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Comparative Evaluation Of Boss Versus Microsoft Windows Using Survey Of Indian Users

Sushil Kumar, Research Scholar, IKGPTU.

Dr.Sumesh Sood, IKGPTU Dinanagar Campus.

INTRODUCTION:

FOSS research from the viewpoint of Indian users is the focus of this research work. Measuring the satisfaction level of these software users is a key issue that has been explored on the basis of users' response to this type of software(s). The same has been performed in the present work. The collected data has been processed using SPSS to find out which software i.e. B.O.S.S. with MS Windows the users' response is favoring. To some factors, the response was found to be positive but in other factors, it was found to be negative. The present paper explores the overall conclusions from data processing.

The objective of this work is to compare B.O.S.S. with MS Windows by applying a vast variety of tests using SPSS on the data collected through questionnaire surveys from Indian users. This work will help the government policymakers by investigating the responses of B.O.S.S. users. This research work includes many aspects of technology like human Interaction with computers using B.O.S.S. with MS Windows, technology-enhanced learning using MS Office versus Open Office and social shaping of technology using two software i.e.Open Office and MS Office.

The questionnaires in the form of Google forms for users at distance have played a good role to collect the users' response on this software. SPSS has been used to create a database table and enter into its users' responses to the questionnaires. The questions asked from the users have been taken from the [1] framework for OSS adoption DOIET Govt. of India.

The overall results have been obtained by processing these responses with factor analysis, K fold cross-validation tests, Cronbach alpha tests, descriptive frequency tests and one Sample T-Tests using SPSS (Statistical Package for Social Sciences). The data has been collected to compare the two software i.e. **B.O.S.S. and MS Windows**

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Development of the Questionnaire as a Measurement Tool for Survey

The steps for the development of scale have been grouped into 3 phases:Existence as well as Importance of theconstruct;Representativeness /appropriateness of collection of data;andStatistical- analysis and statistical -evidence of the construct[2].

Phase1: Existence and Importance of the construct: The first phase is comprised of Domain(s) Identification or specification, item development and evaluation of content validity.

Step1. Domain(s) -Identification or specification: In this step domain under study is identified and specified and a new measure or scale is constructed. The domain in the present research is to perform a comparison of BOSS versus Microsoft Windows using a survey of Indian users. It is all about the features and qualities of the two broad categories of the software i.e. proprietary software and FOSS.The well-defined domain, therefore, provided the understanding of the observable fact under study and the process of item generation became easier. The review of the relevant literature available on university- provided research websites provided the base for the new construct. The new construct was explored and discussed with IT people and teachers also. At the start of scale development, the relevant audience from the IT field were interviewed. McCoach et al. have already mentioned the same steps in scale development; “these are all based onthorough literature review and specifying the purpose of the domain or construct”. A large number of research papers on the related topic were studied which is also mentioned in the chapter of literature review. Framework for FOSS adoption of 2013 and 2015 was also referred which contains all the factors on which such comparison should be made. There was not an existing instrument but was existing a base for the instrument in the form of the factors forcomparison.

Step2: Item Development: Here framework was already available therefore the domain has been determined from it. Statistical computation has decided on the dimensions. Two ways to generate the correct questions are deductive (logical partitioning) and inductive. Many items were developed from the factors mentioned in the Framework of FOSS adoption 2013 and. 2015 by IT Dept. of Govt. of India. These items are mentioned in the online questionnaire uploaded on google forms for comparison. This is also called question -development/ “itemgeneration”.

Step3. Evaluating Content validity: Validity is the extent to which the measurements of the survey provide the information required to achieve the study’s aim (Simon & Francis, 1998) [3]. As already mentioned vast study of literature was performed; also explained in the

ISSN:0971-1260
Vol-22- Issue-14-December-2019

literature review chapter. Interviews of experts like AashishDakhane, Software Test Engineer, Kunal Verma, Freelance Java Developer, Milind Oak (A Mathematics Teacher from Maharashtra who has developed FOSS, and is also a revolutionary in FOSS adoption in India), etc. were also conducted. From many teachers and professionals the questionnaire was discussed andfinalized.

Phase 2: Representativeness/appropriateness of data collection:
This phase contains "questionnaire development and evaluation", pilot study performance, as well as sampling and data collection.
Step1. Questionnaire development and evaluation: Hernandez et. Al. (1991) recommends that in order to collect data, one must first select or design the measurement tool, and this tool must be validated and reliable [4]. The selection of the tool is important. "In the scientific methodology there exist various tools for data collection, but due to recent methodological developments, especially in statistical data analysis, survey methodology (based on questionnaires) has become one of the most common alternatives in recent decades" (Meneses& Rodríguez, 2011). Anguita et. Al. (2003), states that the basic toolused in research by the survey is the questionnaire. The questions for this survey were developed from the factors of the Govt. framework. Most of the questions in the questionnaire are closed-ended. They have comprehensive answer choices. The questions comprise the cost of software, freedom to use Software, piracy of software, data security of software, ease to modify and improve Software. The responses of users of Google form questionnaires have been converted into SPSS (Statistical Package for social sciences) format. In this process, a database file has been developed in SPSS.

All the variables have been named in the name column then the questions of the questionnaire have been put in the label field and various choices of the answers to be chosen by the respondent have been put in the value field, and each choice has been given a value like Q: Which is more costly? Q: What can save Indian nation/company foreign currency? Q: Which category of software(s) provides us better local capacity building opportunities? Q: Which software(s) provide a more good economic opportunity for the local industry. Value=1 MS Windows, Values = 2 BOSS. All this is known as the variable view. The second view is called the data view. Here all the data values have been entered i.e. 1, 2 and/or so on. At some places 1 means yes and 2 meansno.

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Step2. Pilot Study: The first preliminary study should be performed just on the small size of the target population so that newly prepared questionnaires may be tested and any changes, if required in the questionnaires, may be performed so that a large target population may get the corrected questionnaires. However, as this is a small and additional case study, therefore, the number of respondents is not as large as in FOSS versus proprietary questionnaire.

Step3: Sampling cum data collection: "According to Dillman et al., (2009), "Random sampling is the most common type of sampling used in self-administered surveys, every member of the sample frame has an equal chance of selection". According to Pallant, 2005 in factor analysis, respondents should be five times the number of items in the questionnaire. This rule has been followed in the current case study. The respondents of the online Google form of the questionnaire were selected from the mailing lists of Ph.D. Scholars, email Ids of participants of computer conferences, Professors of Computers, school teachers of computer, and students mostly of computer branches. SPIC India (The Society for Promotion of IT in Chandigarh) Dept. from IT Park Chandigarh provided alist of teachers who has experience with Bharat Operating System Solution in computer laboratories of schools provided by C DAC Mohali. The author has also joined the Whatsapp group of BOSS users of all over India named "Bharat operating system". Some members of this group also filled some online questionnaires. The author is also a member of https://groups.google.com/forum/#!forum/BOSS-support here one can easily consult regarding anyquery.

Phase 3: Analyzing Statistically and getting statistical evidence of construct: This part comprises of steps: Assessment of dimensions, assessment of reliability, and validity.

Statistical Examination using SPSS from data collected through questionnaires with Google online forms.

Step1. Assessment of Dimensions: According to Netemeyer et al., (2003), Dimensions of a measure is concerned with the homogeneity of items and is equal to the number of common factors that account for the correlation within items. According to Haynes et al., (1995), a new construct also require dimensions specification. According to Clark & Watson, (1995), homogeneity indicates whether the scale items assess a single underlying factor or construct. Uni-dimensional means one dimension i.e. item has one factor. Multidimensional means many dimensions of an item, i.e. item has many factors. Factor analysis can predict dimensionality. It is performed in the starting of scale development. Step2. Assessment of

ISSN:0971-1260
Vol-22- Issue-14-December-2019

reliability, and validity: K-M-O test (for Sampling- Adequacy), Factor -analysis (to get the most important/ contributing factors or parameters), Cronbach- alpha coefficient test and cross-validation test-retest (reliability and validity), descriptive frequency -tests, one-sample T-tests (to analyze the data especially regarding factors/parameters found from factor analysis for comparative evaluation of B.O.S.S. versus Microsoft Windows) has been conducted as follows and discussed here minutely.

Factor-Analysis

In factor analysis, the respondents should be five times the number of items in the questionnaire. This technique is considered appropriate as it does not need pre-existing functional relationships and is famous for reducing the number of factors in the small number of core factors. The Kaiser-Meyer Olkin (KMO) and Bartlett's- Test measure of sampling-adequacy were used to examine the appropriateness of Factor- Analysis.

Table 4.1:K-M-O and Bartlett'-Test[a]

K-M-OMeasure of Sampling Adequacy.		.638
Bartlett-Test of Sphericity	Approx. Chi-Square	224.362
	Df	36
	Sig.	.000

a. Only cases for which software(s) are more suitable. = BOSS is used in the analysis phase".

As value shown in table 4.1; K-M-O= .638 > 0.5, indicates that the sample is adequate and the factor analysis can be used.

Bartlett's- Test of Sphericity-sig=.000<0.05 therefore the factor analysis is valid As p <.05, It means factor-analysis is useful and appropriate for this data. Therefore the factor analysis is performed as follows:

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Table-4.2: Total-Variance-Explained[a]

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.204	46.709	46.709	4.204	46.709	46.709	3.511	39.008	39.008
2	1.772	19.692	66.401	1.772	19.692	66.401	2.465	27.393	66.401
3	.811	9.007	75.408						
4	.625	6.943	82.351						
5	.545	6.061	88.412						
6	.398	4.423	92.835						
7	.365	4.056	96.890						
8	.197	2.187	99.077						
9	.083	.923	100.000						

Extraction- Method: Principal –Component- Analysis.

a. Only cases for which software(s) are more suitable. = BOSS is used in the analysis phase.

The rotation sums of the squared loading represent the distribution of the variance after the varimax rotation with Kaiser Normalization. The varimax rotation tries to maximize the variance of each of the factors.

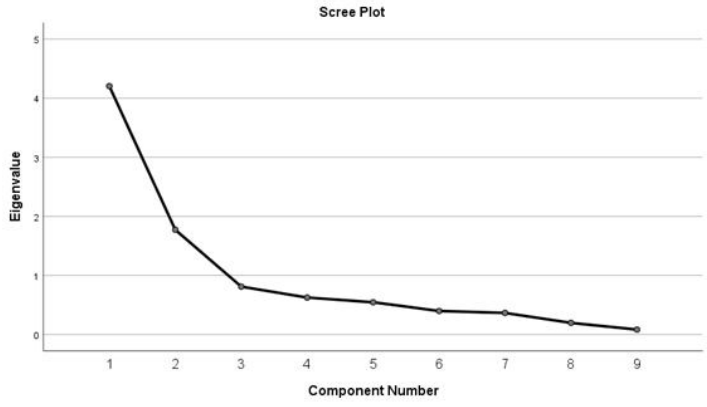

Figure 4.10: Scree Plot

As shown in Table 4.2: Total–Variance-Explained[a] and figure 4.10: Scree Plot; two

ISSN:0971-1260
Vol-22- Issue-14-December-2019

factors have initial Eigen value >1 (which is desired)

Table 4.3: Rotated-Component Matrix[a,b]

	Component	
	1	2
What can save nation/company foreign currency?	.854	
Which is more cost-effective	.824	
Which software possess more trial ability.	.767	
Which software provides us the method to minimize piracy.	.744	
Which category of software(s) provide us Better Local Capacity Building opportunities	.684	
Which software provides freedom to modify and improve.	.660	
Which software provides a better economic opportunity for the local industry.		.914
The public sector should consider the other software solution if it costs less		-.774
Which software(s) provide more source code level security without mistrust code.		.722

It is very easy to see that in Table 4.3: Rotated Component Matrix all the factor loading values are greater than 0.5, which are desired.

Reliability of questionnaire data for comparison of BOSS with Microsoft Windows

Table 4.4:Case-Processing-Summary

		N	%
Cases	Valid	43	56.6
	Excluded[a]	33	43.4
	Total	76	100.0

a. List-wise deletion based on all variables in the procedure.

Table 4.5:Reliability-Statistics

Cronbach- Alpha	N of Items
.779	29

ISSN:0971-1260
Vol-22- Issue-14-December-2019

As shown in table 4.4 and table 4.5; the value of Cronbach- Alpha = .779 > .6, therefore it signifies that collected data is reliable.In the following steps, the data has been divided into two parts i.e. part_1 and part_2 and 2- fold validation test has beenconducted.Reliability of questionnaire data for comparison of B.O.S.S. with MS Windows Part 1

Table 4.6: Case-Processing-Summary

		N	%
Cases	Valid	21	56.8
	Excluded[a]	16	43.2
	Total	37	100.0

a. Listwise deletion based on all variables in the procedure.

Table 4.7: Reliability-Statistics

Cronbach- Alpha	N of Items
.874	29

As shown in table 4.6 and table 4.7; the value of Cronbach-Alpha = .874 > .6, therefore it signifies that collected data is reliable.Reliability of questionnaire data for comparison of B.O.S.S. with MS Windows Part 2

Table 4.8:Case-Processing-Summary

		N	%
Cases	Valid	21	55.3
	Excluded[a]	17	44.7
	Total	38	100.0

a. Listwise deletion based on all variables in the procedure.

Table 4.9: Reliability Statistics

Cronbach-Alpha	N of Items
.655	29

As shown in table 4.8 and table 4.9; the value of Cronbach- Alpha = .655 > .6, therefore it signifies that collected data is reliable.

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Table 4.10: Intra-class–Correlation-Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.933[a]	.863	.968	28.857	28	28	.000
Average Measures	.965[c]	.926	.984	28.857	28	28	.000

. As In Intra-class Correlation Coefficient Table 4.10; the value of Intraclas Correlation= .965 > .6

It represents the correlation between the data of two parts i.e. part_1 : Part_2, Therefore It further confirms the reliability cum validity of the data thro the above performed test-retest process.

Following are all the tables and plots obtained as a result of K-M-O, Fac analysis, and one-sample T-Tests:

Table 4.11:K-M-O and Bartlett's-Test[a"]

K-M-OMeasure of Sampling Adequacy.		.638
Bartlett- Test of Sphericity	Approx. Chi-Square	224.362
	Df	36
	Sig.	.000

a. Only cases for which software(s) are more suitable. = BOSS is used in the analysis phase.

Table 4.12: Rotation- Matrix

What can save nation/company foreign currency?	.854
Which is more cost-effective	.824

Table 4.13: One-Sample- Statistics

	N	Mean	Std. Deviation	Std. Error Mean
What can save nation/company foreign currency.	66	1.80	.401	.049
Which is more cost effective	72	1.76	.428	.050

Table 4.14: One-Sample–Test

	Test Value = 38					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
What can save nation/company foreign currency.	-733.776	65	.000	-36.197	-36.30	-36.10
Which is more cost effective	-718.948	71	.000	-36.236	-36.34	-36.14

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Analysis of Results:

Table 4.15: Descriptive-Statistics for What can save nation/company foreign currency?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MS Windows	13	17.1	19.7	19.7
	BOSS	53	69.7	80.3	100.0
	Total	66	86.8	100.0	
Missing	System	10	13.2		
Total		76	100.0		

Table 4.16: One-Sample–Statistics

	N	Mean	Std. Deviation	Std. Error Mean
What can save nation/company foreign currency.	66	1.80	.401	.049

Table 4.17: One-Sample–Test

	Test Value = 38					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
What can save nation/company foreign currency.	-733.776	65	.000	-36.197	-36.30	-36.10

Analysis of Statistical Output Tables

Assume H0: Null hypothesis is that the users believe that the software of the two categories can save nation/company foreign currency equally or there is no difference between saving nation/company foreign currency by two categories of software.

H1: Alternative Hypothesis: two categories of software can save nation/company foreign currency equally. It means one software can save nation/company foreign currency more than the other.

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Table 4.15 displays descriptive statistics providing insight into the pattern of data. It is easy to see that the users who say that MS Windows can save nation/company foreign currency are 13 and the users who say that BOSS can save nation/company foreign currency are 53. The figures clearly show that significantly more number of users feel that the BOSS can save nation/company foreign currency in place of MSWindows.

One-Sample T-Test: Table 4.16 and Table 4.17 shows that output from one -sample T- Test. The t Value = 733.776. This big value proves that the results are not a matter of chance. Our t value is large. It means results have not come by chance.

Df-Degree of Freedom: This value in this case is 66, which is close to the total number of participants (76). Missing entries are only 10 it means out of 76, only 10 users are not aware of which of two types of software can save nation/company foreign currency.

Sig. (2 -tailed): This significance level or p-value = .000 < .05, this value is low, very less than .05. It represents that the null- hypothesis that two types of software are equally secure is automatically rejected and the alternative-hypothesis is proved. The significantly more number of users have the opinion that BOSS can savenation/companyforeign currency than MS Windows as is clearly visible from the descriptive frequency table

Table 4.18: Descriptive-Statistics for Which is more cost-effective

		Frequency	Percent	Valid Percent	umulative Percent
Valid	MS Windows	17	22.4	23.6	23.6
	BOSS	55	72.4	76.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

Table 4.19: One-Sample-Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Which is more cost effective	72	1.76	.428	.050

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Table 4.20: One-Sample-Test

	Test Value = 38					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Which is more cost effective	-718.948	71	.000	-36.236	-36.34	-36.14

Analysis of Statistical Output Tables

Assume H0: The null-hypothesis is that users believe that the software of the two categories is equally secure or there is no difference between the cost-effective feature of two categories of software.

H1: Alternative -Hypothesis: two categories of software are not equally cost-effective. It means one category of software(s) is more cost-effective than the other.

Table 4.18 displays descriptive- statistics providing insight into the pattern of data. It is easy to see that the users who say that MS Windows is more cost-effective are 17 and theusers who say that the BOSS is more cost-effective are 55. The figures clearly show that a large number of users feel that BOSS is more cost-effective than MSWindows.

One-Sample T-Test:

Table 4.20 and Table 4.20 shows output from “one sample T-Test”. The t Value = 718.948. This big value proves that the results are not a matter of chance. Our t value is large. It means results have not come by chance.

Df-Degree of Freedom: This value in this case is 71, which is close to the total number of participants (76). Missing entries are only 4 it means out of 76,only 4 users are not aware regarding which of two types of software is more cost-effective.

Sig. (2-tailed): This significance level or p-value = .000 < .05, this value is low, very less than .05. It represents that the null- hypothesis that two types of software are equally cost-effective is automatically rejected and the alternative-hypothesis is proved. A significantly more number of users have the opinion that BOSS is more cost-effective than MS-Windows, as is clearly visible from the descriptive frequency table.

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Table 4.21: Descriptive-Statistics for Which Software(s) provide us the method to minimize piracy.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MS Windows	15	19.7	20.8	20.8
	BOSS	57	75.0	79.2	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

Table 4.22: One-Sample-Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Which software(s) provide us the method to minimize piracy.	72	1.79	.409	.048

Table 4.23: One-Sample-Test

	Test Value = 38					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
Which software(s) provide us the method to minimize the piracy.	-751.255	71	.000	-36.208	-36.30	-36.11

Analysis of Statistical Output Tables

Assume H0: Null hypothesis is that users believe that the software of the two categories provides us the method to minimize piracy equally or there is no difference between providing us the method to minimize the piracy by two categories of software(s).

H1: Alternative Hypothesis: two categories of software are not providing us the method to minimize piracy equally. It means one software is providing us the method to minimize piracy more than theother.

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Table 4.21 displays descriptive statistics providing insight into the pattern of data. It is easy to see that the number of users who believe that MS Windows provides us the method to minimize the piracy is 15 and the number of users who believe that BOSS provides us the method to minimize is 57. The figures clearly show that more number of users feel that BOSS provides us the method to minimize piracy more than MS Windows. One-Sample T-Test:

Table 4.22 and Table 4.23 shows that output from one sample T-Test. The t Value = 751.255. This big value proves that the results are not a matter of chance. Our t value is large. It means results have not come by chance.

Df-Degree of Freedom: This value in this case is 71, which is close to the total number of participants (76). Missing entries are only 4 it means out of 76, only 4 users are not aware regarding which of two types of software provide us the method to minimize piracy'

Sig. (2 -tailed): This significance level or p-value = .000 < .05, this value is low, very less than .05. It represents that the null- hypothesis that two types of software are equally secure is automatically rejected and the alternative-hypothesis is proved. A significantly more number of users have the opinion that BOSS provides us the method to minimize piracy more than MS Windows, as is clearly visible from the descriptive frequency table.

Conclusions Drawn from Analysis of Statistical Output Tables

A significantly more number of users have the opinion that BOSS is more cost- effective than MS-Windows. The larger number of users has the opinion that BOSS can save nation/company foreign currency than MS Windows. A significantly more number of users have the opinion that BOSS provides us the method to minimizepiracy.

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ISSN:0971-1260
Vol-22- Issue-14-December-2019

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