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Predictive Variables for Agile Development Merging Cloud Computing Services

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ABSTRACT Cloud Technology is a most challenging modern area in the field of modern technologies in which assets (e.g., CPU and capacity) can be rented and discharged by the clients through internet on-demand basis. The cloud computing has been giving virtual computing services to a little, medium and extensive industries, and services, for example, infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). Cloud computing has a great combination with the agile software development as a research area. Many researchers worked in Agile Cloud field. The software industries are using the agile methodology for efficient software development need some platform to get quick feedback from the client. Therefore, the agile-cloud is a great combination for it but due to security reasons that directly influence the less adoption of cloud in software industries. This paper reports the survey results of software industries. The total of seven IT industries and many professionals was involved in this paper. However, this paper also contributes and reveals how existing issues can affect agile-cloud adoption for efficient software development. Furthermore, we do not find any type of survey conducted in Pakistan's software industries-related to cloud-agile adoption.

INDEX TERMS Agile-cloud computing, industries adoption, challenges and future directions.

I. INTRODUCTION

Cloud Technology is a standout amongst the most essential trends and modern area in the field of data innovation in which assets (e.g. CPU and capacity) can be rented and discharged by the clients through web on-request basis. Cloud basically spotlights to store the information on the offsite storage system that sorts out by the outsider (Third Party). Many organizations are expected to move their information from customary Computing to Cloud Computing [1]. The data can be access remotely by the internet. To facilitating customers in Cloud has a different type of services such as such as infrastructure as a service (IaaS), Platform as a service (PaaS), software as a service (SaaS).These all services used by small, medium and large Industries. These services facilitate the customer to store and access data remotely. The adoption of the cloud in Industries depends on its pros and cons [2]. The main purpose of the study is to take picture of adoption of cloud in IT Industries. In the next section cloud literature explain, later section explain cloud pros and cons. in the last section cloud adoption in IT Industries studied.

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II. LITERATURE WORK

The cloud is a phrasing with a extensive history in communication, which has in the previous decade, been received as an illustration for web based administrations, with a typical delineation in the system. This is a new computing standard. Cloud computing is accessible in an service or infrastructure as a methods for various assets, for example, programming, hardware and capacity sharing and so on [3]. Its primary element is virtualization and dynamic stability. It can be consumed through web Brower or via a defined API. The cloud user can store its data on cloud and access via the internet, Cloud structure explained in the **Fig.1**. The cloud provides services through the **Cloud service provider**. The cloud service provider is the third entities that handle and manage the data in the cloud. There are different services provided by the cloud to store and manage data on the cloud such as IaaS, PaaS [4] and SaaS shown in the Fig.2.

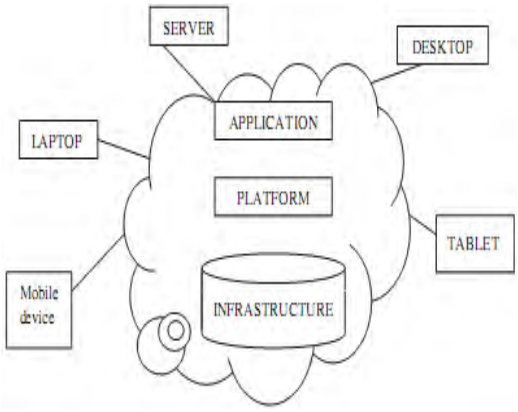

FIGURE 1. Cloud structure [10].

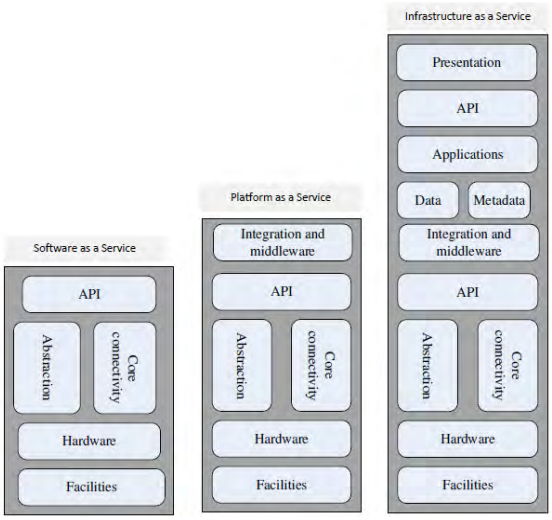

FIGURE 2. Represents the structure of the three delivery models [9].

SaaS has the capacity, that the customer can utilize the supplier's application running in the cloud. It is the in all likelihood possibility for SaaS application. It used for the small-scale software project and collaborated with software [5].

PaaS service the user can use it. Buyers can make are gained applications that can be made by utilizing programming languages or devices that are given by the end or of Cloud foundation [6]. IaaS is a capacity to give the purchaser through which it tends to be temporarily handling, storage, systems and other crucial computing assets where a customer can utilize and run the product [7], [3].

To make the cloud more legitimate and efficient for different types of institutions are working US National Institute of standards and technology (NIST) is one of them. NIST has significant importance in the cloud world because it tells about the five main advantages of Cloud Computing like four cloud deployment models and cloud services models. The US NIST defines cloud computing as a useful statement. NIST defines many standards for the security of data in the cloud.

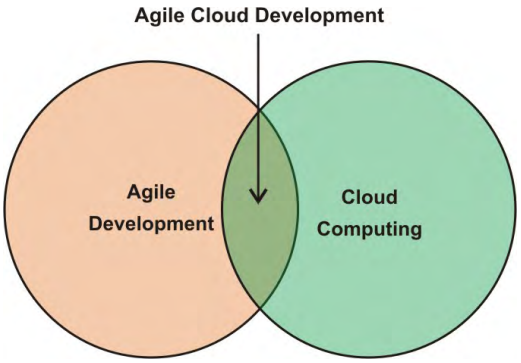

FIGURE 3. Agile-clouds combination [21].

TABLE 1. Agile-clouds benefits & challenges.

Benefits	Difficulties
Cloud is cheaper and more profitable.	Storage service group available at higher cost.
Fully Exploit of Resources	Security Third Party Risk
Choice and Agility	Lack of control
Next Generation Architecture	Lock-in
Distributed Application Development	Migration to Cloud expertise
Data Sharing via Cloud	Storage Capacity
Client quick feedback	Staff training

NIST defines standards on all level and services of Cloud Computing.

Currently agile is the most useful life cycle model in software industries to develop the efficient software application rather than any other traditional life cycle model. It's due to agile's unique features that facilitate the client such as runtime feedback, client involvement, distributed development and distributed client meeting. Now the agile and cloud computing is becoming a new area of interest for researchers to produce some output in it [21], [22].

III. CLOUD–AGILE COMBINATION

The sporty Development Processes enhance (however much as could be expected) the opportunity given by (PCs that do work for you. Yet, that are put away elsewhere and kept up by different organizations) because of doing software releasing rehashing again and again. Customer's perspective getting more all the time additionally helps the IT organizations to check and watch every last at each section of the upgrading benchmarks or versions. The benefits and challenges faced while adopting Agile-Cloud combination are mentioned below in Fig.3 [14], [17], [18]. The cloud offers an agile software development platform that makes it simpler for IT experts to create applications rapidly and to receive them quick time since it takes out the wait for deployment of appropriate hardware and software for the applications [21], [22], [31].

TABLE 2. This is the specification table that explains the whole survey objectives, data sourcing, data collection and survey goals.

Objectives	**To recognize the main confronts and research directions for Agile-Cloud. Also that why the adoption of cloud computing is not trendy in many IT industries.**
Subject Area	**Cloud Security**
Main Research Question	**What are the principle difficulties and research openings in Agile-Cloud, as far as philosophies and what has just**
	been done in these couple of long periods of Agile-Cloud explore, from the software industries viewpoint?
More Specification Subject Area	**Cloud Adoption in IT Industries**
interference	**Surveys, definition and other types of research related to Agile-Cloud research combination**
Type of Data	**Excel Sheet, Questionnaires**
How Data Was Acquired	**Researcher-made Questionnaire Analysis**
Data Format	**Analyzed and statistical data**
Experimental Factors	**Data model consisted of software developers who mostly are software development persons in IT industries. The researcher design the questionnaire which contained data on Cloud Adoption and Security Risks Associated with it.**
Experimental Features	**Cloud Third Party Services security risk is a major factor of Adoption of Cloud.**
Data Source Location	**IT**
Data Accessibility	**Data is Included in this Article and also attached as Supplementary File**

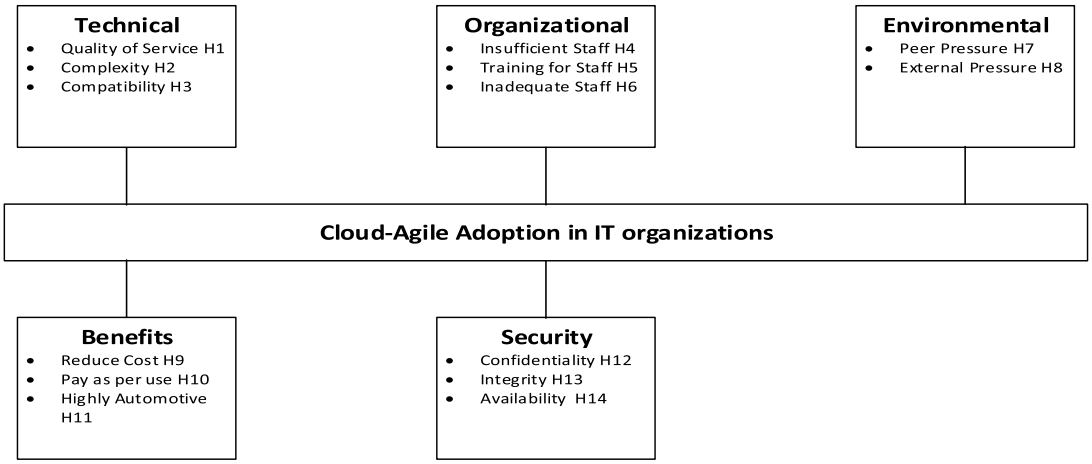

FIGURE 4. Research framework.

The agile-cloud combination has some benefits as well as some challenges mentioned below in the table.1 these directly impact the cloud adoption for agile software development in software industries.

IV. INDUSTRIAL SURVEY

The research framework is shown above in Figure.4. The core Variables of survey research are Technical, Organizational, Benefits, Environmental and Privacy& Security. The main purpose of our study is to explore the adoption of cloud computing in different software industries. We focused that how the companies are getting benefits and are facing issues cloud-agile combination. For this information, we conduct a survey through the questionnaire in different software companies. We collect survey from the 7 software industries and arrange meeting session with developers to complete the study as mentioned below table.3.

The literature of the review examine has been converged under the factors both dependent and independent considered. In the investigation, the dependent factors recognized as cloud computing appropriation in the software Industries. The dependent and independent variables as shown in table.4 below. The value of dependent variables fluctuates with the values of independent variables in the regression

TABLE 3. Surveyed industries.

Goal	Adoption of Agile-Cloud in IT Industries
Targeted Population	Software Developers, Team Leaders, & Project Managers.
Data Collection Mode	Questionnaire, Interviews
No of Industries for Survey	7
Total Questions	14

TABLE 4. Dependent variable & independent variable.

Dependent Variable	Independent Variable
Technical	Quality of Service, Complexity, Compatibility
Organizational	Insufficient Staff, Training for Staff, Inadequate Staff
Security & Privacy	Confidentiality, Integrity, Availability
Environmental	Peer Pressure, External Pressure
Benefits	Reduce Cost, Pay per Use, Highly Automotive

analysis in the table. The dependent and independent variables are shown below in the table. In our survey 5 variables are dependent and 14 independent variables. These 14 variables directly affect and influence the values/rating of 4 dependent variables.

A. VALUE OF DATA & RESEARCH

- These data present research and statistical data on cloud services (e:g Software, Servers and Storing) adoption in IT software Industries as it relates to software development and security issues of It Industries towards Cloud.
- The results show that the use of cloud use is beneficial but the security risk associated with it. That ultimately affects cloud adoption for use.
- The results of this study and survey can be used to introduce a new security mechanism for IT Industries in a most highlighted challenge.

B. RESEARCH METHODOLOGY

Broad literature review, the examination strategy has been fixated on the as of now identified existing core factors. Along these lines the immediate connection between these variables used to make the model of research and study and to demonstrate that what variables give what affect on cloud adoption [19], [20], [23], [30].

1) TECHNICAL

In the technical variable of the research further contains the point to derive the research as Quality of service, Complexity, and Compatibility.

The hypothesis for the following variable:

Hypothesis 1 (H1): Quality of Service has a positive effect in terms of reliability and validity.

Hypothesis 2 (H2): Complexity has negative effect impact on cloud adoption.

Hypothesis 3 (H3): Lower degree of compatibility with the cloud service provider in the adoption of cloud computing has a negative impact.

2) ORGANIZATIONAL

In the organizational variable of the research further contains the point to derive the research as insufficient skilled staff Training for staff and Inadequate resources.

The hypothesis for the following variable:

Hypothesis 4 (H4): Insufficient staff in an organization has a negative impact in the cloud adoption.

Hypothesis 5 (H5): Training for staff has a negative and significant effect.

Hypothesis 6 (H6): Inadequate staff has a negative and significant effect.

3) ENVIRONMENTAL

In the environmental variable of the research further contains the point to derive the research as Peer pressure and External pressure.

The hypothesis for the following variable:

Hypothesis 7 (H7): the Higher rate of peer pressure in cloud computing has a positive impact.

Hypothesis 8 (H8): the Higher rate of external pressure in cloud computing has a positive impact

4) BENEFITS

In the Benefits variable of the research further contains the point to derive the research Reduce cost, Pay as for use and highly automotive.

The hypothesis for the following variable:

Hypothesis 9 (H9): Reduce cost has a positive effect on cloud adoption.

Hypothesis 10 (H10): Pay as for use has a positive impact on cloud adoption.

Hypothesis 11 (H11): Highly automotive has a positive effect on cloud adoption.

5) SECURITY & PRIVACY

In the Security & Privacy variable of the research further contains the point to derive the research as Confidentiality, Integrity, and Availability.

The hypothesis for the following variable:

Hypothesis 12 (H12): Confidentiality has a negative effect on cloud adoption.

Hypothesis 13 (H13): Integrity has a negative impact on cloud adoption.

Hypothesis 14 (H14): Availability has a negative effect on cloud adoption.

V. EXPERIMENTAL DESIGN, MATERIALS AND METHODS

The hypothesis inquiries for our overview are planned by concentrate the other specialist's studies that they directed from various software industries for spry cloud appropriation. We select a few parameters for our investigation based on industries [19], [23], [29]. The questions are mentioned below.

HQ 1	Does your organization use Cloud services ever or using now?
HQ 2	Do you think Quality of Service has a positive effect in terms of reliability and validity?
HQ 3	Do you think Complexity has negative effect impact on cloud adoption?
HQ 4	Do you think a lower degree of compatibility with the cloud service provider in the adoption of cloud computing has a negative impact?
HQ 5	Do you feel Insufficient staff in an association has a negative effect in the cloud reception?
HQ 6	Do you feel Training for staff has a negative and significant effect?
HQ 7	Do you think the inadequate staff has a negative and important effect?
HQ 8	Do you think a Higher degree of peer pressure in cloud computing has a positive impact?
HQ 9	Do you think the Higher degree of external pressure in cloud computing has a positive impact?
HQ 10	Do you think to Reduce cost has a positive effect on cloud adoption?
HQ 11	Do you think to Reduce cost positively affects cloud selection?
HQ 12	Do you think Pay as for use has a positive impact on cloud adoption?
HQ 13	Do you think Confidentiality has a negative effect on cloud adoption?
HQ 14	Do you think Integrity negatively affects cloud reception?

VI. RESULTS AND ANALYSIS

We arranged a survey session in many reputed software companies. When the survey 100 participants joined the surveys session, the questionnaire was checked properly and the overview papers of the members who did not give their unmistakable reaction gave inadequate data and missing data were removed from the variety of complete review papers.

Before testing and applying any statistical analysis of the hypothesis, it is important to check the unwavering quality and legitimacy of the work [7]. For this reliability checking the Structural Equation Model was developed in the SPSS and results are shown below in Table.5.

The outcomes uncovered Cronbach's Alpha of every dormant variable are above 0.7, Composite Reliability factor in the table is additionally more prominent than 0.70 that it ought to be and Average Variance Extract (AVE) of every latent variable is above than the 0.50. In this manner

TABLE 5. Cronbanch's Alpha.

Latent Variable	Cronbanch's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Security	0.8287	0.947	0.70
Technical	0.8023	0.9276	0.67
Organizational	0.8212	0.927	0.62
Environmental	0.7338	0.9428	0.71
Benefits	0.71	0.9221	0.73

TABLE 6. Descriptive analysis of cloud adoption issues.

Latent Variable	Mean	SE	SD	SK	KU	Yes	No
Quality of service	0.84	0.34	0.37	-1.9	1.7	84	16
Complexity	0.74	0.34	0.44	-1.1	-0.7	74	26
Compatibility	0.70	0.34	0.46	-0.9	-1.2	70	30
Insufficient Staff	0.78	0.34	0.41	-1.3	-.06	78	22
Training for Staff	0.60	0.34	0.49	-.42	-1.9	66	44
Inadequate Staff	0.58	0.34	0.49	-.33	-1.9	58	42
Peer Pressure	0.52	0.34	0.50	-.08	-2.0	52	48
External Pressure	0.56	0.34	0.50	-.24	-2.0	56	44
Reduce Cost	0.90	0.34	0.30	-2.7	5.7	90	10
Pay as for Use	0.88	0.34	0.32	-2.4	3.9	88	12
Highly Automotive	0.72	0.34	0.45	-1.0	-1.0	72	28
Confidentiality	0.92	0.34	0.27	-3.1	8.5	92	8
Integrity	0.80	0.34	0.40	-1.5	0.40	75	25
Availability	0.68	0.34	0.47	-0.7	-1.4	68	32

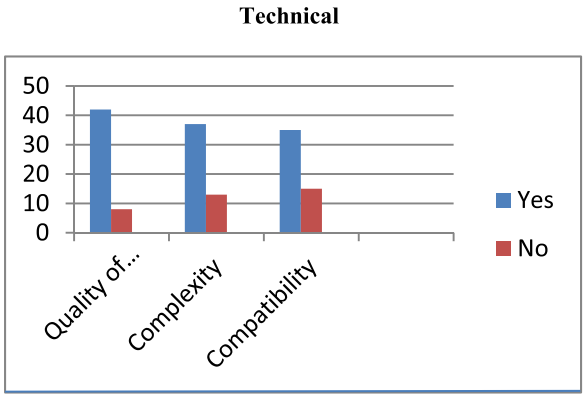

FIGURE 5. Technical factors influencing cloud adoption.

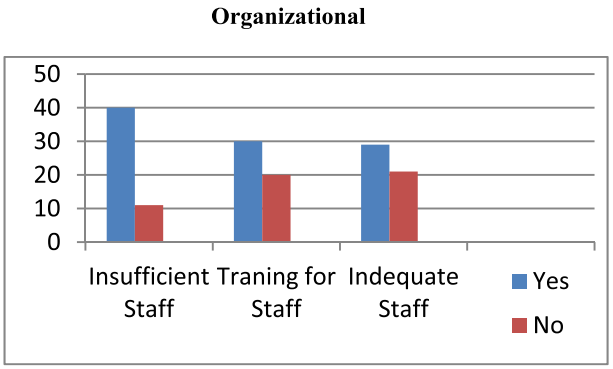

FIGURE 6. Organizational factors influencing cloud adoption.

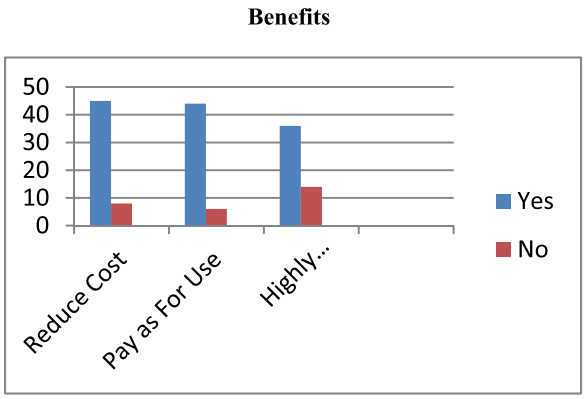

FIGURE 7. Benefits factors influencing cloud adoption.

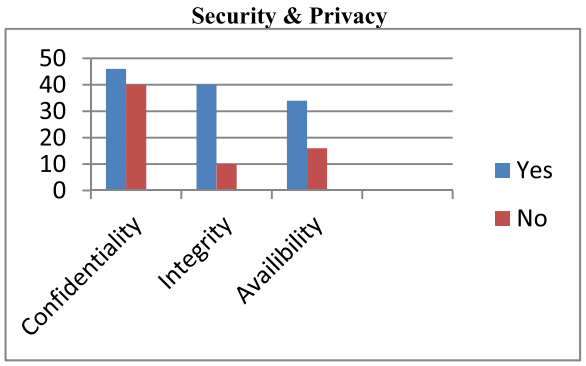

FIGURE 8. Security & privacy factors influencing cloud adoption.

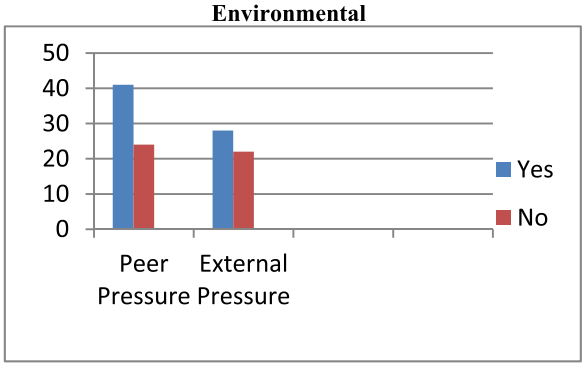

FIGURE 9. Environmental factors influencing cloud adoption.

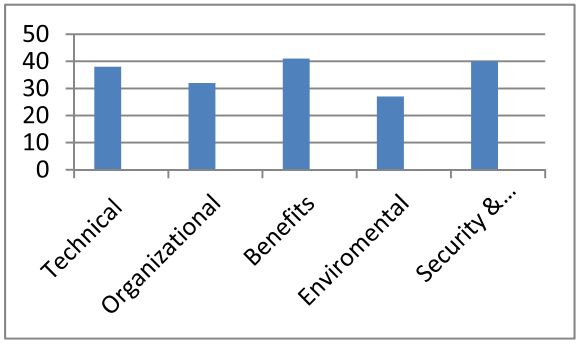

FIGURE 10. Dependent variables ratio/percentage.

the all factors are statistically reliable and legitimate as referenced in [24].

In cloud agile appropriation challenges review, the developers answered Yes/No hypothesis to get their contribution about that which factors according to them should be considered most influential in the agile cloud adoption. For this we 100+ participants took part in a survey.

The means and Mode of all variables in the descriptive are 1 and the estimations of SES and SEK are 0.824 and 0.152 individually for every one of the factors. The Descriptive Analysis of the overview is appeared in table 6.

The above applied descriptive analysis on data states that 89.34% of the developers highlight that cloud computing adoption in the software industries reduce the cost, while developers also observed Pressure 52%-56% (External and Internal), confidentiality is the majority significant factor in the acceptance of cloud computing in software industries with 91.55% and subsequently 72.% and 75.44% participants agreed upon highly automotive and integrity are the most important factors.

For the quality outcomes, we utilized Regression Analysis shown below in table.7. It is utilized to assess the connection between the dependent variable and many independent variables In this paper, linear regression analysis is utilized

TABLE 7. Regression analysis.

Latent variables	Model Summary		ANOVA		Unstandarized Coefficients		Standardized Coefficients	t	Sig. t
	Multiple R	R^2	*F*	*Sig.F*	*B*	*SE*	*ß*		
Quality of service	0.82	0.68	99.84	0.00	0.93	0.09	0.82	9.99	0.00
Complexity	0.76	0.49	47.67	0.00	0.64	0.10	0.76	6.35	0.00
Compatibility	0.70	0.49	47.67	0.00	0.63	0.09	0.70	6.90	0.00
Insufficient Staff	0.53	0.28	19.12	0.00	0.53	0.12	0.53	4.37	0.00
Training for Staff	0.65	0.42	35.20	0.00	0.55	0.09	0.65	5.93	0.00
Inadequate Staff	0.62	0.38	30.62	0.00	0.52	0.09	0.62	5.53	0.00
Peer Pressure	0.55	0.30	21.12	0.00	0.45	0.10	0.55	4.59	0.00
External Pressure	0.50	0.25	16.16	0.00	0.41	0.10	0.50	4.02	0.00
Reduce Cost	0.62	0.39	31.20	0.00	0.86	0.15	0.62	5.58	0.00
Pay as for Use	0.69	0.48	44.92	0.00	0.88	0.13	0.69	6.70	0.00
Highly Automotive	0.74	0.55	59.54	0.00	0.68	0.08	0.74	7.71	0.00
Confidentiality	0.55	0.30	21.39	0.00	0.84	0.18	0.55	4.62	0.00
Integrity	0.94	0.88	37.40	0.00	0.97	0.05	0.94	19.3	0.00
Availability	0.56	0.32	22.76	0.00	0.50	0.10	0.56	4.77	0.00

to clarify the measurable connection between the independent/predicted variable i.e. Cloud Adoption [12], [13], [15], [23] Explained in table.7 underneath. The values in the table are clarified well ordered as pursues: Multiple R is the square of the R square and it picks the association coefficient between the picked predicted dependent variable and independent variable [25]. Table. 5 demonstrates that the Reduce Cast has the most imperative relationship coefficient (0.62) with the cloud selection subordinate variable and exceptionally Socio-economic status has in any event connection (0.503) among 14 anticipated factors. The correlation coefficient is continually going among $+1$ and -1. Correlation coefficient regards among (0 to 0.3) are considered as week coordinate relationship, among (0.3 to 0.7) exhibits sensible relationship among (0.7 to 1) exhibits solid association [26], [29]. The accumulate estimations of affiliation coefficients of the anticipated components are the reasonable and solid association with independent variable. R Square (R2) is known as it is degree or percent of the variable endogenous variable by virtue of exogenous parts or we may state it is the component of variable among foreseen and subordinate variable [27], [29]. It gives the data for all intents and purposes the majority of the reasons of progress inside factor in light of predicted factors and up to what percent each anticipated variable is an outcome of difference [28]. The given underneath Table uncovered that the Reduce Cast variable of Advantage assembling can clear up 94% of the combination in the cloud gathering subordinate variable and fantastically Socio-cash related status variable of Environment make has at any rate R2 (25%) among 14 predicted parts.

F-test in relapse examination portrays that anticipated variable played out his activity well while foreseeing the needy variable and centrality level between exogenous factors and endogenous variable. All the F-values are factually huge as Sig. F (P-esteem <0.05). Consequently, all the

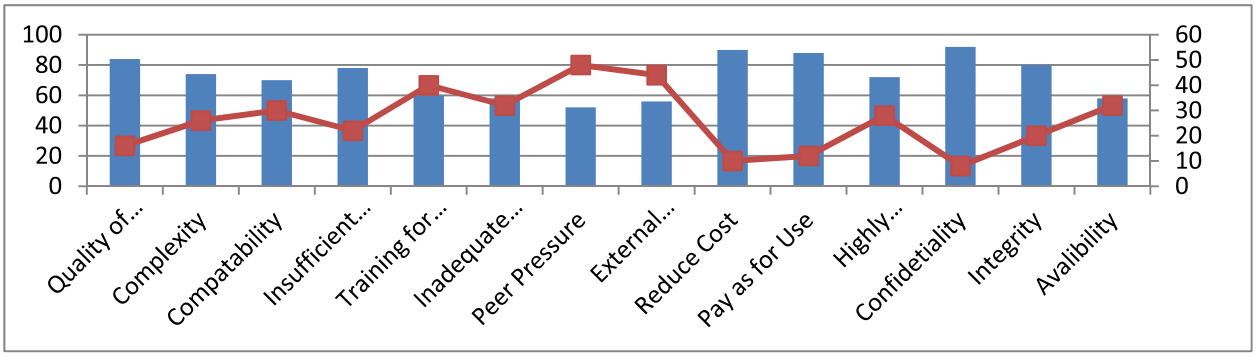

FIGURE 11. Combination results of hypothesis.

anticipated factors are noteworthy and they performed a great job in the expectation of ward variable. B under the segment of Unstandardized Coefficients is utilized to anticipate the needy variable dependent on the estimation of the autonomous variable [6]. It portrays in the event that one unit expanded/diminished in the free factor, what number of units will be expanded/diminished in the reliant variable. Loss of Governance B coefficient is. 845 implies that on the off chance that one unit expanded in the autonomous variable,. 845 unit will be expanded in the Cloud appropriation subordinate variable. Amid the investigation, most elevated B coefficient esteem saw in Table. 7 is a free factor of Integrity (0.97) and afterward Reduce Cost has (0.86). The base B coefficient saw of an autonomous variable (0.41). The ultimate result of the Regression Analysis is ß. It is generally used to contrast the level of free factors with realizing which anticipated variable has more impact on ward variable. Here in this examination, we are not differentiating self-sufficient components and each other, thusly; the ß estimation of each free factor is same as Multiple R regard. It used to recognize and expel the invalid theory. The ß regard is connected with t-regard and criticalness of t-regard (2-tail p-regard) to check whether the coefficient is by and large more than zero or underneath zero and subject to this, ß regard either negative or positive. The ß values, t-characteristics, and p-estimations of Regression are bankrupt down and found all ß values are in a general sense not exactly equivalent to 0 since p-values are under. 05. Thusly, the explanation of augmentation in the reliant variable will be established on the un-standardized beta coefficient of the free factor.

During the survey of results about the factors influencing agile-cloud adoption is presented in Figure. 3 to Fig. 7. Figures 3 to 7 are explaining the separate results of every dependent variable with the independent variables. The graph 8 is highlighting the results summarize all the hypothesis values with the related dependent variables I;e Security & Privacy variable has 3 hypothesis/independent variables as shown above in the research framework diagram. We get research questions answers in Yes and No. Therefore the Yes answer values of this hypothesis added and make a final result analysis shown in Figure.8. The basic purpose of this graph is to categorize the highest and low results of the survey. As mentioned Security & Privacy and Benefits variable's values are almost the same. The software house can get many benefits by adopting agile-cloud computing combination but on the other hand, software house has high-security risks that create challenges for Agile-Cloud Combination. The study concludes that the major reason for less adoption of cloud computing in software Industry is the security and privacy risk of data on cloud services platforms. On the other hand, the major reason for the adoption of cloud services is cost benefits to software industries.

VII. CONCLUSION

In this investigation, we distinguished persuasive factors in the combination of agile-cloud computing dependent on existing writing and suggestions of the analysts. We validate the correctness of our hypothesis by the different tests such as Cronbach's Analysis test. The survey conducted in many software Industries to draw an image of adoption of agile-cloud computing in software Industries. The major reason for the adoption of the cloud in the software Industries is the cost-effectiveness, on another hand major reason for less adoption of cloud-agile is the security and privacy of information. Hence there is a need to address the issue of security so that the adoption rate can become grow.

FUTURE DIRECTIONS

In the future, there is a need to develop the more secure and proficient data security mechanisms in cloud services so that the adoption among the Industries become increase. The cloud security organization such as NIST should introduce the security frameworks for agile-cloud adoption in software industries. There is also a need to train the staff and clients about the use of cloud services and make the feedback meeting more efficient and resulting. Industries should arrange cloud adoption effectiveness sessions among staff. In the next version of this paper, author will propose a security framework with the comparison/analysis of previously proposed work by researchers for agile industries can adopt cloud and more or less control the security risks from Agile-Cloud combination.

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