed that perceived compatibility moderates the relationship between exogenous variables (IR, TR, TU, and OF) and AMA. The findings confirmed past studies, such as Chiyangwa and Mnkandla (2018) and Aldholay et al. (2018), Hunag and Yu (2021) examined the direct and moderating role of perceived compatibility in promoting green behaviour among Taiwanese students. Riketta and Nienaber (2007) mentioned that perceived compatibility is a crucial factor that affects Agile methodology, hence accepting H6.

6. Conclusion

Over the past 15 years, the global oil and gas industry has transitioned from stability and predictability to trepidation, uncertainty, and constant change. Adoption and emphasis on best practices for Agile project management have recently developed across industries and businesses. Agility in project management outlines several benefits, including decreased time and costs, increased effectiveness, and the ability to adapt to changing industry structures. This study provided several relevant theoretical, literary, methodological, and policy contributions based on academic contributions and industry implications. The frameworks and technology acceptance theories in this study offered a theoretical foundation for examining the impact of various adoption factors on the Agile method in Oman. To begin with, the results enhanced the general theoretical understanding of the TOE framework for the fourth industrial revolution. In addition to that this study accelerated the acceptance of UTAUT, IDT, and TAM theories in the technological and Agile framework...

This study also provided insight into how these theories could be used for Agile methods. Various factors, including organisational, technological, and human factors, contributed to the adoption of Agile methodology. Using the Agile technique in the digital age requires all these criteria. Therefore, the findings increased the significance, applicability, and integration of technology acceptance theories. Secondly, the findings supported the theories of technology adoption that perceived compatibility moderates adoption variables and Agile methodology. These theories need simultaneous co-evolution of all components (people, process, and organisation), which must be built upon incorporating these elements. Finally, this study investigated how diverse people, processes, and organisational factors influence the adoption of the Agile approach in Oman enterprises. Essentially, Oman aspires to be a high-income nation, yet internal and external forces affect national development. Oman firms remain a less researched topic in the age of digitisation. The findings offered insightful information about management approaches to adopting the Agile approach, which could resolve adoption-related issues.

The results highlighted the importance of human aspects for both individuals and teams when it comes to adopting the Agile methodology in IR 4.0. The people-related components are in charge of creating efficient procedures that support the organization in managing its resources and setting reasonable standards by which to judge success. The results showed that Omani oil and gas companies haven’t paid attention to certain details. For example, in order to support the adoption of Agile

methodology and help the business find trustworthy people, managers should regard their staff members as team members.

Conducting a case study within oil and gas companies that approached the Agile methodology adoption through the lens of technology acceptance theories would be an intriguing future research path. Future studies should compare the oil and gas industry and other associated businesses, which are crucial for economic growth. Future research should also investigate the function of various mediators and moderator variables in serial or parallel mediation. A longitudinal study could comprehend the dynamics of adoption variables and the Agile technique. Future studies should also utilise a mixed-method approach to acquire qualitative and quantitative insights. As the current findings were based on data from a single nation, future studies should examine potential interactions from a multi-country viewpoint to identify developing patterns. Specifically, a cross-country assessment of the BRICS economies or between developed and emerging economies should be conducted. The evidence foundation for the embedded research strategy to support flexible policies and systems for oil and gas companies is strengthened by this multi-country investigation.

Author contributions: Conceptualization, AKAJ and MKI; methodology, SBD; software, AKAJ; validation, AKAJ, MKI and SBD; formal analysis, AKAJ; investigation AKAJ; resources, MKI; data curation, SBD; writing—original draft preparation, AKAJ, MKI and SBD; writing—review and editing, AKAJ, MKI and SBD; visualization, AKAJ; supervision, MKI and SBD; project administration, MKI, SBD; funding acquisition, AKAJ. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

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Appendix

Table A1. Normality analysis through Skewness and Kurtosis.

Constructs	Items	Skewness	Kurtosis
Team readiness	TR1	−0.512	−1.162
	TR2	−0.466	−1.152
	TR3	−0.492	−1.135
	TR4	−0.448	−1.134
	TR5	−0.493	−1.123
	TR6	−0.489	−1.22
	TR7	−0.422	−1.229
	TR8	−0.375	−1.058
Individual readiness	IR1	−0.374	−1.375
	IR2	−0.400	−1.376
	IR3	−0.293	−1.509
	IR4	−0.28	−1.485
	IR5	−0.436	−1.266
Technology utilisation	TU1	−0.294	−1.247
	TU2	−0.479	−1.149
	TU3	−0.662	−0.949
	TU4	−0.436	−1.153
	TU5	−0.522	−1.13
Perceived compatibility	PC1	−1.331	0.952
	PC2	−1.052	−0.101
	PC3	−1.254	0.643
	PC4	−0.947	−0.278
	PC5	−1.052	0.042
Organisational factors	OF1	−0.731	−0.645
	OF2	−0.615	−0.85
	OF3	−0.561	−0.884
	OF4	−0.691	−0.72
Agile method adoption	AMA1	−0.336	−1.214
	AMA2	−0.323	−1.347
	AMA3	−0.387	−1.221
	AMA4	−0.301	−1.213
	AMA5	−0.418	−1.231

Table A2. Results of discriminant validity (Fornell-Larker Criterion).

	TR (1)	**IR (2)**	**TU (3)**	**PC (4)**	**OF (5)**	**AMA (6)**
TR (1)	0.771					
IR (2)	0.333	0.733				
TU (3)	0.539	0.436	0.803			
PC (4)	0.358	0.234	0.268	0.827		
OF (5)	0.335	0.36	0.346	0.059	0.779	
AMA (6)	0.516	0.313	0.495	0.34	0.403	0.796

Table A3. Results of discriminant validity (cross-loading).

	TR	**IR**	**TU**	**PC**	**OF**	**AMA**
TR1	0.786	0.309	0.413	0.303	0.342	0.452
TR2	0.765	0.253	0.476	0.265	0.233	0.395
TR3	0.772	0.263	0.366	0.282	0.253	0.390
TR4	0.787	0.265	0.384	0.296	0.240	0.437
TR5	0.772	0.270	0.401	0.250	0.268	0.381
TR6	0.775	0.257	0.446	0.263	0.284	0.346
TR7	0.774	0.231	0.409	0.251	0.188	0.388
TR8	0.735	0.199	0.438	0.294	0.251	0.375
IR1	0.270	0.706	0.317	0.174	0.278	0.206
IR2	0.183	0.712	0.282	0.107	0.260	0.210
IR4	0.276	0.779	0.355	0.224	0.260	0.266
TU1	0.408	0.357	0.813	0.190	0.279	0.380
TU2	0.421	0.339	0.794	0.185	0.289	0.403
TU3	0.427	0.398	0.781	0.198	0.270	0.355
TU4	0.402	0.343	0.804	0.277	0.238	0.400
TU5	0.500	0.322	0.821	0.224	0.312	0.440
PC1	0.211	0.036	0.060	0.722	−0.078	0.154
PC2	0.352	0.239	0.297	0.878	−0.042	0.337
PC3	0.240	0.142	0.189	0.815	−0.130	0.241
PC4	0.347	0.264	0.290	0.860	−0.008	0.324
PC5	0.286	0.203	0.186	0.849	−0.022	0.286
OF1	0.284	0.273	0.227	−0.063	0.787	0.322
OF2	0.246	0.319	0.325	−0.078	0.760	0.310
OF3	0.279	0.286	0.326	0.000	0.808	0.334
OF4	0.231	0.242	0.193	−0.046	0.759	0.285
AMA1	0.367	0.251	0.411	0.247	0.325	0.786
AMA2	0.437	0.240	0.402	0.306	0.303	0.832
AMA3	0.479	0.257	0.435	0.256	0.339	0.778
AMA4	0.399	0.255	0.346	0.291	0.320	0.802
AMA5	0.360	0.241	0.369	0.251	0.316	0.782

Table A4. Results of Discriminant validity (HTMT).

	TR (1)	IR (2)	TU (3)	PC (4)	OF (5)	AMA (6)
TR (1)						
IR (2)	0.457					
TU (3)	0.611	0.618				
PC (4)	0.387	0.292	0.283			
OF (5)	0.396	0.539	0.417	0.101		
AMA (6)	0.580	0.441	0.572	0.372	0.491	

Table A5. Measurement model statistics.

Constructs	Items	Loading	VIF	rho_A	CR	AVE
TR	TR1	0.786	2.065	0.905	0.921	0.594
	TR2	0.765	1.900			
	TR3	0.772	1.938			
	TR4	0.787	2.000			
	TR5	0.772	1.955			
	TR6	0.775	2.105			
	TR7	0.774	2.007			
	TR8	0.735	1.738			
IR	IR1	0.706	1.178	0.583	0.777	0.538
	IR2	0.712	1.180			
	IR4	0.779	1.160			
TU	TU1	0.813	1.978	0.865	0.901	0.645
	TU2	0.794	1.810			
	TU3	0.781	1.808			
	TU4	0.804	1.872			
	TU5	0.821	1.925			
PC	PC1	0.722	1.792	0.914	0.915	0.684
	PC2	0.878	2.502			
	PC3	0.815	2.102			
	PC4	0.86	2.331			
	PC5	0.849	2.288			
OF	OF1	0.787	1.549	0.786	0.86	0.606
	OF2	0.76	1.464			
	OF3	0.808	1.626			
	OF4	0.759	1.525			
AMA	AMA1	0.786	1.788	0.857	0.896	0.634
	AMA2	0.832	2.085			
	AMA3	0.778	1.669			
	AMA4	0.802	1.931			
	AMA5	0.782	1.811			