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Ethics in Cloud Computing: Implications for India

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Abstract : ***Cloud Computing (CC) has drawn the attention in global business level. It is another age of computing systems, progressively creating a promising answer to computing complexity and increasing size of data. Although the evolution has not reached the maturity level but still there is adequate research about this topic. The study is proposed to identify the factors, which influences cloud computing adoption (CCA) in India through ethical context. Research was conducted using methodology of quantitative technique, which was based on study of 149 respondents from different industries in India. A research model was proposed which consisted of 6 hypothesis and then tested through multiple regression methods and factor analysis. The findings of the study shows that reliance on technology, proscriptive pressure and control are significant contributors and functional creep, compliance and educational pressure were insignificant contributors. It classifies probable advantages and probable ethical or moral issues for would be clients, particularly in the field of business.***

KEYWORDS Factors, Cloud Computing, Ethical, India

I. INTRODUCTION

It is quite simple to see that Cloud computing (CC) can prompt various issues related to ethics. The most evident one is privacy that can emerge as an issue when clients store individual information in clouds and lose control on access and utilization rights. Along these lines, there is a valid justification to trust that CC warrants moral or ethical investigation. Are there inescapable moral issues in CC? In what capacity may we realize which issues consider noble and how are they to be evaluated? At present there is 'no' for the most part concurred answer to these enquiries. Hence, it is basic to not just comprehend the effect and advantages of rising advances like CC as a conceivably widespread innovation because of advances universal nature but also comprehend their probable ethical or moral issues logically and at application level in developed and developing nations.

The vast majority of the writing originates from computer engineering and concerns innovation in technology [1] [2]. Various business magazines have committed respect for the clarifications behind grasping CC in trade, to request concerning the money related execution of specific firms, and to a lesser degree to the possible perils [3].

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This paper means to give a preliminary insight into ethical or moral issues of CC.

II. RELATED WORKS

CC is quite a developing innovation. We do not yet envision its proper use for later on and which moral, social, or lawful outcomes these uses will have. We do not yet comprehend its utilization in later stage and which moral, social, or lawful results these utilizations will have. If we pay, attention to moral and issues related to them at an early stage then one can save both money and time that can be used later in vanquishing them.

It can support client acknowledgment and advance advantageous parts of the innovation.

John McCarthy along with Douglas Parkhill, imagined in the start of 60s envisioned that calculation may some time or another be organized as an open utility like power and water [4] [5].

As per study conducted by Mohamed and Dikaiakos et al., 2009, CC has been amid the sixties and since the offer of a significant bandwidth in the nineties; it could be produced to serve the majority. The advancement of CC has experienced numerous stages, for example, utility and grid computing, application benefit arrangement (ASP), and SaaS [6] [7].

Also, as per Dikaiakos et al. (2009) and Gartner, (2010), the growing trend of IT is CC that moves computing and information far from work area and convenient PCs into extensive data centres. It essentially implies that applications are conveyed as administrations over the internet and additionally to the real cloud infrastructure [7] [8].

As per Kim (2009), from client perspective it implies, that the client can get to his/her records, information, programs and different administrations from a net portal by means of the net that are facilitated by different service providers [9].

CC not only make it less difficult for individuals for working on shared projects, reduction of IT infrastructure, expensive software, data servers whose use is minimal and various distinctive stuffs. One needs a genuinely plain PC, related with the web, some fundamental programming, and a pay-per-use participation as per requirement to providers of service. The servers in the datacenters may go down clearly. To control the hazard of intruded with administration because of power blackouts, datacenters are organized close power plants also, information are verified on different grouped physical locales—the more noticeable the amount of regions where your data are secured, as you pay more [14].

Illustration is datacentres of Google, are in Oregon, Oklahoma, and two or three diverse US states, likewise in Chile, Belgium, Ireland, Finland, Netherlands, Taiwan, Singapore and Changhua County.

This is moreover substantial for various firms. Cloud services may stand up to issues in light of which they become quickly out of reach. For the various firms reliant on cloud benefits, this induces intrusion of their areas, their customer services or possibly their business firms. New companies are mostly affected, cloud firms require their clients to pay more to store information in more server firms to decrease the hazard; at any rate, and littler firms are progressively unwilling to have the ability to deal with the expense of this. Insurance agencies have started making things covering a bit of the dangers of power blackout and administration interference, publicizing them both to suppliers and clients of cloud administrations; anyway it is dark to what degree littler associations benefit from this progression [14].

From the extant literature the following factors has been identified and is used for further study

Table 1. Provides the list of factors, which are found from extant literature as determinants for CCA.

Context	Factors	Definitions in the study	Sources
Ethical	Control	It refers to direct control over the data once it is stored.	[10] [11] [12]
	Functional Creep	Information collected for a particular reason, after some time may finish up utilized for other (sudden, undesirable) things.	[12]
	Reliance on Technology	Alludes to customers encounter issues when they have ended up being too much dependent on the innovation especially in association with interoperability of gadgets and frameworks.	[10] [12] [13] [14] [15]
	Proscriptive Pressure	Refers to pressure when government allows a new innovation and if it has some major drawbacks or dangers then it reconsiders its strategy.	[14]
	Compliance	A noteworthy piece of protection and safety systems are built as a set of guidelines. A Cloud administration ought to follow a subset of the norms regarding the utilization of the services.	[14] [15]
	Educational Pressure	Clouders need general information about the preferences and burdens of CC. The terms of utilization by the cloud suppliers are hard to comprehend which is one of the fundamental barriers impeding satisfactory correspondence between the business and their clients.	[14]

3.1 Ethical Factors Affecting Cloud Computing Adoption

3 RESEARCH FRAMEWORK AND HYPOTHESIS

From the identified ethical factors, the research framework has been proposed and the hypothesis is developed below.

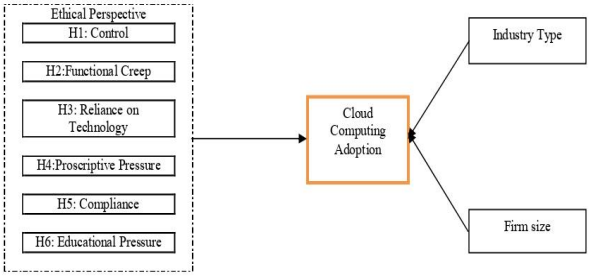

Fig. 1. Ethical factors that effect CCA

3.1.1 Control (CO) CC involves the redistributing of ICT assignments to outsider specialist co-ops. Any data that used to put away locally is put away in the cloud. Subsequently the clients of a cloud PC benefit give up command over calculation and information [10] [11] which can be hazardous if something turns out badly like unapproved get to, data debasement, infrastructure failure, or inaccessibility [16] it very well may be hard to perceive who has caused the issue, and, without strong proof it is almost outlandish for the gatherings required to consider each other in charge of the issue if a debate emerges [11]. It is an important ethical factor for CCA. Hence, the proposed hypothesis is:

H1: CO influences CCA

3.1.2 Function creep (FC) Another risk to information put away in the cloud is the alleged functional creep: information gathered for a particular reason, after some time may end up utilized for other (unforeseen, undesirable) things. A biometric information database of subjects might be intended for confirmation goal however may then end up being extremely useful for crime examinations is an illustration [12]. It is an important ethical factor for CCA. Hence, the proposed hypothesis is:

H2: FC influences CCA

3.1.3 Reliance on technology (RT) RT also is an important factor the data stored in a cloud may be hacked by hackers. There may be involvement of the cloud provider also for the same. As data or information is not stored locally, authority over the information is moved to the service providers. The off shoring of information similarly raises the issue of who has the information, which the client stores in cloud and what can suppliers of the cloud firms do with this data. The off shoring of information likewise brings up the issue of who has the data a customer stores in the cloud and what can providers of the cloud firms do with this information. The two reasons gather that to clients it won't by and large be clear what they can foresee from expert firms in the cloud concerning security [10] [12] [13] [14]. Hence, RT has been considered as an important factor in CCA. Hence, the proposed hypothesis is:

H3: RT influences CCA

3.1.4 Proscriptive Pressure (PP) We work from the doubt that inconsequential PP must be put on encouraging firms and cloud suppliers, anyway that genuinely wide PP may be applied on business clouders. The case isn't that growing obviously destructive innovation ought to be permitted; it doesn't promptly apply to atomic power, as its dangers are somewhat clear to decide. Or, on the other hand possibly, the thinking is that in a condition wherein clear indications of real disadvantage threats are so far lacking, government bans are troublesome. If we consider this viewpoint, CC industry requires just minor proscriptive pressure [14] [17]. Hence, the proposed hypothesis is:

H4: PP influences CCA

3.1.5 Compliance (COM): This factor plays an important role. A noteworthy piece of protection and safety systems are built as a set of guidelines. A Cloud administration ought to follow a subset of the norms regarding the utilization of the services. At the end of the day, compliance covers an arrangement of rules that ought to be considered amid both advancement and support procedure of the framework [15]. Hence, the proposed hypothesis is:

H5: COM influences CCA

3.1.6 Educational Pressure (EP) Clouders need general information about the preferences and burdens of CC; and they need specific learning about the administrations they purchase and utilize or think about purchasing or utilizing. The terms of utilization by the cloud suppliers are hard to comprehend which is one of the fundamental barriers boundaries impeding satisfactory correspondence between the business and their clients. The arrangement we propose here is that the CC industry ought to make progress toward interlucent communication [14]. Along these lines, the clouders should be careful about picking the words in the records and keeping in mind that disclosing them to the probable customers.

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Interlucent specialist co-ops convey their conversation to the target group, and their comprehension is tracked. Hence, the proposed hypothesis is:
H6: EP influences CCA.

Two control factors were distinguished. Right off the bat, the industry segment inside which firms work has been appeared to impact IT adoption [30]. Distinctive business needs in various industry segments may influence advancement takes-up [26] [27] [28]. Furthermore, bigger firms ostensibly have more assets, skills, experience and subsequently capacity to receive new advancement than smaller firms. Similarly smaller firms can be progressively creative as their more straightforward hierarchical structures seemingly grant greater business agility [29]. In this manner industry segment and association estimate (micro, small and medium) are viewed as control factors.

III. RESEARCH METHODOLOGY

This research means to decide the factors affecting firm's choices to CCA from various industries in India, with the end goal to enable firms to more readily think about their future adoption of cloud. For micro enterprises, the maximum number of employees is up to 10 employees, for small enterprises, it is from 10 to 50 and for medium enterprises, it is from 50 to 100. Data was collected through secondary sources like literature review and various other reports. Also, primary data was collected through preparation of structured questionnaire. The research design of the current study is based on empirical research. The target populations were SMEs operating in India and stratified random sampling technique was adopted as it allows population harmony from the sub population [18]. The sample was selected through the technique of Stratified Random Sampling method. The analysis was done in SPSS 21.0. The reliability of the items was accessed using Cronbach's alpha which was analysed using descriptive summary analysis (α>0.70). Validity of each factor was verified using confirmatory factor analysis (CFA), on all 28 survey items, principal axis factoring extraction was used. For testing all the six hypotheses, factor analysis's consequences were utilized as intake values for analysis of multiple regression (MLR). The six independent factors (CO, FC, RT, PP, COM and EP) and dependent variable (CCA) was tested utilizing Pearson's relationship and multiple regression. Control variables' (firm size and type) effect on measure of dependency, ANNOVA test was utilized.

IV. RESULTS AND DISCUSSION

191 responses were received in total. 42 were excluded due to incompleteness, leaving 149 usable responses. Descriptive analysis (table 2) demonstrated the sampled SMEs contained small enterprises (20.8%), medium (17.4%) and mostly micro enterprises (61.8%). The indications showed that 15.5% respondents used CC forms.

Table 2. Responding firms' demographics characteristics (n = 149)

Group	Number of Reaction	%
No. of employees		
0 - 10 (micro)	92	61.80%
10 - 50 (small)	31	20.80%
50 - 100 (medium)	26	17.40%
Use of cloud computing		
Yes	20	15.50%
No	129	84.50%

So as to decide if there was sufficient unwavering validity and reliability of the measures Cronbach's alpha and factor analysis were utilized.

For each reflective indicator the Cronbach's alpha was >0.7 so it permits to accept internal consistency [19]. The eigenvalue of extracted factors is greater than 1, (refer Table 3) and on its associated factor (loadings >0.50) each reflective indicator loaded strongly. As no reflective indicators cross-loaded as a result Discriminant validity was established (refer Table 4). In order to produce uncorrelated factor structures, orthogonal varimax rotation was used. Factor analysis was run many times and indicators which did not load were removed i.e., <0.50 [20] except FC4. There were three items (1 PP item and 2 RT items) which was removed as per assumptions associated with Cook's distance [21]. Finally, 62% of variability is explained by the 6 extracted factors.

Table 3. Explanation of Total Variance

Factor	Initial Eigenvalues			Extraction Sum of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
CO	5.814	27.688	27.688	5.435	25.882	25.882	3.231
FC	3.089	14.711	42.399	2.838	13.514	39.396	2.435
RT	2.08	9.906	52.305	1.707	8.128	47.524	2.137
PP	1.799	8.568	60.873	1.329	6.33	53.854	1.85
COM	1.353	6.445	67.318	0.951	4.529	58.383	1.685
EP	0.987	4.698	72.016	0.583	2.777	61.16	1.506

Note: Extraction Method is Principal Axis Factoring

From table 4 we can see that all reflective indicators (items) loads significantly on their factors (CO, FC, RT, PP, COM and EP) respectively except, FC4, although its loading (0.464) is above the 0.4 threshold [19]. Further, as it supported discriminant validity the items were not cross-loaded. As such, there is inspiration to recognize that the instrument gives a reasonable measure of the estimated variables.

Factor analysis yielded one factor (CCA) for the dependent variable with an eigenvalue >1 clarifying 97.4% of the variance. No rotated pattern matrix was imposed because of one extracted factor.

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Table 4. Pattern matrix of factor analysis for the independent variables

Items	Factors					
	RT	FC	PP	EP	COM	CO
RT3	**0.704**	0.266	0.119	0.14	-0.18	0.062
RT1	**0.678**	0.189	0.167	0.16	-0.17	0.064
RT2	**0.617**	0.183	0.100	-0.117	-0.062	0.173
RT4	**0.588**	0.255	0.153	0.045	-0.118	0.044
FC1	0.33	**0.733**	0.203	0.075	-0.081	0.135
FC2	0.313	**0.693**	0.139	0.096	-0.034	0.135
FC3	0.244	**0.564**	0.252	0.081	-0.133	-0.123
FC4	0.255	**0.464**	0.249	0.064	-0.004	0.014
PP1	0.264	0.158	**0.728**	0.137	0.083	0.163
PP2	0.142	0.136	**0.74**	0.044	0.053	0.148
PP3	0.105	0.321	**0.627**	0.077	-0.006	0.133
EP3	0.05	0.078	0.13	**0.722**	-0.013	0.109
EP1	-0.104	0.112	-0.001	**0.685**	-0.166	-0.005
EP2	0.266	0.000	0.072	**0.622**	0.032	-0.064
COM2	0.092	-0.132	-0.07	0.001	**0.879**	0.057
COM3	-0.019	0.095	0.175	-0.085	**0.724**	0.023
COM1	-0.215	-0.159	-0.008	-0.06	**0.551**	-0.056
CO4	0.112	-0.011	0.131	-0.014	-0.018	**0.966**
CO2	0.106	-0.039	0.127	0.002	0.013	**0.914**
CO1	0.121	0.062	0.16	0.007	-0.018	**0.846**
CO3	-0.012	0.131	0.028	0.056	0.04	0.752

Note: Extraction Method (Principal Axis Factoring); Rotation Method (Varimax with Kaiser Normalization); Rotation converged in 7 iterations.

In order to determine if the extracted factors could significantly explain CCA in SMEs', MLR using simultaneous enter method was utilized.

Underlying assumptions of the regression analysis were assessed and met (ANOVA p-value <0.001). Parametric testing of our data, which was derived on a likert scale, is justified as testing by Norman (2010) showed that (1) "parametric tests not only can be used with ordinal data, such as data from likert scales, but also that parametric tests are generally more robust than nonparametric tests " and (2) "parametric tests are adequately strong to yield to a great extent fair answers that are acceptably near "reality" while examining likert scale reactions" [22] [23]. Factors significantly contributing to these results were CO, RT and EP. Practically all SMEs underscored that their necessities could be met by CC and agreed/strongly agreed (Mean 5.03 out of 7, SD 1.5458) with the explanation that their firm would find a way to embrace CC in future to come. To recognize the overall commitment of each extracted factor MLR can be considered for hypothesis 1-6. In the prior IT adoption studies, this is the widely used technique [24] [25]. The analysis are shown in Table 5 below. Thus, the accepted hypotheses are hypotheses 1, 3 and 6 (from Table 5 and Fig. 2).

Table 5. Coefficients of MLR

Model	B	Beta	t	Sig.	Tolerance	VIF
(Constant)	0.037		1.156	0.247		
RT	0.186	0.19	5.634	**0.000**	0.995	1.005
FC	-0.002	-0.002	-0.049	0.961	0.993	1.007
PP	0.192	0.187	5.495	**0.000**	0.985	1.011
EP	-0.017	0.018	-0.563	0.574	0.999	1.001
COM	0.006	0.006	0.188	0.851	0.998	1.002
CO	0.853	0.873	25.969	**0.000**	0.998	1.002

Note: R2 = 0.840; Adj. R2 = 0.833; F (6,142) = 19.834; P<0.001

In the output it is shown that there is positive, significant and strong relationship of CO, PP and RT with CCA (p<0.001). EP, COM, and FC were insignificant contributors to CCA (p >0.05). Inorder to check the effect of independent (autonomous) variables on the dependent (reliant) variable (CCA), ANOVA test was performed which varied on firm size and industry type.

From Table 6, the results indicate that CCA as a function firm size is statistically insignificant (p<0.05), i.e. micro firms are less likely to CCA than SMEs. A probable reason can be micro ones do not have larger funds to allocate whereas; large amount of funds can be allocated by small to medium firms to these initiatives. SMEs' industry types variances related were not different and statistically insignificant (p >0.05). It gave opposite discoveries from earlier research [26] [27], this result is unexpected.

Table 6. ANOVA (firm size and CCA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.239	2	3.120	3.363	0.037
Within Groups	135.432	146	0.928		
Total	141.671	148			

The model below finally explains 83.3% of the variance. Examination indicates motivation to acknowledge that the final model has statistical significance.

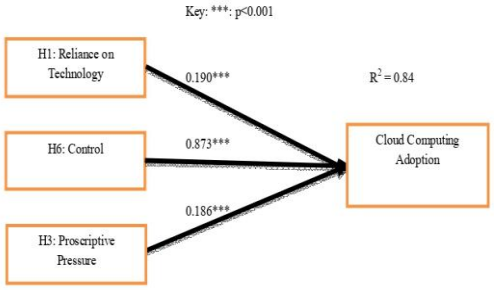

Fig. 2. Factors affecting CCA.

V. CONCLUSION

This research determined the ethical factors of CCA among various firms from different industries in a developing nation like India. This examination only considered the ethical context. The factors used in this research were tested and approved utilizing factor analysis and MLR. The research model initially consisted of six
variables. The results from factor analysis and MLR provided supported three out of initial six. The confirmed variables are: RT, CO and PP. The three other variables namely FC, COM and EP were insignificant to the model and were therefore rejected as determinants of CCA from a developing country context.

Therefore it is suggested that firms should pay more attention to the significant ethical factors especially in developing country context. The empirical investigation on ethical context is missing in other studies for Indian context.

6.1 Limitation and Further Research

This study focussed on mainly on firms in developing country i.e. India. Hence, similar studies can be done for other developing countries on ethical context. Further investigation can be done on specific sector especially on ethical context.

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