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The AGP Model for Risk Management in Agile I.T. Projects

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Abstract: The vast majority of articles on risk in agile-managed projects fail to adequately address the interplay between the agile methodology, the risk management process, and the elements that ultimately determine the success or failure of the project. Too frequently, processes and models are given undue priority over the human element. The aim of this article is to create a risk management model for agile I.T. projects (AGP model). The study sample consists of 1868 valid survey responses from European and Asian countries received between February 2022 and January 2023. We subjected the data to Exploratory Factor Analysis (EFA) and Cronbach's alpha to identify four key factors for dealing with risks in I.T. projects and create the AGP model. The proposed AGP model outlines up to 76% variability in the potential risks that could arise during an I.T. project's deployment. The findings of this study are critical for project managers, I.T. professionals, developers, and system architects involved in I.T. projects. Other stakeholders may be interested in understanding the risks associated with the project and developing strategies to mitigate these risks.

Keywords: agile; project management; risk; information technology; risk management model

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1. Introduction

Conducting business in an atmosphere characterized by high levels of volatility and responsiveness to market demands is a major contributor to the recent shifts in project management strategies, notably in the I.T. sector (Garwood and Poole 2018). For projects with high levels of uncertainty and high levels of structural complexity, conventional project management approaches may be insufficient and even harmful in such an environment (Marle and Vidal 2016). As a consequence of these shifts and the criticism of the old method, new trends in project management are developing. The term "agile project management" has been coined to describe this new method that allows for more leeway and adaptability during project execution by eschewing overly rigid procedures in favor of a more fluid response to changing conditions (Bogdanova et al. 2020).

The agile approach to risk management focuses on continuous improvement, communication, and adaptive planning to deliver projects quickly and efficiently. It is an iterative and incremental project management method that emphasizes early and frequent delivery while allowing for adaptation to changing requirements and customer needs. Projects in I.T. that use an agile approach are the primary subject of this article because of the unique challenges that they provide and the literature's suggestions for addressing these challenges (Schwaber and Sutherland 2017; Pereira and Russo 2018; Shao and Müller 2011; Trzeciak 2021).

With this article, we explored whether the risk factors identified by Trzeciak (2021) for dealing with risks in agile I.T. projects can be identified in other European and Asian countries with observations over a different period. To accomplish this, we created a survey based on the 19 risk management factors identified by Trzeciak (2021) and empirically validated for Polish businesses. This survey was self-administered using the Qualtrics XM® application software to managers and employees of I.T. project teams from different European and Asian I.T. companies who are linked to the authors' network on Linked-in, other social networks, and email. The total 1868 responses were subjected to statistical analysis—specifically, descriptive statistics and Exploratory Factor Analysis using SPSS (version 24)—which highlighted four main factors and an AGP model for dealing with risks in agile I.T. projects, from which we developed the AGP model.

Our contribution to the academic literature and practical implications is threefold. First, we developed a risk management AGP model that accounts for up to 76% variability in the potential risks that may arise while implementing an agile I.T. project. Furthermore, we discovered that the number of years of experience, participation in the project process, and gender all have a statistically significant relationship with the AGP model, whereas completed projects in the last 5 years do not. Second, this study provides a better understanding of how risk is managed in agile I.T. projects by ensuring that resources are used efficiently to minimize the negative effects of potential risks. Third, the effects of potential risks are assessed at both the project and project team levels. Assessing potential risks at the project level assists in identifying any potential risks that may jeopardize the project's success, whereas assessing potential risks at the project team level assists in ensuring that necessary resources are available and the team is prepared to address any issues that may arise.

The article is organized as follows. Section 2 discusses the literature review, which we used to develop the theoretical framework, and Section 3 discusses the research methodology used. The research findings are presented in Section 4. Section 5 discusses the findings, while Section 6 discusses the study's scientific and practical implications and makes recommendations for future research.

2. Literature Review

Projects are vulnerable to various threats due to the dynamic nature of the internal and external environments in which they are implemented (Schwaber and Sutherland 2017). It is critical to remember that risks exist at every stage of a project's life cycle. Project risk management is inextricably linked to risk treatment, which is a series of interconnected steps to mitigate any given crisis's impact. According to Woźniak (2021), risk management is prophylactic, while risk treatment is therapeutic. Project risks can lead to unfavorable events during implementation, impacting the project's final outcome (Ward and Chapman 2008).

There is some variation in how different projects are categorized in terms of the risks that they face. It is possible for a phenomenon that poses a significant threat to one project to be a regular occurrence in another (Hohl et al. 2018). This means that no one approach works for all projects when it comes to managing risks. Loss of time, loss of money, the threat to the success or failure of the entire project, and so on are the most common forms of project risk (Barghi and Shadrokh Sikari 2020). Studies examining the effectiveness of various risk management approaches have highlighted the importance of risk analysis in the final outcome of an I.T. project (Zavyalova et al. 2020).

The fundamentals of an agile management approach emerged around the year 2000 (Özkan and Mishra 2019; Ruhe and Wohlin 2014). Agile methodologies exploded in 2001, with several new developments and widespread adoptions (Hohl et al. 2018). The Agile Manifesto was written then by pioneers of the agile methodology in project management, including the 12 principles and 4 key postulates (Peraza-Baeza et al. 2016). The purpose of their work was not to create elaborate procedures but rather to define their essential features. As a result, agile methodologies, which are based on the Manifesto's postulates, have emerged as a viable alternative to more conventional approaches to project management and software development (Gatner 2018).

Nonetheless, despite the passage of time, the subject of project risk management has grown in importance (Rupeika-Apoga et al. 2022a). A project's delivery at any stage is not immune to the incidence of risk. Risks might be large or small depending on the project's nature, but they should always be recognized (Shrivastava and Rathod 2015). Depending on the context, the term "risk" can have a variety of meanings. According to Knight (1921), risk applies to situations in which we do not know the outcome but can accurately measure the odds. In this study, the risk is defined as the extent to which a given set of events, whether favorable or unfavorable, may have an impact on the project's ultimate outcome (Pavia et al. 2021; Grima et al. 2021; Jangir et al. 2022).

Instead of being seen as a separate technical investigation, risk management is now included in the larger decision-making process. The human element is an important consideration in "risk management for sustainable I.T. project management" because of the nature of I.T. project management (Woźniak 2021; Dávid and Szűcs 2009). Depending on how rigorous or relaxed the approach is, three basic risk management tendencies emerge in the agile methodology for managing projects (Munteanu and Dragos 2021). A three-stage risk management approach is used to differentiate models in the literature on hard agile methodologies (i.e., detection, analysis of effects, and preparation of responses) under the constant vigilance of the project's management (Ahn et al. 2020).

There are now two main schools of thought regarding lean agile practices. The former emphasizes the significance of team leader risk assessments during project management (Schwaber and Sutherland 2017), while failing to provide any practical risk management solutions for usage in the real world. The latter strategy views project risk as inherent, using strategies such as prioritizing, open communication with the contracting body, and iterative development to quickly adapt to any changes in the project's needs, technologies, or scope (Qazi et al. 2021).

The agile methodology considers risk by striking a balance between it and the delivery of customer value when setting priorities (Dingsøyr et al. 2012). The idea is to reduce the time and effort spent in managing risks and provide more value to stakeholders (Bhatnagar et al. 2022). The agile methodology for managing projects relies heavily on interpersonal interactions, focusing on the open and frequent dialogue between all those who have a stake in seeing the project through to fruition (Stare 2014).

A review of prior research works reveals an absence of well-established, systematic procedures for handling risks in agile project management. In addition, neglecting the human element is usually the driving force behind the criteria that determine success. The motivation for this paper's research is a lack of literature on incorporating a model approach to risk management into an agile project management methodology that values the input of all parties involved in the project's delivery. As such, this study intends to provide a risk management model for I.T. projects using an agile approach to project management.

The elements that determine the success or failure of a project, such as the use of an agile project approach, the effectiveness of risk management, and the involvement of key players in an I.T. project, are synthesized from the relevant literature (Trzeciak 2021; Stare 2014; Niazi et al. 2016; Raharjo and Purwandari 2020; Rupeika-Apoga and Petrovska 2022). According to the available literature, the human element is often downplayed in favor of processes and procedures in risk assessments of agile-managed projects (Tavares et al. 2021). Meanwhile, research into the risks of I.T. projects handled agilely found that the project staff stands out as a major source of potential trouble. According to practitioners, risk analysis in agile project management is unnecessary when relying on client judgments for aspects such as feature selection and short iterations to mitigate risk (Rupeika-Apoga et al. 2022b). Reports describing critical success elements for I.T. projects stress the significance of the team's collective performance and the unique contributions of its individuals.

3. Materials and Methods

The 19 potential risk factors were derived from the Trzeciak (2021) study "Sustainable Risk Management in I.T. Enterprises," which we modified using a pilot test and a review of the literature on agile I.T. projects (Marnada et al. 2022; Schwaber and Sutherland 2017; Shrivastava and Rathod 2015). We conducted a pilot test to validate the reliability of the questions. In the pivot test, we asked I.T. project managers and colleagues from universities in Malta, Latvia, Poland, Kosovo, Italy and India, and colleagues from the Federation of European Risk Management Association and Public Risk Management Organisation, whether the statements were reliable and accurately described risk factors (see Table 1).

Table 1. Measurement items (Trzeciak 2021).

Abbreviation	Questionnaire Items
AGP1	Effective communication among the project team members
AGP2	Involvement of customer or user in the development of functionality
AGP3	Effective tools and technology
AGP4	Culture in company
AGP5	Assessment of labor concentration
AGP6	Estimation of resources
AGP7	Absence of particular needs on the user or customer level
AGP8	Communication at the project environment level
AGP9	Misinterpretation related to the needs of the customer
AGP10	Sensitivity of the team members
AGP11	Rearrangement of needs
AGP12	Project management techniques and approaches
AGP13	Integration of projects
AGP14	Test environment
AGP15	Business goals
AGP16	Cordial relationships among project team members
AGP17	Estimation of project budget
AGP18	Non-functional needs
AGP19	Cordial relationship among team and project managers

The study's questionnaire, designed to be answered anonymously, was distributed physically at events in Asia and Europe, where agile project management was discussed, and digitally via an email list that the authors had previously assembled. This survey was self-administered using the Qualtrics XM® application software to managers and employees of I.T. project teams from different European and Asian I.T. companies who were linked to the authors' network on Linked-in, other social networks, and email. The criteria used for targeting possible candidates to participate in the survey were as follows:

- The respondents had to be experienced in both the theory and practice of agile project management in the I.T. industry.
- Participants that met this criterion had to have participated in at least one project during the preceding five years.
- Participants had to have managed a team or participated in the project as team members.
- Participants had to have used a flexible method of project management.

The target participants were asked to answer four demographic questions, as shown in Table 2, and to rate their level of agreement with the 19 statements in Table 1 on a Likert scale of 1 to 5. Using a non-probability purposeful and snowballing sampling method, '5' indicated the highest level of agreement, and '1' indicated the lowest level.

A total of 1868 valid survey responses were received between February 2022 and January 2023. We received 1903 responses; however, during the preliminary analysis of the gathered findings, it was discovered that 15 of the questionnaires were not completed correctly, resulting in the acceptance of 1888 valid records for further examination. After confirming the target groups' adopted features, it was discovered that 23 questionnaires fell short in at least one respect, and 1868 responses were used as the primary basis for analysis. Table 2 shows the experts' demographics and professional backgrounds and their experience.

Table 2. Experts' demographics and professional backgrounds in the study.

Prime Attributes	Category			
		Number	**Percentage**	**Cumulative Percent**
Number of years of experience	below 1 year	322	17.80%	17.80%
	from 1 to 5 years	251	13.90%	31.70%
	from 6 to 10 years	356	19.70%	51.40%
	from 11 to 15 years	171	9.50%	60.90%
	over 15 years	707	39.1%	100.00%
Completion of projects in the last 5 years	less than 1 project	69	3.80%	3.80%
	from 1 to 5 projects	151	8.40%	12.20%
	from 6–10 projects	416	23.00%	35.20%
	From 6–10 projects	718	39.70%	74.90%
	more than 10 projects	453	25.10%	100.00%
Participation in the building of the project	lower management	6	0.30%	0.30%
	middle management	129	7.10%	7.50%
	top management	328	18.20%	25.60%
	non-executive	586	32.40%	58.10%
	consultant	758	41.90%	100.00%
Gender	Male	1212	67.10%	67.10%
	Female	594	32.90%	99.99%
	Other	1	0.1%	100.00%

The respondents' data were inputted into SPSS (Version 24) and subjected to statistical analysis. Since the items used the ordinal measurement scale, we used the median (Md) as a measure of central tendency and the interquartile range (IQR) as a measure of spread. A group of items could be grouped into a construct (or theme). After the items were combined into a single Likert scale, we computed the mean (M) as a measure of central tendency and the standard deviation (S.D.) as a measure of spread (Cresswell 2009).

For our factor analysis, we used Equamax, a rotation method that combines the varimax and the quartimax methods, simplifying the factors and the variables. The number of variables that load highly on a factor and the number of factors needed to explain a variable are minimized. It combines the characteristics of quartimax and varimax, balancing their strong and weak aspects. It is a simple structure that provides perfectly interpretable, meaningful factors for our data to reach the factor matrix in the rows and columns of the load values handled together (Dempster 1971). As a general rule, tilt rotation is recommended if the researcher is mainly interested in obtaining the best-fit results with the data. On the other hand, if the researcher is more interested in the generalizability of the results, i.e., the optimal solution for the future, vertical rotation is recommended.

The next phase involves ensuring that the variables can be properly analyzed. Checking the variables for correlations is advised for this reason. Furthermore, it is emphasized that any uncorrelated or poorly correlated variables must be eliminated from the study. No variables with very low levels of correlation (below 0.2) were identified based on reliability, and the item analysis that displayed the overall correlation position between the evaluated variables. Repeated item analysis of the overall correlation between the research variables was undertaken to rule out any potential mistakes that may have been introduced during factor analysis. Determinants of the correlation matrix and Bartlett's sphericity test are two methods recommended in the literature for verifying the reliability of component analysis (Beaudry and Miller 2016). There are likely substantial correlations between the variables in the research if the coefficient value is small. The calculated value of the empirical Chi^2 in this study is 2970.70. If the correlation matrix is unitary, as was assumed above, the probability of the outcome is near zero. In addition, given that the examined data are perfect enough for directing a factor analysis, the correlation matrix is not unitary.

However, it can be said that perpendicular rotation is preferred since both rotation results almost always produce similar results, making them easy to interpret in close proximity to all applications (Schumacker and Lomax 2010). Using principal component extraction with Equamax and Kaiser Normalization, Exploratory Factor Analysis was performed by computing the Cronbach's alpha coefficients. The Kaiser–Meyer–Olkin (KMO) statistic, which is a measure of sampling adequacy for the appropriateness of applying factor analysis, fell within the acceptable range (above 0.6), with a value of 0.885, which is close to 1. Hence, the sample size was large enough to perform factor analysis (Mishra et al. 2017).

Cronbach's alpha is the standard for evaluating test validity. In particular, Cronbach's alpha reveals whether or not the replies to the scale items are consistent with one another. The accepted academic literature states that a dependability score of 0.6 or above is acceptable, 0.8 or higher is very good, and 0.9 or higher is outstanding (see Table 3) (Cresswell 2009).

Table 3. KMO and Bartlett's Test.

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.885
Bartlett's Test of Sphericity	Approx. Chi-Square	2970.701
	Df	123
	Sig.	0.000

4. Results

Factor analysis loaded best on 4 factors and 18 statements. One statement was omitted (i.e., statement AGP15—'Business goals'). This was because it explained little variance and fell under factors defined by one or two variables, making it unstable and generally unreliable (Tabachnick and Fidell 2001).

The factors were interpreted or omitted cautiously with scientific utility. Therefore, variables that gave a low level of association with several factors at the same time are neglected in the analysis (Tabachnick and Fidell 2001). Principal component analysis (PCA) was conducted on the remaining 18 items with Equamax and Kaiser Normalization, and four components had eigenvalues greater than Kaiser's criterion of one, and, combined, the factors explained 76.24% of the variance, as shown in Table 4.

Table 4. The portion of variation that can be attributed to each specific component after rotation adjustment.

Number	Total	Initial Eigenvalues % of the Variance	Cumulative Percentage %
Factor 1	6.271	34.83	34.836
Factor 2	3.480	19.33	54.169
Factor 3	2.842	15.79	69.958
Factor 4	1.130	6.27	76.236

Table 5 shows which statements are grouped under each of the four factors. The pattern of items loading onto factors after rotation was clear and interpretable. Factor 1, termed 'organizational culture', explained 34.84% of the variance and comprised seven items. Factor 2, which has been termed 'timeframe and budget stress', explained 19.33% of the total variance and comprised four items. Factor 3, which has now been termed 'project team', explained 15.79% of the total variance and comprised three items. Factor 4, termed 'project organizational environment', explained 6.27% of the total variance and comprised four items (Hair et al. 2012).

Table 5. Exploratory Factor Analysis (Rotated Component Matrix).

Component Factors	Factor 1	Factor 2	Factor 3	Factor 4
AGP9. Misinterpretation related to the needs of the customer	0.840			
AGP7. Absence of particular needs on the user or customer level	0.837			
AGP8. Communication at the project environment level	0.771			
AGP10. Sensitivity of the team members	0.770			
AGP1. Effective communication among the project team members	0.752			
AGP11. Rearrangement of needs	0.701			
AGP4. Culture in company	0.686			
AGP5. Assessment of labor concentration		0.810		
AGP6. Estimation of resources		0.797		
AGP17. Estimation of project budget		0.792		
AGP3. Effective tools and technology		0.702		
AGP14. Test environment			0.889	
AGP19. Cordial relationship among team and project managers			0.780	
AGP2. Involvement of customer or user in the development of functionality			0.748	
AGP18. Non-functional needs				0.729
AGP13. Integration of projects				0.653
AGP12. Project management techniques and approaches				0.626
AGP16. Cordial relationships among project team members				0.473

Notes: Rotation Method: Equamax with Kaiser Normalization (rotation converged in 9 iterations).

The results of the Cronbach's alpha calculation are higher than 0.5 and therefore are acceptable (Table 6). Hulin et al. (2001) claim that "as a rule of thumb, a Cronbach alpha value of 0.6–0.7 indicates an acceptable level of reliability, with 0.8 and above producing a very good level". However, Hinton et al. (2004) note that a Cronbach's alpha value between 0.5 and 0.7 shows moderate reliability. Therefore, it can be concluded that the scale of the agile-managed I.T. projects' AGP model is reliable (Taber 2018).

Table 6. Cronbach's alpha.

Characteristic	Name of Characteristic Variable	Item	Mean	Min–Max	Variance	Cronbach's Alpha
Factor 1	Organizational culture (OC)	7	2.542	2.044	3.090	0.924
Factor 2	Timeframe and budget stress (TB)	4	3.209	2.770	3.464	0.804
Factor 3	Project team (PT)	3	3.746	3.424	4.090	0.766
Factor 4	Project organizational environment (POE)	4	2.425	2.267	2.594	0.659
	The AGP model	4	3.004	2.542	3.746	0.612

Furthermore, we are now able to compute an inventory of characteristics that agile-managed I.T. projects should possess by using EFA with our sample as our case study.

From these four characteristics (Variables F1 to F4) and 18 statements, we compute the AGP model.

The computed 'AGP model' measure for agile I.T. projects shows a mean of 3.004 (SD = 2.24). All the factors (1, 2, 3 and 4) produced means that were close to the computed AGP model (Table 6). This shows that participants, overall, believe in this measure for agile I.T. projects.

The computed one-way analysis of variance (ANOVA) was used to show that there were statistically significant differences between the means of the independent (unrelated) groups ($p < 0.01$) (see Table 7).

Table 7. ANOVA.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.705	4	7.426	24.856	0.000
	Residual	538.400	1802	0.299		
	Total	568.105	1806			

Notes: Dependent variable: AGP model; predictors: (constant), participation in the project process, number of years of experience, completed projects in the last 5 years, gender.

The multiple regression analysis F (4, 1802) = 24.856, $p < 0.01$ and the variables explained 5.2% of the variability in the AGP model. The regression coefficients in Tables 8 and 9 yield some interesting findings. Firstly, the 'number of years of experience', 'participation in the project process' and 'gender' show a significant relationship with the AGP model (β = −0.13, t = −4.766, $p < 0.01$); (β = −0.146, t = −6.24, $p < 0.01$) and (β = 0.055, t = 2.10, $p < 0.05$). However, there is no relationship between the number of completed projects in the last 5 years and the AGP model ($p > 0.05$). The Durbin–Watson value (<2) shows positive autocorrelation in the model. These results further strengthen the value of our model, showing that the demographic variables, although showing a significant relationship among three variables, do not have a large impact on the variance in the AGP model (5.2%).

Table 8. AGP model summary.

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin–Watson
				R Square Change	F Change	df1	df2	Sig. F Change	
0.229	0.052	0.050	0.54661	0.052	24.856	4	1802	0.000	0.893

Notes: Predictors: (constant), participation in the project process, number of years of experience, completed projects in the last 5 years, gender.

Table 9. AGP model coefficients.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.401	0.094		36.313	0.000
	Number of years of experience	−0.046	0.010	−0.126	−4.766	0.000
	Gender	0.065	0.031	0.055	2.104	0.036
	Completed projects in the last 5 years	0.006	0.013	0.012	0.495	0.621
	Participation in the project process	−0.086	0.014	−0.146	−6.244	0.000

5. Discussion

To control risks in agile I.T. projects, it is critical to identify them. The identification of risks can be accomplished using a variety of techniques. Comprehensive risk checklists, document reviews, analyses of assumptions and constraints, and other methods are a few of the common risk identification techniques used by agile practitioners. Along with encouraging the entire agile team to identify the risks involved, the project manager should also provide them with the procedures to be followed in risk identification to control and minimize risk. Our developed AGP model consists of four factors that outline up to 76% of the variability in the potential risks that may arise during the deployment of an I.T. project.

We explored whether the risk factors identified by Trzeciak (2021) for dealing with risks in agile I.T. projects can be the same for other European and Asian countries using observations from a different sample and time period. Trzeciak's study (Trzeciak 2021) was limited to Polish companies, whereas our study included companies from other European and Asian countries with a significantly larger sample size. Our research found, through EFA, that 18 of Trzeciak's (2021) 19 risk management factors are useful for agile risk management in I.T. projects. The statement 'business goals' was removed from our model because it explained little variance and because it fell under factors defined by one or two variables, making it unstable and generally unreliable. This can be explained in part by the essence of the agile approach, which is that a project's objectives (project scope, configuration, and deadline) are defined in less detail at the start of the project, and a rough project execution schedule is also prepared—the project is divided into equal iterations with assigned parts of the project scope to be created (Stare 2014).

Trzeciak's study (Trzeciak 2021) classified risk factors into six categories, whereas our study allowed us to reduce the number of factors to four. Both studies refer to the first factor as 'organizational culture'. This factor, which is the most important in both studies, explains 34.84% of the variance in our study and 29.28% in Trzeciak's study (Trzeciak 2021). To respond effectively to changes in an uncertain world, the concept of agility was first introduced in organizational theory and social science as corporate agility (Zielske and Held 2022). A good organizational culture encourages open communication and proactive problem-solving, which can aid in identifying potential risks early on and providing the tools needed to manage them effectively. Furthermore, a shared understanding of how risks are managed can promote collaboration and ensure that everyone works together to achieve successful outcomes. Moreover, according to Marnada et al.'s (2022) systematic literature review on agile project management, one of the most significant challenges is 'people and organization'.

With the exception of the statement 'sensitivity of team members', the statement combinations for the first factor in both studies are very similar. According to Trzeciak's study (Trzeciak 2021), the sensitivity of team members' statements belongs to the factor 'project team', a risk area resulting directly from the human factor, which is the team. Our findings suggest that team members' sensitivity is more closely related to the organizational culture. Team members' sensitivity is an important aspect of the organizational culture because it creates an open and accepting environment in which everyone feels safe and respected, regardless of their differences. It also encourages people to be more conscious of their own behavior and how it affects others. Sensitivity promotes collaboration, trust, and mutual respect among all team members, all of which are necessary for any organization's success.

Our second factor, titled 'timeframe and budget stress,' explains 19.33% of the variance in our study. This factor's content is also similar to Trzeciak's study (Trzeciak 2021), which named it 'schedule/cost', with 13.17% explanatory power. 'Effective tools and technology' is an additional statement in our factor. Effective tools and technology are critical components of project budget risk management because they enable more accurate forecasting and analysis. Tools such as enterprise resource planning (ERP) software, process automation, data visualization, project scheduling software, and predictive analytics can provide valuable insights into cost and time estimates, assisting in the identification of potential delays or budget overruns. Furthermore, by utilizing project management technologies, it is possible to reduce costs and promote team collaboration, resulting in better project planning and project budget outcomes. The study by Marnada et al. (2022) supports the inclusion of this statement, as the importance of their category 'tools and process' is highlighted by the lack of a newer technology to handle a change request.

Factor 3, which has been termed 'project team,' explained 15.79% of the total variance and comprised three items. Trzeciak's study (Trzeciak 2021) identified this factor as 'project team,' with explanatory power of 8.37%. In addition, as a result of the EFA analysis, the 'non-functional needs' statement was incorporated with the 'project team' for our factor. Non-functional requirements are frequently more abstract than functional requirements, making them more difficult to define in concrete terms. This can lead to confusion and misinterpretation of the project's goals, which can have a negative impact on the project team's performance and the end result. Project teams can improve the visibility of potential problem areas and ensure that they are properly addressed by including non-functional needs in the risk assessment process.

The human factor is important in risk management because people have unique skills, abilities, and knowledge that can be used to identify, assess, and manage a company's risks (Rupeika-Apoga et al. 2022b). In addition, the importance of the human factor was emphasized in the Marnada et al. (2022) study under the category 'communication and coordination.' People can also play an important role in developing an organization's safety culture, which can help to reduce risk (Pavia et al. 2021). The focus on the user is very important in agile projects, and the project team usually includes a representative of the end users who regularly checks the project's partial results (to ensure greater suitability of the final product with regard to the users' wishes and demands (Stare 2014)).

People's cognitive biases can significantly impact risk management because they can lead to inaccurate assessments of potential threats and the creation of unexpected risks. Cognitive biases can cause decision-makers to disregard important data or overestimate the magnitude of risks. To reduce the negative effects of cognitive biases on risk management, decision-makers must recognize their biases and take steps to mitigate them in their risk management. One of the alternatives to dealing with cognitive biases is the nudge theory, which provides an effective tool to manage risks while allowing people to retain autonomy and choice (Espinosa et al. 2022).

Finally, factor 4, which has been termed 'project organizational environment', explained 6.27% of the total variance and comprised four items. The explanatory power for this factor in Trzeciak's study (Trzeciak 2021) was 10.8%. Both studies use the same statements for this factor, but our research shows that the combination of the previous fifteen statements has greater explanatory power than the last three.

6. Conclusions

The theoretical contribution of this study is that the AGP model enables scholars to understand how to identify and minimize risks while maximizing agility in their projects. Agile projects often require a high level of collaboration and trust between team members, and the organizational culture plays a key role in enabling these factors. With a better understanding of the timeline and budget, it is easier to identify potential issues and take corrective action before they become major problems. This helps to minimize the risk of project failure and ensure successful completion. The project team provides the human resources needed to identify risks, plan for them, and respond to them promptly. The project's organizational environment ensures that everyone is aware of their responsibilities and has the information that they need to make informed decisions by providing visibility on project decisions, objectives, and progress.

The study's practical contribution is the ability to anticipate, identify, analyze, and respond to risks associated with agile I.T. projects more accurately and proactively. This can help the project team to better allocate resources, manage budget constraints, and develop successful strategies. In addition, the AGP model can provide a structured framework and common language in quickly assessing and mitigating risks. Furthermore, it can aid in better decision-making by revealing previously hidden factors and patterns. To summarize, the practical contribution of developing a risk management model for agile projects is the ability to improve the visibility, dependability, and agility within an organizational setting.

This study is not without limitations. The study sample is based on survey results from specific European and Asian I.T. firms known to the authors or referred by their colleagues; it would be interesting to expand the study to include other industries and countries. Because the agile approach to risk management is widely used in I.T. companies, we can generalize the study results to other I.T. projects in Europe and Asia but not to other regions or industries.

Agile project management is a project management methodology that is linked to entrepreneurial theory. It would be beneficial to expand on the ideas discussed by Foss and Klein's (2012) theory of the entrepreneurial firm in future research, as agility emphasizes customer feedback and encourages teams to be more flexible and proactive in responding to customer needs. This can assist entrepreneurial firms in remaining competitive by responding quickly to customer needs and producing products that meet their requirements.

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