USE OF STATISTICAL ANALYSIS PROGRAM (SPSS) IN ASCERTAINING RELEVANCE OF BEST HR PRACTICES

Maj Gen Gurdeep Singh Narang (Retired)[*]

Dr Archana Sharma[**]

Abstract:

Requirement of collating, analyzing and drawing accurate useful inferences from a large sample can be very time consuming process. SPSS is a widely used program for statistical analysis in social science. This software package takes the raw data, the researcher inputs, calculates significance tests that the researcher specifies. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners, and others. To practice this program, this paper suggests the methodology of using the software with the help of a case study on Relevance of Best human resource practices in the Corporate Sector to the Indian Armed Forces. An e questionnaire was administered to 650 officers of Indian Armed Forces to show preference for the relevant HR practices. The responses have been tabulated and analysed using SPSS.

Key Words :, Human resource practices , Descriptive statistics, one way Anova test, Chi-square test, Rank correlation coefficient

[*] **Dean Student Welfare, Amity University, Lucknow Campus**

[**] Asst Professor at Amity Lucknow Campus

Biographical notes :

The author is Dean Student Welfare with Amity University, Lucknow Campus. He has served in Indian Armed Forces for 38 Years. He is a post graduate with degrees in Defence Studies from Madras University, Weapon Technology from Pune University and Master of Business Administration from IGNOU, New Delhi. He has done M Phil from Indore University. With vast experience in human resource management in Indian Armed forces, he has lectured extensively in various Armed forces Institutes and has been Head of Training team at Defence Services Staff College Wellington (India).
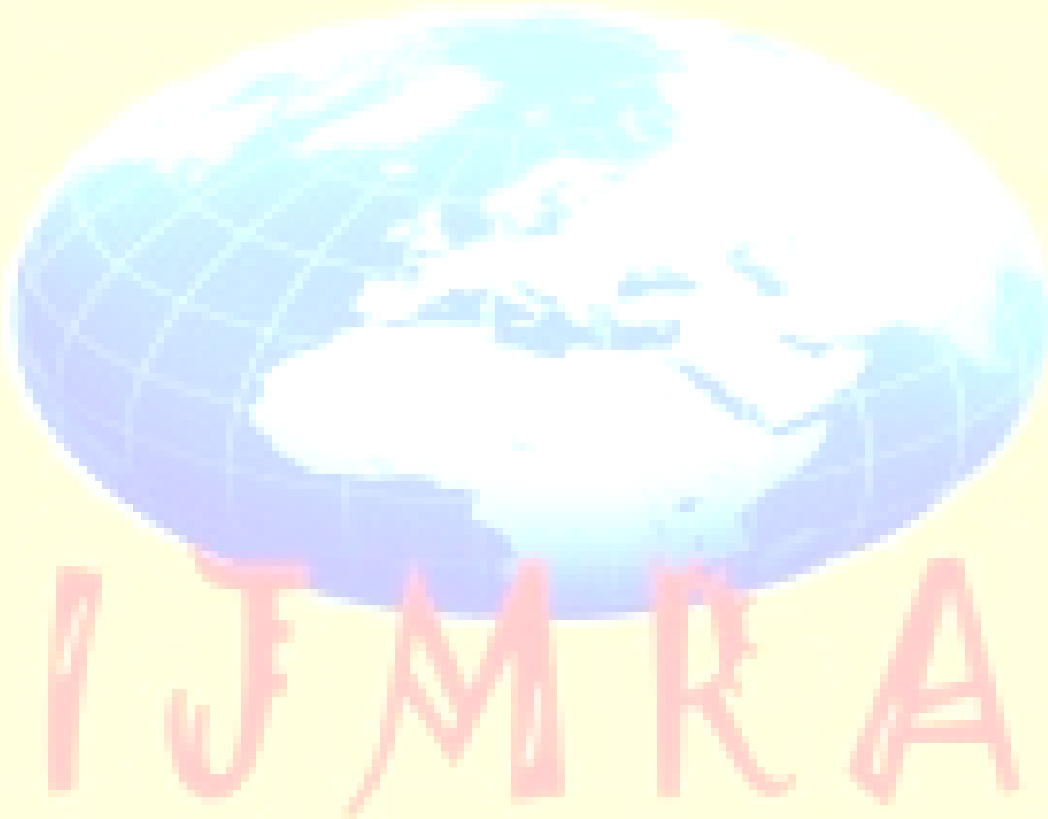
INTRODUCTION

IBM SPSS Statistics is an integrated family of products that addresses the entire analytical process, from planning to data collection to analysis, reporting and deployment. With more than a dozen fully integrated modules to choose from, this software provides the specialized capabilities needed to increase revenue, outperform competitors, conduct research and make better decisions. With the help of a case study: ' Best HR Practices in the Corporate Sector and their relevance to Indian Armed Force', use of SPSS has been illustrated.

HUMAN RESOURCE MANAGEMENT IN ARMED FORCES

The human resource is the most valuable and scarce resource available to any organization including the Indian Armed forces and its management has become a greater challenge to the military leaders due to increasingly better socio-economic conditions and improved education standards of the Armed forces personnel. The Indian Armed forces are facing a severe manpower crunch especially in the junior officer's cadre, the cutting edge of any force, due to their falling intake and rising premature retirements. There is a need to initiate suitable measures with a view to retain and ensure enhance utilization of this limited manpower for optimizing the effectiveness of the Indian Armed forces.

Good HR practices can create or add value for the organization. The corporate sector has evolved and adopted a number of contemporary and good HR practices to effectively manage their human resources. Could the HR practices in vogue in corporate sector be relevant and adopted in the Indian Armed forces to overcome their HR related problems of attrition, retention and motivation and thereby enhance their effectiveness in meeting the National Security objectives? This has been taken on as the Research problem.

(a) **Data Collection**. The primary data on Human resource practices in corporate sector has been collected through personal interaction and interviews from 35 companies and organisations, viz, Banking (Axis, SBI, OBC, Andhra Bank), Information Technology (Info Sys Technologies Limited, Wipro and TCS), Power generation and distribution(Bharat Electricals Ltd and Power Grid Corporation of India Ltd),Communication (Bharti Airtel, Motorola), Manufacturing (Maruti Udyog, Crompton Greaves, Essar Group, Steel Authority of India and LG Electronics India Pvt Ltd) and Exploration(Oil India Ltd, Shipping Corporation of India Ltd and Coal India Ltd) .Use

of e questionnaire and interaction with Armed forces officers through seminars and interviews to get their views and preferences on relevance of HR practices in corporate sector was made.

(b)   **Sampling.**   Convenient and simple random method of sampling was used to conduct the survey which comprised of 240 respondents consisting of HR executives in three services, at grass root level, middle level and senior level, both in age and service profile.

On the basis of review of literature and interactions with HRM executives from corporate sector, the following HRM Practices (HRMPs) were identified as relevant practices for adoption in Indian Armed Forces:

Table -1 Human Resource Management Practices (HRMPs)

S. No.	Name of HRM Practice	S. No.	Name of HRM Practice	S. No.	Name of HRM Practice
1	Open Book Management Style	11	Employee Assistance Program	21	Leisure and Entertainment
2	Clearly Defined and Measurable KRA	12	Knowledge Sharing Sessions	22	Idea Acceptance Reward
3	Job Rotation	13	I4 Teams	23	Employee of the Month
4	Flexi time	14	Code Camp Workshop	24	Calling Everyone By Name
5	Stress Relieving Measures	15	Cross Functional Teams	25	Fair Evaluation
6	Professional Counseling Services	16	Competency Mapping	26	360 Degree Performance Management Feedback
7	Staff Management	17	Performance Linked Bonus	27	Open Door Policy
8	Safe , Healthy , and Happy Workplace	18	Highlight Performer	28	Open house Discussion
9	Coaching and Mentoring	19	Delight Employee With Unexpected	29	Coffee With Boss
10	Cross Functional Training	20	Reward And Recognition	30	Mentoring

A   Questionnaire was administered to six hundred fifty officers of Indian Armed Forces. Out of this, responses from two hundred forty officers were included in our data set. Rest of the responses were ignored due to reasons such as ambiguity, incompleteness of data provided, and

inconsistency. Respondents were asked to express their opinion about the relative significance of various HRM Practices by selecting their choice on a five point Likert Scale as follows: 1 means "Strongly Disagree",2 means "Disagree", 3 means "Neither Agree nor Disagree" or "Neutral",4 means "Agree", 5   means "Strongly Agree"   Responses received from the first 09 respondents and the last 240th respondent have been tabulated in table 2.

Figures in the Table 2 & histogram are based on the values in the column "Total Scores". These values are from 240 respondents. The first 120 figures relate to Army, next 60 to Navy, and the last 60 relate to Air Force.

Table -2 Basic data collected from 240 respondents

S. No.	Open Book Management Style	Clearly Defined and Measurable KRAs	Job Rotation	Flexitime	Staff Management	Stress Relieving Measures	Professional Counselling Services	Safe, Healthy & Happy Workplace	Coaching and Mentoring	Cross-Functional Training	Employee Assistance Programs	Knowledge Sharing Sessions	14 Teams – Ingenious, Idea, Incubation & Implementation	Code Camp Workshop	Cross Functional Team	Competency Mapping	Performance linked Bonus/Incentives	Highlight Performers	Delight Employees with the Unexpected	Rewards and Recognition	Leisure and Entertainment Activities	Idea Acceptance Reward	Employee of the Month	Calling Everyone by Name	Fair Evaluation System	360 Degree Performance Management Feedback System	Open Door Policy	Open House Discussions	Coffee with Boss	Mentoring	Total Score
1	1	5	1	1	5	4	5	5	5	4	4	4	5	5	5	5	4	4	3	5	3	5	3	3	5	1	1	5	4	5	115
2	5	5	2	5	5	4	5	5	5	4	4	5	5	5	5	5	2	4	4	5	4	5	4	4	5	4	4	5	4	5	133
3	2	4	5	5	5	4	4	4	4	2	3	3	2	1	5	5	1	4	4	5	5	5	1	2	5	2	2	5	1	4	105
4	2	5	5	3	5	4	5	5	4	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	4	5	3	138
5	4	5	5	4	5	4	5	5	5	4	4	5	5	5	5	5	1	5	4	5	4	5	5	3	4	3	3	5	4	5	133
6	3	5	5	5	5	5	5	5	5	5	5	5	2	5	3	3	3	5	5	5	5	5	4	5	4	4	5	4	4	5	138
7	5	4	5	5	5	5	4	4	3	2	2	2	2	5	5	5	5	5	3	5	5	5	5	5	5	3	2	5	2	4	119
8	5	4	5	2	5	4	4	5	5	4	4	5	5	5	5	5	5	3	5	4	5	5	5	5	1	1	5	5	2	4	127
9	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	146
240	2	5	4	2	2	4	5	5	3	4	4	4	2	2	2	5	5	5	5	4	5	5	4	5	5	4	5	4	5	5	122
Total	931	1129	996	885	1087	1062	1121	1140	1108	947	1035	1092	959	984	1026	1103	923	1055	960	1103	1083	1110	975	935	1145	939	830	1125	923	1107	30818

	Open Book Management Style	Clearly Defined and Measurable KRAs	Job Rotation	Flexitime	Staff Management	Stress Relieving Measures	Professional Counselling Services	Safe, Healthy & Happy Workplace	Coaching and Mentoring	Cross-Functional Training	Employee Assistance Programs	Knowledge Sharing Sessions	14 Teams	Code Camp Workshop	Cross Functional Team	Competency Mapping	Performance linked Bonus/Incentives	Highlight Performers	Delight Employees with the Unexpected	Rewards and Recognition	Leisure and Entertainment Activities	Idea Acceptance Reward	Employee of the Month	Calling Everyone by Name	Fair Evaluation System	360 Degree Feedback	Open Door Policy	Open House Discussions	Coffee with Boss	Mentoring	Total Score
Army	429	566	507	425	547	534	563	570	559	501	513	533	469	488	527	555	412	527	463	549	533	554	478	499	572	436	376	569	424	555	15233
Navy	282	281	229	285	265	268	273	282	278	199	262	280	266	245	235	272	266	261	268	274	280	285	239	215	287	232	251	276	257	272	7865
Air F	220	282	260	175	275	260	285	288	271	247	260	279	224	251	264	276	245	267	229	280	270	271	258	221	286	271	203	280	242	280	7720
Overall	931	1129	996	885	1087	1062	1121	1140	1108	947	1035	1092	959	984	1026	1103	923	1055	960	1103	1083	1110	975	935	1145	939	830	1125	923	1107	30818

Histogram **(Graph 1)** of the "Total Scores" given in the last column of the above table appears as follows:-
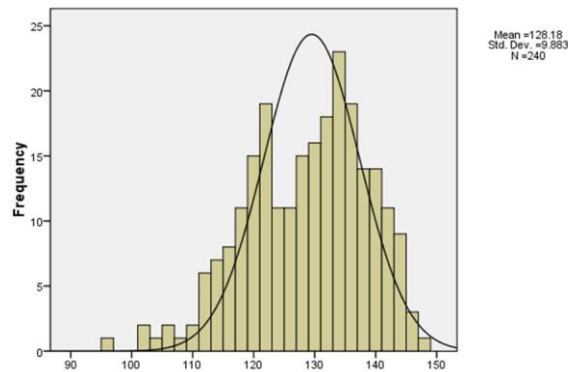

Mean =128.18
Std. Dev. =9.883
N =240

Table – 3   "Total Scores"

S. No.	Total Score	S. No.	Total Score	S. No.	Total Score	S. No.	Total Score	S. No.	Total Score	S. No.	Total Score
1	115	41	140	81	125	121	138	161	118	201	101
2	133	42	133	82	135	122	139	162	128	202	143
3	105	43	120	83	128	123	128	163	142	203	125
4	138	44	144	84	133	124	130	164	136	204	126
5	133	45	135	85	144	125	122	165	138	205	136
6	138	46	130	86	141	126	133	166	137	206	131
7	119	47	136	87	120	127	139	167	147	207	112
8	127	48	112	88	114	128	124	168	142	208	135
9	146	49	106	89	120	129	144	169	131	209	121
10	134	50	113	90	115	130	130	170	121	210	128
11	118	51	119	91	124	131	133	171	139	211	143
12	130	52	127	92	133	132	129	172	116	212	129
13	122	53	133	93	120	133	116	173	123	213	136
14	119	54	117	94	137	134	111	174	141	214	120
15	135	55	131	95	135	135	137	175	140	215	136
16	121	56	117	96	121	136	134	176	138	216	113
17	128	57	127	97	127	137	128	177	145	217	121
18	126	58	133	98	109	138	118	178	112	218	133
19	136	59	118	99	128	139	132	179	138	219	143
20	101	60	134	100	138	140	131	180	117	220	120
21	133	61	122	101	139	141	124	181	124	221	133
22	114	62	125	102	129	142	140	182	117	222	141
23	133	63	123	103	139	143	130	183	127	223	120
24	131	64	127	104	117	144	127	184	134	224	131
25	124	65	112	105	132	145	141	185	133	225	122

26	122	66	139	106	116	146	141	186	104	226	136
27	144	67	133	107	121	147	133	187	129	227	132
28	144	68	130	108	127	148	131	188	137	228	139
29	142	69	124	109	134	149	142	189	121	229	131
30	131	70	122	110	125	150	124	190	132	230	139
31	114	71	130	111	138	151	116	191	129	231	119
32	139	72	145	112	129	152	135	192	138	232	126
33	129	73	136	113	122	153	121	193	112	233	133
34	117	74	107	114	117	154	126	194	96	234	134
35	132	75	132	115	119	155	122	195	126	235	143
36	129	76	136	116	125	156	137	196	132	236	113
37	110	77	126	117	113	157	123	197	121	237	135
38	139	78	130	118	116	158	135	198	119	238	142
39	140	79	116	119	120	159	141	199	124	239	136
40	135	80	122	120	120	160	131	200	132	240	122

References

1. McBride, Dawn M,"The process of Research in Psychology",pp259-264
2. www.ibm.com/software/analytics/**spss**/ IBM
3. www.ibm.com/software/analytics/**spss**/products/statistics/
4. www.**spss**.co.in/

TEACHING NOTES

Case Synopsis

The case study relates to use of SPSS for cross tabulation of the responses received on the Research questionnaire, carrying out ABC Classification for prioritizing the best practices found to be relevant, establishing correlation in the responses by Pearson Correlation & Spearman's Rank Correlation Coefficient method, carrying out analysis of variance by using One way Anova test and ascertaining Independence of the responses from three services by Chi Square test.

Learning Objectives

(a)   Introduction to SPSS software.

(b)   To provide a practical exercise on data processing and data analysis on SPSS.

(c)   Application of principles of research methodology in a live research problem particularly with reference to issues such as Scale Construction, Administration of Questionnaire, Method of Sampling, Sample Size, Work Sampling or Occurrence Sampling etc.

Discussion Questions: (Analysis of data given above by answering the following Questions)

Question 1.   How would you Cross tabulate the basic data for the above case problem? Do you agree with the arrangement shown in Table 1?

Question 2   Make an analysis of the data given in the table 1 to find out the rank order of the HRM Practices on overall basis, and separately for the Army, Navy, and Air Force?

Question 3   Researcher wants to find out the most desirable HRM Practices. Develop a system of ABC classification of HRMP (Human Resource Management Practices) for the entire Armed Forces, and separately for "Army", "Navy", and "Air Force". Develop a system of ABC classification of HRMP (Human Resource Management Practices) for the entire armed forces, and separately for "Army", "Navy", and "Air Force". Which one of the practices can be implemented without much financial commitment?

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories
Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A.

International Journal of Management, IT and Engineering
http://www.ijmra.us

26

Question 4   Draw the histogram of the "Total Scores" as shown on page - 4 and examine whether the data is normally distributed or not. You may use all the six important criteria of checking normality of the data.

Question 5   Apply One Way ANOVA to test the hypothesis that with averages of "Total Scores" does not differ between "Army", "Navy", and "Air Force". Use "Turkey's Test" while Answering this Question.

Question 6   Make data analysis of "Total Scores" give in Table-3.

Question 7   Use Chi square to test the null hypothesis that High, Medium, and Low levels of "Total Scores" and the Wings of the Armed Forces viz "Army", "Navy", and "Air Force" are independent of each other. To do this analysis, convert the "Total Scores" into three categories "High", Medium and "Low".

Question 8   Look at the bottom rows of Table -2 showing figures relating to Army, Navy, and Air Force. Find Pearson's correlation coefficient between them. Convert these values by their rank order and find Pearson's correlation coefficient between them. Note how the values have changed. Interpret the values obtained by you. Draw a scatter matrix based on the ranks obtained above and interpret the graph.

Question 9   Suggest an alternative research design (Answering the issues of measurement instrument, sampling method, sample size) to answer the research questions formulated by you.

Teaching Plan

The students should be first introduced to SPSS in the class room. The software can be installed in their respective laptops/tablets/PCs. The case should be thereafter handed over to them a week in advance with a request to study and develop a deeper understanding of use of SPSS for cross tabulation, analysis and interpretation of data.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories
Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A.
International Journal of Management, IT and Engineering
http://www.ijmra.us

27

Duration	Activity

- (05 min):   Faculty Member to revise use of SPSS.

- (10 min):   Case Study (Pick Sample 2-3 from Group)

- (05 min):   Deliberating over Learning/ objectives

- (15 min):   Cross tabulation of data using SPSS.

- (05 min):   ABC Classification Analysis

- (15 min):   Correlation Analysis (Using Pearson's as well as Spearman's Formula) on the basis of Absolute values as well as Ranked Values.

- (15 min):   One Way Anova: Analysis of Scores for differences between the three Services of Armed Forces.

- (10 min)-   Chi- Square Test of Independence.

- (30min) -   Faculty Member to review responses by groups and provide brief over view .

Suggested Answers to Questions

Question1.   **How would you cross tabulate the basic data for the above case problem? Do you agree with the arrangement shown at Table 1?**

Answer   Usual procedure in SPSS is to record respondents row wise and responses to multiple choice questions in columns. Each row represents the respondent and each column represents HRMP (Human Resource Management Practice). This procedure has been followed in the table shown in the case problem. Consequently, there are 240 rows and 30 columns. Arranging data in rows and columns gives rise to Data Matrix. This is the starting point in data analysis through SPSS. The arrangement shown in Table 1 is as per the requirements of SPSS package and is correct.

Question 2.   **Make an analysis of the data given in the table above to find out the rank order of the HRM Practices on Overall Basis, and separately for the Army, Navy, and Air Force.**

Answer   Analysis of the data reveals the rank order of the HRMPs. These are arranged in a descending order as shown in the table. Higher score means higher rank given to HR practice. The table also shows the combined ranking of HR practices.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories
Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A.
International Journal of Management, IT and Engineering
http://www.ijmra.us

28

S. No.	Combined	Score	Army	Score	Air Force	Score	Navy	Score
1	Fair Evaluation	1145	Fair Evaluation	572	Fair Evaluation	287	Safe Healthy and Happy Workplace	288
2	Safe Healthy and Happy Workplace	1140	Safe Healthy and Happy Workplace	570	Flexitime	285	Fair Evaluation	286
3	Clearly Defind and Measurable KRA	1129	Open House Discussion	569	Idea Acceptance Reward	285	Professional Counselling and Services	285
4	Open House Discussion	1125	Clearly Defind and Measurable KRA	566	Open Book Management Style	282	Clearly Defind and Measurable KRA	282
5	Professional Counselling and Services	1121	Professional Counselling and Services	563	Safe Healthy Happy Workplace	282	Reward and Recognition	280
6	Idea Acceptance Reward	1110	Coaching and Mentorizing	559	Clearly Defind and Measurable KRA	281	Open House Discussion	280
7	Coaching and Mentorizing	1108	Competency Mapping	555	Knowledge Sharing Sessions	280	Mentoring	280
8	Mentoring	1107	Mentoring	555	Leisure and Entertainment	280	Knowledge Sharing Sessions	279
9	Competency Mapping	1103	Idea Acceptance Reward	554	Coaching and Mentorizing	278	Competency Mapping	276
10	Reward and Recognition	1103	Reward and Recognition	549	Open House Discussion	276	Staff Management	275
11	Knowledge Sharing Sessions	1092	Staff Management	547	Reward and Recognition	274	Coaching and Mentorizing	271
12	Staff Management	1087	Stress Relief Measures	534	Professional Counselling	273	Idea Acceptance Reward	271
13	Leisure and Reward	1083	Knowledge Sharing Sessions	533	Competency Mapping	272	Leisure and Entertainment	270
14	Stress Relief Measures	1062	Leisure and Entertainment	533	Mentoring	272	Highlight Performers	267
15	Highlight Performers	1055	Cross Functional Team	527	Stress Relief Measures	268	Cross Functional Team	264
16	Employee Assistance Program	1035	Highlight Performers	527	Delight Employee with Unexpected	268	Job Rotation	260

S. No.	Combined	Score	Army	Score	Air Force	Score	Navy	Score
17	Cross Functional Team	1026	Employee Assistance Program	513	I4 Teams – Ingenious, Idea, Incubation & Implementation	266	Stress Relief Measures	260
18	Job Rotation	996	Job Rotation	507	Performance Linked Bonus	266	Employee Assistance Program	260
19	Code Camp Workshop	984	Cross Functional Team	501	Staff Management	265	Employee of the Month	258
20	Employee of the Month	975	Calling Everyone by Name	499	Employee Assistance Program	262	Code Camp Workshop	251
21	Delight Employee with Unexpected	960	Code Camp Workshop	488	Highlight Performers	261	Cross Functional Team	247
22	I4 Teams – Ingenious, Idea, Incubation & Implementation	959	Employee of the Month	478	Coffee with Boss	257	Performance Linked Bonus	245
23	Cross Functional Team	947	I4 Teams – Ingenious, Idea, Incubation & Implementation	469	Open Door Policy	251	Coffee with Boss	242
24	Calling Everyone by Name	935	Delight	463	Code Camp Workshop	245	Delight Employee with Unexpected	229
25	Open Book Management Style	931	360 Degree Performance Management Feedback System	436	Employee of the Month	239	I4 Teams – Ingenious, Idea, Incubation & Implementation	224
26	Performance Linked Bonus	923	Open Book Management	429	Cross Functional Team	235	Calling Name	221
27	Coffee with Boss	923	Flexitime	425	360 Degree Performance Management Feedback System	232	Open Book Management Style	220
28	Flexitime	885	Coffee with Boss	424	Job Rotation	229	360 Degree Performance Management Feedback System	217
29	360 Degree Performance Management Feedback System	885	Performance Linked Bonus	412	Calling Everyone by Name	215	Open Door Policy	203
30	Open Door Policy	830	Open Door Policy	376	Cross Functional Team	199	Flexitime	175
	Total	**30764**	**Total**	**15233**	**Total**	**7865**	**Total**	**7666**

Question 3.   Researcher wants to find out the most desirable HRM Practices. Develop a system of ABC classification of HRMP (Human Resource Management Practices) for the entire Armed Forces, and separately for "Army", "Navy", and "Air Force".

Answer.   From the table developed as the Answer to Question. No. 2 above, we select 10 % items (three items) from the top as "A" category items. Next 20% (six) items are classed as "B" category items. The remaining 70% (21) items may be classed as "C" category items. The rank order of the HRMPs determines its desirability in the eyes of the respondents. This may not be the same as in the entire population. Gap between views contained in the sample and in the population are tried to be minimized by adoption of appropriate technique of research. Students may be called upon to rank order the HRMPs on the basis of financial commitment involved. This Question can become basis for group discussion among participants.

Question 4.   Please illustrate the procedure to draw the histogram of the "Total Scores" from the data given at Table – 2. Examine whether the data are normally distributed or not. You may use all the important criteria for checking "normality" of the data. (Example shown as Graph -1).

Answer.   SPSS procedure is as follows:-

Analyze ⟶   Descriptive Statistics ⟶   Explore ⟶   Put "Total Score" in the

Dependent List and "Wing" in the Factor List. ⟶   Select "Both" in Display ⟶

Select "Plots" ⟶ Select "Factor Levels together" ⟶   Select "Normality Plots with tests"

⟶   Select "Stem & Leaf" ⟶   Select "Histogram" ⟶ Select "Ok".

Interpret the results.

Mean results are as follows:-

(a)	Army	Air Force	Navy
Mean	126.94	131.08	127.77

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories
Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A.
International Journal of Management, IT and Engineering
http://www.ijmra.us

31

(b)   KS test is used to test the null hypothesis that the underlying population is normally distributed or not. P values are as follows

	Army	Air Force	Navy
P value	0.045	0.065	0.028

At 1% level of significance, we find that in all cases, our data is normal.

This is verified from the shapes of "Histograms" as well as "Stem and Leaf Plots".

This same result is verified from Q-Q Plots.

Similar result is seen from "Box Plots" as well.

Thus, our data is normal and the conditions necessary for the application of "One Way ANOVA" are met.

Computer output is not given and students are required to work out the same. (copy of the same is as shown on the next page

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	Wing	N	Percent	N	Percent	N	Percent
Sum Row Wise	Army	120	100.0%	0	.0%	120	100.0%
	Air Force	60	100.0%	0	.0%	60	100.0%
	Navy	60	100.0%	0	.0%	60	100.0%

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Wing	Statistic	df	Sig.	Statistic	df	Sig.
Sum Row Wise	Army	.082	120	.045	.984	120	.176
	Air Force	.111	60	.065	.962	60	.057
	Navy	.121	60	.028	.944	60	.008

a. Lilliefors Significance Correction

Normal Q-Q Plot of Sum Row Wise

for Wing= Army
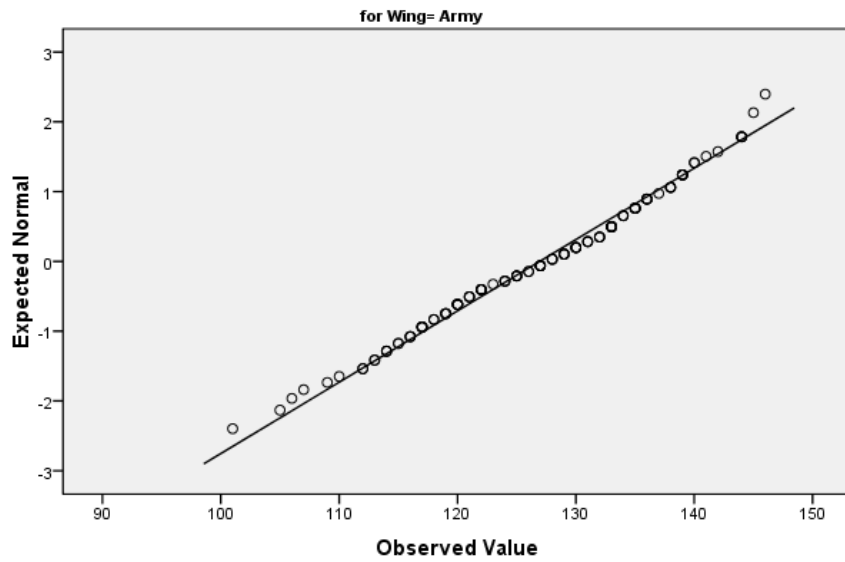
Detrended Normal Q-Q Plot of Sum Row Wise

for Wing= Air Force
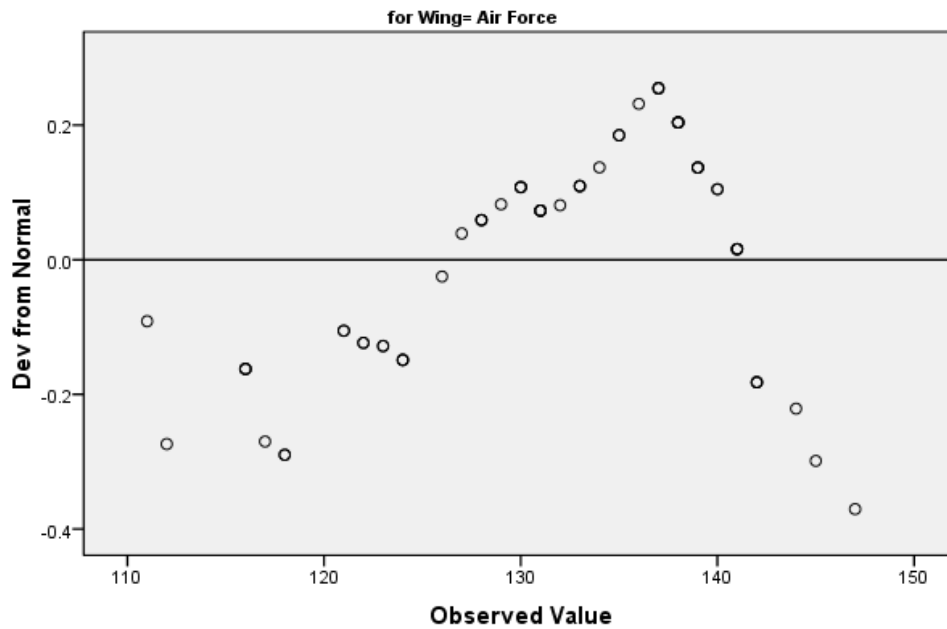
Box Plots
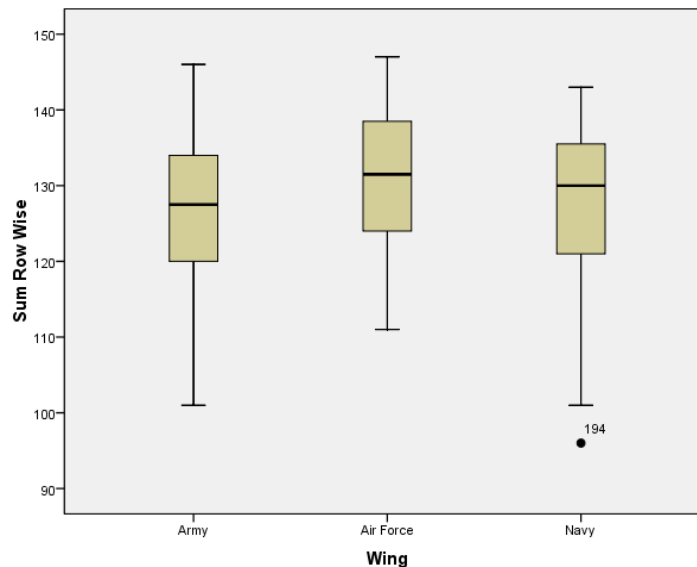
Question 5   Apply "One Way ANOVA" to test the hypothesis that averages of "Total Scores" of "Army", "Navy", and "Air Force" do not differ among themselves. Use "Tukey's Test" while answering the question.

<u>Answer</u>   Using SPSS,   we proceed as follows:-

Analyze ⟶ Descriptive statistics ⟶ Explore

Insert "Total Score" in Dependent List, and "Wing of the Army" in the Factor List to get the answer as 126.94, 131.08, and 127.77 for Army, Air Force, and Navy respectively.

[A new variable "Wing of the Army" should be introduced in which ARMY is denoted by 1, AIR FORCE is denoted by 2, and NAVY is denoted by 3].

We proceed as follows:-

Analyze ⟶ Descriptive Statistics ⟶ Explore

⟶ "Plots" in Display and in Plots options ⟶ Histogram, ⟶ "stem and leaf"

⟶ "Normality plots with tests" ⟶ continue. ⟶ OK

 It will give several results which are helpful in data analysis.

The null hypothesis of no difference between the answers of Army, Air Force and Navy is tested by using the following procedure:-

Analyze ⟶ Compare Means ⟶ One Way ANOVA ⟶ Put "Total Score" in the box "Dependent List" and "Wing of the Army" in Factor, ⟶Post Hoc, ⟶ Tukey's, ⟶ continue ⟶ options ⟶ descriptive and " Means plot" ⟶ continue ⟶ ok .

We get Anova table and other details as shown below

Descriptive

Sum Row Wise

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum
					Lower Bound	Upper Bound	
Army	120	126.94	9.782	.893	125.17	128.71	101
Air Force	60	131.08	9.022	1.165	128.75	133.41	111
Navy	60	127.77	10.461	1.351	125.06	130.47	96
Total	240	128.18	9.883	.638	126.93	129.44	96

ANOVA

Sum Row Wise

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	700.025	2	350.013	3.663	.027
Within Groups	22645.908	237	95.552		
Total	23345.933	239			

Post Hoc Tests

Multiple Comparisons

Sum Row Wise
Tukey HSD

(I) Wing	(J) Wing	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Army	Air Force	-4.142[*]	1.546	.021	-7.79	-.50
	Navy	-.825	1.546	.855	-4.47	2.82
Air Force	Army	4.142[*]	1.546	.021	.50	7.79
	Navy	3.317	1.785	.153	-.89	7.53
Navy	Army	.825	1.546	.855	-2.82	4.47
	Air Force	-3.317	1.785	.153	-7.53	.89

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

Sum Row Wise

Tukey HSD[a,,b]

Wing	N	Subset for alpha = 0.05 1	Subset for alpha = 0.05 2
Army	120	126.94	
Navy	60	127.77	127.77
Air Force	60		131.08
Sig.		.868	.106

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 72.000.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.
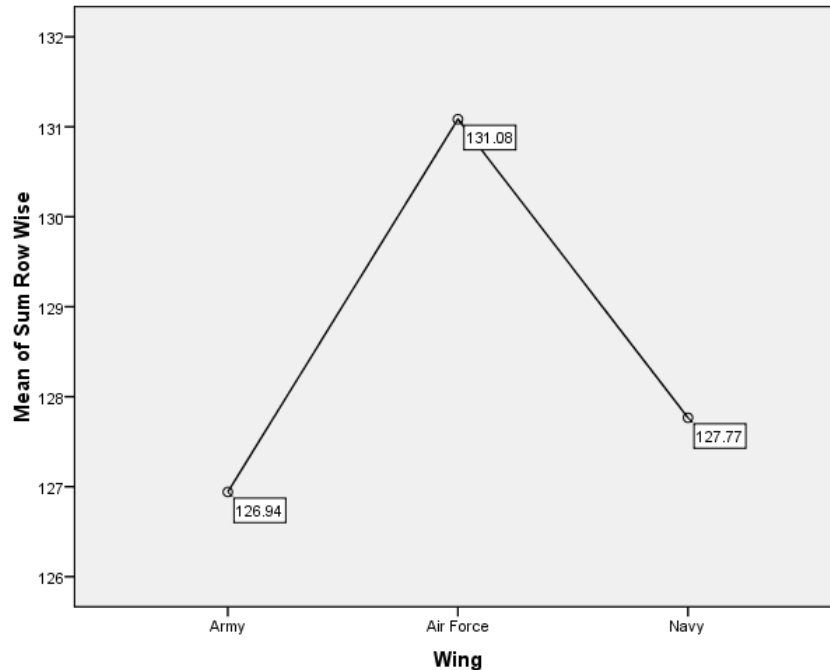
Question 6   **Make data analysis of "Total Scores" given in Table-3.**

Answer.   There are 240 data points in Table-3. Do the following on SPSS.

(a)   Data ➔ Define Variable Properties ➔ Put "Total Scores" in the "Variables to Scan" Box ➔ Continue.

(b)   Data ➔ Transform ➔ Visual Binning ➔ Continue ➔ Select Total Score.

Now, we can see a graphical view of our data.

Now, we select "Excluded" option in Upper End Points.

Go to make cut points.

We put First Cut point location as 120 and Number of Cut Points as 2.

Now, width of 13.5 would automatically appear.

Select "Apply".

Select "Make Labels"

Select "OK"

We should not forget to name the "Binned Variable" as "Binned" or some other name,

Select "OK"

Question 7. **Use Chi square to test the null hypothesis that High, Medium, and Low levels of "Total Scores" and the Wings of the Armed Forces viz "Army", "Navy", and "Air Force" are independent of each other. To do this analysis, convert the "Total Scores" into three categories "High", Medium and "Low".**

Answer.   SPSS Procedure is as follows:-

Analyze ⟶ Descriptive Statistics ⟶ Cross Tabs

⟶ Insert "Wing" in the Rows and Total Score (Binned) in columns

⟶   Select Display Clustered Bar Chart ⟶ Statistics ⟶ Select Chi Square ⟶ OK

Now, we get chi square value as 6.68 and p = 0.154. Since the p value is higher than .05, this leads us not to reject the null hypothesis of independence.

Conclusion: The scores high, medium, and low and wings of armed forces are independent.

Question 8. **Look at the bottom rows of Table -2 showing figures relating to Army, Navy, and Air Force. Find Pearson's Correlation Coefficient between them. Thereafter, convert these values into their rank order and find again Pearson's Correlation Coefficient between them. Find Spearman's Rank Correlation as well.**

See how the values have changed.

Interpret the values obtained by you.

Draw a "Matrix Scatter" based on the ranks obtained above and interpret the graph.

Answer 8.   SPSS procedure is

Analyze   →   Correlate   →   Bivariate

Based on the data given for "Total Scores", by using Karl Pearson's method, we get the values 0.31, 0.87 and 0.3

When ranked data are used, we again get the values as 0.5, 0.94 and 0.49

Using Spearman's rank correlation, these values are 0.5, 0.94 and 0.49.

When ranked data is used, Karl Pearson's Coefficient of Co relation is the same as Spearman's rank correlation Coefficient.

In all cases, we find , there to be positive correlation. Values closer to one are indicative of High level of correlation. Values closer to Zero are indicative of Low level of Correlation. In all cases, we find there to be high and quite high co relation.

Students are required to discuss these results.

In order to generate "Matrix Scatter" we proceed as follows on SPSS:

Select Graphs   →   Legacy Dialogues   →   Scatter/Dot → Matrix Scatter

→   Define   →   Insert Variables in the box "Matrix Variables ", then insert HRMP Variable in the "Label Cases by" → OK.

Similarly, insert Rank Variables in the box "Matrix Variable", and HRMP in the "Label cases by" box, and then OK to get "Matrix Scatter"

Graph 2 : Matrix scatter
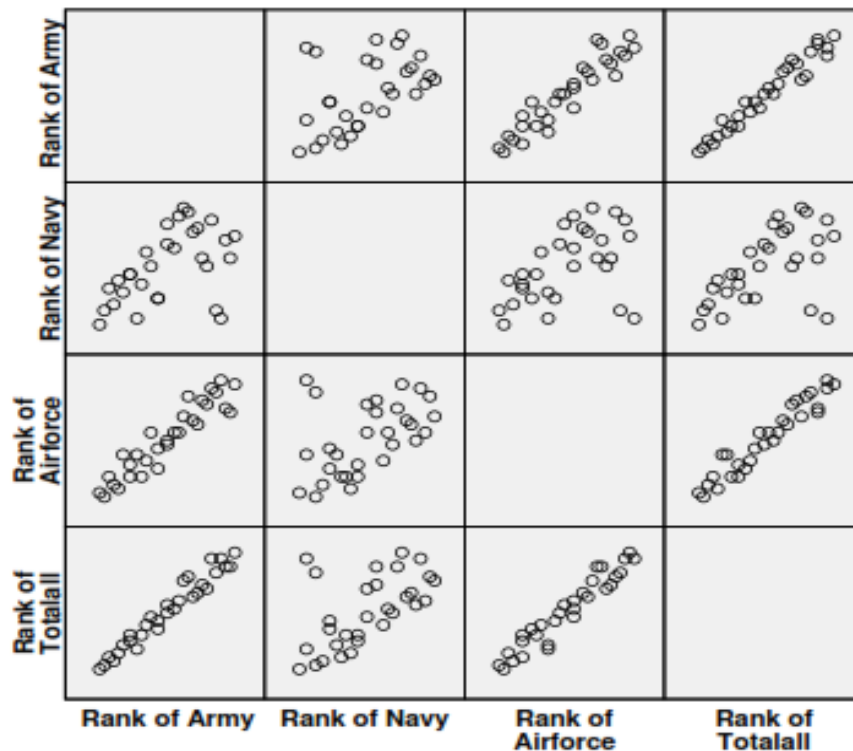
Question 9. **Suggest an alternative research design (Answering the issues of measurement instrument, sampling method, sample size) to answer the research questions formulated by you.**

Answer.   Research begins with articulation of research questions. What does the researcher try to Answer through research work? Once meaningful research Question has been explicitly stated, the next stage of determination of research design follows in a natural way.

This Question is an exercise to test the imagination power of students. There is no unique Answer to this Question.

Detailed elaboration on topics such as "Development of Measurement Instrument", "Determination of Method of Sampling", "Determination of Sample Size" etc is covered in a course in Research Methodology.