

## Original Article

# Impact of Digitalization on Cash Circulation in India

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**Abstract:** Management of currency deals with maintaining proper balance of demand and supply of cash. Equilibrium for demand and supply of cash has to be maintained so that it can not only build the requirement of the Cash but also suffice it. Cash is the King in the making of financial system of any nation. If Cash is not handled properly than it may lead to disrupted financial system. Cash handling becomes more important when the aspect of digitalization is added in it. Digitalization becomes more and more important at the times of 21<sup>st</sup> century. Even though Digitalization has been initiated but still Cash circulation is still prevalent in the society. People dealing with cash transactions have favored more of cash driven transactions rather than Digital Payments driven transactions. There are many factors which led to less usage of Digital Payment platforms like low Digital Awareness, less Knowledge of the Digital Payment platforms, more biased towards Cash payments. One of the most striking features of Cash is the feel of cash which Digital Payments rarely fulfill. This paper is an attempt to analyze is there any impact of Digitalization on Cash Circulation in India or not.

**Keywords:** Cash, Circulation, Digitalization, Impact.

## I. INTRODUCTION

Commerce has been part and parcel of people's life. This has been since time immemorial. As civilizations have been growing to their potential, money has seen its evolution. Earlier barter system was most prevalent in the world. Barter system was necessary as the availability of materials was less in the initial days of human evolution. Due to different climatic conditions and other factors, all materials were not available at all places. Due to this, the exchange of material started happening. Under this the material availability of made possible to each and everyone. When times changed, slowly the transaction took the form of purchasing power. This purchasing power was directly linked with money. So minting and printing of money took the further form of currency. In order to show the impressions of different kings and their kingdoms, the money was made with specific design and logo. Money took the form of Physical notes and entities. Money got evolved into so many ways. Major evolution took at the time of covid. This brought the idea of Digitalization into reality. With Digitalization, technology took a step ahead and made a significant remark in history. With this, tussle between cash circulation and Digital payments started.

### A. Objectives:

1. To study the amount of Cash circulation in India before Digitalization
2. To Study the amount of Cash Circulation in India after Digitalization
3. To Study the Impact of Digitalization on Cash Circulation in India

## II. LITERATURE REVIEW

Different nations do have different kind of need of money and liquidity. Each nation is having its own culture, background and agenda. Similarly under the money factor, supply and demand are very important factors contributing to its struggle for survival in the market. It has been observed that the impact of supply of money is very high. This impact is huge if there is no hindrance in transmitting the supplying the money directly to the residents of the people [Yung Chul Park(1973)].

There is a relationship between money and stability of the economy. More savings with the people of any nation would build a string foundation for the economic growth. If the economy becomes strong then the overall progress can be made very easily. By having more savings the proportion of debt recovery will increase. By this the problem of Non Performing Assets will see a downward inclination [ Artur Ribaj, Fitim Mexhuani (2021)].

On the way of money management, the most important aspect which has to be dealt is Financial Literacy. Proper Financial Literacy program would help in making the ease of transactions much better as compared to other factors. Financial



Literacy leads to the implementation of Financial Inclusion. In this regard, the financial services will be made available to the last citizen of the society with the help of financial inclusion [Annamaria Lusardi (2019)]

To manage money in a nation, an institution called Financial Institution is very important. This would not only build the capacity to retain the money safe but also help in making the money available at the time of requirement. Such financial institutions are called as Banking Firms. These banking firms would help maintaining the firms at the rate of requirement [John L. Douglas (2008)]

When it comes to regulation of money for the benefit of the nation, most importantly the control and issues of money in the form of debt has to be done by a competing authority. This kind of authority should be none other than the execution pillar of democracy. The execution should directly involve itself in the regulation of money disbursement. This will in long help in controlling the debt form of money [Judge, Kathryn (2024)]

Under the influence of Globalization, the regulation of money is a challenge. This regulation becomes a challenge when Globalization is welcomed under the other two factors namely, Liberalization and Privatization. By adding two other factors under the title of globalization, the impact of Foreign Direct Investment becomes very high. Under the influence of these kind of factors, the regulation of money becomes difficult. Due to rise in difficulty, another challenge is to maintain the economic stability. This in turn will bring more responsibility of competent authority.

For the management of money, a liberal yet a committed kind of system has to be followed. Liberty with Commitment can be easily fulfilled with the help of democratic kind of governance. Under the system of democracy, the heterogeneity of money can be easily managed [Alberto Alesina, Paola Giuliano, Bryony Reich (2021)] .

Under the currency, there are types of forms available. These two types are Coins and Notes. One of the most striking feature of having currency in physical form is that it gives a sense of cash availability as compared to Non Cash Forms. Bank Notes are the most preferred due to less variety and less confusion. Coins on the other hand create confusion as some coins look similar. Due to this similarity it becomes very difficult to recognise the coins. [Srinivasan, Chinnammai. (2013)]

In order to maintain the decorum of money, currency's status has to be maintained with the help of reforms. Reforms in short continuous reforms are important for the maintenance. Under this there are certain categorized policies which are made only for currencies. These policies are known as Currency Policy. [R. Vijay Krishna, Oksana Leukhina (2019)]

Physical Payments have been shifting towards Non Physical Payments. Under the advent of Digitalization has taken place. Digitalization has led to go for Digital Payments. In order to make people go for Digital payments there are many factors which do affect the execution of Digital Payments. Such factors are Financial Knowledge, Financial Awareness and Capacity to adhere to the new technological changes. [Wu G, Yang J and Hu Q (2022)]

There are many types in currencies. One such type is community currency. These community currencies help in building business at the time of worst economic condition. When the demand and supply of currencies do not match, community currencies act as reservoir for helping the business in such time. The stabilized effect provided by the community currency helps in not only stabilizing the currency but also provokes to go for better future in the market. [Zeller, Sarah. (2020)]

In the research of Currency, there has been a debate that whether there can be a common currency for all. This question arises due to the problems of exchange rates changing every second within the same country domain. Due to this kind of change, there has been always a question mark to use same currency rate all over the regions. This idea will work best if the nations of small currencies could come forward and make a union. Under their union, a common currency can be made which would help in making a common currency to run. This would help in regulating the demand and supply of currencies. [Chiara Forlati (2015)]

On the same lines, the internationalization of currencies can be made but it costs many things. Internationalization of Currencies would solve the problem of exchange rate fluctuations. [Cohen, Benjamin. (2012)]

Making a common currency is a challenge. It takes many generations, factors and mediating items to grab under the arms of common currency. The list of problems has to be made in order to deal with the common currency. And the problem becomes more tedious when the Digital payments are at the verge of application. [Pelagidis, T., Mitsopoulos, M. (2016)]

As Digitalization is new under the Indian scenario; it has been found that the awareness with respect to Digitalization has to be made. Under this act, there is a need of more research and development. Both Qualitative and Quantitative research has to be done so that the boundaries of research can be pushed in the field of Digitalization [Lin Tan, Liyan Xue, (2021)].

Both the forms of financial transactions are available to the customers. But there are certain groups which favor digitalization and another set of group which take the side of cash transactions. Due to this there is always a clash between Cash and Digital Payments [intér, Zsófia & Nagy, Mónika & Tóth, Katalin & Varga, József. (2022)].

**III. RESEARCH METHODOLOGY**

- **Research Design:** Causal Research
- **Sampling Design:** Convenience Sampling
- **Sample Size:** From 2006 to 2023, the data has been taken. Digitalization was initiated in the year 2015. So in order to have a symmetrical analysis under ANOVA, 9 years’ data before digitalization and 9 years data after Digitalization has been taken, making a sample size of 18 samples in total.

**A. Theoretical Framework:**

Both the kinds of statistics are used for developing research methodology. One is Descriptive Statistics. In this a theoretical framework is developed in order to understand the quantity of growth that has taken place in the field of cash circulation before digitalization and after digitalization. In the below Theoretical Framework, 2015 year has been taken as base year. 2015 has been taken as base year because Digitalization was implemented in the year 2015. The Theoretical Framework is as follows:

**Table 1: Before Digitalization**

Year	Cash Circulation Before Digitalization	Difference	Ratio	Percentage
2006	X <sub>1</sub>	X <sub>1</sub> -Y <sub>1</sub>	(X <sub>1</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>1</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2007	X <sub>2</sub>	X <sub>2</sub> -Y <sub>1</sub>	(X <sub>2</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>2</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2008	X <sub>3</sub>	X <sub>3</sub> -Y <sub>1</sub>	(X <sub>3</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>3</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2009	X <sub>4</sub>	X <sub>4</sub> -Y <sub>1</sub>	(X <sub>4</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>4</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]*100
2010	X <sub>5</sub>	X <sub>5</sub> -Y <sub>1</sub>	(X <sub>5</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>5</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]*100
2011	X <sub>6</sub>	X <sub>6</sub> -Y <sub>1</sub>	(X <sub>6</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>6</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]*100
2012	X <sub>7</sub>	X <sub>7</sub> -Y <sub>1</sub>	(X <sub>7</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>7</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]*100
2013	X <sub>8</sub>	X <sub>8</sub> -Y <sub>1</sub>	(X <sub>8</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>8</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]*100
2014	X <sub>9</sub>	X <sub>9</sub> -Y <sub>1</sub>	(X <sub>9</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(X <sub>9</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]*100

**Table 2: After Digitalization**

Year	Cash Circulation Before Digitalization	Difference	Ratio	Percentage
2015	Y <sub>1</sub>	Y <sub>1</sub> -Y <sub>1</sub>	(Y <sub>1</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>1</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2016	Y <sub>2</sub>	Y <sub>2</sub> -Y <sub>1</sub>	(Y <sub>2</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>2</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2017	Y <sub>3</sub>	Y <sub>3</sub> -Y <sub>1</sub>	(Y <sub>3</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>3</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2018	Y <sub>4</sub>	Y <sub>4</sub> -Y <sub>1</sub>	(Y <sub>4</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>4</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2019	Y <sub>5</sub>	Y <sub>5</sub> -Y <sub>1</sub>	(Y <sub>5</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>5</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2020	Y <sub>6</sub>	Y <sub>6</sub> -Y <sub>1</sub>	(Y <sub>6</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>6</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2021	Y <sub>7</sub>	Y <sub>7</sub> -Y <sub>1</sub>	(Y <sub>7</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>7</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2022	Y <sub>8</sub>	Y <sub>8</sub> -Y <sub>1</sub>	(Y <sub>8</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>8</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100
2023	Y <sub>9</sub>	Y <sub>9</sub> -Y <sub>1</sub>	(Y <sub>9</sub> -Y <sub>1</sub> )/Y <sub>1</sub>	[(Y <sub>9</sub> -Y <sub>1</sub> )/Y <sub>1</sub> ]* 100

After Theoretical Framework is framed, Descriptive Statistics parameters are used such as Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Variance, Standard Deviation, Skewness and Kurtosis. With the help of these parameters, the comparison is done. The comparison describes about the population distribution. Then the Data is subjected to different statistical tests under Inferential Statistics. These tests are Non Parameteric test and Parameteric test. Under Non Parametric test, Kruskal Wallis test is used to understand the two distributions. In the domain of Parametric test, T test and ANOVA test is used.

**Table 3: Data Collection:**

Year	Notes in Circulation ( In Billions)
2006	4219.22
2007	4959.38

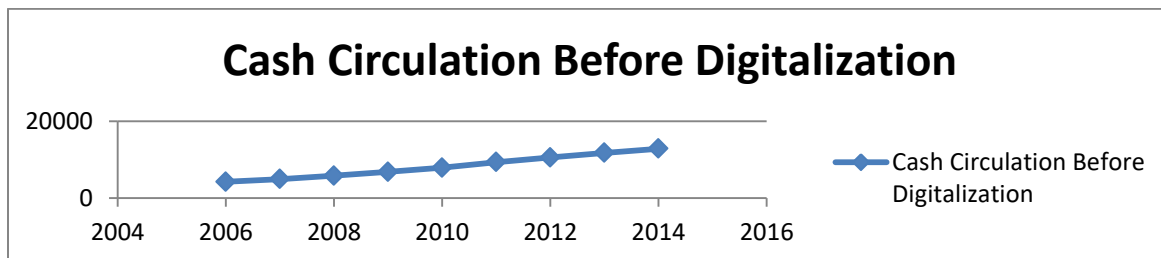
2008	5815.77
2009	6810.99
2010	7882.79
2011	9369.35
2012	10537.86
2013	11756.35
2014	12837.35
2015	14288.82
2016	16415.58
2017	13101.81
2018	18037
2019	21109
2020	24209.75
2021	28268.63
2022	31057.21
2023	33482.28

Source: <https://www.statista.com/statistics/631157/notes-issued-and-circulated-india/>

**A. Data Analysis:**

**Table 4: Cash Circulation before Digitalization**

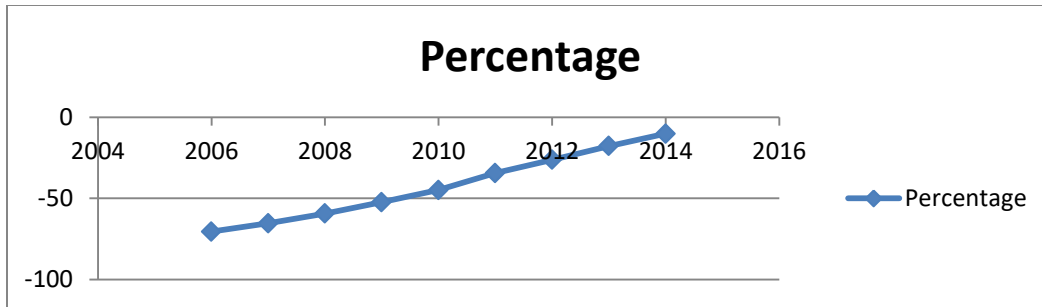
Sl.No	Year	Cash Circulation Before Digitalization
1	2006	4219.22
2	2007	4959.38
3	2008	5815.77
4	2009	6810.99
5	2010	7882.79
6	2011	9369.35
7	2012	10537.86
8	2013	11756.35
9	2014	12837.35



**Inference:** The volume of cash circulation is increasing year after year before digitalization. There is a rise in the number of cash circulated currencies in the year. The rise in the volume of cash shows that the need of cash had increased from one to another year.

**Table 5: Cash Circulation before Digitalization Difference, Ration & Percentage**

Year	Cash Circulation Before Digitalization	Difference	Ratio	Percentage
2006	4219.22	-10069.6	-0.7047	-70.4718794
2007	4959.38	-9329.44	-0.6529	-65.2918855
2008	5815.77	-8473.05	-0.593	-59.2984585
2009	6810.99	-7477.83	-0.5233	-52.3334327
2010	7882.79	-6406.03	-0.4483	-44.8324634
2011	9369.35	-4919.47	-0.3443	-34.4288052
2012	10537.86	-3750.96	-0.2625	-26.251013
2013	11756.35	-2532.47	-0.1772	-17.7234369
2014	12837.35	-1451.47	-0.1016	-10.1580816



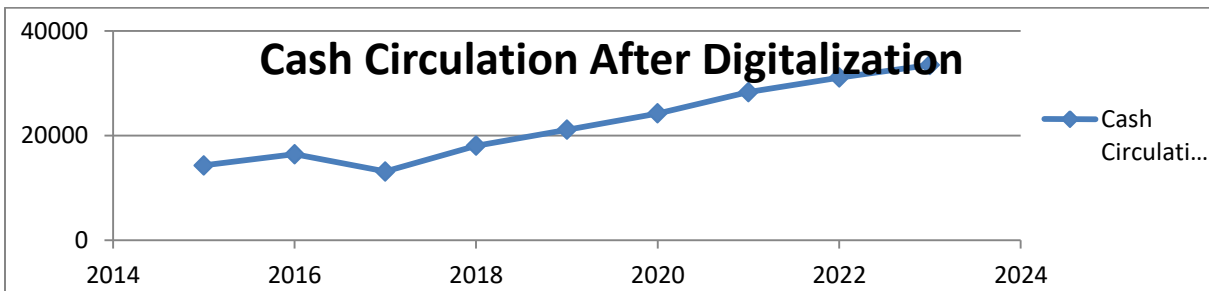
**Inference:** The negative percentage is decreasing and increasingly moving towards positive side of the Quadrant. The negative percentage is decreasing due to rise in the supply of cash circulation.

**Table 6: Descriptive Statistics**

Sl.No	Parameter	Value	Sl.No	Parameter	Value
1	Arithmetic Mean	8243.229	5	Variance	9378943
2	Geometric Mean	7719.627	6	Standard Deviation	3062.506
3	Harmonic Mean	7206.571	7	Measure of Skewness	0.201276
4	Median	7882.79	8	Kurtosis	1.3907

**Table 7: Cash Circulation after Digitalization**

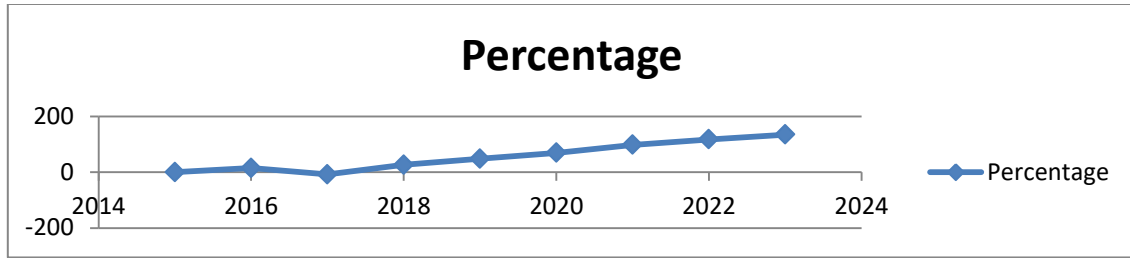
Sl.No	Year	Cash Circulation After Digitalization
1	2015	14288.82
2	2016	16415.58
3	2017	13101.81
4	2018	18037
5	2019	21109
6	2020	24209.75
7	2021	28268.63
8	2022	31057.21
9	2023	33482.28



**Inference:** Even though there is a rise in the cash circulation year after year, a dip has been observed in the amount of cash circulation from 2016 to 2017. This is due to the implementation of demonetization.

**Table 8: Cash Circulation before Digitalization Difference, Ration & Percentage**

Year	Cash Circulation After Digitalization	Difference	Ratio	Percentage
2015	14288.82	0	0	0
2016	16415.58	2126.76	0.148841	14.8840842
2017	13101.81	-1187.01	-0.08307	-8.307264001
2018	18037	3748.18	0.262316	26.23155726
2019	21109	6820.18	0.477309	47.73088331
2020	24209.75	9920.93	0.694314	69.43141561
2021	28268.63	13979.81	0.978374	97.83740015
2022	31057.21	16768.39	1.173532	117.3532174
2023	33482.28	19193.46	1.34325	134.3250177



**Inference:** Even though the percentage rise is seen still a dip in percentage can be seen in 2016 due to the implementation of demonetization policy.

**C. Descriptive Statistics:**

**Table 9: Descriptive Statistics**

S. No	Parameter	Value	S.No	Parameter	Value
1	Arithmetic Mean	22218.9	5	Variance	55493545
2	Geometric Mean	21110.51	6	Standard Deviation	7449.399
3	Harmonic Mean	20054	7	Measure of Skewness	0.319633
4	Median	21109	8	Measure of Kurtosis	-1.45258

**Table 10: Comparison**

S.No	Parameters	Before Digitalization	After Digitalization
1	Arithmetic Mean	8243.229	22218.9
2	Geometric Mean	7719.627	21110.51
3	Harmonic Mean	7206.571	20054
4	Median	7882.79	21109
5	Variance	9378943	55493545
6	Standard Deviation	3062.506	7449.399
7	Measure of Skewness	0.201276	0.319633
8	Measure of Kurtosis	1.3907	-1.45258

**Inference:** From the above table it can be seen that the all the values of different parameters of cash circulation after digitalization are higher as compared to cash circulation before digitalization. Only one parameter of cash circulation before digitalization is high as compared cash circulation after digitalization which is Measure of Kurtosis

**Table 11: Parameters of Digitalization**

S. No	Parameters	Before Digitalization	After Digitalization	Before Digitalization	After Digitalization
1	Arithmetic Mean	8243.229	22218.9	low	High
2	Geometric Mean	7719.627	21110.51	low	High
3	Harmonic Mean	7206.571	20054	low	High
4	Median	7882.79	21109	low	High
5	Variance	9378943	55493545	low	High
6	Standard Deviation	3062.506	7449.399	low	High
7	Measure of Skewness	0.201276	0.319633	low	High
8	Measure of Kurtosis	1.3907	-1.45258	High	Low

**Table 12: Non-Parametric Test and Parametric Test:**

Year	Cash Circulation Before Digitalization	Year	Cash Circulation After Digitalization
2006	4219.22	2015	14288.82
2007	4959.38	2016	16415.58
2008	5815.77	2017	13101.81
2009	6810.99	2018	18037
2010	7882.79	2019	21109
2011	9369.35	2020	24209.75
2012	10537.86	2021	28268.63

2013	11756.35	2022	31057.21
2014	12837.35	2023	33482.28

**D. Non Parametric Test:**

a) Mann Whitney U Test:

$$R_1 = 1+2+3+4+5+6+7+8+9 = 45$$

$$R_2 = 10+11+12+13+14+15+16+17+18 = 126$$

$$U_1 = n_1 * n_2 + n_1(n_1+1)/2 - R_1$$

$$U_1 = 9*9 + 45 - 45$$

$$U_1 = 81$$

$$U_2 = n_2 * n_2 + n_2(n_2+1)/2 - R_2$$

$$U_2 = 9*9 + 9*5 - 126$$

$$U_2 = 81 + 45 - 126$$

$$U_2 = 0$$

As  $U_2$  is equal to 0, there is a clear difference in the population.

b) Parametric Test:

i) T Test:

T calculated value for 95% level of Significance and two sample unequal variance = 0.000326482

T Table value for 95% level of significance and 2 tailed = 1.860

**E. ANOVA Test:**

**Table 13: ANOVA Test**

Replications/ Treatment	Treatment 1	Treatment 2
R1	4219.22	14288.82
R2	4959.38	16415.58
R3	5815.77	13101.81
R4	6810.99	18037
R5	7882.79	21109
R6	9369.35	24209.75
R7	10537.86	28268.63
R8	11756.35	31057.21
R9	12837.35	33482.28

**Table 14: Results of ANOVA Test**

Replications/ Treatment	Treatment 1	Treatment 2	Sum
R1	4219.22	14288.82	18508
R2	4959.38	16415.58	21375
R3	5815.77	13101.81	18917.6
R4	6810.99	18037	24848
R5	7882.79	21109	28991.8
R6	9369.35	24209.75	33579.1
R7	10537.86	28268.63	38806.5
R8	11756.35	31057.21	42813.6
R9	12837.35	33482.28	46319.6
Sum	74189.06	199970.08	274159.1

Correction Factor:  $274159.1 * 274159.1 / 18$

Correction Factor = 4175735225

Total Sum of Squares =

**Table 15: Sum of Squares of Replication**

Replications	T1	T2	Sum	Squared Form	Squared Form	Sum of Squares of Replication
R1	4219.22	14288.82	18508	17801817.41	204170377	221972194.4
R2	4959.38	16415.58	21375	24595449.98	269471266.7	294066716.7
R3	5815.77	13101.81	18917.6	33823180.69	171657425.3	205480606

R4	6810.99	18037	24848	46389584.78	325333369	371722953.8
R5	7882.79	21109	28991.8	62138378.18	445589881	507728259.2
R6	9369.35	24209.75	33579.1	87784719.42	586111995.1	673896714.5
R7	10537.86	28268.63	38806.5	111046493.4	799115442.1	910161935.5
R8	11756.35	31057.21	42813.6	138211765.3	964550293	1102762058
R9	12837.35	33482.28	46319.6	164797555	1121063074	1285860629
Sum	74189.06	199970.08	274159.1	5504016624	39988032895	9227266453

Total Sum of Squares= 5573652067 - 4175735225

T.S.S= 1397916843

Tr.S.S = (5504016624 +39988032895)/8 - 4175735225

Tr.S.S= 878936944

Replication sum of Squares = 9227266453/2 - 4175735225

R.S.S= 437898001.9

**Table 16: ANOVA Table**

SV	df	SS	MS	F value	F table
TrSS	2-1=1	878936944	878936944	86.7209062	5.32
RSS	9-1=8	437898001.9	54737250.2	5.4006877	3.44
ESS	8*1=8	81081896.67			
TSS	18-1=17	1397916843			

Coefficient of Variation:

CV of first treatment= 37.15178

CV of Second Treatment= 33.52731093

#### IV. FINDINGS AND RESULTS

1. From Mann Whitney U Test it can be seen that there is a clear difference between cash circulation before digitalization and after digitalization.
2. T Test confirms that both populations before and after digitalization are different.
3. From F test it is confirmed that the Replication and treatment are different for both the population.
4. F test suggests that the effect of Digitalization on cash circulation is different.
5. Effect of Digitalization is confirmed by Coefficient of Variation parameter where the coefficient of variation is more for Cash circulation before digitalization as compared after digitalization.

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