EXPLORING MEDIATING AND MODERATING MECHANISM FOR PROJECT UNCERTAINTY UNDER AGILE METHODOLOGY USE IN IT SECTOR

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ABSTRACT- Agile software methodology describes an approach forthe development of software under whichsolutions of requirements evolve through the collaborative effort of cross-functional teams. This research study analyzed the impact of agile methodology usage on project uncertainty along with userparticipation acting as a mediator and managerial support acting as a moderator. . The said relationships were investigated under the support of agile governance theory. Data was collected from middle-tier officers of renowned IT companies in Pakistan through adapted questionnaires.The data was analyzed through AMOS-SEM statistical techniques. Results show that agile methodology usagesignificantly decreased impacts of uncertainty in projects but User Participation doesn't act as a mediator in therelationship. Moreover, managerial support is established as a moderator in the hypothesizedrelationship. Thus, implications are discussed and implications are provided for the targeted sector.

Keywords: **Agile methodology use; with User Participation; Managerial support; ProjectUncertainty; Software Industries**

I. INTRODUCTION

Numerous information technology departments are adopting agile methodology but the failure of some information technology projects is quite higher because some agile methodology unhidden features still essential and require to discover such features (Livermore, 2007). A much active, enhanced, and good quality of projects especially the software developing activities are presented by the agile methodologies. The project management is also allowed and supported by the agile methodology to improve the project by reviewing it throughout the project period (Sun & Schmidt, 2018b). There are support and help of agile methodology for focusing on the project-related chief objectives and requirements. It has been considered as a significant tool for tracking the needs of the users to deliver the suitable and correct qualities of products to them for present and future projects and uncertainties of projects (Chiyangwa & Mnkandla, 2018).

A significant function is played by the agile methodology used in the qualities that involve the steadiness, and data reliabilities composed of information technology staff. The agile methodology tool is developing rapidly and has the main focus towards the information technology sectors especially the environment regarding projects, and implementation of novel agile techniques, that are compulsory and there is a requirement to discuss them for making projects successful (Sun & Schmidt, 2018b). It displays that agile methodology still requires experiential proof inside numerous aspects. In numerous prior studies, the agile methodology usage was discovered as it has a high influence on the project uncertainties (Sun & Schmidt, 2018a).

There are some reasons due to that the project uncertainty increases and the difficulties in the achievement of the projects decrease and due to this there is also fear of reducing user participation. When we work on such reasons which become the reason for project uncertainty then the probabilities of project uncertainties increase (Taipalus, Seppänen, & Pirhonen, 2018). Due to project uncertainty, the risks are increasing in the project management that are presenting outdated opinion towards project risk managing activities and these

activities explain risks as an uncertain occasion or situation that, it happens, then will have an optimistic or a negative result on the goals of the project, like timing, price, scope or project qualities (Hostettler, Böhmer, Lindemann, & Knoll, 2017).

When risks increase then, the chances of failure of the projected increase as well as it also creates a sign for showing the weakness of the project managing team because the project fails due to poor management. The project managing activities also depend on exterior contributions (Marinho, Sampaio, & Moura, 2018). It has been considered an essential activity to create a distinction among uncertainties and risks for the purpose to clarify and describe the influence of these on the performances of the projects. According to the managerial point of view, uncertainty has considered a significant factor in performance-oriented project risk management. Some important sum of working efforts has been completed for conceptualizing and measuring uncertainties (Jørgensen, 2016).

There is one technique that is called agile methodology and it can be very helpful to minimize and decrease the project uncertainties because this method displays one-to-one teamwork and cooperation with customers (Marinho et al., 2017). The difficulties that occur due to project uncertainty and reduce user participation in project management can be controlled with the help of agile methodology. So, there are some requirements for studying that, how project uncertainty influences the uncertainty regarding the project, and how the project uncertainty might be decreased (Waterman, 2018). The project uncertainty is not only or exclusively depending on the methods that are using by this study but it is also depending on a lot of other elements as well as containing the supports of project managers (Klinc, 2018).

Both things, Project managing methodologies and uncertainties of projects are depending on similar lines and the directions that are given by project managers. A most basic object exists inside the information technology sectors for exploiting and gaining advantages from upper managers for effective implementation of management information system "MIS". There will be the need for upper-level management for dealing with the uncertainties in the case when project uncertainty will exist. For this purpose, we must have managerial or management supports by way of a moderator inside our model.

A lot of emerging trends inside the software companies are using the agile methodology to conduct growth and expansion in the development of software-related projects. This wording or idea was firstly used in 2001. This method of developing and completing software projects is completely dissimilar from the old-style and outdated project methodologies and techniques (Case, 2019). This idea has been considered an evolutionary project managing method.

A lot of features and elements exist that are essential for making the project successful by increasing user participation and controlling or decreasing project uncertainty. The success will depend on the working activities and fulfillment of the user's requirements. The outdated and old-style methodologies are working good but agile forces are working for the projects with excellence and achievement (Ciric et al., 2018). It has also stated in the background of the study that, to facilitate the interaction among software developers some companies use dynamic system developing techniques for collaborations among customers and companies. Some iterative-aspects become a cause of breaking down the functions regarding projects. So, these aspects of old-style methods are dangerous and have risks (Shumaiev et al., 2018).

In the agile methodology, there are possibilities for user gratification and fulfillment by initial and constant deliveries to customers regarding valued software. The software company must change the design according to the requirement of the users (Thakurta, 2017). Companies must deliver the software to the customers as soon as possible and don't become late to deliver it. Routine collaboration among customers, companies, and developers is necessary for getting user participation. According to the prior studies the users must be motivated towards the company services and the company should never break the trust of the customers. In the agile methodology straight and direct conversation has been considered as the greatest procedure of communication. Agile methodology is also essential for measuring the development progress of software.

According to Serrador and Pinto (2015), the agile methodology has considered as a developing trend between project methods and practices so, numerous of the object still requires few experiential shreds of evidence inside a modern investigation or research (Serrador & Pinto, 2015). According to Madden (2017), agile methodology has been considered as a group of principles, somewhat than a procedure, that is well-defined

through the agile manifesto and has focused on creating employed software and highlighting nearby customer teamwork, relationship, and association.

As agile governance theory byLuna, Kruchten, andde Moura, (2015) described that a lot of critical areas are considering essential to discover for agile achievement. The agile methodology has been not only following through information technology but it's similarly has been using in a lot of other business grounds and continuously require to attach with project managing methodology related to agile methodology as presently. Scholars have explained the technique for the purpose to reduce the difficulty and uncertainty in project management that is called agile methodology because one to one teamwork or cooperation has shown with clients and it has suggested for upcoming research that, there is a requirement for studying that how project uncertainty impact the project achievement.

This study focuses to follow the agile methodology for getting good results from projects. The main purpose of this investigation is to find out the influence of the agile methodology on user participation and success that is extremely overlooked inside the present literature. This research also has the main purpose of checking the instrument of project uncertainty lengthways the fast examination of this theme the investigations usually disregard how agile methodology is influenced by the project uncertainty. It is also the main and last purpose of the study to resolve the difficulties in present literature for checking the

This research will be very helpful for the Practitioners of information technology projects as well as it also helps to provide experiential proof relevant to agile methodology usage. This investigation will provide novel eyesight and vision towards the Practitioners of the business for using the agile methodology for the purpose to complete the project successfully. This study will show how the elements affect the users of the business successfully when agile methodology usage gives evidence on perfect teamwork, association, and relationship with the users. This research will also provide a platform and new ways to the management of agile methodology projects by examining the hidden aspects of performing the projects positively and effectively with success. This research will be significant at a global level because mostly prior old-style methods are today considered out-of-date and the failure rate of projects and information technology is more than another substructure and project evolution. This study also gives proof about how agile methodology usage is affected by the involvement or participation of the users and what's the impact of users' participation towards the project uncertainties. Since the developing information technology projects are extra users oriented and better than old-style or outdated projects. Due to this research and study the management can easily know the significance regarding users' participation for the purpose to attain and accomplish long period achievement in business.

II.   LITERATURE REVIEW

2.1 Agile methodology usage and project uncertainty

It has been proved by previous scholars that, agile methodology is also dependent and connected or linked with the participation of customers. So, it has considered significant for attainment, accomplishment, and success of goals regarding project also to get responses and check the reaction of customers or stockholders (Little, 2005). Agile methodology has also allowed the stockholders and investors a relaxed and recurrent stockholder communication through applying and executing such a methodology (Thomke & Reinertsen, 1998). The use of agile methodology has done by the preparation of a plan and growth stage regarding projects from various places we collect the info or data. There are remarkable and amazing outcomes when the agile methodology for project managing activity has become very famous and useful within some continual altering environment, assignment, and necessities either relevant costs, time, or some requirements related to it as compared to previous methods of managing projects (Sillitti, Ceschi, Russo, & Succi, 2005).

According to Magazinius and Feldt (2011) during the investigating various two corporations, one corporation that uses and adopts the agile methodology and the second corporation that does not use and adopt the agile methodologies are reporting by not a great dissimilarity and the achievement for the purpose to meet timing and budgeting objectives also the reasons regarding failure is not considerably dissimilar from one and other company (Fernandez & Fernandez, 2008; Magazinius & Feldt, 2011). The achievement of the project contains a great sum or degree to deal with project uncertainty also includes and achieves whole requirements

regarding projects that involve timing, costs, and presentation with a lot of intentions (Logue & McDaid, 2008a).

Prior scholars have described uncertainty as an unavoidable facet of furthermost projects. Sometimes the more capable managers face difficulties to control and handle it. Because these managers use judgment milestones for anticipating results and consequences like risk managing activities for preventing tragedies and successive iteration to make surety that, everybody is creating the desire goods, however, the project finishes up by an overrunning program overfilling budgets and compromised conditions (Harris, Collins, & Hevner, 2009).

By some prior scholars, sometimes there is a negative relation between agile methodology and project uncertainty because some clear areas of uncertainties are the sizes of project limits like timing, costs, and qualities relevant to specific actions. For instance, people don't have any information about how much period and struggle is compulsory for completing some specific activities (Chin, 2004). The reasons regarding such uncertainty may involve one or many elements that include; i) absence of clear requirements about whatever is needed, ii) novelty, absence or know-how regarding such specific activities; iii) difficulty within the terms regarding the quantity of influencing elements and interdependency amongst such factors; iv) incomplete analysis of procedures included in the activities; v) potential incidence of specific proceedings or circumstances that might have a few uncertain and inexact result on the activities.

H1:_Agile methodology usage is negatively related to project uncertainty._

2.2 Agile methodology use and user participation

In accordance to Serrador and Pinto (2015) agile methodology is also broadly useful in the industries that are developing software and other businesses as it's an alteration and a counter substitute towards outdated project managing tactics such as waterfall that are compulsory for the effective and successive execution of difficult projects thus through these facts it has discovered that agile methodology usage has been leading towards the achievement and accomplishment of projects (Serrador & Pinto, 2015). It has considered a significant method within industries or businesses that are straightly relevant to variations inside the markets it's only a technique or system that is related to project management. In this, we cooperate with users at every iteration where we can share info or data. So, it is essential for all organizations that, they should identify the requirement for implementing the agile methodology (Hope & Amdahl, 2011).

It has also been supposed by some reviews that there is no great difference betweenthe usage of agile methodology and the organization that utilizes the old-style project managing methods (Abelein & Paech, 2015). But some studies proved that the iterative attitude regarding the agile methodology system is also very beneficial for collaborating with software users or clients at every stage therefore, we can continue in constant touch with user's necessities, wants, and demands (Näkki & Koskela-Huotari, 2012). The scholars relevant to the information system field have also discussed the user's participation in prior studies interactively and mentally and also discussed the developing procedures of the information system. Though, it has been understood that the user's contribution is essential for making development successful (Bano & Zowghi, 2013). In the software development procedures, the user's participation has broadly familiar in the literature review.

Some scholars said that user participation is essential for improving the qualities of the systems by giving perfect, truthful, and whole valuation regarding user's information requests or needs (Holgersen et al., 2019). However, scholars also identified that we can also implement an agile methodology in other businesses. In software and information system agile methodology has novelty and innovation to complete different kinds of projects and don't have an outdated and difficult system and it becomes very helpful for the success of projects (Kulkarni, Robles-Flores, & Popovič, 2017). User participation and agile methodology have positive relations because agile methodology provides different possibilities to users for participation in the development of software and information for making and developing software according to the needs and requirements of the users. Due to these methods of implementing the agile methodology, the effective delivery of projects occurs with success (Holgersson et al., 2018). This relation becomes helpful for satisfying the users and whole stockholders regarding projects and also provides the possibilities for improvement in the delivery period for launching projects. Some scholars said that agile methodology has no straight link with project achievement and success.

H2: *Agile methodology usage is positively related to user participation.*

2.3 Users participation and project uncertainty

Some scholars have also defined that user participation means, noticeable conduct or activities of system users in the developing procedures of information systems. For example, the user's participation in the software system developing, implementing, and executing activities (Micholia, Karaliopoulos, & Koutsopoulos, 2016). Scholars have also discovered the term user's engagement that is useful for referring the whole set of user's association to the software system and its growth. This term involves the user's attitude and conduct (Micholia et al., 2016).

To make the project successful the involvement and engagement of users is a necessary and essential element. The prior scholars have also talked about the involvement of users and they referred this element towards a specific behavior categorized as a mental state and its ID with some object (Gabbert et al., 2010). Sometimes, scholars have different perceptions about user participation and project uncertainty. They said that user participation and project uncertainty have negative relations sometimes. Because in case of project uncertainty participation of the users can be disturbed towards the development of software or any information database (Alter & Ginzberg, 1978). Different scholars have defined project uncertainty as risk and risk means destructive results and it is observed as a destructive result and holds component of fear. Some prior studies have defined uncertainty as the capability for forecasting parameter results or forecast events that might influence the projects (Ward & Chapman, 2008). Due to the absence of certainty, there is variability and ambiguity therefore, user participation towards company projects regarding software systems decreased and negatively affect the progress of the project. Due to variability, information is absent, absence of detailed absence of description, involvement, skill, and know-how then chances of uncertainty increase (Ahimbisibwe, Daellenbach, & Cavana, 2017).

Due to project uncertainty user participation declines and decreases a company fails to provide software products according to their needs, requirements, and desires. Scholars have advised to companies for making project managing plans in which they can get proper information and data due to this the risks regarding uncertainty can be controlled and a lot of chances increase for making the project successful (Buchan et al., 2017). When project uncertainty occurs and the user's participation is negatively affected by uncertainty then, the company fails to plan windows, milestone constructions, interface controlling or managing systems, critical achievement factors, and leading signs. Researchers also used impersonal mode of direction for reducing project hazards or uncertainty, an individual style of management is supported for moderating stages of uncertainties. Project uncertainty signifies a threat, then the company can't get surety what will occur from it. Uncertainty means some risks or threats that can occur or cannot occur (Young, Beebe, Dietrich, & Liu, 2016). Some scholars defined uncertainty as incorporeal measures in which the company doesn't know what will occur. It means the threat is a declaration of what can rise due to the absence of information and data. Therefore, the company projects fail due to Project uncertainty and due to less participation of users.

H3: *User participation is negatively related to the uncertainty of the project.*

2.4 Users' participation mediates the relationship between agile methodology and project uncertainty

Inside the framework of information and software system development, a lot of prior scholars have defined users' participation by way of the degree to which the assignments are carried out through users or through their agents and execute various accomplishments and attitude throughout information system development and intellectualized it alongside four measurements such as, hands-on of the users towards the presentation of accomplishments, accountability, relation with information systems and communiqué through a letter, email or fax with workforce and high-ranking management of information and software development system (Bertholdo, Kon, & Gerosa, 2016). The users' participation mostly inside the framework of company users participating with information system specialists and experts in the planning, designing, and execution system is inspected by information system departments to get informative appraisals (Jia & Capretz, 2018).

Three fundamental theories are recognized by the current combination of the literature review of users' participation and considered as buying system qualities, and emerging interaction. These theories described how the success of the systems is influenced by users' participation. Following the buying-in theory regarding user participation, the efforts that are invested and performed by users throughout their contribution and the

impact that users' consume in information and software system development create them to observe the system as further personally related and significant (Abrahamsson, Salo, Ronkainen, & Warsta, 2017). Such a mental state of augmented participation is supposed to influence their behaviors optimistically (for example users who are participating and have a tendency to like the system more) as well as their use of the system. But in some cases, this mental state might be decrease and the user's participation as a mediator also decline when there is project uncertainty (Tam, da Costa Moura, Oliveira, & Varajão, 2020).

If we discuss the system quality theory as it has described in prior investigations, then scholars explained that when customers participate in information system development, system designers and makers became well knowledgeable or familiar about company requirements, due to this there is positive outcome and qualities of system increase in a successful way (Truong & Jitbaipoon, 2016). Finally, following the theory of emergent interactions scholars described that, when users involve in information system development, then users create a relation or association with the information system experts, and the success of the system is influenced by the situation of such association and relationship (Setor & Joseph, 2020).

As it has proved by prior scholars that the user's requirements and needs can be easily met by the use of the agile methodology. According to prior scholars, there is a positive relationship between agile methodology because agile methodology promotes more user participation in software development projects (Memmel, Gundelsweiler, & Reiterer, 2007). In recent years the agile methodology usage seemed like a response towards the old-style conducts of creating software and admit the requirement for a substitute to certification-driven heavyweight software developing procedures (Teka, Dittrich, & Kifle, 2018). Agile methodology usage is a modern innovative method for making user-friendly software and increases user participation in providing products according to their requirements. So, user participation as a mediator is positively related to agile methodology and due to the involvement of risks, threats, and hazards during the development of the projects, it is negatively related to project uncertainty and has a negative relation with project uncertainty (Stickel et al., 2016).

Scholars have also discussed the reasons behind the failure of the projects due to risks as the rate of failure of the projects is increasingly high and a lot of software projects fail due to some uncertainties (Pries-Heje & Baskerville, 2017). Scholars have also discovered some methods to avoid failure. The developers of the software and management must be aware of future predictions that what will become in the future through having proper data and information regarding projects. Project uncertainty is also high when there is less user participation.

H4: *User participation mediates the relationship between agile methodology usage and project uncertainty.*

2.5 Managerial support moderates the relationship between user participation and project uncertainty

The roles and functions that are performed by management are necessary for such kind of relations as user participation and project uncertainty in project management. Some scholars have considered management support as a decision-making approach (Liu, 2016). So, decisions are made by directors or executives and employees can be influenced by these decisions for achieving and attaining business objectives with the help of mutual struggles (Sanchez & Terlizzi, 2017). The significance of management support has been acknowledged and got familiar with the literature review of the information system.Businesses must have managers who are leading through worth purposes and honesty. Businesses need a manager who tries to create an enduring business association in every project that is running in an organization (Liu, 2016).

Prior studies have explained that managers must have the capability of encouraging, influencing, and motivating employees to deliver outstanding services to customers are users and get more user participation during different business projects. Due to this struggle by managers create long period stockholder worth (Naeem, Khanzada, Mubashir, & Sohail, 2018). User participation can be increased through management supports. If the leader of the organization is capable to recognize the difficult conditions, then the problem can be solved through communicating with the whole project team. A lot of researchers have given perfect proof relevant to the significance of management support as a moderator for increasing user participation. Some scholars said that involvement in management support is not well established (Maqsoom et al., 2020).

Management support is much significant in the whole stages of planning accomplishment and implementation for software or information system projects (Chipulu & Vahidi, 2019). If we discuss user

participation and project uncertainty, then there is a negative relation due to different reasons because when user participation decreases at the same time project uncertainty increases. There are few outcomes from prior investigations in this area where scholars have discussed the conditions wherever user participation can be counterproductive. For instance, some writers have discussed a corporation in a prior investigation where users got annoyed or irritated and acted dysfunction ally throughout developing and implementing systems. The reason was that on prior events they had been obligatory for participating in the procedure of developing the systems but felt their user's ideas and desires were disregarded through the developers of the information system (Kemei, Oboko, & Kidombo, 2018).

On numerous events, upper management or leaders take interest to interfere in systems installations timing to evade outright system refusal through singular user or user departments. With information technologies playing a cumulative part and the corporations are grown up further deeply reliant on the effective and victorious delivery of IS. Though, failure of the development of the information system is communal due to project uncertainty. It has specified through a report by (Standish Group International, 2009) that 44% of projects related to software or operating system were incapable to remain delivered in time or according to the timetable, inside a financial plan, budgeting or by obligatory functions, also 24% of whole software projects stood canceled due to project uncertainty (Chaos, 2012).

H5: *Management support moderates the relationship between users' participation and project uncertainty, in such a way that Management support strengthens the relationship.*

2.6 Conceptual Framework
The figure below represents a conceptual model

Figure 1. *Conceptual Framework*

III.   RESEARCH METHODOLOGY

Research design is a structure or framework that guides the researcher on how to use certain methods in the collection and analysis of the data. Saunders, Lewis, and Thornhill, (2009) have classified the research design into three categories, exploratory, descriptive, and explanatory. In this study, an explanatory, descriptive, single cross-sectional research design was adopted and the survey method was used to collect the primary data. The middle-tier officers working on certain projects in the software houses operating in major cities of Punjab, Pakistan were the unit of analysis for this study. Data was collected from 254 employees through a self-administered questionnaire. The questionnaire technique was employed to collect the research data, the close-ended questions were adapted because these questions are considered as most perfect technique to collect data and information during the collection of primary research data. The question was coded to achieve statistical significance. The Likert scales (1 to 5) were adapted to record the responses against the questions. The structured questions in the questionnaire were divided and placed in five sections.The non-probability and convenient sampling method wasadopted in the research to collect the data from the selected sample. From the region mentioned above, only 25 software houses have been chosen for data collection. The 350 questionnaires were distributed and 254 were fully responded, yielding a response rate of 73%.

The questionnaire wasmeasured on a five-point Likert scale where 1 (strongly disagree) to 5 (strongly agree). Agile Methodology Usewas measured through 10 items scale which was developed by Maruping, Venkatesh and Agarwal (2009). Project Uncertaintywas measured through 6 items scale which was developed by

Iacovou, Charalambos, Ronald, Thompson, and Jeff Smith, (2009). Managerial Supportwas measured with 15 items scale developed by Elie-Dit-Cosaque, Pallud, and Kalika, (2011). User Participationwas measured with a 15-item scale, developed by Barki et al., (2001).

3.1 Data reliability

Table 1: *Summary of the Reliabilities*

Variables	*Cronbach's Alpha*
Agile Methodology Use (10 items)	0.872
User Participation (15 items)	0.919
Managerial Support (3 items)	0.979
Project Uncertainty (6 items)	0.931

N = 254

3.2Demographics

Table 2: *Summary of general information about respondents*

Gender	Frequency	Percent
Male	162	63.8
Female	92	36.2
Level of Education		
Graduate	97	38
Masters	147	58
Above Masters	10	4
Work Experience		
Less than 5 Years	54	21
5 to 10 Years	147	58
11 to 15 Years	53	21

3.3 Control Variables

Demographic variables (gender, education, and experience) were controlled during the analysis process. The result of One-Way ANOVA shows an insignificant effect of these variables on the dependent variable, project uncertainty (see table 4).

Table 3: *One Way ANOVA*

Covariates	F Value	Sig.
Gender	0.16	>.05
Age	0.24	>.05
Experience	0.37	>.05

IV.   RESULTS AND ANALYSIS

The empirical results after analyzing the data of the current study by using Structural Equation Modeling (SEM) through AMOS version 24. To identify the uniqueness of the study variables and to prove that there is no measurement error, confirmatory factor analysis was used. To assess the relationship between variables, descriptive, correlation, structural path, and mediation analysis was performed.

4.1 Descriptive Statistics

Descriptive statistics (means and standard deviation) are presented in table 5. The higher mean value shows that respondents' reactions are more inclined near the agreement side, while a lower mean value demonstrates respondents' tendency toward the contradiction side for a variable's given item.

Table 4: *Descriptive Statistics*

Variables	Min	Max	Mean	S.D
Agile Methodology Use	1.00	4.70	1.81	.69
User Participation	1.00	4.00	1.78	.64
Managerial Support	1.00	2.00	1.59	.48
Project Uncertainty	1.00	5.00	3.57	1.01

N = 254

4.2 Correlation Analysis

Correlation analysis of the study variables is also presented in table-6. According to (Kline, 2005) the correlation among the variables should be less than 0.85 for the divergent validity of constructs. This analysis shows relationships among the variables either positively or negatively. The correlation analysis results depict a significant positive relationship between the study variables. The correlation analysis also provides the basis for hypothesized directions for the relationship between the study variables. The results of the correlation analysis revealed that all variables are significantly and positively correlated as all values are less than 0.85 and there is also no negative value (see table 6).

4.3 Discriminant and Divergent Validity

The values of composite reliability (CR) and average variance extracted (AVE), determine the discriminant and convergent validity (Fornell & Larker, 1981; Henseler, Ringle, & Sarstedt, 2015). The value greater than 0.60 for CR, and 0.50 for AVE demonstrate excellent convergent validity (Bagozzi & Yi, 1988), whereas, the greater value of the square root of AVE than the construct's correlation, confirms divergent validity (Fornell & Larker, 1981). As shown in table 06, all the values of CR are greater than 0.60, AVE greater than 0.70, and the square root of AVE is also greater than the correlations, hence, it confirms both convergent and discriminant validities. Moreover, the HTMT ratio of correlation shows that there is no validity issue as all the values are less than 0.85 (see table 7)

Table 5: *Validity and Correlation Analysis*

Variables	CR	AVE	MSV	1	2	3	4
1- Agile Methodology Use	0.89	0.50	0.16	**0.707**			
2- User Participation	0.93	0.50	0.16	0.437***	**0.706**		
3- Managerial Support	0.98	0.94	0.02	-0.01	0.067	**0.970**	
4- Project Uncertainty	0.93	0.69	0.07	-0.253***	-0.211**	-0.138†	**0.833**

*N = 254; Significance of Correlations: † p < 0.100; * p < 0.050; ** p < 0.010; *** p < 0.001; MSV = Maximum Shared Variance; Diagonal elements (in bold) are the square root of the AVE.*

Table 6: *HTMT Analysis*

Variables	1	2	3	4
1- Agile Methodology Use	**0.707**			
2- User Participation	0.411	**0.706**		
3- Managerial Support	0.034	0.045	**0.970**	
4- Project Uncertainty	0.279	0.167	0.143	**0.833**

Note: Diagonal elements (in bold) are the square root of the AVE.

4.4 Factor Analysis

Anderson & Gerbing, (1988) recommended the two-staged SEM process, presupposed measurement model and structural model (Anderson & Gerbing, 1988). By performing CFA, we will be able to refine our model. In the first stage of the measurement model, the researcher scrutinized each latent variable with linked items by making a Confirmatory factor analysis before going for estimation of the structural model. In the current study while performing CFA, factor loading recommendations of Gagne and Hancock, (2006) were followed and items having loading value less than 0.40 were dropped from the analysis as table-8 indicates.

Table 7: *Factor Analysis (Factor Loading Values of Survey Items)*

Variables	Items	Items Loadings	SMC
	AM1	0.75	0.56
	AM2	0.59	0.35
	AM3	0.8	0.64
	AM4	0.82	0.68
Agile Methodology Use	AM5	0.66	0.44
	AM6	0.72	0.51
	AM7	0.78	0.61
	AM8	0.38	0.15
	AM9	0.37	0.14
	AM10	0.48	0.23
	UP1	0.45	0.2
	UP2	0.57	0.33
	UP3	0.65	0.42
	UP4	0.61	0.38
	UP5	0.62	0.38
	UP6	0.75	0.57
	UP7	0.76	0.57
User Participation	UP8	0.78	0.62
	UP9	0.72	0.52
	UP10	0.81	0.66
	UP11	0.44	0.19
	UP12	0.79	0.62
	UP13	0.68	0.46
	UP14	0.8	0.64
	UP15	0.17	0.03
	MS1	0.98	0.95
Managerial Support	MS2	0.98	0.97
	MS3	0.95	0.90
	PU1	0.88	0.77
	PU2	0.90	0.81
Project Uncertainty	PU3	0.81	0.66
	PU4	0.83	0.68
	PU5	0.76	0.58
	PU6	0.81	0.65

SMC = Squared Multiple Correlations

4.5 Measurement Models

4.5.1 Individual Measurement Models

CFA was conducted to check the individual fitness of all study variables. To achieve better model fit certain items were either deleted due to poor loading or modified by correlating with certain items. For example, to

measure agile methodology use, 10 items were used. Although all the items have excellent loading except items 8 and 9, hence two items were dropped. The results show poor fit as all fit indices like RMSEA, IFI, CFI, and TLI were poor and not according to the recommended fitness levels as shown in table 8. According to the results of the initial model the values of fit indices RMSEA was 0.13, IFI, TLI, and CFI were 0.87, 0.84 & 0.87 respectively. After modifying and correlating certain item error terms, the model was improved and the values of RMSEA became 0.05 and other fit indices IFI, TLI and CFI also became 0.98, 0.98 and 0.98 which shows a good fit.

Table 8: *Individual Measurement Models*

Individual Measurement Models	Models	Fit Indices			
		RMSEA	IFI	TLI	CFI
Agile Methodology Use	Original	0.13	0.87	0.84	0.87
	Revised	0.05	0.98	0.98	0.98
User Participation	Original	0.20	0.67	0.61	0.67
	Revised	0.07	0.95	0.94	0.95
Managerial Support	Original	0.06	0.99	0.99	0.99
Project Uncertainty	Original	0.10	0.98	0.97	0.98
	Revised	0.06	0.99	0.99	0.99

Then 15 items were used to measure user participation, and the CFA results show for the initial model that values of fit indices indicate poor data fit as RMSEA value was 0.20 and it should be ≤ 0.08 as per the recommended level of fitness. After correlating some items by following modification analysis, the standardized level of fit was achieving and the revised value of RMSEA, IFI, TLI and CFI were 0.07, 0.95, 0.94 and 0.95, which indicates a good model fit.In the case of managerial support, 3 items were used and the results indicate a good fit of the data and all the fit indices were according to the recommended standards. Values of RMSEA, IFI, LTI, and CFI were 0.06, 0.99, 0.99 and 0.99 respectively; hence, there was no need for any modification in items for a better fit.Finally, 6 items were used to measure project uncertainty, and the CFA results show for the initial model that values of fit indices indicate poor data fit as RMSEA value was 0.10 and it should be ≤ 0.08 as per the recommended level of fitness. After correlating some items by following modification analysis, the standardized level of fit was achieving and the revised value of RMSEA, IFI, TLI and CFI were 0.06, 0.99, 0.99 and 0.99, which indicates a good model fit.

4.5.2. Overall Measurement Model Fit

To test the overall model fitness, all latent variables were tested collectively. Table-9 presents fit indices for both the revised and original measurement model.

Table 9: *Overall Measurement Model*

Measurement Models	χ^2	df	χ^2/df	RMSEA	IFI	TLI	CFI
1-Measurement Model (Original)	1485.20	521	2.85	0.09	0.84	0.83	0.84
2- Measurement Model (Revised)	953.17	423	2.25	0.07	0.92	0.91	0.92

The original measurement model shows the comparatively very poor model fit as shown in table 9. The values of fit indices for the original model, RMSEA 0.09, IFI 0.84, TLI 0.83 and CFI 0.84, are not according to the recommended levels of fitness. By correlating certain items' error terms, modifications were made to achieve a standard fitness level. After modifications revised values of RMSEA, IFI, TLI, and CFI were 0.07, 0.92, 0.91 and 0.92, which shows a good model fit.

4.6 Test of Hypotheses
To test the direct and indirect effect, Structural Equation Modeling (SEM) was performed by using AMOS 24 and results are given in Table 10.

Table 10: *Test of Hypothesis (direct and mediation effect)*

Relationships	Effect	P-Value	LB(CI) 95%	UB(CI) 95%
AMU → PU	-0.371	<.001	-0.547	-0.147
AMU → UP	0.408	<.001	0.304	0.512
UP → PU	-0.332	<.001	-0.523	-0.141
AMU → UP → PU	-0.08	>.05	-0.208	0.013

Note: AMU = agile methodology used; PU = project uncertainty; UP = user participation; CI = confidence interval; LB = lower bond; UB = upper bond.

The results of standardized coefficients for structural paths as shown in table 10 depicts that there The results shown in table 10 reveal that there is a significant negative effect of agile methodology use on project uncertainty (β = -0.371, p < .001), hence, hypothesis H1 is accepted.The results presented in table 10 indicate that there is a significant positive effect of agile methodology use on user participation (β = .408, p < .001). Therefore, hypothesis H2 is accepted.The results of standardized coefficients for structural paths show that user participation harms project uncertainty (β = -0.332, p < .001). As a result, H3 is also accepted.Results of mediation or indirect effect of user participation between the relationship of agile methodology and project uncertainty, indicate that indirect effect is negative but insignificant (β = -0.08, p > .05). Moreover, the indirect effect values lie between -0.208~ 0.013. Thus, there is zero value in the confidence interval of 95%. So it can be concluded that user participation does not mediate the relationship between the agile methodology use and user participation. Therefore, hypothesis H4 is not supported by study results and rejected.

4.6.1 Moderation

The moderation effect of managerial support between the relationship of user participation and project uncertainty was tested using slope test developed by (Preacher & Hayes, 2008), by plotting the significant interactions of managerial support (moderator) for low and high values of (mean ± SD).

Table 11: *Moderation Effect*

Project uncertainty predicted from user participation and managerial support

DV: *Project Uncertainty*	β	*p*	95% CI	
UP**	-0.994	< .01	-1.674	-0.314
MS**	-0.994	< .01	-1.735	-0.246
UP x MS*	0.410	< .05	0.011	0.808

Test(s) of highest order unconditional interaction: (X*W)

R^2 -chng = .015*

F Statistics = 4.086

Conditional Effects of the focal predictor (UP) at values of the moderator (MS)

	β	*p*	95% CI	
Low MS	-0.542	< .001	-0.827	-0.258
Moderate MS	-0.344	< .001	-0.533	-0.154
High MS	-0.174	< .01	-0.412	0.065

*** p<.001, ** p<.01, * p<.05

Table 11, and figure 02 shows these interactions of the moderator, which demonstrate that the relationship between agile methodology use and project uncertainty was (β = -0.542, P <.001) for low managerial support, while this relationship was (β = -0.174, P <.01) in the presence of high managerial support. Therefore, the study results support hypothesis 5 proposing that managerial support moderates the relationship between user participation and project uncertainty.
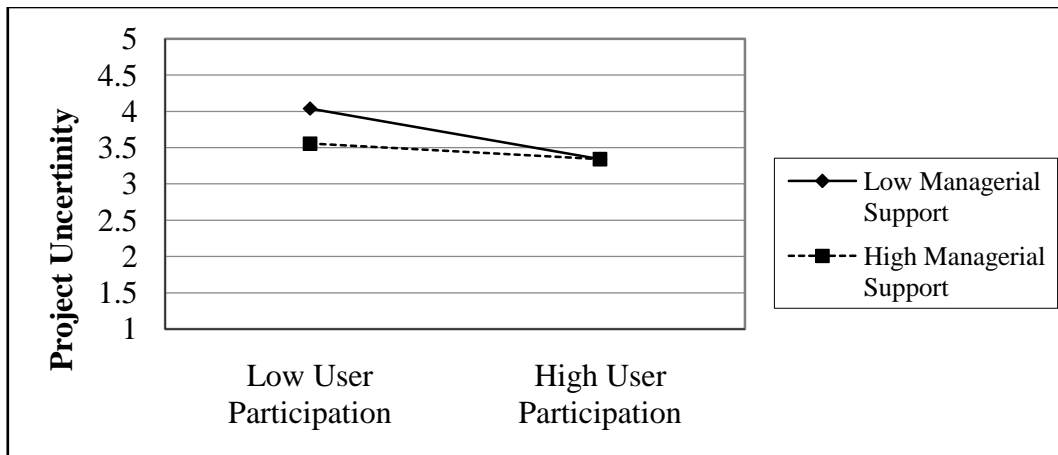
Slop Test (Mod Graph)

Figure 2. *Mod Graph*

V. DISCUSSION AND CONCLUSION

5.1. Discussion

To answer the research questions that is to investigate the direct impact of agile methodology use on project uncertainty, indirect effect through the mediation of user participation and the moderating impact of managerial support between the relationship of user participation and project uncertainty, five hypotheses (H1, H2, H3, H4, and H5) were formulated and tested. The results reveal that four hypotheses H1, H2, H3, and H5 are accepted, while H4 is rejected.

The outcomes demonstrate that the use of agile methodology lessens the project uncertainty. The projected relationship between agile methodology use and project uncertainty was negative, and study results have supported our prediction. Literature provides that agile methodology is the most emerging trend and a collaborative technique need at each iteration of the projects to decrease uncertainty which leads toward successful implementation of the project in many ways (Stankovic, Nikolic, Djordjevic & Cao, 2013;Mann & Maurer, 2005; Budzier & Flyvbjerg, 2013),Some studies suggest that it is compulsory to implement the agile methodology for successful implementation to avoid some uncertainty mostly in the large projects. These study findings are well aligned and supported by numerous past studies (Chin, 2004; Dönmez & Grote, 2018; Howell, Windahl, & Seidel, 2010; Logue & McDaid, 2008b; McDaid et al., 2006; Reed, Damiani, Gianini, & Colombo, 2004; Sillitti et al., 2005).

In hypothesis 2, we have predicted a positive relationship between agile methodology use and user participation. This means that the use of agile methods will facilitate user participation. In the present scenario of the market mostly Pakistani's projects have a strong collaboration with the customers as well as many Pakistan projects follow agile methods to engage with their customers. These study findings are aligning with many past research studies which suggests that using Agile Methodology ensure users participation in each iteration of the project to attain the desired outcome i.e. (Abelein & Paech, 2015; Akinnuwesi, Uzoka, Olabiyisi, Omidiora, & Fiddi, 2013; Colazo, 2014; Fox, Sillito, & Maurer, 2008; Hope & Amdahl, 2011; Schmitz et al., 2018).

In hypothesis H3, this study predicts a negative relationship between user participation and project uncertainty. When there will be high user participation there will be low project uncertainty. These findings are validated by numerous scholars in the past, such as (Abelein & Paech, 2015; McKeen, Guimaraes, & Wetherbe, 1994; Saarinen & Sääksjärvi, 1990; Subramanyam, Weisstein, & Krishnan, 2010).The uncertainty of the project is the factor that has received the most attention in recent times, as the agile methodology is having an iteratively and continuously interact with their customers to get the right information for the successful implementation and execution of projects to get goings with the right information sharing's with the stakeholders makes the project uncertainty lower. So, in this method, the project moves toward success for attaining their desired requirements.

Hypothesis H4 was formulated to investigate the mediating role of user participation between the relationship of agile methodology use and project uncertainty. The results of this hypothesis H4 reveal that there is no significant mediating effect found, hence H4 was rejected. We have also predicted that user participation mediates the relationship between agile methodology use and project uncertainty. Many past studies have proved that agile methodology use encourages user participation that ultimately leads to decrease uncertainty and increased project success i.e. (Akinnuwesi, Uzoka, Olabiyisi, Omidiora, & Fiddi, 2013; Colazo, 2014 Colazo, 2014). The findings of this study reveal that agile methodology has a significant negative direct effect, but the indirect effect through user participation is insignificant. This might be due to some contextual factors that have made the impact insignificant.

Hypothesis H5 was formulated to examine the moderating role of managerial support between the relationship of user participation and projected uncertainty. The moderation results demonstrate that there is significant moderation, so, H5 is accepted. The current study predicts a significant moderation effect of managerial support between the relationship of user participation and project uncertainty. Study results revealed that with low user participation and low managerial support, the project uncertainty was high. But with the increase of managerial support and high user participation the project uncertainty became lower. These findings are well aligned with the past studies of Liu, (2016), Naeem et al., (2018), and Maqsoom et al., (2020). In every project: management is the most eventual dimension which is a necessity of each iteration in the project and along with project management support is the main key to control some uncertainty and increase the chances of project success, as management support consider the backbone of agile methodology use for new changes in project planning and decisions.

5.2 Conclusion
The central research agenda of this study was "how to minimize project uncertainty by using agile methodology and through enhancing user participation and managerial support". This study identifies the possible factors from the literature that can contribute either to induction or reduction of project uncertainty. As in emergent and rapidly changing technological environments, organizations related to information technology and software development need to adopt modern methods like agile. Most of the literature is focused on the uses and benefits of agile methodology, along with enhanced user participation and managerial support to decrease project uncertainty. This study, based on existing literature, also identifies some long-term and short-term methods for the reduction of uncertainty and enhancement of project success. To achieve a competitive edge in the current marketplace, the companies need to distinguish themselves from their competitors, not only in prices but also in the "value" of the products and services. In the current competitive market, it is more important for the software development companies "to be more focused on continuous releases and incorporating customer feedback with every iteration" and any negligence can cause loss of positional business/customers/market. This study recommends that continuous improvement in the software development process and integration of users' feedback are essential to strive and survive in the current technological world. This study also discusses the key benefits and advantages of agile methodology use along with enhanced user participation. Moreover, this study also emphasizes the increase of managerial support as management support plays a key role in the success of any project.

5.3 Implications
There are some practical and theoretical implications of the current study, which are as follows.

5.3.1 Theoretical Implications

This study has theoretical implications while Implementing the agile methodology in real-time IT projects it should be kept in mind that the market is continuously going toward adopting agile methodology use in each project so it is must keep these dimensions in mind to decrease unwanted uncertainties in the projects to implement and execute projects successfully while proactively dealing with user participation. Management should aware of the depth and level of uncertainty and participation of users as it is an important element to be resolve and dealt with proactively in the projects.

Therefore, the finding of this study contributes to the existing body of knowledge aboutIn underdeveloped economies like Pakistan, there are very few or rare studies that have investigated the impact of agile methodology use on project uncertainty. Moreover, according to the best of the author's knowledge, there is no study found especially in Pakistan that has discussed or investigated the mediating role of user participation or moderating role of managerial support to lessen the project uncertainty.Agile methodology

use, user participation, managerial support, and project uncertainty, and measures to improve project performance in the software development industry of Pakistan, where people have very inadequate comprehension about this fact.

5.3.2 Practical Implications

The study finding will help the top management of IT firms to formulate efficient software development strategies that can enhance the company's efficiency as well as industry outcomes. This study presents imperative implications for the IT industry as using agile methodology for IT project decrease unwanted uncertainties but using user participation as the mediator doesn't impact on reducing uncertainty in the study. To overcome this the IT Firms need to provide proper training workshops to develop knowledge in employees of IT firms about how to engage users in every iteration of the project while using an agile methodology. The first and principal finding is that in the IT industry the continuous software releases along with the incorporation of customer's or user's feedback plays an important role in the project's success and reduced uncertainty. The IT can get a competitive advantage over its competitors by use of agile methods and enhanced user participation in software development projects.

5.6   Limitations andFuture Research Directions

The current study also has some limitations that need to be addressed in future studies.First of all, the findings of the current study cannot be generalized because of the limited sample size and only targets the IT sector of Pakistan.Secondly, the current study is limited to a specific geographic location i.e. only two cities Rawalpindi and Islamabad.Thirdly, the current study is focused only on the use of the agile methodology to decrease project uncertainty and ignores other factors that can also influence project uncertainty. Finally, the current study utilized a cross-sectional research design hence there are chances of response biases.

Future researchers are required to collect data with an increase in sample size and collect data from other sectors.Future research is required to find out the other factors that affect project uncertainty. Future studies should examine the other intervening variables between agile methodology use and project uncertainty, such as training and customer support.Future research should examine the other moderators between the relationship of user participation and project uncertainty, such as risk management.

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