IMPACT OF USING AI TO MANAGE PROJECT RISKS INCLUDING CHANGE IN SCOPE AND LACK OF REQUIRED SKILLS: MODERATING EFFECT OF TEAM EXPERTISE IN IT INDUSTRY OF PAKISTAN

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Abstract
The aim of this paper is to study the impact of using Artificial Intelligence to manage project risks within IT industry by IT project managers. By implementing the socio technical system theory the model was derived to implement technology i.e. Artificial Intelligence to enable project managers assess risks beforehand and reduce the risk of project failure rate, The study was quantitative in nature and survey was conducted to collect data from 249 respondents which include project managers, functional managers and project team members of different software houses present in Lahore which included NETSOL, Systems, Tkxel, InvoZone. The results of this study clearly showed positive relationship between the variables, showing the use of artificial intelligence can create a significant impact on managing project risks and gaining expertise in AI can contribute towards managing project risks more effectively.
Key Words*: Artificial Intelligence, Risk, Project, Team, Implementation Technology*

1. INTRODUCTION AND BACKGROUND OF STUDY

1.1 Introduction

Projects succeed when risks associated with the projects are managed successfully. To manage these projects effectively and efficiently, it is necessary that these project risks are first identified correctly. Many project fail due to the risks that are associated with them. Various studies show that most of the projects fail due to budget and schedule overrun, whereas another major reason identified for IT project failure is unmanaged project risks (Kumar et al., 2021). Project risk management covers certain steps, which involves risk identification, risk estimation and risk evaluation (Elkington & Smallman, 2002). In the first phase of risk management i.e. risk identification risks are identified and categorized to determine what are the potential threats to the project (Tchankova, 2002). The second phase is risk estimation where it is determined that how important or crucial the risk is to the project (Elkington & Smallman, 2002). The third phase is risk evaluation where the project manager has to decide what appropriate action has to be taken to deal with that risk (Elkington & Smallman, 2002).

Artificial Intelligence has made its place amongst one of the most innovative and disruptive technologies around the world (Yigitcanlar, Butler, et al., 2020). AI is defined as machines or computers that are designed specially to replicate or mimic human's cognitive functions such as thinking, learning, decision making and improving them (Bajwa et al., 2015; Yigitcanlar, Desouza, et al., 2020). This research will focus on how the use of AI can help managing IT project risks where we will be focusing on two major IT [project risks that we have identified with the help of literature. This research will identify the impact of using AI by software project managers on software project risks such as change in scope and lack of required skills for the project while using team expertise as a moderating variable.

1.2 Background of the Study

Project risks are the reason why projects fail. It is important to identify all the risks associated with the projects at the right time. According to a study provided by the Standish Group, only 32% of the projects' success rate was recorded which was less than the previous year whereas 44% of the projects were challenged for being late and over budgeted and 24% of the projects were cancelled (Susser, 2012). Advocates of risk management claim that successfully identifying project risks can reduce the threat of project failure (Wallace et al., 2004a). Researchers have categorized and identified several risks that pose a threat to IT projects which include changing scope, lack of required skills/personnel for the project, gold plating, Unrealistic budgets and schedules, wrong development of functionalities and interface and performance shortfalls (Kwak & Stoddard, 2004).

In Pakistan 90% of the IT projects are outsourced which is because many multinationals have built their offices in Pakistan due to cheap labor having international clients, which is why most of their projects are from developed countries (Jahan et al., 2019). Research has shown that in Pakistan, implementation of large IT projects is possible through the employees who have the required skills and knowledge to implement those projects(Abbas et al., 2017).A lot of research has been conducted to identify risks associated to IT projects however, this research will focus to fill the gap in previous literature by testing the use of Artificial Intelligence for managing IT project risks. This study will unfold the impact of using AI for managing two major IT project risks 1) change in scope and 2) Lack of required skills for the projects (Keil et al., 1998). Tis research will also use team expertise to unfold the moderating impact of AI on It project risks and on change in scope and lack of required skills for the project.

1.3 Problem Statement

According to a research, IT projects have a high rate of failure with every third project being terminated before completion (Kutsch & Hall, 2005). Another research states that 25% of the IT projects are terminated before their completion (Ahmed et al., 2007). The reason for the failure of these projects are the risks that are associated with these IT projects. Research has shown that within the approaches of project management, project risk management is the best practice to achieve success (Keil et al., 1998). Literature has shown several risks that has resulted in the form of failure of IT projects which includes budget, schedule, gold plating, misunderstanding requirements, unclear system requirements, lack of top management support, changing scope, lack of required skills (Arnuphaptrairong, 2011).

Digitization in the past few years has revolved the approach of Project management, introducing new technologies such as Artificial Intelligence to match human intellect to perform complex tasks (Uchihira et al., 2020). This research will focus specifically how the use of AI will help in managing two major IT project risks, identified through literature, that are, (1) Change in scope (2) Lack of required skills while using moderating variable of team expertise, where the research will analyze how the team competencies in AI will moderate the use of AI in managing IT project risks.

1.4 Research Objectives

This research was conducted to achieve following objectives:

- To identify the impact of using Artificial Intelligence on project Rusks
- To identify the relationship between Artificial Intelligence and two constraints of Project risks
- To identify team competencies is important for managing project risks
- To identify significance of team competencies on managing project risks

1.5 Research Questions

- Does using Artificial Intelligence effect management of project risks?
- How team competencies can contribute towards managing project risks if project constraints are defined?
- Does team competencies have any impact to project risks?
- Does usage of Ai have any impace to reduce project risks?

1.6 Hypothesis

- H1: AI has significant effect on managing project risks
- H1a: AI has significant effect on change in scope in project risks
- H1b: AI has significant effect on lack of required skills in project risks
- H2: Team competency moderates the relationship between AI and project risks
- H3: There is a positive relationship between team competencies and managing project risks

1.7 Significance of the study
This study holds a lot of significance for the software project managers and for the IT industry. According to the Standish Group, an IT consulting firm reports that $275 billion alone is spent on the IT projects in U.S., and more than 70% suffer total failure (Wallace & Keil, 2004). Another research shows that 15% of the projects were terminated before they could return anything (Jalil & Hanif, 2009). This shows that the rate of failure of IT projects across the world has remained high over the past few decades. Today the success of a project strongly depends upon how the risks associated with the projects are identified and managed. Since the world is evolving, technology is playing its playing its part in modernizing the project management practices. This research will contribute towards how the use of AI will help IT project managers in managing IT project risks. This research will also shed light on how gaining team expertise in AI can help IT project managers in managing project risks effectively and efficiently. This study will also provide analysis of how the use of AI can help in managing two major IT project risks, identified through literature, (1) Change in scope (2) Lack of required skills.

2. LITERATURE REBIEW

The term "Artificial Intelligence" is defined as the ability of computers performing human like tasks like thought processing which includes learning, reasoning and self-correction (Kok et al., 2009). (Marino et al., 2022), Artificial Intelligence, now-a-days is playing its role in managing projects within different industries including construction, healthcare, pharmaceuticals etc. The application of AI has been made possible via machine learning, supervised learning, semi-supervised learning, re-enforcement learning and neural networks allowing the use of AI at workplaces via sensor devices, robotic devices, decision support system that empowers automation and a positive interaction between humans and machines (Howard, 2019). Machine Learning is a sub discipline of AI that enables the machine to learn from data and has played a major role in the growth of AI and its application in workplace enables machine to obtain cognitive insights, make predictions and support decisions (Kreuzberger et al., 2022). Deep learning is defined as a sub domain of neural networks and works on the basis of multiple interconnected neurons that are layered between input and output to recognize a certain pattern (Dixit & Silakari, 2021).

2.1 Origins of AI
The idea of Artificial Intelligence was first presented in a proposal in a workshop in 1956 at Dartmouth College in New Hampshire where the idea of AI was defined as making machines behave in a way that they would be able to take intelligent decisions just like human beings (Howard, 2019). The advent of this technology has proven to be of great benefit to professionals that belong to different industries. Whether it be healthcare sector, clinical research, business sector, finance and banking sector; The use of Artificial Intelligence is now contributing a lot towards the development of every industry. The last two decades have witnessed a significant amount of growth in the artificial intelligence within every industry around the globe. The future is expected to be more innovative as more and more work is done around Artificial Intelligence, enabling Artificial Intelligence to become a more critical part of every industry in the future (Acemoglu & Restrepo, 2018).

2.2 Project Management and Artificial Intelligence
In the past few years, advancement in global economy has resulted in the form of mega complex projects (Davahli, 2020). Increasing complexity of the projects has made it a challenging task for the project managers to manage the projects. Such projects require adoption of appropriate project management methodologies to avoid project risks (Gil et al., 2021). Research has identified several reasons that become the cause for the failure of projects which includes no communication protocols, undefined roles and responsibilities, expectation management, changing scope, ignorance of project risks, lack of planning, unrealistic budgets and schedules, lack of skills (Gil et al., 2021). In the past years several technologies has been introduced to improve the project management practices, one of the latest technology benefitting the project management practice is the Artificial Intelligence (Davahli, 2020). Within these complex projects, large amount of data is gathered throughout the project lifecycle that is transferred between project teams. Here comes the role of AI which enables

the project managers these large amount of data in these complex projects (Davahli, 2020). AI also enables the project managers to reduce uncertainties in projects by using logical reasoning and probability calculation (Davahli, 2020).

2.3 Artificial Intelligence in Construction Projects

With the revolution of industry, projects are also getting bigger. This has resulted in the form of complex projects with high uncertainties, making project management practitioners to rethink their practices to avoid risks within these complex and large scale projects (Basaif et al., 2020). Risk management has now become a very crucial part of construction projects, enabling project managers to predict the risks beforehand to avoid big loss (Schwarz & Sánchez, 2015). Artifcial Intelligence is said to provide more accurate and satisfactory results as compared to traditional methods for analyzing risks (Basaif et al., 2020). Implementation of AI enables project managers to predict cost overruns, this is possible through Monte Carlo technique that enables project managers to come up with strategies to mitigate uncertainties for large scale projects (Afzal et al., 2019).

2.4 Project Risk Management in IT Industry

IT projects are complex in nature and due to increased complexity and projects being carried out on a larger scale, it becomes relatively difficult for project managers to manage such projects (Keil et al., 1998). IT risk management is used to identify, address and eliminate risks that occur within a software to avoid any major rework that needs to be done as a result of the risk occurred (Boehm, 1989; Rehman, Aslam, et al., 2021). Many researches have highlighted number of risks that occur during IT projects. These risks become the reason why these projects fail. Advocates of software project management have highlighted several risks that occur during IT projects which include personnel shortfalls, developing incorrect software functionalities, developing non-user friendly interface, gold plating, late changes to requirements, shortfalls of externally supplied components or resources, shortfalls of outsourced tasks, performance shortfalls (Arnuphaptrairong, 2011).

2.5 Team Competencies

Team competencies are developed within the teams when the project teams are aware of their project roles and responsibilities, have understanding of theoretical knowledge and applies that theoretical knowledge to critical situations (Figl, 2010). However, it is not necessary that a well performing team is also competent. Following are the nine factors that are required within a team to be competent which includes advising, innovating, promoting, developing, organizing, producing, inspecting, maintain and linking (Margerison, 2001; Rehman, Mata, et al., 2021).

3. THEORETICAL FRAMEWORK

3.1 Research Philosophy

This research is built upon the positivist approach. The positivist paradigm explains that there is only a single reality that exists – a reality that can be identified, understood and measured (Park et al., 2020). This philosophy allows to create cause and effect relations enabling the positivists to develop causal frameworks (Park et al., 2020). Positivist approach views knowledge more objectively as compared to observing it from a subjective point of view (Bunniss & Kelly, 2010).

3.2 Research Approach

This research uses deductive approach. This research aims to discover what exists through prediction. Theory that is devised deductively uses scientific methods to develop laws (Hodges & Kuper, 2012). This study uses literature to develop framework which is why the research approach used for this research is deductive in nature. Researches with this approach looks for causality and fundamental laws (Hodges & Kuper, 2012) .

3.3 Purpose of Research

The purpose of this research is explanatory. The explanatory research defines the causal relationship between the variables, where the occurrence of one event causally relates to the occurrence of another of other relevant event (Bentouhami et al., 2021). In explanatory research, the framework represents the causal relationship between the variables. An explanatory study is used to define the hypothesis of causal relationship, estimation of causal models and testing the models' validity and hypothesis (Cooley, 1978). This research highlights the problem of managing risks in IT projects and highlights two IT project risks that are identified using prior literature. This research highlights how usage of technology i.e. artificial intelligence contributes towards managing project risks in the IT industry of Pakistan while using team competencies as a moderating variable to check the impact of AI on IT project risks.

3.4 Data Collection Method

This study will be quantitative in nature and data will be collected in the form of numbers through the help of survey questionnaires to test the hypothesis.

3.5 Time Horizon

The study will be cross-sectional in nature. Cross sectional studies assess a phenomenon at a certain point in time (Rindfleisch et al., 2008).

3.6 Unit of Analysis

The unit of analysis for this research is individual as every individual of the sample size was assesses individually as a separate unit. Unit of analysis is related to what factor(s) is/are being studied by the researcher during the research or what actor(s) or object(s) is/are being studied (Yurdusev, 1993). It basically refers to the object or the character being studied by the researcher. Unit of analysis can be classified as individual human person, society or group of people and universe or humanity (Yurdusev, 1993). The unit of analysis chosen for this research is individual in nature as we want to study individual responses of our sample size.

3.7 Sampling Technique

Convenience sampling will be used to draw a sample from the population. The objective of the study is to gain observations from a sample of IT project managers, line managers, senior project managers and project team members that are directly involved within the IT industry of Pakistan, with age ranging from 25 to 50. Survey will be conducted based on their convenience of accessibility and availability to us since these are high level professionals and are available at their own convenience. This research will be based on a sample size of 250 respondents (Memon et al., 2020). Since according to literature a sample size between 100 to 400 is the best fit for simple models such as the one tested in the this study (Murtagh & Heck, 2012).

3.8 Population and Sample Size

This research will target the population of IT industry of Pakistan and will focus to collect the sample from a sample size of 200 respondents.

3.9 Data Collection Instrument

The data collection instrument that will be used to collect data for this research is survey questionnaire with likert scale. A total of 30 items were adopted in the questionnaire to measure usage of AI as IV, IT project risks as DV and team competencies as a moderator. The questions used in the questionnaire were based on a five point LIKERT scale. The five-item scale included the items: Strongly Disagree; Disagree; Neutral; Agree and Strongly Agree. These items were adopted from prevuous studies of similar topics.

The questionnaire will consist of different sections. The first section will be based on the demographic assessment of the respondents and consists of questions like age, gender, occupation, location, current job position, experience and industry.

The second section of the questionnaire will assess the construct usage of AI to manage IT project risks. Total of 6 items will be used for this study from different articles (Eschert et al., 2022) (asrt, 2019). These were based on LIKERT scale that ranges from 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

The third section will be based upon the questions related to IT project risk management. Questions for this section were adopted from (Islam, 2009)**. A total of 12 items will be adopted which will be based upon LIKERT 5-point scale that ranges from** 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

The last section will consist of items that will assess construct team competencies as moderator. The items for this study were adopted from (Baig, 2019)**. A total of 6 items will be adopted which will be based upon LIKERT 5-point scale that ranges from** 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

3.10 Data Analysis Data Collection Instrument

The instruments that was used to analyze data for this research is SPSS to check cause and effect relationship between the variables. Regression analysis will be performed to check the cause and effect relationship between the proposed variables. As regression tests are used to test cause and effect relationships and the effect of one variable on another variable (Freund et al., 2006).

4. RESULTS AND INTERPRETATION

Before conducting research on the actual sample size and collecting data from them, a pilot study was conducted where the same survey was distributed to a small number of people having same characteristics in the population of actual sample size. A total of 20 respondents were chosen to perform the pilot study where all the respondents approached were project managers, functional managers or project team members. The use of pilot study aids in measuring the relationship between the constructs and also test whether the hypothesis that were devised by the researcher have a testable relationship or not (Salimon et al., 2016). This preliminary step also saves researcher's time and efforts.

4.1 Reliability Test

Reliability is defined as a practice to measure same efforts by applying different methodologies (Hammersley, 1987). The reliability test that was performed for 20 respondents showed satisfactory scores where Cronbach's Alpha for 32 items of survey recorded foe n=20 0.811; shown in the table below:

Reliability Statistics

Cronbach's Alpha	N of Items
.811	32

After the pilot test was conducted, survey was distributed to 249 respondents and data was collected from them. Respondents that were part of the sample size include project managers, functional managers and project team members. Reliability test when performed on actual sample size, we got the satisfactory results of Cronbach's Alpha for 32 survey items collected from 249 respondents shown in the table below:

Reliability Statistics

Cronbach's Alpha	N of Items
.866	32

The reliability test performed individually for each variable showed different results for each variable where the results for

	Cronbach's Alpha (n=249)
Artificial Intelligence (AI)	0.685
Project Risk (PR)	0.818
Change in Scope (CS)	0.607
Lack of Required Skills (LRS)	0.628
Team Competencies (TC)	0.778

Reliability of data is tested using Cronbach's Alpha where the significant value for Cronbach's Alpha is said to be closer to 1. After running Cronbach's Alpha test we observed satisfactory results closer to 1 shown in the table above.

4.2 Frequency Distribution

After checking the reliability of the data through Cronbach's Alpha, frequency test was performed on the demographic data that was collected. We used Gender, Number of workers, Years of experience, Level of education, and position as the demographic items in our survey to collect data against these items from our respondents. Description of the data we collected and test we performed is mentioned in the tables below:

4.2.1 Gender

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	183	73.5	73.5	73.5
	Female	66	26.5	26.5	100.0
	Total	249	100.0	100.0	

The frequency test performed for the demographic variable: gender showed the distribution of data collected from 249 respondents. Out of 249 respondents 183 were Males and 66 were females.

4.2.2 Number of workers

Number of workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	50-200	92	36.9	36.9	36.9
	200-400	28	11.2	11.2	48.2
	500-1000	29	11.6	11.6	59.8
	1000-2000	100	40.2	40.2	100.0
	Total	249	100.0	100.0	

The frequency test performed for the demographic variable: Number of workers showed the distribution of data collected from 249 respondents. Out of 249 respondents 92 respondents were those who worked in the organization having number of employees ranging from 50 – 200, 28 were those worked in an organization having employees ranging from 200 – 400, 29 were those worked in an organization having employees ranging from 500 – 1000, 100 were those worked in an organization having employees ranging from 1000 – 2000.

4.2.3 Years of experience

Years of experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-3 Years	126	50.6	50.6	50.6
	3-5 Years	50	20.1	20.1	70.7
	5-7 Years	32	12.9	12.9	83.5
	7-10 Years	17	6.8	6.8	90.4
	10+ Years	24	9.6	9.6	100.0
	Total	249	100.0	100.0	

The frequency test performed for the demographic variable: Years of Experience showed the distribution of data collected from 249 respondents. Out of 249 respondents 126 respondents were those who had 0 – 3 years of work experience, 50 respondents were those who had 3 – 5 years of work experience, 32 respondents were those who had 5 – 7 years of work experience, 17 respondents were those who had 7 – 10 years of work experience, 24 respondents were those who had 10+ years of work experience,

4.2.4 Level of education

Level of Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelors	135	54.2	54.2	54.2
	MS/M.Phil	114	45.8	45.8	100.0
	Total	249	100.0	100.0	

The frequency test performed for the demographic variable: Level of Education showed the distribution of data collected from 249 respondents. Out of 249 respondents 135 respondents were those who have done bachelors and 114 were those who had MS/M.Phil qualification.

4.2.5 Position

Position

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Functional Manager	40	16.1	16.1	16.1
	Project Manager	52	20.9	20.9	36.9
	Team Member	105	42.2	42.2	79.1
	Other	52	20.9	20.9	100.0
	Total	249	100.0	100.0	

The frequency test performed for the demographic variable: Position showed the distribution of data collected from 249 respondents. Out of 249 respondents 40 respondents were Functional managers, 52 were Project managers, 105 were working as team members and 52 were others.

4.3 Descriptive statistics

The next step is to perform descriptive statistics where we calculated minimum, maximum, mean, standard deviation, skewness and kurtosis. The main objective of performing descriptive statistics is to define distributional characteristics. They are used to describe the basic features of a data. It is a numerical technique that is used to describe the basic feature of sample data (Fisher & Marshall, 2009). Descriptive statistics including frequency distributions such as mean and standard deviation are used to analyze the basic features of a data (Fisher & Marshall, 2009). Mean is defined as the average value calculated whereas standard deviation is defined as average difference of each value to the mean (Fisher & Marshall, 2009). After running the descriptive statistics test for each variable including AI, PR, CS, LRS and TC we get following results:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
AI_TOTAL	249	1.00	3.83	2.1673	.54553	.298
PR_TOTAL	249	1.00	3.50	2.0904	.55662	.310
CS_TOTAL	249	1.00	3.50	2.1118	.50145	.251
LRS_TTL	249	1.00	4.00	2.2169	.53870	.290

TC_TOTAL	249	1.00	4.40	1.9984	.63905	.408
Valid N (listwise)	249					

The above table shows the minimum and maximum valye for each variable. On the other side the mean values for each variable lies below 3 which means respondents answered mostly Agreed or Strongly Agreed with the questions that were asked against each variable. Low standard deviation is showing the spread is of data and the response of the respondents is closer to that of mean.

4.4 Correlation

Correlation is defined as a technique that is used to demonstrate association between two or more variables (Gogtay & Thatte, 2017). Two methods are used to calculate the correlation which includes Karl Pearson's Correlation Coefficient or Spearman's Rank Correlation Coeeficient. The one used here is Karl Pearson's technique. The degree of perfect correlation lies between -1 to +1. Where if the value of coefficient is observed to fall between ± 0.50 and ± 1, than it is said to have a high degree of correlation. However if the value is recorded between ± 0.30 and ± 0.49 than there is moderate correlation and if the value is recorded below ± 0.29 than there is low corrlelation whereas zero represents no correlation.

In this research the value of correlation is significant at 0.01 so SPSS signifies the value of correlation coefficient with "*" (Field, 2009). The results in the table below shows AI_TOTAL is positively correlated to PR_TOTAL with a coefficient of r= 0.246 which is also significant at p < 0.01 (Field, 2009). AI_TOTAL is also positively correlated to CS_TOTAL with a coefficient of r= 0.182, significant at p < 0.01 (Field, 2009). AI_TOTAL is also positively correlated to LRS_TTL with a coefficient of r= 0.094, significant at p < 0.01 (Field, 2009). AI_TOTAL is also positively correlated to TC_TOTAL with a coefficient of r= 0.266, significant at p < 0.01 (Field, 2009).

Correlations

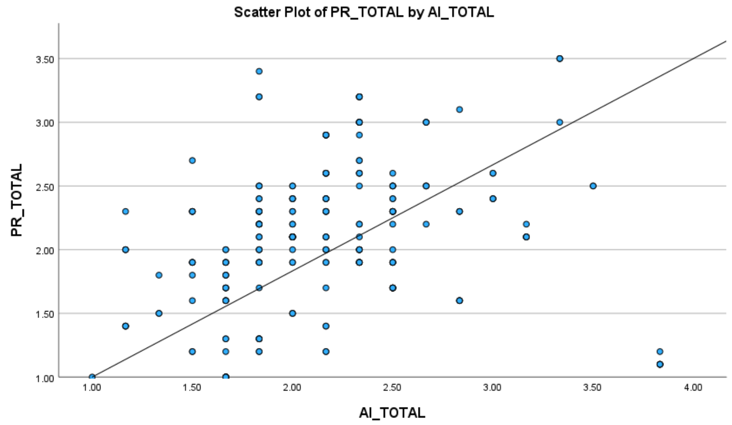
		AI_TOTAL	PR_TOTAL	CS_TOTAL	LRS_ TTL	TC_TOTAL
AI_TOTAL	Pearson Correlation	1	.246**	.182**	.094	.266**
	Sig. (2-tailed)		<.001	.004	.140	<.001
	N	249	249	249	249	249
PR_TOTAL	Pearson Correlation	.246**	1	.480**	.286**	.477**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	249	249	249	249	249
CS_TOTAL	Pearson Correlation	.182**	.480**	1	.453**	.481**
	Sig. (2-tailed)	.004	<.001		<.001	<.001
	N	249	249	249	249	249
LRS_TTL	Pearson Correlation	.094	.286**	.453**	1	.415**
	Sig. (2-tailed)	.140	<.001	<.001		<.001
	N	249	249	249	249	249
TC_TOTAL	Pearson Correlation	.266**	.477**	.481**	.415**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	249	249	249	249	249

**. Correlation is significant at the 0.01 level (2-tailed).

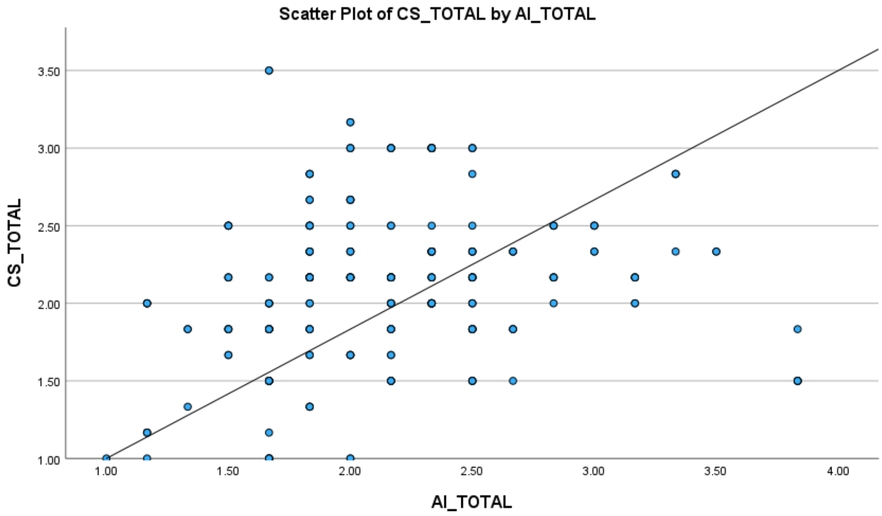
4.5 Scatter Plots

4.5.1 Scatter plot of PR_TOTAL by AI_TOTAL

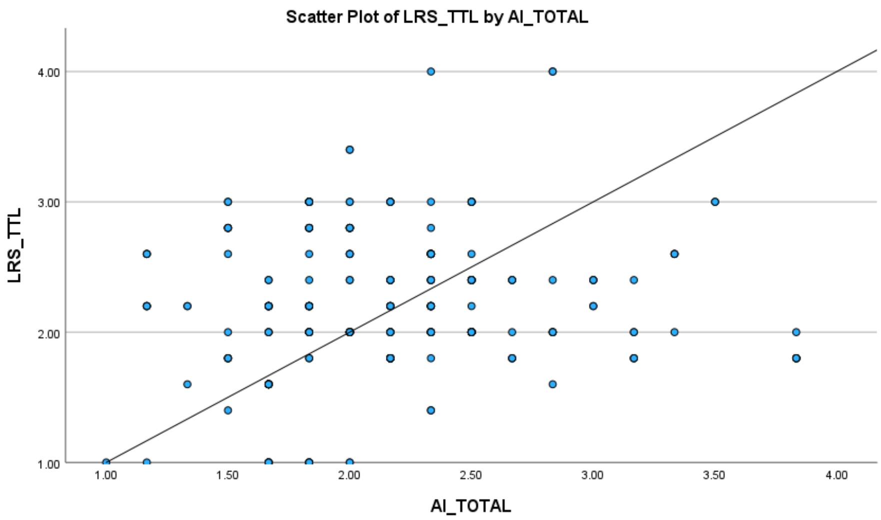
The following graph shows positive relationship between both the variables.



4.5.2 Scatter Plot of CS_TOTAL by AI_TOTAL
The following graph shows positive relationship between both the variables.



4.5.3 Scatter Plot of CS_TOTAL by AI_TOTAL
The following graph shows positive relationship between both the variables.

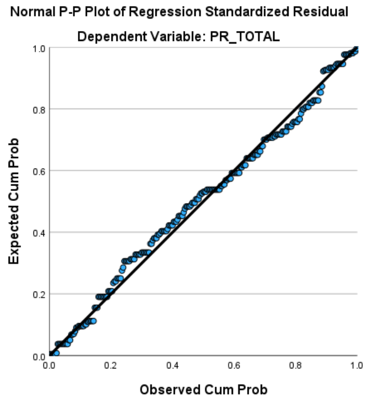


4.6 Regression Analysis

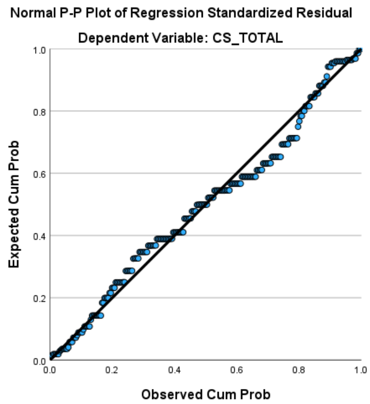
Regression analysis was conducted to check the effect of independent variable on dependent variable and for that 6 assumptions were tested and should be verified as valid:

4.6.1 Assumption 1

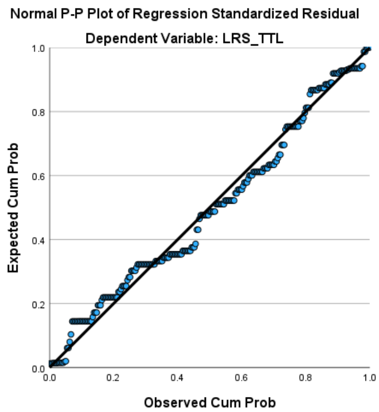
A linear relationship should be observed between the IV(AI) and DV(PR) when the graph is plaotted



A linear relationship should be observed between the IV(AI) and DV(CS) when the graph is plaotted



A linear relationship should be observed between the IV(AI) and DV(LRS) when the graph is plaotted



4.6.2 Assumption 2

There should not be multiple regression. Analysis of collinearity show that this assumption is correct, as VIF scores are less than 10 and tolerance scores are above 0.2 (statistics = 1.00 and 1.00 respectively). This shows that the criteria for the fulfillment if assumption 2 has been met for the DV Project Risk (PR_TOTAL).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.546	.141		10.992	<.001		
	AI_TOTAL	.251	.063	.246	3.995	<.001	1.000	1.000

a. Dependent Variable: PR_TOTAL

The same assumption should be tested for the constructs of the DV Change in Scope (CS_TOTAL). The data shows that the assumption is correct as the VIF scores are less than 10 and the tolerance scores are above 0.2.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.749	.129		13.606	<.001		
	AI_TOTAL	.168	.058	.182	2.915	.004	1.000	1.000

a. Dependent Variable: CS_TOTAL

The same assumption should be tested for the constructs of the DV Lack of Required Skills (LRS_TTL). The data shows that the assumption is correct as the VIF scores are less than 10 and the tolerance scores are above 0.2.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.016	.140		14.424	<.001		
	AI_TOTAL	.093	.063	.094	1.479	.140	1.000	1.000

a. Dependent Variable: LRS_TTL

4.6.3 Assumption 3

The Durbin Watson value should range from 1 to 3. The residual values in linear regression should be independent. The Durbin Watson value for our data is 1.670, thus this also verifies this assumption for dependent variable PR_TOTAL

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.246[a]	.061	.057	.54056	1.670

a. Predictors: (Constant), AI_TOTAL

b. Dependent Variable: PR_TOTAL

The same assumption is tested for the constructs of the DV i.e. CS_TOTAL.. The Durbin Watson value for CS_TOTAL is 2.178, which also verifies this assumption.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.182[a]	.033	.029	.49404	2.178

a. Predictors: (Constant), AI_TOTAL
b. Dependent Variable: CS_TOTAL

The same assumption is tested for the second construct of the DV i.e. LRS_TTL.. The Durbin Watson value for CS_TOTAL is 2.323, which also verifies this assumption.

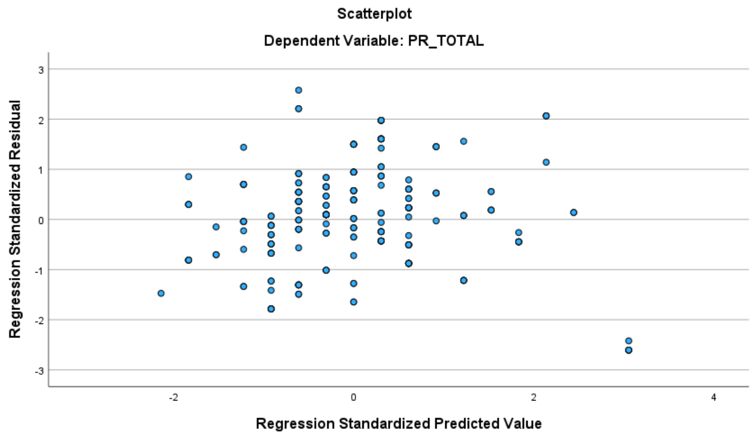
Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.094[a]	.009	.005	.53741	2.323

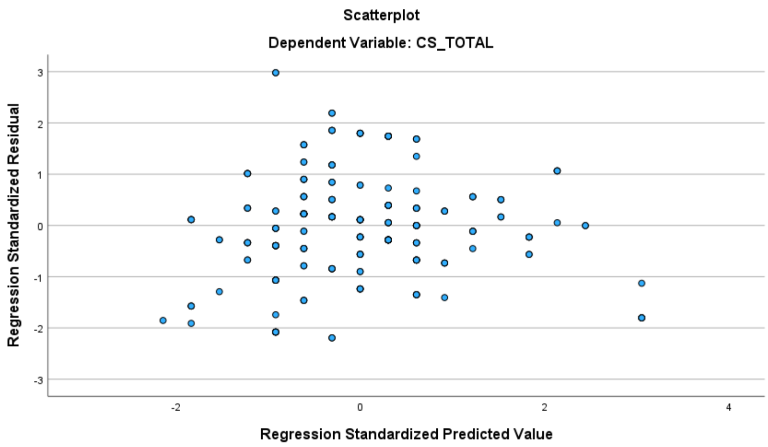
a. Predictors: (Constant), AI_TOTAL
b. Dependent Variable: LRS_TTL

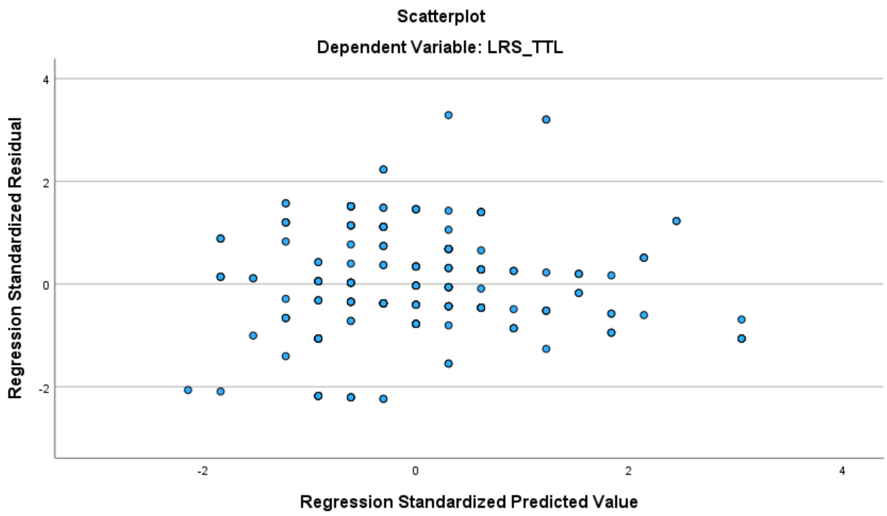
4.6.4 Assumption 4

The residual value should be constant.



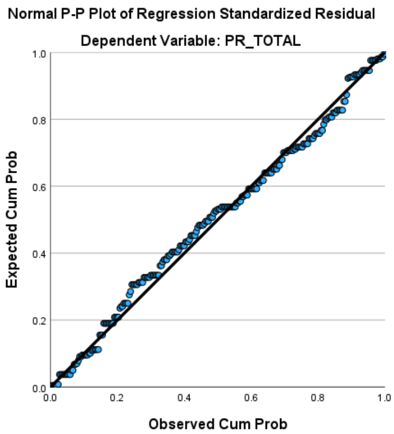
The same assumption is tested for other constructs of DV which includes CS_TOTAL and LRS_TTL.



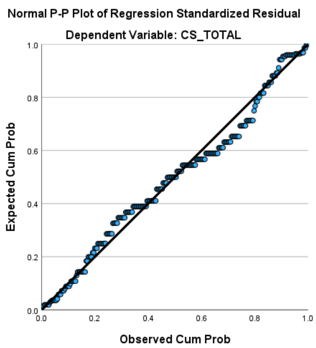


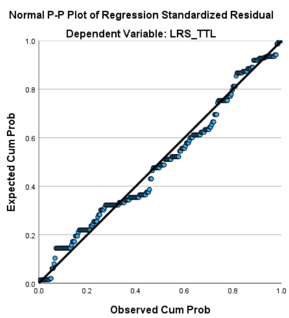
4.6.5 Assumption 5

To fulfill this assumption residual value needs to be normally distributed. In our case the values are normally distributed on graph as shown below, thus this assumption is also met.



The same assumption is tested for other constructs of DV which includes CS_TOTAL and LRS_TTL.





4.6.6 Assumption 6

In our case the Cook's Distance statistic is lower than 1 and no outliner is there to impact any influential bias on the model. The Cook's Distance values that were generated for Project Risk (PR_TOTAL), Change in Scope (CS_TOTAL) and Lack of Required Skills (LRS_TTL) had all the values below 1 which means there were no outliers in the data. Hence 6th assumption is met.

It is now concluded that all 6 assumptions of linear regression are met.

4.7 Linear Regression

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.073	1	2.073	8.494	.004[b]
	Residual	60.288	247	.244		
	Total	62.361	248			

a. Dependent Variable: CS_TOTAL
b. Predictors: (Constant), AI_TOTAL

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-atson
1	.182[a]	.033	.029	.49404	2.178

a. Predictors: (Constant), AI_TOTAL
b. Dependent Variable: CS_TOTAL

After running the analysis on AI_TOTAL (IV) and CS_TOTAL (DV), we got the following results where R^2=0.033, F(1,247)= 8.494, p<0.001. Thus this verifies the second hypothesis for the model.

- H1a: AI has significant effect on change in scope in project risks

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.632	1	.632	2.189	.140[b]
	Residual	71.337	247	.289		
	Total	71.969	248			

a. Dependent Variable: LRS_TTL
b. Predictors: (Constant), AI_TOTAL

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.094[a]	.009	.005	.53741	2.323

a. Predictors: (Constant), AI_TOTAL
b. Dependent Variable: LRS_TTL

After running the analysis on AI_TOTAL (IV) and LRS_TTL (DV), we got the following results where R^2=0.009, F(1,247)= 2.189, p<0.001. Thus this verifies the third hypothesis for the model.

- H1b: AI has significant effect on lack of required skills in project risks

4.8 Moderation Analysis

A moderator variable is a variable that occurs in a pathway between IV and DV and that moderates the relationship between the two variables. Thus, to analyse this relationship between the two variables we used the Hayes Process Macro to test the moderating effect of team competencies on Artificial Intelligence (IV) and (DV) Project risk, Change is scope and Lack of Required skills.

4.8.1 Artificial intelligence and project risk

Run MATRIX procedure:

*************** PROCESS Procedure for SPSS Version 4.2 beta ***************

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2022). www.guilford.com/p/hayes3

****

Model : 1
Y : PR_TOTAL
X : AI_TOTAL
W : TC_TOTAL

Sample
Size: 249

****

OUTCOME VARIABLE:
PR_TOTAL

Model Summary

R	R-sq	MSE	F	df1	df2	p
.4939	.2439	.2371	26.3455	3.0000	245.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	.8172	.3997	2.0444	.0420	.0299	1.6046
AI_TOTAL	.2313	.1812	1.2768	.2029	-.1255	.5881
TC_TOTAL	.4950	.1938	2.5545	.0112	.1133	.8768
Int_1	-.0492	.0841	-.5844	.5595	-.2149	.1165

Product terms key:
Int_1 : AI_TOTAL x TC_TOTAL

Covariance matrix of regression parameter estimates:

	constant	AI_TOTAL	TC_TOTAL	Int_1
constant	.1598	-.0699	-.0732	.0314
AI_TOTAL	-.0699	.0328	.0313	-.0144
TC_TOTAL	-.0732	.0313	.0376	-.0157
Int_1	.0314	-.0144	-.0157	.0071

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0011	.3415	1.0000	245.0000	.5595

Focal predict: AI_TOTAL (X)
Mod var: TC_TOTAL (W)

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
AI_TOTAL TC_TOTAL PR_TOTAL .

```
BEGIN DATA.
    1.6667    1.4000    1.7811
    2.1667    1.4000    1.8623
    2.5000    1.4000    1.9165
    1.6667    2.0000    2.0289
    2.1667    2.0000    2.0954
    2.5000    2.0000    2.1398
    1.6667    2.6000    2.2768
    2.1667    2.6000    2.3286
    2.5000    2.6000    2.3630
END DATA.
GRAPH/SCATTERPLOT=
 AI_TOTAL WITH     PR_TOTAL BY       TC_TOTAL .

********************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

------ END MATRIX -----
```

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.663	1	4.663	15.959	<.001[b]
	Residual	72.174	247	.292		
	Total	76.837	248			

a. Dependent Variable: PR_TOTAL
b. Predictors: (Constant), AI_TOTAL

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.246[a]	.061	.057	.54056	.061	15.959	1	247	<.001	1.670

a. Predictors: (Constant), AI_TOTAL

b. Dependent Variable: PR_TOTAL

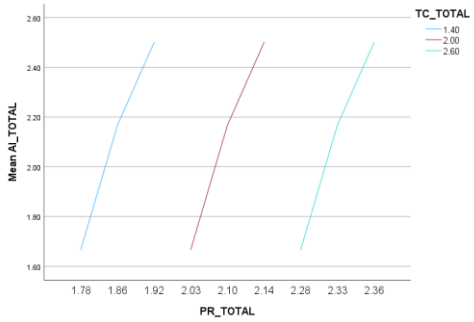
Model Summary[b]

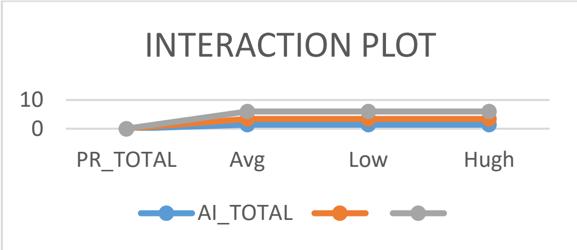
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.246[a]	.061	.057	.54056	1.670

a. Predictors: (Constant), AI_TOTAL
b. Dependent Variable: PR_TOTAL

After running the analysis on AI_TOTAL (IV) and PR_TOTAL (DV), we got the following results where R^2=0.061, F(1,247)= 15.95, p<0.001. Thus this verifies the first hypothesis for the model.

- H1: AI has significant effect on managing project risk





The Interaction plot drawn from the data generated by performing Regression through Process Hayes shows increasing effect. The interaction plot was drawn by adding AI_TOTAL and PR_TOTAL with the moderator TC_TOTAL to the regression model which shows significant results, where $\Delta R^2 = 0.057$, $\Delta F(1, 247) = 15.96$, $p = .001$, $b = .03$, $t(247) = 1.01$, $p < .01$. Thus, examining of the interaction plot shows an enhancing effect which proves that an increase in the usage of AI with increasing team competencies in this particular software will also contribute towards increased project risk management.

This shows a positive relationship between team competencies and project risks. Thus this accepts H2 and H3

- H3: There is a positive relationship between team competencies and managing project risks
- H2: Team competency moderates the relationship between AI and project risks

This accepts all five hypothesis.

- H1: AI has significant effect on managing project risks
- H1a: AI has significant effect on change in scope in project risks
- H1b: AI has significant effect on lack of required skills in project risks
- H2: Team competency moderates the relationship between AI and project risks
- H3: There is a positive relationship between team competencies and managing project risk.

5. DISCUSSION AND CONCLUSION

5.1 Analysis of the Research Findings

This chapter will discuss data analysis results that was conducted on the data that was collected from a sample size of 249 respondents. Furthermore, this chapter will also summarize the key findings of the results that we generated from the data collected and will also focus towards interpretation of the results collected. We will also discuss future implications of our research and will discuss the limitations that we faced while conducting this research. In the end we will present the conclusion of our research that will summarize our findings for this research.

5.2 Recapitulation of the Study

This research is based on the socio technical system theory (Ropohl, 1999), which clearly states that the concept of socio technical system theory was established to maintain interrelationship between human and machines and to shape the technical and social work in such a way that efficiency does not get effected and both technical and social aspects can coexist in the same structure. This study contribute towards the growing literature for Artificial Intelligence and its impact on managing project risks which include Change in Scope and Lack of Required Skills while Team Competencies as moderating variable in IT industry of Pakistan.

This study aims to address the lack of empirical evidence of using Artificial Intelligence as a technology to address and resolve Project risks in IT projects of Pakistan. To fill this gap we first observed a relationship between Artificial Intelligence (IV) and Project Risks (DV). Team Competencies as a moderator was also observed to create a positive impact on the relationship between Artificial Intelligence and management of Project risks. The socio technical system theory builds the concept of humans and machine coexisting in the same environment in such a way that efficiency of none is affected. This model also presents the thought of using technology to manage project risks while using team competencies (which involves human involvement with machines) as a moderator.

5.3 Discussion

5.3.1 Relationship between artificial intelligence and project risk

The first objective of this study is to observe the relationship between Artificial Intelligence (IV) and Project Risk (DV) in IT industry of Pakistan. H1 was devised to test the relationship between these two variables.

After running analysis on the data that was collected we observed that a significant relationship was found between the two variables showing results of R^2=0.061, F(1,247)= 15.95, p<0.001.

H1: AI has significant effect on managing project risks

Thus this verifies the first hypothesis for the model.

Prior literature also shows a relationship between the two variable (Diekmann, 1992) (Schwarz & Sánchez, 2015).

5.3.2 Relationship between artificial intelligence and change in scope

This study devised a DV Project Risk and after doing thorough research of the literature we presented two constructs of the project risks. Change in Scope and Lack of Required Skills. These two variables were also treated as the DV. From there the relationship was devised between Artificial Intelligence and Change in Scope. After running analysis on the data that was collected we found significant relationship between the two variables. Results of the test that were ran showed following results where R^2=0.033, F(1,247)= 8.494, p<0.001. Thus this verified the second hypothesis for the model and showed a significant effect of Artificial Intelligence on Change in scope in project risks.

- H1a: AI has significant effect on change in scope in project risks

5.3.3 Relationship between artificial intelligence and lack of required skills

Third objective of this study was to test the relationship between Artificial Intelligence and Lack of Required Skills. This study devised a DV Project Risk and after doing thorough research of the literature we presented two constructs of the project risks. Change in Scope and Lack of Required Skills. These two variables were also treated as the DV. From there the relationship was devised between Artificial Intelligence and Lack of Required Skills. After running analysis on the data that was collected we found significant relationship between the two variables. Results of the test that were ran showed following results where R^2=0.009, F(1,247)= 2.189, p<0.001. Thus this verified the third hypothesis for the model and showed a significant effect of Artificial Intelligence on Lack of Required Skills in project risks.

- H1b: AI has significant effect on lack of required skills in project risks

5.3.4 Moderating role of team competencies between artificial intelligence and project risk

Team competencies was added as a moderator in the model to test the impact of team competencies on Artificial Intelligence and Project Risk. The objective of adding a moderating variable was to test if the relationship between IV and DV is effected by a moderating variable. The addition of team competencies to the model developed the relationship and presented the following hypothesis:

- H3: There is a positive relationship between team competencies and managing project risks
- H2: Team competency moderates the relationship between AI and project risks

The objective of these hypothesis was to test that there is a positive relationship between team competencies and project risk (H3). Another hypothesis was derived which shows that team competencies moderates the relationship between Artificial Intelligence (IV) and Project Risk (DV). After running moderation and regression test on the data that was collected, we got significant results that showed following results $\Delta R^2 = 0.057$, $\Delta F(1, 247) = 15.96$, $p = .001$, $b = .03$, $t(247) = 1.01$, $p < .01$. Thus, this proves that there is a significant positive relationship between team competencies and project risk and also analyzing the interaction plot diagram showed the enhancing effect which proved that the team competencies moderates the relationship between Artificial Intelligence and Project Risk. The results are also aligned with other studies that states that project managers having team with adequate competencies can manage risk effectively (Cowie, 2003).

5.4 Practical Implications

The research provides practical implications of how using Artificial Intelligence can help project managers, functional managers, line managers, program managers and project team members manage project risks effectively and efficiently. This research also presents a practical implication for project managers that how increasing team competencies to use a certain technology specifically the use of Artificial Intelligence can contribute towards better project risk management. Research presents how risk management can be improved and how we can bring efficiency in risk management process by using Artificial Intelligence to identify Risks and eliminate risks in IT projects of Pakistan. The practical application of this study in IT industry of Pakistan will assess the level of team competencies of project team members to manage project risks and their competencies to use Artificial Intelligence to manage project risks within IT projects.

5.5 Limitations of the Study

The current data that was collected to study the impact of Artificial Intelligence on Project risk while using team competencies as a moderating variable showed significant results. Still there were some limitations that were faced while conducting this research that needs to be pointed out that will be presented as a direction for future research for other researchers. One of the limitation that was faced while conducting the research was that the research was conducted cross-sectional; as due to time and cost restriction the research was carried out over a specific period of time and not over the long period of time. Other than that the research was only carried out from the people residing in Lahore as location was one of the limitation. Another limitation was the industry that the data was needed to be collected only from the project managers of IT industry. One of the potential limitation was that since we were targeting IT industry and we did not know the actual number of IT companies registered in Pakistan so we had to choose convenience sampling for this particular study.

5.6 Future Recommendations

There were a number of limitations while conducting this research that can be used as future research directions for other researchers. This research since lays a foundation to use Artificial Intelligence to manage project risks and presents the two constructs of project risks which includes change in scope and lack of required skills; future researchers can check direct impact of using Artificial Intelligence to manage one of other project risks that occur in IT projects which includes lack of top management commitment to the project, failure to gain user commitment, misunderstanding user commitment, Lack of adequate user involvement, failure to manage end user experience, conflict between user departments (Tesch et al., 2007) (Wallace et al., 2004b). Future researchers can also add team competencies team competencies as a moderator or add more than one intervening variables like team effectiveness, team management, team cohesion. Future research may also be carried out by conducting the same research in other regions as the current research is conducted for Pakistan, future researchers can carry the same research for some other region. The current research is carried out for IT industry of Pakistan, for future this research can be implemented in other industries such as healthcare or construction.

CONCLUSION

This study aims to investigate the impact of using Artificial Intelligence on managing project risks which includes change in scope and lack of required skills while using team competencies as a moderating variable. This particular study is based on the socio-technical system theory that supports the concept of coexistence of humans and machines working within the same environment. The hypothesis that were proposed for this particular study were all accepted and significant relationship was observed between the proposed variables. The results helped us to prove that the use of Artificial intelligence can help project managers to manage project risks that can occur within IT projects; more effectively and efficiently. Also the results showed significant relationship between team competencies and managing project risks and proved that the increased team competencies of project team members to use Artificial Intelligence can also increase their ability to manage project risks more effectively and efficiently. Thus it is therefore suggested that the use of Artificial intelligence should now become a common practice to manage project risks by project managers so that the projects can be delivered on time and risks are managed more effectively and efficiently.

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