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Effect of Cloud Computing on Cost Savings and Data Security – A Survey on IT Companies in Bangalore

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Abstract:

Cloud computing has become a major driver for technology in IT companies to reduce operation costs, organizational efficiency, and resource usage. This study investigates the relation between adoption of cloud computing and cost savings across IT companies in Bangalore, while also determining difference in perception of male and female employees about data security with cloud computing. This study adopts quantitative research design to collect primary data from 200 participants. For statistical testing, Cronbach's Alpha, Pearson correlation and independent samples t-test were conducted using SPSS v.25 software.

Cronbach's Alpha value observed was 0.892 to confirm strong internal consistency. In addition, relation between adoption of cloud computing and cost savings is positive ($p<0.01$). There is also statistically significant difference in perception of male and female employees in independent samples t-test ($p<0.001$). It is concluded that adoption of cloud computing is related to cost savings, while there are different perceptions of data security across male and female employees. Overall, this study recommends IT companies and managers to implement cloud computing properly and integrate employee awareness programs and data security to make the most of cloud technology.

Keywords – cloud computing, cost savings, data security, IT companies, employee awareness

1. Introduction

Cloud computing is the core of mechanisms for outsourcing computing resources and services to various people in a way similar to systems related to utility like water, sewage, and electricity. For instance, people connect with electric grids, supported by utilities instead of depending on own capabilities for power generation. This migration is needed to reduce the time and cost of production to increase reliability and performance (Tripathi and Mishra, 2011). In the same way, clouds provide more reliable and high performing services to their consumers like instant messaging, e-mail, and web services at reasonable prices.

There is no specific definition of cloud computing yet (Wang and Mu, 2011). There are five common characteristics of cloud computing defined by the "National Institute of Standards and Technology (NIST) – wider coverage, on-demand service, rapid expansion, pooling of resources, and restrained service (Wang and Mu, 2011). In addition, cloud computing is defined as a platform which is easily extended and dynamic to deliver transparent resources to users over the web (Lv and Hu, 2011). There are three layers of cloud system architecture – (1) Platform as a Service (PaaS); (2) Software as a Service (SaaS); and (3) Infrastructure as a Service (IaaS) (Mell and Grance, 2011).

Clients, platforms, applications, servers, and infrastructure are the five components of cloud architectures (Jain et al, 2011). Existing clouds are organized in one of 4 models of deployment – (1) community clouds (where a group of organizations own the physical infrastructure); (2) public clouds (where a service provider owns and manages physical infrastructure; (3) private clouds (where a specific organization owns and manages the infrastructure); and (4) hybrid clouds (having all the above models) (Gowrigolla et al, 2010). Figure 1 illustrates models used for cloud deployment with IaaS, SaaS, and PaaS infrastructures. There are similar infrastructures in cloud deployment models, varying in their user access and political levels.

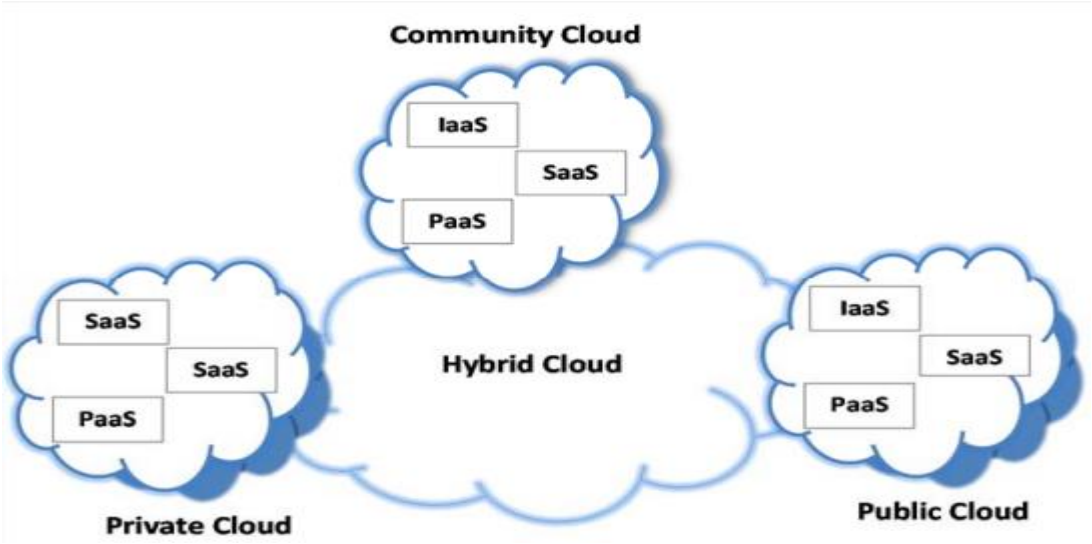


Figure 1 – Models and Infrastructure for Cloud Deployment

Source – Khalil et al (2014)

There are several benefits of cloud for both organizations and individual users. Clouds promote sharing of resources, outsourcing, financial savings, wide accessibility, flexibility of service, and scalability on demand. Clouds reduce the need for involving the users by covering technical specifications like licenses, maintenance, and software upgrades from its consumers. Clouds could also add benefits related to security over deploying servers. As resources are aggregated by cloud, expert security experts are provided by cloud vendors while organizations could be specific to administrator who might not be excellent in resolving cybersecurity problems. In the same way, clouds are robust against attacks like "Distributed Denial of Service (DDoS)" because of having elastic architecture and resources. Clouds also support mobile computations where migration happens between Virtual Machines (VMs). Along with addressing DDoS attacks, mobile computations have exclusive control with single administrator to avoid settings. Hence, this study aims to develop the knowledge of various effects of cloud computing on security and cost savings in IT companies.

2. Literature Review

Cloud computing can reduce the dependency on expensive computing systems for IT services and solutions. It adds flexibility to the architecture with internet from portable devices. It enables multi-fold rise in capabilities and capacity of latest and current software. The whole data resides over a range of resources in a cloud environment for accessing the data using VMs. As data centers may be placed anywhere in the world beyond users 'control and reach, there are various challenges related to privacy and security that one should address and understand. In addition, one can never deny breakdown of a server which has been observed. Bhadauria and Sanyal (2012) analyzed several issues that have been unresolved affecting the diffusion and adoption of cloud resources affecting several stakeholders related to it.

Cloud computing provides architecture online on demand and access on the basis of pay per use to a pool of resources like shared servers, storage, networks, applications, and services without having to acquire them. It saves time and management cost for enterprises. A lot of industries are focusing on cloud like healthcare, banking, and education because of efficient services offered by pay-per-use platform. Cloud computing depends widely on the internet where client data is retained and stored in the data center of Amazon, Google, Microsoft, and other cloud service providers. Limited control may add several security threats and issues like unsafe interface, data leakage, data availability, resource sharing, and inside attacks. Padhy et al (2011) explained the use of cloud computing, major security issues and risks, and cloud models which are present widely in cloud computing sector.

Priyadarshinee et al (2018) measured the corporate performance with adoption of cloud services in industries across India. They collected data through online survey with a questionnaire filled by 660 managers from

industries in India. They used "structured equation modeling (SEM)" to test hypotheses. It is found that there is a major impact of trust on adoption of cloud computing along with perceived risk of IT security, risk analysis, innovation, and management style. In addition, there is a highly insignificant impact of using technology on cloud adoption. Here, trust is identified as the major factor affecting the rate of cloud adoption.

IT has come a long way with cloud computing by providing data storage with flexible and scalable solutions to match supply and demand, while minimizing capital expenditure. However, managing cloud security is needed for implementing computing infrastructure. There are several security concerns and consciousness as soon as applications are run beyond the given firewall while moving closer to public domain. Ramgovind et al (2010) offered an overall security point of view of cloud computing to highlight security challenges which should be managed and addressed well to realize the complete potential of cloud.

Innovations are needed to ride the unavoidable tide of changes. Majority of organizations are minimizing their computing cost through virtualization. For minimizing the computing cost, cloud computing has come as an innovative solution that improved usage. Cloud computing is still at a nascent stage and a new technology for organization. Hence, majority of organizations are not completely confident in adopting the same. Saleem (2011) addresses this issue for organizations in terms of security and cost. This paper explores the pros and cons of enterprise in terms of security and cost for cloud computing. Finally, it is concluded that cloud computing has been found to be helpful for SMEs more than large organizations for both data security and cost.

2.1.Research Gap

Even though cloud computing has been studied widely in terms of flexibility, efficiency, cost-saving, and data security in an enterprise, more focused study is needed to investigate these aspects in IT companies in Bangalore. Existing studies discuss the possible benefits of cloud computing widely, without paying much attention to the actual relation between adoption of cloud computing and perceived cost savings among IT employees. In the same way, data security has become the major concern in cloud settings. While previous research has investigated risks related to cloud security and concerns about data security, there is still scope to explore the difference in perceptions towards data security with cloud computing among male and female employees as they haven't received much attention.

2.2.Research Objectives

- To investigate the relation between adoption of cloud computing and cost savings across IT organizations in Bangalore
- To find out difference in perceptions of male and female employees about data security in cloud computing in IT companies

2.3.Hypotheses

H1 – There is a significant relationship between adoption of cloud computing in an enterprise and cost savings among IT companies

H2 – There is a significant difference in perceptions of male and female employees for data security related to cloud computing in IT companies in Bangalore

3. Research Methodology

3.1.Research Approach

This study adopts quantitative research approach for hypotheses testing by collecting primary data from IT companies in Bangalore. This approach is selected to collect measurable responses from participants and for statistical analysis. This study also follows analytical and descriptive research design to add understanding on demographic profile of respondents and their perceptions.

3.2.Study Population and Sampling Technique

Target population includes employees in IT companies who have experience with cloud computing approaches. Since the study focuses majorly on cloud computing, participants must have enough knowledge about cloud platforms, applications, infrastructure, or storage systems for meaningful responses. This study collects data from 200 participants using purposive sampling technique to meet basic needs of the study for participants having exposure to cloud resources.

3.3.Data Collection

A self-structured questionnaire was used to collect primary data. There are two major sections covered in the questionnaire – Demographic profile and perceptions of participants. Respondents 'opinions are measured with 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

3.4.Data Analysis

IBM SPSS software will be used to analyze collected data. The demographic profile of participants will be first summarized with frequency and percentage. Cronbach's Alpha test was conducted to assess the reliability of questionnaire having the value of 0.70 being acceptable for internal consistency of responses. Pearson's correlation test will be conducted to find the strength of relationship mentioned in the hypothesis. Value of significance is 0.05 will be considered to know statistical significance. For second objective, Independent Samples t-test was conducted to determine perceptions of employees about data security related to cloud computing. The mean scores will be compared among both groups with p-value under 0.05 showing statistical significance.

4. Results

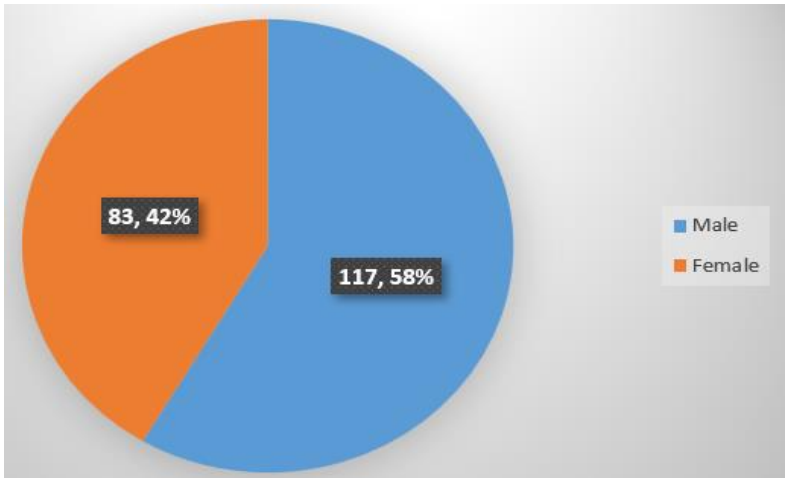
4.1.Demographics

In this study, 117 (58.5%) participants are male and 83 (41.5%) participants are female (Table 1) (Figure 2).

Table 1 - Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	117	58.5	58.5	58.5
	Female	83	41.5	41.5	100.0
	Total	200	100.0	100.0	

Figure 2 – Gender of participants

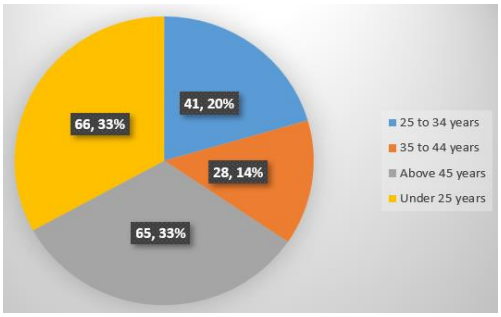


When it comes to age group of participants, 41 (20.5%) participants are 25 to 34 years old, 28 (14%) participants are 35 to 44 years old, 65 (32.5%) participants are above 45 years old, and 66 (33%) participants are under 25 years old (Table 2) (Figure 3).

Table 2 - Age Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25 to 34 years	41	20.5	20.5	20.5
	35 to 44 years	28	14.0	14.0	34.5
	Above 45 years	65	32.5	32.5	67.0
	Under 25 years	66	33.0	33.0	100.0
	Total	200	100.0	100.0	

Figure 3 – Age Group of participants

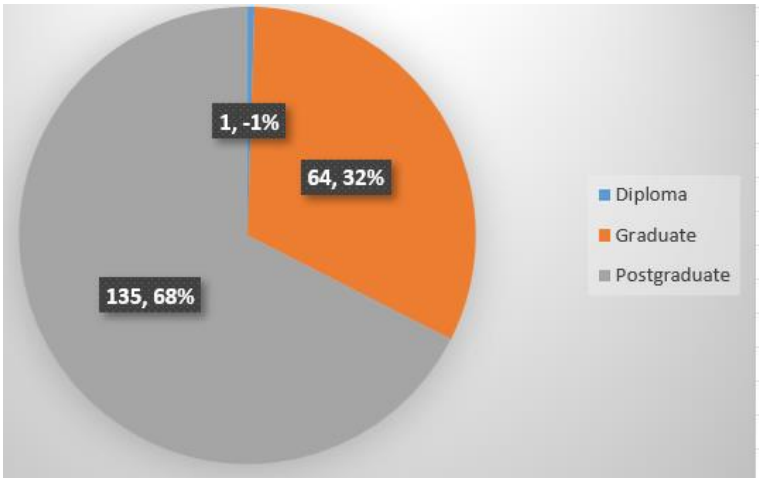


When it comes to academic qualification, 135 (67.5%) participants are postgraduate, 64 (32%) participants are graduate, and only one participant had diploma (Table 3) (Figure 4).

Table 3 - Academic qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Diploma	1	.5	.5	.5
	Graduate	64	32.0	32.0	32.5
	Postgraduate	135	67.5	67.5	100.0
	Total	200	100.0	100.0	

Figure 4 – Academic qualification

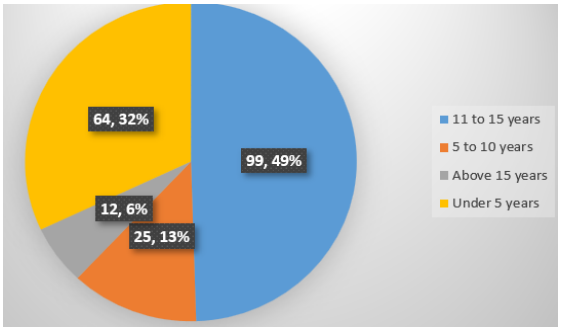


When it comes to work experience, 99 (49.5%) participants have 11 to 15 years of work experience, 25 (12.5%) participants have 5 to 10 years of experience, 12 (6%) participants have more than 15 years of experience, and 64 (32%) participants have less than 5 years of experience (Table 4) (Figure 5).

Table 4 - Work Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	11 to 15 years	99	49.5	49.5	49.5
	5 to 10 years	25	12.5	12.5	62.0
	Above 15 years	12	6.0	6.0	68.0
	Under 5 years	64	32.0	32.0	100.0
	Total	200	100.0	100.0	

Figure 5 – Work Experience

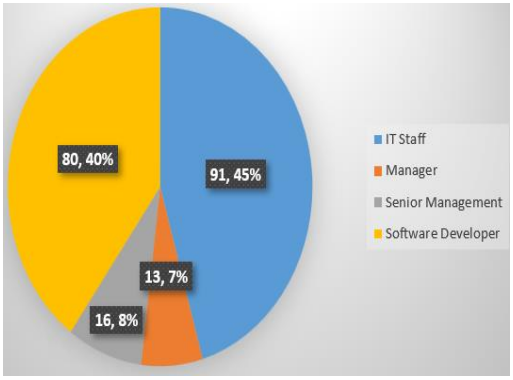


There are 91 (45.5%) participants are IT staff, 13 (6.5%) participants are managers, 16 (8%) participants are the part of senior management, and 80 (40%) participants are software developers (Table 6) (Figure 7).

Table 6 – Role in the organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	IT Staff	91	45.5	45.5	45.5
	Manager	13	6.5	6.5	52.0
	Senior Management	16	8.0	8.0	60.0
	Software Developer	80	40.0	40.0	100.0
	Total	200	100.0	100.0	

Figure 7 – Role in the organization



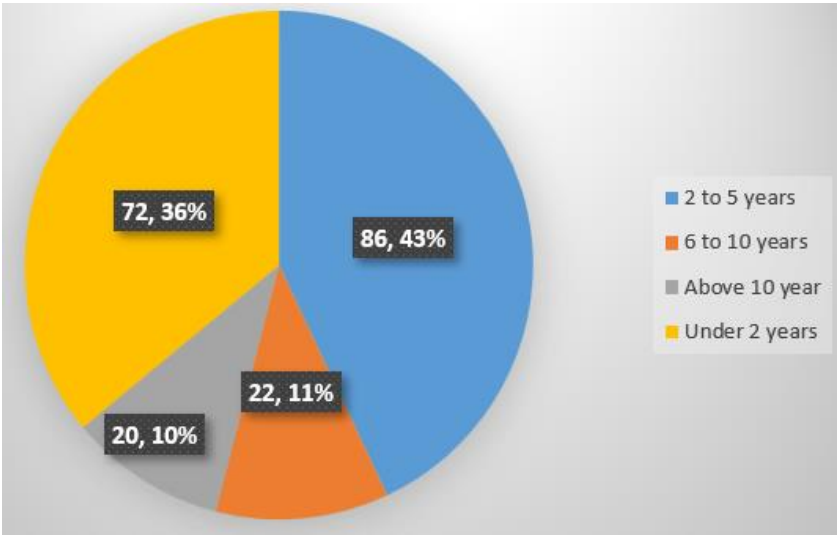
When it comes to exposure, 86 (43%) participants have been exposed to cloud computing for 2 to 5 years, 22 (11%) participants have been using cloud computing for 6 to 10 years, 20 (10%) participants have been using cloud computing for more than 10 years, and 72 (36%) participants have used cloud computing for only 2 years (Table 7) (Figure 8).

Table 7 - Exposure to Cloud computing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 to 5 years	86	43.0	43.0	43.0
	6 to 10 years	22	11.0	11.0	54.0

	Above 10 year	20	10.0	10.0	64.0
	Under 2 years	72	36.0	36.0	100.0
	Total	200	100.0	100.0	

Figure 8 – Exposure to Cloud computing



4.2.Adoption of cloud computing

There are 84 (42%) participants who agree and 73 (36.5%) participants strongly agree that cloud computing is used widely in their organizations, 53 (26.5%) participants agree and 86 (43%) participants strongly agree that cloud services and applications are widely used for operations, 88 (44%) participants agree and 50 (25%) participants strongly agree that their enterprise no longer needs to maintain large-scale physical structure, 104 (52%) participants agree and 61 (30.5%) participants strongly agree that cloud computing added flexibility in IT resources, and 66 (33%) participants agree and 43 (21.5%) participants strongly agree that efficiency of using IT resources has been improved with cloud computing (Table 8).

Table 8 – Participants 'opinion on adoption of cloud computing

Particulars	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Cloud computing is used widely in my organization	13 (6.5%)	7 (3.5%)	23 (11.5%)	84 (42%)	73 (36.5%)
Cloud services and applications are widely used for operations	10 (5%)	10 (5%)	41 (20.5%)	53 (26.5%)	86 (43%)

My enterprise no longer needs to maintain large-scale physical structure	10 (5%)	16 (8%)	36 (18%)	88 (44%)	50 (25%)
Cloud computing added flexibility in IT resources	15 (7.5%)	14 (7%)	6 (3%)	104 (52%)	61 (30.5%)
Efficiency of using IT resources has been improved with cloud computing	5 (2.5%)	40 (20%)	46 (23%)	66 (33%)	43 (21.5%)

4.3.Cost Savings

There are 70 (35%) participants who agree and 45 (22.5%) participants strongly agree that cost of hardware management has been reduced by cloud, 81 (40.5%) participants agree and 54 (27%) participants strongly agree that software costs have been reduced by cloud infrastructure, 53 (26.5%) participants agree and 22 (11%) participants strongly agree that their organization's IT expenditure has been reduced by cloud computing, 90 (45%) participants agree and 53 (26.5%) participants strongly agree that their organization uses IT resources more efficiently with cloud computing (Table 9).

Table 9 – Participants opinion on cost savings with cloud computing

Particulars	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Cost of hardware management has been reduced by cloud	24 (12%)	16 (8%)	45 (22.5%)	70 (35%)	45 (22.5%)
Software costs have been reduced by cloud infrastructure	2 (1%)	25 (12.5%)	38 (19%)	81 (40.5%)	54 (27%)
My organization's IT expenditure has been reduced by cloud computing	25 (12.5%)	32 (16%)	68 (34%)	53 (26.5%)	22 (11%)
My organization uses IT resources more efficiently with cloud computing	6 (3%)	24 (12%)	27 (13.5%)	90 (45%)	53 (26.5%)

4.4.Perception towards data security

There are 99 (49.5%) participants who agree and 38 (19%) participants strongly agree that cloud computing protects company data by preventing unwanted access, 90 (45%) participants agree and 55 (27.5%) participants

strongly agree that cloud storage protects data from unexpected loss, 106 (53%) participants agree and 48 (24%) participants strongly agree that cloud computing has been effective to manage access to company data, 80 (40%) participants agree and 70 (35%) participants strongly agree that they are confident in confidentiality of company data on cloud servers, and overall, 63 (31.5%) participants agree and 90 (45%) participants strongly agree that cloud computing is safe for their company data (Table 10).

Table 10 – Participants 'perception on data security with cloud computing

Particulars	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Cloud computing protects company data by preventing unwanted access	24 (12%)	-	39 (19.5%)	99 (49.5%)	38 (19%)
I believe that cloud storage protects data from unexpected loss	1 (0.5%)	-	54 (27%)	90 (45%)	55 (27.5%)
Cloud computing has been effective to manage access to company data	7 (3.5%)	6 (3%)	33 (16.5%)	106 (53%)	48 (24%)
I feel confident in confidentiality of company data on cloud servers	1 (0.5%)	23 (11.5%)	26 (13%)	80 (40%)	70 (35%)
Overall, I find cloud computing safe for my company data	12 (6%)	12 (6%)	23 (11.5%)	63 (31.5%)	90 (45%)

4.5.Hypotheses Testing

Before hypotheses testing, Cronbach's Alpha test was conducted and alpha value was 0.892, suggesting high internal consistency in questionnaire. As the value is above 0.7 threshold, items are found reliable to measure constructs (Table 11).

Table 11 - Reliability Statistics

Cronbach's Alpha	N of Items
.892	14

H1 – There is a significant relationship between adoption of cloud computing in an enterprise and cost savings among IT companies

For testing H1, Pearson's correlation test was conducted. It was found that correlation between adoption of cloud computing and cost savings was positive (0.332) with value of significance (0.000), which is under 0.01 threshold. Hence, H1 is accepted (Table 12).

Table 12 – Correlation between adoption of cloud computing and cost savings

		CA	CS
CA	Pearson Correlation	1	.332**
	Sig. (2-tailed)		.000
	N	200	200
CS	Pearson Correlation	.332**	1
	Sig. (2-tailed)	.000	
	N	200	200

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

H2 – There is a significant difference in perceptions of male and female employees for data security related to cloud computing in IT companies in Bangalore

For testing H2, Independent samples t-test was conducted. For this test, group statistics table shows mean perception score of 4.1504 for male participants and 3.5687 for female participants. It means perception score was higher among male employees (Table 13).

Table 13 - Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
PERC	Male	117	4.1504	.43858	.04055
	Female	83	3.5687	1.02576	.11259

The difference between perception of male and female participants is statistically significant with p-value of 0.000. Levene's test of specificity also came up with significant value (p = 0.000). Hence, H2 is accepted, which means there is a significant difference in perception of male and female employees about data security (Table 14).

Table 14 - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PERC	Equal variances assumed	90.535	0.000	5.474	198	0.000	0.58175	0.10628	0.37217	0.79134
	Equal variances not assumed			4.861	103.418	0.000	0.58175	0.11967	0.34443	0.81908

5. Conclusion

It is concluded that there is a significant positive relationship between adoption of cloud computing and cost savings in IT companies ($p<0.001$). It is also concluded that perception of data security also varies significantly across male and female employees. Overall, cloud computing plays a vital role in saving operation costs with varying perceptions of data security, highlighting the significance of effective practices and awareness of employees in cloud settings.

Future studies can focus on adoption of cloud computing across more diverse and larger number of IT companies in other tier-1 cities in India. They may also consider other factors like employee awareness, privacy, scalability, ROI, and productivity. Future research may also adopt longitudinal research design to further assess security perceptions and benefits of cloud computing.

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