Correlation and Regression Analysis on Savings and Loans

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Abstract:

In this project work we studied the statistical information used in banking system. This project shows the collection of data, analyzing, presentation and interpretation of list of items in banking. Determination of correlation, regression coefficient and coefficient of determination between the yield of snap bean with some parameters of growth and plant development, shows the interaction between them and the significance of these relationships. These application i.e.; correlation and regression analysis on savings and loans suggest the development of innovative project to improve growth rate of the banking system. A Model is defined as abstraction of real situations, which aim to give the empirical content to relationships of variable and their interpretation. Modelling techniques are very common in basic as well as multidisciplinary research. This paper discusses the modelling and regression techniques for specific circumstances. Regression analysis technique explains the importance of variables and amount of change in exogenous variables if explanatory variables change with one unit. In this paper also describes the multiple and limited dependent variables especially logistic regression In this way mathematics can be a very important tool for technological and societal development.

Key words: **Statistical Model, Linear Regression, Logistic Regression, snap bean, correlation coefficient, banking system.**

Introduction:

Correlation is a measure of the relationship between two or more variables1 the measurement scales used should be at least interval scales, but other correlation coefficients are available to handle other types of data. Correlation coefficients can range from -1.00 to +1.00. The value of -1.00 represents a perfect *negative* correlation while a value of +1.00 represents a perfect *positive* correlation. A value of 0.00 represents a lack of correlation. Results of analysis of the interaction of yield from some parameters of snap bean plants- quality of bean production, physiological process during growth and development of plants, chemical contents of pods-macro and micro nutrients gave valuable information about which steps of agro techniques of snap bean growing needs more attention to enhance best quality and quantity of yield. Between the symptoms of live organisms there are dialectic relations, which influenced each other's and depended on the abiotic factors of environment affected on their formation.

This relation some time could be determined very easily, but often must be determined exactly (Zaprianov, 1983). Examples of this include: plant productivity related with the efficacious plant nutrition with its interaction with other factors of the environment (humidity, temperature, light conditions etc.), any change in the values of each factor results in many other changes.

Linear Correlation:

The Pearson correlation coefficient is also known as the sample correlation coefficient *(r),* product-moment correlation coefficient, or coefficient of correlation. It was introduced by Galton in 1877and developed later by Pearson. It measures the linear relationship between two random variables. For example, when the value of the predictor is manipulated (increased or decreased) by a fixed amount, the outcome variable changes proportionally (linearly). A linear correlation coefficient can be computed by means of the data and their sample means (Appendix A). When a scientific study is planned, the required sample size may be computed on the basis of a certain hypothesized value with the desired statistical power at a specified level of significance.

Rank Correlation:

The Spearman _ is the sample correlation coefficient *(rs)* of the ranks (the relative order) based on continuous data (19,20). It was first introduced by Spearman in 1904 (6). The Spearman _ is used to measure the monotonic relationship between two variables (ie, whether one variable tends to take either a larger or smaller value, though not necessarily linearly) by increasing the value of the other variable.

Linear versus Rank Correlation Coefficients

The Pearson correlation coefficient necessitates use of interval or continuous measurement scales of the measured outcome in the study population. In contrast, rank correlations also work well with ordinal rating data, and continuous data are reduced to their ranks . The rank procedure will also be illustrated briefly with our example data. The smallest value in the sample has rank 1, and the largest has the highest rank. In general, rank correlations are not easily influenced by the presence of skewed data or data that are highly variable.

SIMPLE LINEAR REGRESSION:

The purpose of simple regression analysis is to evaluate the relative impact of a predictor variable on a particular outcome. This is different from a correlation analysis, where the purpose is to examine the strength and direction of the relationship between two random variables. In this article, we deal with only linear regression of one continuous variable on another continuous variable with no gaps on each measurement scale (3). There are other types of regression (eg, multiple linear, logistic, and ordinal) analyses, which will be provided in a future article in this Statistical Concepts Series in *Radiology*.

Regression analysis is a mathematical measure of the average relationship between two are more variables in terms of the original unit of data. The variable whose value is influenced is called dependent variable and the variable which influences the values is defined as independent variable. In regression analysis independent variable is also known as regress or predictor while the dependent variable is known as regressed or explained variable. Simple linear regression analysis is a technique used for estimating the unknown value of a dependent variable from the known value of independent variable. In other words, X and Y are two related variables, then linear regression techniques helps to estimate the value of Y for a given value of X. Similarly, estimate the value of X for given value of Y. For example Market price, demand and supply related variables. In other hand linear regression analyses predict the market price based on demand and supply. It means that simple linear regression, one explanatory and one exogenous variable.

Correlation analysis:

Correlation is a statistical measure that indicates the extent to which two or more variables fluctuate together. A positive correlation indicates the extent to which those variables increase or decrease in parallel.A negative correlation indicates the extent to which one variable increases as the other decreases (or) notes.

Regression analysis:

In statistical modeling regression analysis is a set of statistical process for estimating the relationships among variables.it includes many techniques for modeling and analyzing several variables. When the focus is on the relationship between a dependent variable and one or more independent variables. More specialfically,regression analysis helps one understand how the typical value of the dependent variable changes when any one of the independent variable is varied while the other independent variable are help fixed.

Savings: Saving is income not spent, or deferred consumption. Methods of saving include putting money aside in, for example, a deposit account, a pension account, an investment fund, or as cash.[1] Saving also involves reducing expenditures, such as recurring costs. In terms of personal finance, saving generally specifies low-risk preservation of money, as in a deposit account, versus investment, wherein risk is a lot higher; in economics more broadly, it refers to any income not used for immediate consumption.

Loans: In finance, a loan is the lending of money by one or more individuals, organizations, or other entities to other individuals, organizations etc. The recipient (i.e. the borrower) incurs a debt, and is usually liable to pay interest on that debt until it is repaid, and also to repay the principal amount borrowed.

The document evidencing the debt, e.g. a promissory note, will normally specify, among other things, the principal amount of money borrowed, the interest rate the lender is charging, and date of repayment. A loan entails the reallocation of the subject asset(s) for a period of time, between the lender and the borrower.

The interest provides an incentive for the lender to engage in the loan. In a legal loan, each of these obligations and restrictions is enforced by contract, which can also place the borrower under additional restrictions known as loan covenants. Although this article focuses on monetary loans, in practice any material object might be lent.

Correlation & Regression Analysis on Savings and Loans:

The term regression was originally used by FRANCIS GALTON (1822 - 1911) in a statistical examination of human inheritance to denote certain hereditary relationship very often in practice, a relationship is found to exist between these variables and often this make it possible to predict one or more variables in terms of others. For instance, studies are made to predict the future sales of a new product with respect to its price, family expenditure on feeding in terms of the family income, the consumption of certain food items in relation to the amount spend on its advertisement, quality of a product depending on the temperature of the product at production etc.

In this study, the focus is to examine the relationship between savings and loans with reference to EDE COMMUNITY MICRO FINANCE BANK NIGERIA LIMITED (ECB).

The group of data to be used involved only two variables; savings and loans, hence the simple linear regression and correlation analysis shall be used. The saving is taken to be independent variable (X) on which the loans (Y) depend.

The statistical model for sample linear regression assumes that for each value of X, the observed value of the response variable Y are normally distributed about a mean that depends on X. we use m_y to represent these means. Rather than just two m_1 and m_2, we are interested in how many means $m_y$changes as X changes. In general the m_y changes according to any sort pattern as X changes. In linear regression, we assume that they all line on a line when plotted against X. the equation of the line is given by

$$Y = a + bx$$

Where,

y = dependent variable

a = constant parameter which is autonomous (intercept)

b = parameter which shows the rate of change y with respect to x (slope).

With intercept a and slope b; this is the regression line. It describes how the mean response change with x. actually observed y's will vary the mean. The model assumes this variation measures by the standard deviation r is the same for all the value of x. the response y to a given x is a random variable that will take different value if we have several observations with the x – value.

The strength of this relationship is determined by the amount of effect that any change in one variable may cause on the other hand.

1.1 Historical Background of Regression and Correlation Analysis

The fundamental philosophy of Regression and Correlation were first proved and applied by SIR FRANCIS GALTON (1822 - 1911).

Galton was engaged in the study of heredity one of his observation was that the children of tall parents tends to be taller than average but not do tall as their parents. Whereas children of unusually short person tends to be shorter than their parents. This regression toward mediocrity gave these statistical method their name.

In a sense, the successive generation of offspring from tall person "regress" downward toward the mean height of population and reverse is true of the offspring from short families. Since Galton used one variable (i.e. height of the parent) to predict another (i.e. height of the child) the original term regression was eventually applied to general analysis by which the unknown variables are predicted through the known variables.

Correlation analysis also tell us the degree to which two variables are related. It is useful in expressing how efficiently one variable has estimated the value of the other variable. The word that is used to describe relationship between two categorical variables is association.

If two variables are found to be either associated or correlated, that doesn't necessarily mean that a cause and effect relationship exist between the two variables whether two variables are found to be casually associated depends on how the study was conducted.

Five different Criteria:

In economics, a country's current account is one of the two components of its balance of payments, the other being the capital account (also known as the financial account). The current account consists of the balance of trade, net *primary income* or *factor income* (earnings on

foreign investments minus payments made to foreign investors) and net cash transfers, that have taken place over a given period of time. The current account balance is one of two major measures of a country's foreign trade (the other being the net capital outflow). A current account surplus indicates that the value of a country's net foreign assets (i.e. assets less liabilities) grew over the period in question, and a current account deficit indicates that it shrank. Both government and private payments are included in the calculation. It is called the current account because goods and services are generally consumed in the current period.

Savings Account: A savings account is a deposit account held at a retail bank that pays interest but cannot be used directly as money in the narrow sense of a medium of exchange (for example, by writing a cheque). These accounts let customers set aside a portion of their liquid assets while earning a monetary return.

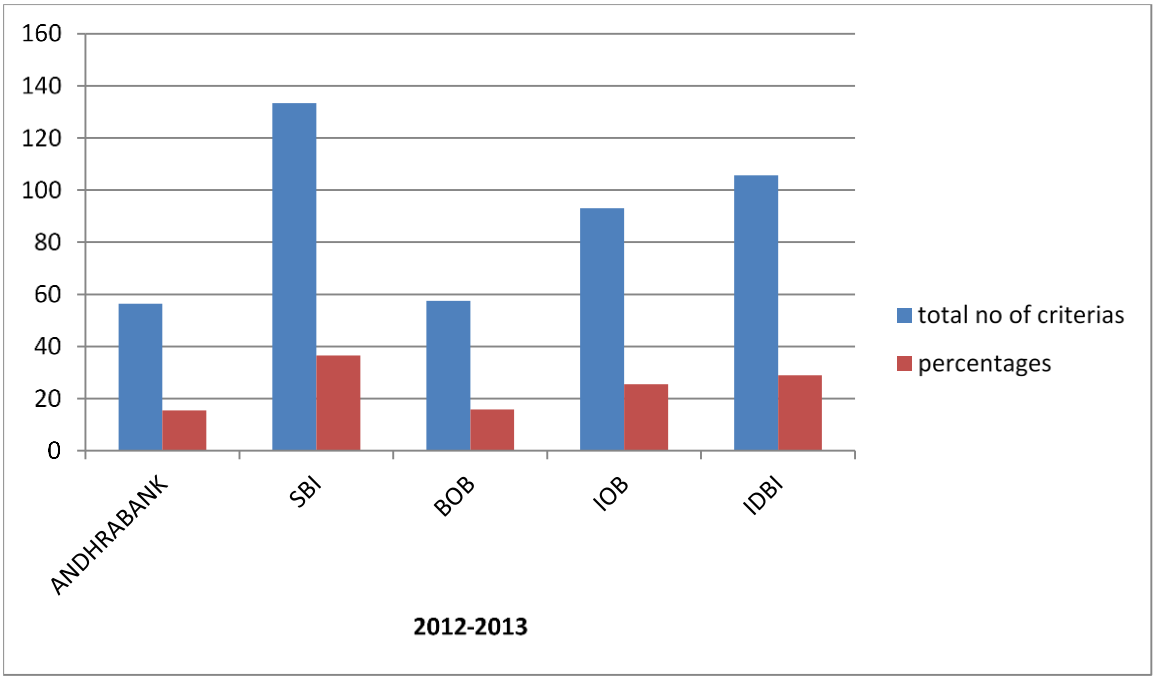
The other major types of deposit accounts are the transactional account (usually known as a "checking" (US) or "current" (UK) account), money market account and time deposit.

Fixed deposit: A fixed deposit (FD) is a financial instrument provided by banks or NBFCs which provides investors a higher rate of interest than a regular savings account, until the given maturity date. It may or may not require the creation of a separate account. It is known as a term deposit or time deposit in Canada, Australia, New Zealand, and the US, and as a bond in the United Kingdom and India. They are considered to be very safe investments. Term deposits in India, Nepal, and Pakistan are used to denote a larger class of investments with varying levels of liquidity. The defining criteria for a fixed deposit is that the money cannot be withdrawn from the FD as compared to a recurring deposit or a demand deposit before maturity. Some banks may offer additional services to FD holders such as loans against FD certificates at competitive interest rates. It's important to note that banks may offer lesser interest rates under uncertain economic conditions. The interest rate varies between 4 and 7.25 percent. The tenure of an FD can vary from 7, 15 or 45 days to 1.5 years and can be as high as 10 years. These investments are safer than Post Office Schemes as they are covered by the Deposit Insurance and Credit Guarantee Corporation (DICGC). However, DICGC guarantees amount up to ₹ 100,000 (about $1555) per depositor per bank. They also offer income tax and wealth tax benefits.

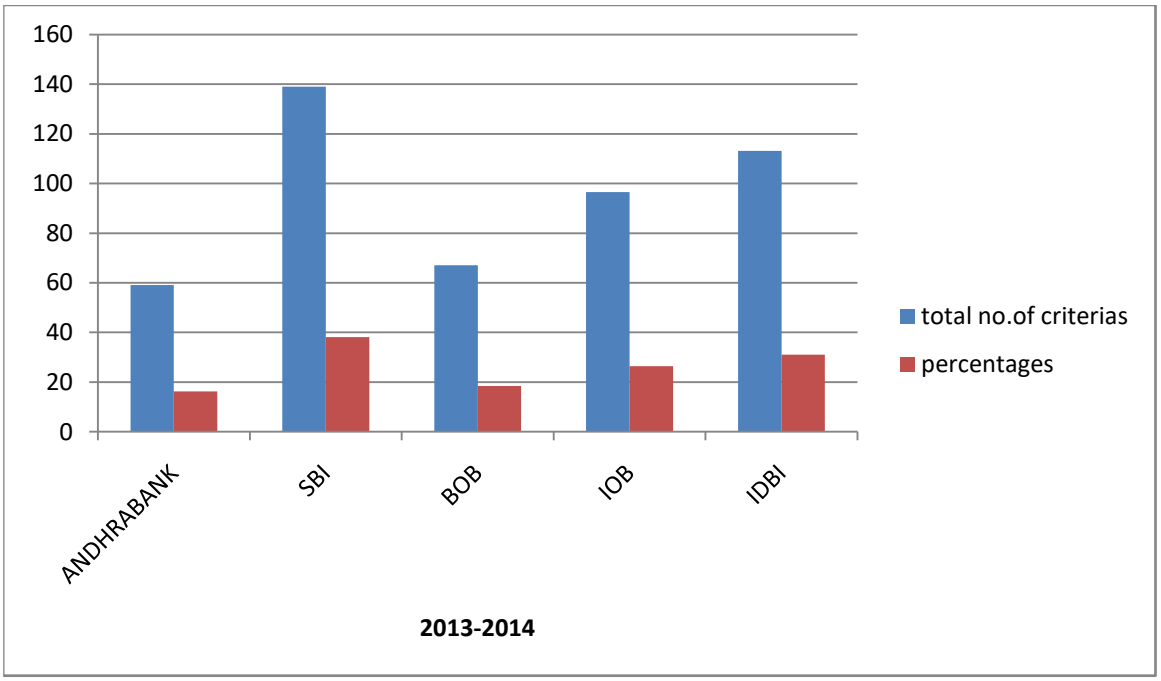
Consider different banks for analysis with different years and different criteria:

Year(2011-2012)	TOTAL NO.OF CRITERIAS	PERCENTAGES
ANDHRABANK	50.55	13.84
SBI	126.65	34.69
BOB	47.8	13.09
IOB	89.46	24.51
IDBI	99.13	27.15

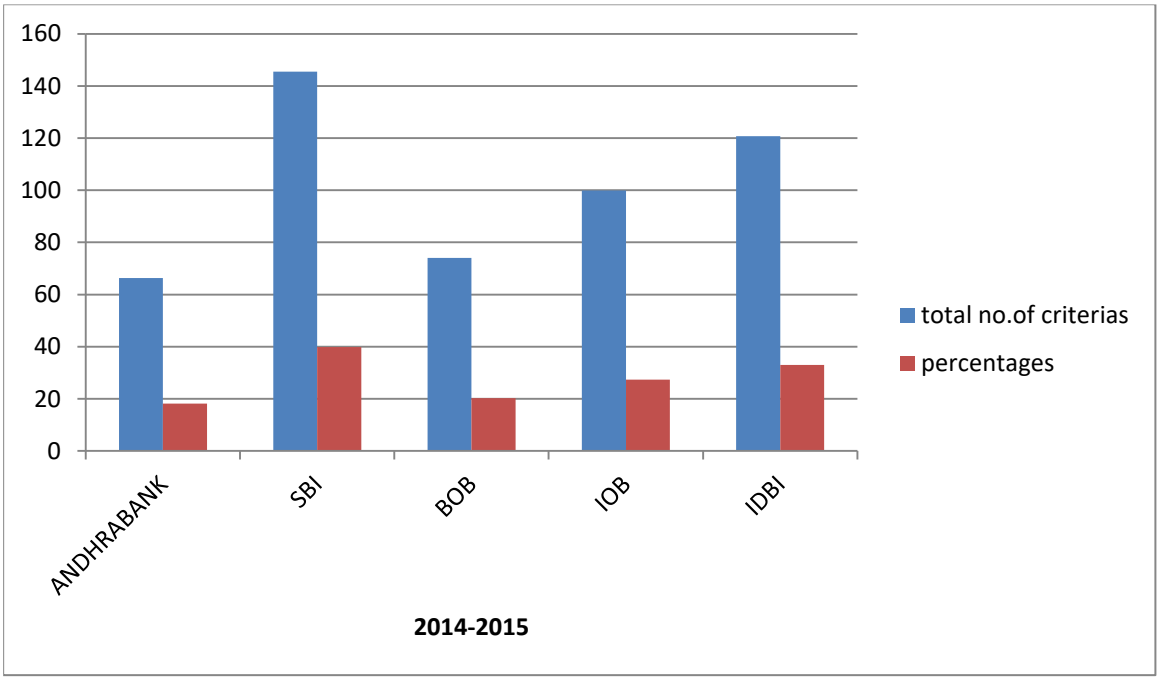
YEAR(2012-2013)	TOTAL NO.OF CRITERIAS	PERCENTAGES
ANDHRABANK	56.4	15.45
SBI	133.38	36.54
BOB	57.5	15.83
IOB	93	25.47
IDBI	105.65	28.94



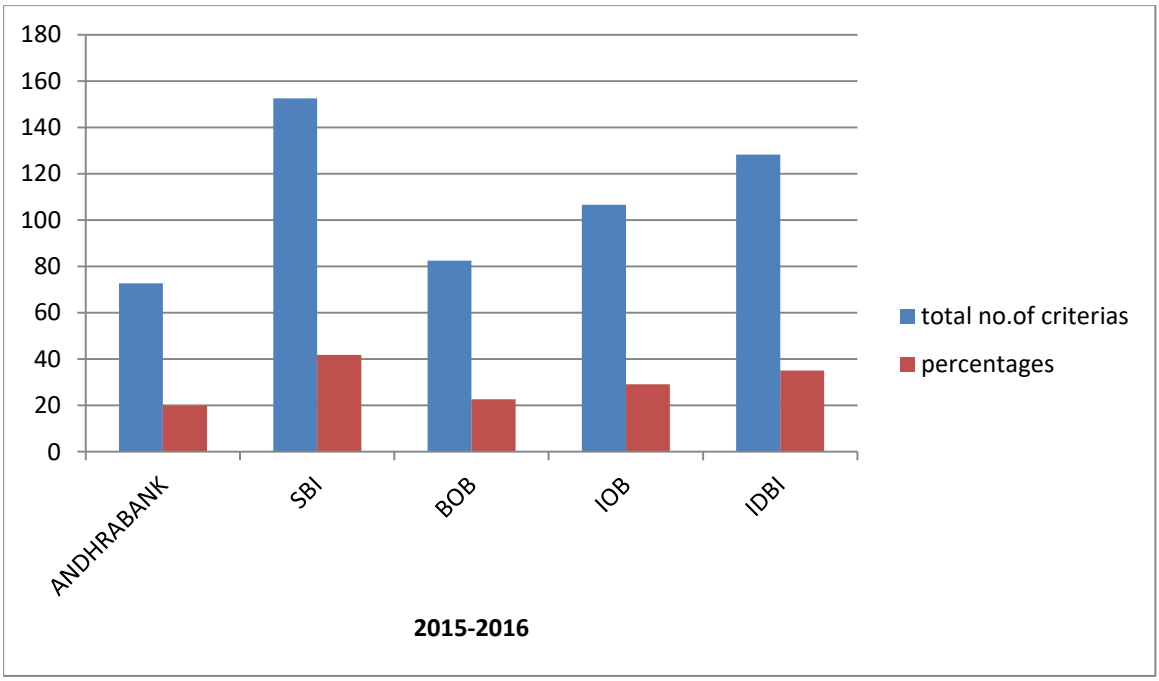
	TOTAL NO.OF CRITERIAS	PERCENTAGES
ANDHRABANK	59.12	16.19
SBI	139	38.08
BOB	67.1	18.38
IOB	69.53	26.44
IDBI	113.18	31



YEAR(2014-2015)	TOTAL NO.OF CRITERIAS	PERCENTAGES
ANDHRABANK	66.35	18.17
SBI	145.53	39.87
BOB	74	20.27
IOB	99.95	27.38
IDBI	120.7	33.06



YEAR(2015-2016)	TOTAL NO.OF CRITERIAS	PERCENTAGES
ANDHRABANK	72.65	19.90
SBI	152.56	41.79
BOB	82.5	22.60
IOB	106.58	29.2
IDBI	128.23	35.13



YEAR(2016-2017)	TOTAL.NO OF CRITERIAS	PERCENTAGES
ANDHRABANK	80.03	21.92
SBI	158.6	43.45
BOB	91.5	25.06
IOB	110.55	30.28
IDBI	137.47	37.66

Andhra bank

2011-2012:

50.55*100/365 = 5,055/365=13.8493=13.84%

2012-2013:

56.4*100/365=5,640/365=15.4520=15.45%

2013-2014:

59.12*100/365=5912/365=16.1972=16.19%

2014-2015:

66.35*100/365=6635/365=18.1780=18.17%

2015-2016:

72.65*100/365=7265/365=19.9041=19.90%

2016-2017:

80.03*100/365=8003/365=21.9260=21.92%

SBI

2011-2012:

126.65*100/365=12665/365=34.6986=34.69%

2012-2013:

133.38*100/365=13338/365=36.5424=36.54%

2013-2014:

139*100/365=13900/365=38.0821=38..08%

2014-2015:

145.53*100/365=14553/365=39.8712=39.87%

2015-2016:

152.56*100/365=15256/365=41.7972=41.79%

2016-2017:

158.6*100/365=15860/365=43.4520=43.45%

BOB

2011-2012:

47.8*100/365=4780/365=13.0958=13.09%

2012-2013:

57.5*100/365=5780/365=15.7534=15.75%

2013-2014:

67.1*100/365=6710/365=18.3835=18.38%

2014-2015:

74*100/365=7400/365=20.2739=20.27%

2015-2016:

82.5*100/365=8250/365=22.6027=22.60%

2016-2017:

91.5*100/365=9150/365=25.0684=25.06%

IOB

2011-2012:

89.49*100/365=8949/365=24.5178=24.51%

2012-2013:

93*100/365=9300/365=25.4794=25.47%

2013-2014:

96.53*100/365=9653/365=26.4465=26.44%

2014-2015:

99.95*100/365=9995/365=27.3835=27.38%

2015-2016:

106.58*100/365=10658/365=29.2%

2016-2017:

110.55*100/365=11055/365=30.2876=30.28%

IDBI

2011-2012:

99.13*100/365=9913/365=27.1589=27.15%

2012-2013:

105.65*100/365=10565/365=28.9452=28.94%

2013-2014:

113.18*100/365=11318/365=31.0082=31%

2014-2015:

120.7*100/365=12070/365=33.0684=33.06%

2015-2016:

128.23*100/365=12823/365=35.1315=35.13%

2016-2017:

137.47*100/365=13747/365=37.6630=37.66%

2011-2012

BANKS	ANDHRABANK	SBI	BOB	IOB	IDBI
NO.OF CRITERIAS	50.55	126.65	47.8	89.49	99.13
PERCENTAGES	13.84	34.69	13.09	24.51	27.15

X_I	Y_I	X_I^2	Y_I^2	X_iY_I
50.55	13.84	2555.3	191.5	699.61
126.65	34.69	16040.2	1203.3	4393.48
47.8	13.09	2284.8	171.3	625.70
89.49	24.51	8008.4	600.7	2193.39
99.13	27.15	9826.7	737.1	2691.37

$\Sigma_I X_i$ =413.6;$\Sigma_I Y_I$ =113.28 $\Sigma_I X_I^2$ = 38715.4; $\Sigma_I Y_I^2$ = 2903.9: $\Sigma X_I Y_I$=10603.55;

$\bar{x}$ =$\Sigma_I X_i$/n=82.72

$\bar{y}=\Sigma_i y_i/2=22.65$

$\sigma_x=\sqrt{}_{1/n}\Sigma x_i^2-(\bar{x})^2=30.008$

$\sigma y=\sqrt{1/n_n}\Sigma y_i^2-(\bar{y})^2=8.2314$

$cov(xy)=1/n\Sigma X_I Yi-\bar{x}\bar{y}=247.102$

$r_{xy}=cov(xy)/\sigma_x\sigma y=247.102/(30.008)(8.2314)=1.0003$

2012-2013

BANKS	ANDHRABANK	SBI	BOB	IOB	IDBI
NO.OF CRITERIAS	56.45	133.38	57.5	93	105.65
PERCENTAGES	15.45	36.54	15.83	24.47	28.94

X_i	Y_i	x_i^2	Yi^2	x_iy_i
56.4	15.45	3180.96	238.70	871.38
133.38	36.54	17790.22	1335.17	64873.70
57.5	15.83	3306.25	250.58	910.22
93	25.47	8649	648.72	2368.71
105.65	28.94	11161.92	837.52	3057.51

$\Sigma_I X_{i=}$ 445.93; $\Sigma_I Y_I=122.5$ $\Sigma_I X_I^2=44088.35$; $\Sigma_I Y_I^2=3310.69$: $\Sigma X_I Y_I=12082.52$

$\bar{x}=\Sigma_I X_i/n=445.93/5=89.186$

$\bar{y}=\Sigma_i y_i/2=122.5/5=24.5$

$\sigma_x=\sqrt{}_{1/n}\Sigma x_i^2-(\bar{x})^{2=}$ 29.381

$\sigma y=\sqrt{1/n_n}\Sigma y_i^2-(\bar{y})^2=7.87$

$cov(xy)=1/n\Sigma X_I Yi-\bar{x}\bar{y}=231.44$

$r_{xy}=cov(xy)/\sigma_x\sigma y=1.0009$

2013-2014

BANKS	ANDHRA BANK	SBI	BOB	IOB	IDBI
NO: OF CRITERIAS	59.12	139	67.1	96.53	113.18
PERCENTAGE	16.19	38.08	18.38	26.44	31

X_i	Y_I	X_i^2	Y_I^2	$X_i Y_I$
59.12	16.19	3495.17	262.11	957.15
139	38.30	193.21	1450.08	5293.12
67.1	18.38	4502.41	337.82	1233.29
96.53	26.44	9318.0	699.07	2552.25
113.18	3	12809.7	961	3508.58

$\Sigma_I^{X_i} = 474.938$ $\Sigma_I Y_I = 130.09$

$\Sigma_I^{X_I^2} = 49446.28$; $\Sigma_I Y_I^2 = 3710.08$: $\Sigma X_I Y_I = 13544.39$

$\sigma_x = \sqrt{1/n \Sigma x_i^2 - (\bar{x})^2} = 29.71$

$\sigma y = \sqrt{1/n_n \Sigma y_i^2 - (\bar{y})^2} = 8.092$

$cov(xy) = 1/n \Sigma X_I Yi - \bar{x}\bar{y} = 240.529$

$r_{xy} = cov(xy)/\sigma_x \sigma y = 1.00048$

2014-2015

BANKS	ANDHRA BANK	SBI	BOB	IOB	IDBI
NO: OF CRITERIAS	66.35	145.53	74	99.95	120.7
PERCENTAGE	18.17	39.87	20.27	27.38	33.06

X_i	Y_i	X_i^2	Y_i^2	$X_i Y_i$
66.35	18.17	4402.32	330.14	1205.5
145.53	39.87	21178.98	1589.61	5802.28
74	20.27	5476	410.87	1499.98
99.95	27.38	9909.0	749.66	2736.631
120.7	33.06	14568.49	1092.96	3990.34

$\Sigma_I^{X_i} = 506.53$ $\Sigma_I Y_I = 138.75$ $\Sigma_I^{X_I^2} = 55615.79$ $\Sigma Y_I^2 = 4173.24$: $\Sigma X_I Y_I = 15234.731$

$\bar{x} = \Sigma_I^{X_i}/n = 101.30$

$\bar{y} = \Sigma_i y_i/2 = 27.75$

$\sigma_x = \sqrt{1/n \Sigma x_i^2 - (\bar{x})^{2=}}$ **29.35**

$\sigma y = \sqrt{1/n_n \Sigma y_i^2 - (\bar{y})^2} = 8.03$

$cov(xy) = 1/n \Sigma X_I Yi - \bar{x}\bar{y} = 235.87$

r_{xy}=cov(xy)/$\sigma_x\sigma y$ =1.0008

2015-2016

BANKS	ANDHRA BANK	SBI	BOB	IOB	IDBI
NO: OF CRITERIAS	72.65	152.56	82.5	106.58	128.23
PERCENTAGE	19.90	41.70	22.60	29.2	35.13

X_i	Y_i	X_i^2	Y_i^2	$X_i Y_i$
72.65	19.90	5278.02	396.01	1445.73
152.56	41.79	23274.5	1746.40	6375.48
82.5	22.60	6806.25	510.76	1864.5
106.58	29.2	114359.29	852.64	3112.13
128.23	35.13	16442.93	123411	4504.7

$\Sigma_I X_i$ = 542.52$\Sigma_I Y_I$=148.62 $\Sigma_I X_I^2$ =63160.9ΣY_I^2 =4739.92 : $\Sigma X_I Y_I$= 17302.5

$\bar{x}$ =$\Sigma_I X_i$/n=108.5

$\bar{y}$=$\Sigma_i y_i$/2= 29.72

σ_x=$\sqrt{}$ $_{1/n}\Sigma x_i^2$-($\bar{x}$)$^{2=}$ 29.32

σy=$\sqrt{}$1/$n_n\Sigma y_i^2$-($\bar{y}$)^2 = 8.03

cov(xy)=1/n$\Sigma X_I Yi$- $\bar{x}\bar{y}$ = 235.88 r_{xy}=cov(xy)/$\sigma_x\sigma y$ =1.0018

2016-2017

BANKS	ANDHRA BANK	SBI	BOB	IOB	IDBI
NO: OF CRITERIA	80.03	158.6	91.5	110.55	137.47
PERCENTAGE	21.92	43.45	25.06	30.28	37.66

X_i	Y_i	X_i^2	Y_i^2	$X_i Y_i$
80.03	21.92	6404.8	480.4	1754.2
158.6	43.45	25153.9	1887.9	6891.1
91.5	25.06	8372.2	628.0	2292.9
110.55	30.28	12221.3	916.8	3347.4
137.47	37.66	18898.0	1418.2	5177.1

$\Sigma^{X}_{i=}$ 578.1 ΣY_I=158.38$\Sigma_I^{X}{}_I^2$ =71050.2ΣY_I^2 =5331.3 $\Sigma X_I Y_I$=3892.5

$\bar{x}$ =$\Sigma_I^{X}{}_i/n$=115.6

$\bar{y}=\Sigma_i y_i/2$ = 31.6

$\sigma_{x=}\sqrt{}_{1/n}\Sigma x_i^2-(\bar{x})^{2=}$ 29.09

$\boldsymbol{\sigma y=\sqrt{1/n_n}\Sigma y_i^2-(\bar{y})^2}$ = 8.22

$\mathbf{cov(xy)=1/n\Sigma X_I Yi-\bar{x}\bar{y}}$ = **239.54**

$\mathbf{r_{xy}=cov(xy)/\sigma_x\sigma y}$ = **1.00017**

Conclusion:

The significance of coefficient of correlation and its expression as coefficient of determination between the yield components (yield of fresh weight of snap bean pods/ experimental unit, index of productivity, fresh weight of pods /plant and fresh weight of whole snap bean plant) and the total yield was very high with positive sign.Research investigation and their analysis is the part of a wider development of any nation with regard to finance, education, public health, and agriculture, etc. that are indicators of better life of human beings. Any social phenomenon and especially those that can be characterized by numerical facts are the results of one or more causes of action. The concept of models is simplified to describe the complex economic, social, biological etc. processes. The regression analysis is a powerful technique of applied research and it becomes efficient through the skill of the researcher to replace a complex system of causes with a simple system where causative situations change with time.

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