CHAPTER 3
METHODOLOGY

Research methodology is a structured set of guidelines or activities to generate valid and reliable research results (Mingers, 2001). The basic materials to conduct any research are unbiased information and facts. A clear and systematic explanation of the methods used to collect data for analysis is a characteristic of a good researcher. This Chapter deals with the research methodology, which includes methods and procedures to collect and analyze data. It is an essential and integral part of conducting any research. So, it deserves careful and sincere consideration on the researcher's part. An appropriate methodology helps researchers to collect valid and reliable information, and analyze the information to arrive at correct decisions. The purpose of this Chapter is to describe the methods and procedures followed in conducting the present study. This Chapter has been divided into nine sections. The first one deals with the locale of the study, the second section describes the population and sampling procedure, and the third section depicts the study's research design. The development of the interview schedule, the collection procedure, and the variables' measurements are described in sections four, five, and six, respectively. The seventh section deals with the measurements of the challenges to improve work design and job performance, whereas section eight describes the data processing and analyses of the research, and finally, the formulation of hypotheses is described in the last section.

3.1 Locale of the Study

The study was conducted in Dinajpur district of Rangpur division. It is the largest district among all the sixteen districts of northern Bangladesh. It is purposively selected as the study area due to many reasons: (a) geographically remote region of DAE; (b) Dinajpur is an ancient, historical, and large district and has better agricultural areas than other districts of this region; (c) driving distance is about 340km north from the capital city; (d) the headquarters of the DAE (Department of Agricultural Extension) is also located at a notable distance to this district; (e) it is an agro-based district, and finally (f) here the DAE is the largest and most efficient agricultural organization and the SAAOs working under this organization directly serve agricultural extension services to the farmers.

3.1.1 Basic information about the study area

The total area of Dinajpur district is 3437.98 sq km, located between 25°10' and 26°04' north latitudes and 88°23' and 89°18' east longitudes. It experiences a hot, wet, and humid tropical climate. The economy of this district depends mainly upon agro-based production. It is famous for rice production; its *'Katharivog'* variety is the best-produced rice in Bangladesh. Apart from rice, maize, wheat, and potato production is good. The litchi fruit of Dinajpur is the best in Bangladesh. Dinajpur is also famous for its Mangoes. It also grows plenty of vegetables and seasonal fruits. A considerable percentage of people of Dinajpur depend upon agro-based products.

There are 13 Upazilas in the Dinajpur district. Seven of those were selected randomly, viz., Birganj, Bochaganj, Biral, Chirirbandar, Kaharol, Khansama, and Sadar. The basic information of the study area is given in Table 3.1. Also, the map of Bangladesh highlighting the selected district Dinajpur has been presented in Figure 3.1, and the map of Dinajpur district indicating the selected Upazilas is shown in Figure 3.2.

Table 3.1 Basic information about the study area (Wikipedia, 2022)

Sl. no.	Information criteria	Birganj	Bocha-ganj	Biral	Chirir bandar	Kaharol	Khan-sama	Sadar
1	Area (sq. km.)	413	224.81	352.16	308.86	205.54	179.72	354.34
2	Population (no.)	3,31,305	1,35,376	2,04,420	2,32,409	1,18,379	1,23,782	3,57,888
3	Literacy (%)	32.40	32.40	32.40	99.90	32.40	32.40	32.40
4	Unions (No.)	12	7	12	12	6	6	11
5	Blocks (No.)	36	18	34	36	18	18	31
6	SAAOs (No.)	26	12	22	30	12	15	24
7	Distance (km) from district town	29	28	10	15	27	39	0

Source: Wikipedia (2022)

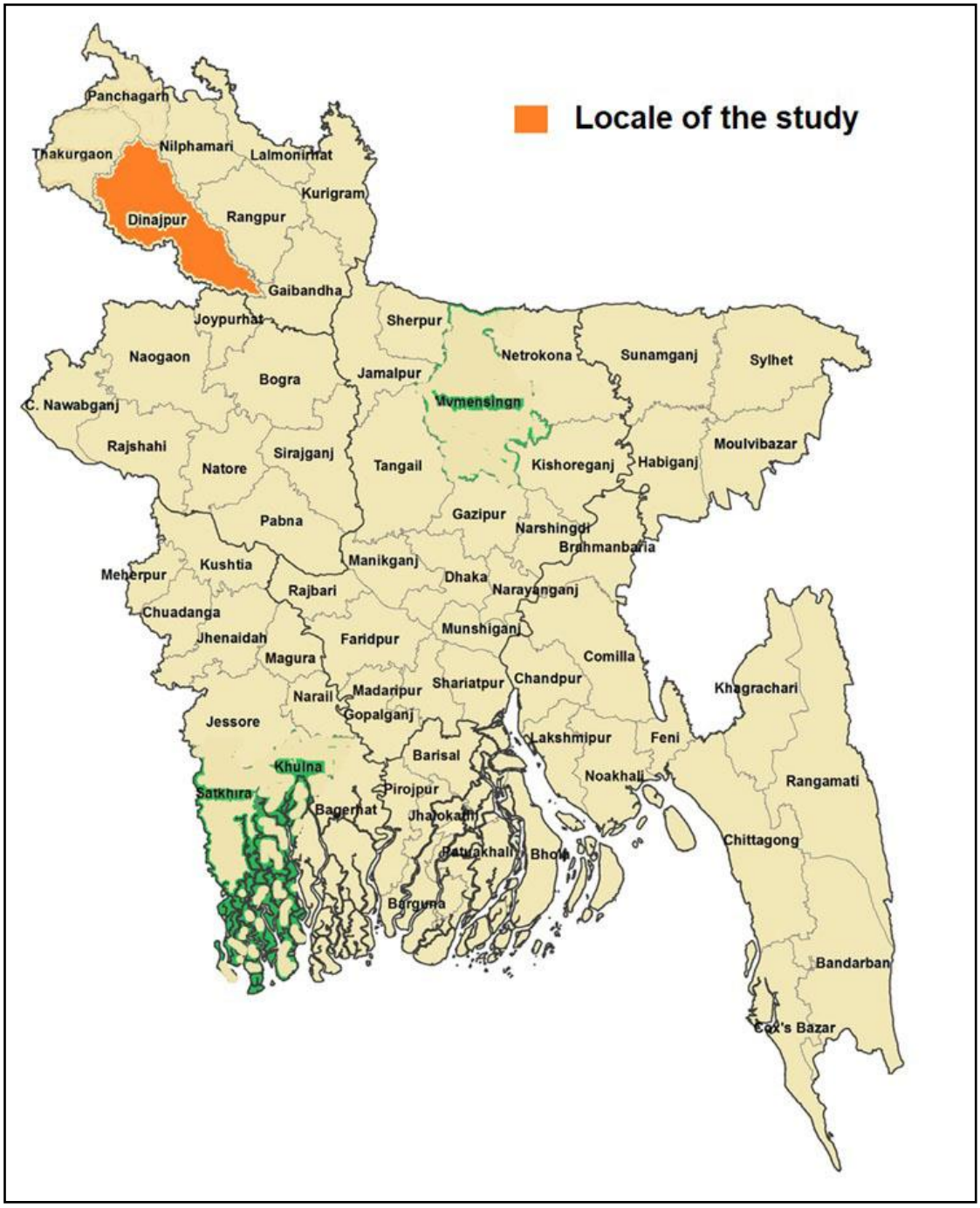

Figure 3.1 Map of Bangladesh showing Dinajpur district

Source: Wikimedia Commons (n.d.a)

Figure 3.2 Map of Dinajpur showing the selected seven Upazilas

Source: Wikimedia Commons (n.d.b)

3.2 Population and Sampling Procedure

The Sub-Assistant Agricultural Officers (SAAOs) were the population of the study area. All the SAAOs from the randomly selected seven Upazilas of Dinajpur district were the targeted population for this study. At the time of the study, 142 SAAOs were working in different blocks of the selected upazilas. Thus, the total number of active officers obtained was 142, which constituted the population of this study. However, data were obtained from a sample rather than the population. Thus, out of 142 officers, 50% i.e., 71 SAAOs were selected as the sample following the simple random sampling method.

In order to measure the job performance of the SAAOs, their supervisors, such as the Upazila Agriculture Officer (UAO), Additional Agriculture Officer (AAO), and Agriculture Extension Officer (AEO) of the concerned Upazilas were also considered for the study. For each SAAO, one out of three respective authorities (AEO, AAO, and UAO), under whose supervision they were working, was selected to mention their perception regarding their job performance. Thus, a total of 71 (= 71×1) respective authorities were selected to make their perception of the job performance of the respective SAAOs. In some cases, a sole authority was interviewed to determine the job performance of several SAAOs.

Moreover, the beneficiary farmers under the agricultural extension services of the concerned blocks were also considered a vital component for measuring the job performance of the SAAOs. Perception of the farmers as a client system was an important criterion to evaluate the job performance of SAAOs. By using the simple random sampling method, 142 farmers were selected for this purpose. A list of 10 farmers was supplied by the SAAO from his/her block. From that list, two farmers were selected randomly for each SAAO. Thus, a total of 142 (= 71×2) farmers were selected to obtain their perception of the job performance of the respective SAAOs.

Therefore, a total of 71+71+142 = 284 individuals were selected for the data collection of the study. The details of the population and sample sizes of different research sites (Upazila) included in the study are presented in Table 3.2.

Table 3.2 Distribution of the population and the sample of the study

District	Upazila	Population under each SAAOs	Sample of SAAOs	Sample authority for each SAAO	Sample farmers for each SAAO
Dinajpur	Birganj	26	13	13	13 × 2 = 26
	Bochaganj	12	6	6	6 × 2 = 12
	Birol	22	11	11	11 × 2 = 22
	Chirirbandar	30	15	15	15 × 2 = 30
	Kaharol	13	6	6	6 × 2 = 12
	Khansama	15	8	8	8 × 2 = 16
	Sadar	24	12	12	12 × 2 = 24
	Total =	142	71	71	142

3.3 Research Design

The ex-post-facto explanatory cross-sectional research design (Hasan et al., 2018) was used for this study as it is quasi-experimental in nature, and a number of uncontrollable and non-manipulating variables were present in the study. In the present study, the effect of work design on the job performance of the SAAOs was investigated using a survey approach. The survey was conducted with a structured questionnaire using the face-to-face interview method. A pre-tested interview schedule containing both open and closed-form questions was used for data collection.

3.4 Developing the Interview Schedule

The interview schedule was designed based on the objectives as well as the independent and dependent variables of the study. To facilitate the respondents, the interview schedule was translated into Bengali. Before finalizing the interview schedule, each question was thoroughly examined and discussed with the experts. Adequate precautions and care were taken into consideration to formulate the questions in a manner that they were well understood by the respondents and would find it easier to respond. Before using the prepared interview schedule for data collection, it was pre-tested by eight (8) SAAOs. In addition, the job performance scale was pre-tested with 5 Agricultural Extension Officers (as the authority of SAAOs) and 5 farmers (as clients of SAAOs), and their validity and reliability were also checked.

3.4.1 Validity

The validity of the interview schedule used for this study was maximized by taking the following steps:

i. The interview schedule was thoroughly discussed with the concerned scientists, and members of the advisory committee and their suggestions were incorporated.

ii. Pre-testing of the interview schedule provided an additional check for improving the instrument.
iii. The relevancy of each question in terms of the objectives of the study, their logical orders, and the wordings of each question was checked carefully.

Judge rating: The initially selected items of different scales were judged by expert judges through the judge rating. As the work design and the job performance were the focus of the study, 50 judges were requested with letters for rating the suitability of the work design and job performance items. But 29 judges responded, and their responses were analyzed. The analyses and their discussion are presented in the respective measurement section of the work design and job performance. The irrelevant items were eliminated after the judge's rating. The instrument was then administered for pre-testing. After correcting, changing, modifying, and updating the items based on the procedures mentioned above, the instrument was ultimately finalized. So, it confirmed the validity of the scales.

3.4.2 Reliability

The reliability of the interview schedule used in the study was tested using the test-retest method of estimating reliability. Previously pre-tested eight (8) SAAOs, five (5) Agricultural Extension Officers (as the authority of the SAAOs), and five (5) farmers (as the clients of the SAAOs) were re-interviewed after 2 to 3 weeks with the same schedule used at the time of the first interview. Since the same responses were observed, the reliability of the interview schedule was authentic.

3.4.3 Final version of the interview schedule

A simple, unambiguous, well-organized, and purpose-oriented data collection instrument is a prerequisite for conducting empirical research. The pre-test result facilitated the researcher to examine the suitability of different questions in the instrument. Based on the experience gained during pre-testing, necessary corrections, modifications, additions, and deletions were made to obtain the best outcome. Then the final interview schedule was made and multiplied as much as necessary for data collection. The interview schedule has been incorporated in Appendix A.

3.5 Procedure of Data Collection

The researcher himself collected data from the above-mentioned 71 SAAOs of the said seven Upazilas of Dinajpur district. Data were also collected from one authorized personnel (either

AEO, AAO, or UAO) for each SAAO at the Upazila Agriculture Office regarding their perception of the job performance of the SAAOs. The SAAOs work under the direct supervision of the respective personnel. Moreover, the data were collected from the two farmers from each of the SAAO's blocks regarding their perceptions of the job performance of SAAOs. Thus, data were collected from 284 individuals (71 SAAOs, 71 authority personnel, and 142 farmers) for measuring the job performance of the SAAOs. Face-to-face interview with the respondents was conducted at their offices and fields. For collecting data, the researcher established a good rapport with the respondents so that they did not hesitate to furnish proper responses to the questions and statements. Necessary precautions were also maintained before the data collection to achieve valid and reliable information. Data were collected from the respondents from the 01st October to the 31st December, 2020, i.e., a period of three (3) months.

3.6 Measurement of Variables

A variable is any measurable characteristic that can assume varying or different values in successive individual cases (Hasan et al., 2018). A well-organized piece of research usually contains at least two important elements, viz., an independent variable and a dependent variable. An independent variable is a factor that is manipulated by the researcher in his/her attempt to ascertain its relationship to an observed phenomenon. In contrast, a dependent variable is a factor that appears, disappears, or varies as the researcher introduces, removes, or varies the independent variables (Hasan et al., 2018). In any scientific research, selecting and measuring variables constitute a significant task. In this connection, the researcher reviewed the literature to widen his/her panoramic understanding of the nature and scope of the variables relevant to the research he/she will conduct.

3.6.1 Measurement of independent variables

Many factors were likely to influence the SAAOs about their job performance. But dealing with all the factors in a single study was tedious. Nevertheless, after careful consideration, 13 independent variables: age, additional education, family size, annual family income, service tenure, job facilities, professional training received, managerial orientation, psychological strain, affective commitment, self-efficacy, job satisfaction, and work design, were assessed in the study. Finally, the interview schedule was used to collect relevant information regarding the independent variables in that track.

3.6.1.1 Age

The age of the respondent was determined in terms of actual years passed from his/her date of birth to the day of interviewing him/her. A unit score of one (1) was assigned for each year of age (Sarmin, 2019). The variable appears in item number 1 of the interview schedule (Appendix A).

3.6.1.2 Additional education

Education might play a significant role in improving the individual and professional performance of the respondent. Formal degrees other than an agricultural diploma were considered as additional education. This variable appears in item number 2 of the interview schedule (Appendix A). It was operationalized by the number of years spent to attain any formal education from any college/technical institution/university and was measured in terms of grades passed by an individual. In his study, Uddin (2010) used this method to measure educational qualifications. And the following scores were given for each degree completion.

Education Level	Score
S.S.C. and agricultural diploma	13
H.S.C. and agricultural diploma	15
Honors and agricultural diploma	17
Master's and agricultural diploma	18

3.6.1.3 Family size

The family size of a respondent was measured in terms of the actual number of members in his/her family including himself/herself, spouse, children, brothers, sisters, parents, and other persons (if any) who jointly lived and ate together during the interviewing period. The total number of family members was considered as his/her family size score. If a respondent had five members in his/her family, the family size score was given as 5 (Abedin & Bool, 2014; Alamin, 2014). This variable appears in item number 3 of the interview schedule (Appendix A).

3.6.1.4 Annual family income

The annual family income earned by the respondent and his/her family from all available resources was assessed considering agriculture sources (crops, fruits, and vegetables, trees/nursery, livestock, and fisheries) and non-agricultural sources (services, businesses, and others if any). Thus, yearly earnings from agricultural and non-agricultural sources were added together to obtain the annual family income of a respondent. A respondent's annual family income was calculated by multiplying his/her monthly family income by 12 (=

months). The annual family income of an individual was expressed in thousand taka. In their respective studies, Rahman (2014) and Laizoo (2011) used the same procedure to measure annual family income. This variable appears in item number 4 of the interview schedule (Appendix A).

3.6.1.5 Service tenure

A respondent's service tenure was determined by the number of years he/she has worked as a BS/SAAO from the date of his/her joining in the DAE to the date of his/her interview. It was measured in complete years (Raihan, 2011). This variable appears in item number 5 of the interview schedule (Appendix A).

3.6.1.6 Job facilities

This variable was determined by recording the responses of the respondents regarding the extent of availability of 10 particular facilities in their workplaces. It was measured using a 3-point rating scale; scores 0, 1, and 2 were assigned to the responses i.e., 'not available', 'available with difficulties', and 'easily available', respectively. The scores of the job facilities of the SAAOs' were determined by summing up the weights for their responses to all 10 items. Thus, the scores of the job facilities could range from 0 to 20, where 0 indicates no job facilities while 20 indicates the highest availability of job facilities (Bose et al., 2014). This variable appears in item number 6 of the interview schedule (Appendix A).

3.6.1.7 Professional training need

It indicates the extent of the need for the professional training for the SAAOs in office-works and field-works too. This variable was measured on a four-point rating scale and the score was assigned as 0 for 'not needed', 1 for 'slightly needed', 2 for 'moderately needed', and 3 for 'highly needed', respectively. The score for professional training need was computed for each respondent on the basis of his/her extent of need with 10 selected items. The scores for professional training need could range from 0 to 30, where 0 indicated no need for training while 30 indicated a high need for professional training (Chahardoli et al., 2014). This variable appears in item number 7 of the interview schedule (Appendix A).

3.6.1.8 Managerial orientation

It indicates the extent of the managerial orientation of the SAAOs. This was measured on a four-point rating scale, viz., 'strongly agree', 'agree', 'disagree', and 'strongly disagree'. For measuring the positive questions of managerial orientation, the score was assigned as 1 for 'strongly disagree', 2 for 'disagree', 3 for 'agree', and 4 for 'strongly agree', respectively.

And for the negative questions, the reverse scoring method was used. A managerial orientation score was computed for each respondent on the basis of his/her extent of orientation with 10 selected statements. The score for managerial orientation could range from 10 to 40, where 10 indicated low managerial orientation while 40 indicated excellent managerial orientation. Islam (2015) and Khanom (2014) also used 4-point response categories to measure the variables of marketing orientation. This variable appears in item number 8 of the interview schedule (Appendix A).

3.6.1.9 Psychological strain

It refers to the extent of agreement of some items against the psychological strain of the job of the SAAOs. The items were designed to ask informants about their complex reactions regarding their minds and bodies trying to deal with work challenges, decision-making, problem-solving, level of anxiety, self-worth, etc. This variable was measured on a four-point rating scale, viz., 'not at all', 'little', 'moderate', and 'high'. For measuring the psychological strain, the score was assigned as 0 for 'not at all', 1 for 'little', 2 for 'moderate', and 3 for 'high', respectively (Abbas & Nasir, 2021). The score for the psychological strain was computed for each respondent on the basis of his/her extent of agreement with these selected six items. The scores for psychological strain could range from 0 to 18, where 0 indicated no psychological strain but 18 indicated the highest level of psychological strain. The variable appears in item number 9 of the interview schedule (Appendix A).

3.6.1.10 Affective commitment

Affective commitment refers to an employee's perceived emotional attachment to their organization. It is found when employees feel like their values and priorities align with the company's mission and feel at home in the organization. To build affective commitment, jobs should be enriched with challenges in activities and opportunities to utilize many different skills. Allen et al. (1990) used the 'Affective Commitment Scale' to measure affective commitment. On the basis of that scale, a four-point rating scale comprising of 'not at all', 'little', 'moderate', and 'high' was used to record the responses of the respondents. For measuring the affective commitment, the score was assigned as 0 for 'not at all', 1 for 'little', 2 for 'moderate', and 3 for 'high', respectively. The affective commitment score was computed for each respondent on the basis of his/her extent of commitment with these selected 5 items. The score could range from 0 to 15, where 0 indicated no commitment whereas 15 indicated the highest level of commitment. The variable appears in item number 10 of the interview schedule (Appendix A).

3.6.1.11 Self-efficacy

Self-efficacy is an individual's belief in their capacity to act in the ways necessary to reach specific goals. 'The Personal Efficacy Beliefs' scale developed by Riggs et al. (1994) was used to measure the self-efficacy of the respondents. On the basis of the 'Personal Efficacy Beliefs' scale, this variable was measured on a four-point rating scale, viz. 'disagree', 'neutral', 'agree', and 'strongly agree'. For measuring self-efficacy, the score was assigned as 1 for 'disagree', 2 for 'neutral', 3 for 'agree', and 4 for 'strongly agree', respectively. The self-efficacy score was computed for each respondent on the basis of his/ her extent of beliefs with 10 selected statements. The scores of self-efficacy could range from 10 to 40, where 10 indicated the lowest level of efficacy of the respondent but 40 indicated the highest level of efficacy. The variable appears in item number 11 of the interview schedule (Appendix A).

3.6.1.12 Job satisfaction

Job satisfaction, employees' satisfaction, or work satisfaction is a measure of workers' contentedness with their jobs, whether they like the jobs or individual aspects or facets of jobs. Warr et al. (1979) designed a scale to measure the satisfaction or dissatisfaction felt by participants in relation to various facets of work (e.g., physical conditions, management, salary, and job security). The scale attempts to measure the degree of satisfaction with intrinsic and extrinsic components of jobs. This variable was measured using a 4-point rating scale as described by Bose et al. (2014). The score was assigned as 1 for 'dissatisfied', 2 for 'fairly satisfied', 3 for 'satisfied', and 4 for 'highly satisfied'. The job satisfaction score was computed for each respondent on the basis of his/her extent of satisfaction with 10 selected items. The score could range from 10 to 40, where 10 indicated dissatisfaction but 40 indicated the highest level of satisfaction with his/her job. The variable appears in item number 12 of the interview schedule (Appendix A).

3.6.1.13 Work design

The work design was considered using the following dimensions: job demands, job control, perceived organizational support, and perceived colleagues' support (Johnson & Hall, 1988; Karasek, 1979; Karasek & Theorell, 1990). The selection procedure of the items of these four dimensions and the measurements of dimension-wise work design and the overall work design is given here:

3.6.1.13.1. Item collection: After a thorough consultation, searching of relevant literature, and discussion with experts, the items were collected to measure the work design of the SAAOs. The items found similar were not considered during the item collection. Finally, 22 job demands, 23 items of job control, 7 items of perceived organizational support, and 6 perceived colleagues' support were selected and sent to the judges (experts) for Judge ratings.

3.6.1.13.2. Judges' ratings of the work design scale

The items of work design (job demands, job control, perceived organizational support, and perceived colleagues' support) were sent to 50 experts to rate the items. A request letter was also sent to the experts from the Supervisor of the study (Appendix D) to rate the items with a scale of 1-5 (1 for the least appropriate and 5 for the most appropriate). But out of the 50, 29 experts made their opinions. Based on the ratings of those 29 judges, the average appropriateness of each of the items was measured with the following formula:

$$AAS = (\Sigma ASJ)/N.$$

here, AAS = Average Appropriateness Score (out of 5)

ASJ = Appropriateness Score given by the individual judge, and

N = Number of judges (here, it is 29)

Afterward, the AAS for each of the items was determined, and those having an AAS > 2.50 (i.e., more than average) were selected (Ahamed, 2017). Based on the results of the AAS, it was decided to include all the items in the scale for the interview schedule with slight modifications as suggested by some of the experts. The AAS of all the items is given in Appendix E. After correction and modification following the AAS and comments of the experts, the variable was finalized along with 15 items for job demands, 16 items for job control, 5 items for perceived organizational support, and 5 items for perceived colleagues' support. The measurement techniques of the job demands, job control, perceived organizational support, and perceived colleagues' support are given here:

3.6.1.13.3 Measurement of job demands

Job demands are the physical or emotional stressors in one's work-role. These could include time pressures, a heavy workload, a stressful working environment, role ambiguity, emotional labor, and poor relationships as well. This study determined it based on the four sub-dimensions, i.e., attention demands, problem-solving demands, responsibility demands, and quantitative demands. In order to measure these four dimensions, several popular measures of job demands, as have been used in the previous literature [e.g., quantitative demands- Van Yperen & Snijders (2000), attention demands- Mullarkey et al. (1997), problem-solving demands- Wall et al. (1995), for responsibility demands- Mullarkey et al.

(1997), etc.] were reviewed and finally a suitable scale was formulated for measurement. A four-point rating scale along with the responses ‘not at all’, ‘little’, ‘moderate’, and ‘high’ was assigned with the score of 0 for ‘not at all’, 1 for ‘little’, 2 for ‘moderate’, and 3 for ‘high’. The job demand score was computed for each respondent on the basis of his/her extent of demands with 15 selected items. The job demand scores of a respondent could range from 0 to 45, where 0 indicated no job demands while 45 indicated the highest level of job demands. This variable appears in item number 13.1 of the interview schedule (Appendix A).

3.6.1.13.4 Measurement of job control

The job control is a ’person’s ability to influence what happens in their work environment, particularly to influence matters relevant to their personal goals. It was determined based on the four sub-dimensions, i.e., timing control, methods control, skill discretion, and decision authority. Several scales from diverse researchers were reviewed for measuring job control [e.g., for skill discretion and decision authority- Karasek (1985), for timing and method control -Wall et al. (1995)]. Based on that, a four-point rating scale along with the responses ‘not at all’, ‘little’, ‘moderate’, and ‘high’ was assigned with the scoring of 0 for ‘not at all’, 1 for ‘little’, 2 for ‘moderate’, and 3 for ‘high’. The job control score was computed for each respondent on the basis of his/her extent of control with the selected 16 items. The job control score of a respondent could range from 0 to 48, where 0 indicated no job control while 48 indicated the highest level of job control. This variable appears in item number 13.2 of the interview schedule (Appendix A).

3.6.1.13.5 Measurement of perceived organizational support

Perceived Organizational Support (POS) refers to employees’ perception concerning the extent to which the organization values their contribution and cares about their well-being. It has been found to have important consequences on employees’ performance and well-being. Based on the perceived organizational support scale of Eisenberger et al. (1997), a four-point rating scale was constructed along with the responses ‘not at all’, ‘little’, ‘moderate’, and ‘high’ was assigned with the scoring of 0 for ‘not at all’, 1 for ‘little’, 2 for ‘moderate’, and 3 for ‘high’. The perceived organizational support score was computed for each respondent on the basis of his/her extent of perception with 5 selected items. The score of a respondent could range from 0 to 15, where 0 indicated no support from the organization and 15 indicated the highest level of support from the organization. The variable appears in item number 13.3 of the interview schedule (Appendix A).

3.6.1.13.6 Measurement of perceived colleagues' support

An employee receiving co-workers' support perceives his/her colleagues as a kind and cooperative person, and thus gets positive energy from relations with them. Co-workers' support can improve the well-being of an employee by reducing stress, role conflict, and role overload (Chiaburu & Harrison, 2008). The four-point scale developed by O'Driscoll (2000) was used to measure the respondents' perceptions of the level of supervisors' and co-workers' support they received. The respondents were asked how often they get support from their supervisors or co-workers when facing work problems. A four-point rating scale along with the responses 'not at all', 'little', 'moderate', and 'high' was assigned with the scoring of 0 for 'not at all', 1 for 'little', 2 for 'moderate', and 3 for 'high'. The perceived colleagues' support score was computed for each respondent based on his/her extent of perception with 5 selected items. The perceived colleagues' support scores could range from 0 to 15, where 0 indicated no support from colleagues while 15 indicated the highest support. This variable appears in item number 13.4 of the interview schedule (Appendix A).

3.6.1.13.7 Ranking of the items of the dimensions of the work design

Job Demands Index (JDI), Job Control Index (JCI), Perceived Organizational Support Index (POSI), and Perceived Colleagues' Support Index (PCSI) were considered to assess the item-wise rankings of the dimensions of the work design. The measurement technique of the item-wise indices is as follows:

Job Demands Index (JDI)

The job demands index for the selected 15 items was computed using the following formula:

$$\text{Job Demands Index } (JDI_i) = JD_{hi} \times 3 + JD_{mi} \times 2 + JD_{li} \times 1 + JD_{ni} \times 0$$

here, JD_{hi} = Number of SAAOs response as 'high' to the *i*th item of job demands

JD_{mi} = Number of SAAOs response as 'moderate' to the *i*th item of job demands

JD_{li} = Number of SAAOs response as 'little' to the *i*th item of job demands

JD_{ni} = Number of SAAOs response as 'not at all' to the *i*th item of job demands, and

I = Specific item of the job demands

The JDI_i of the selected 15 items could range from 0 (0×71 SAAOs =0) to 213 (3×71 SAAOs = 213), where 0 indicates that the respective item ranked the least considering the JDI, and 213 indicates the respective item ranked the top considering the JDI. Based on these scores, the item-wise rank orders of the job demands were determined.

Job Control Index (JCI)

The job control index for the selected 16 items was computed using the following formula:

$$\text{Job Control Index } (JCI_j) = JC_{hj} \times 3 + JC_{mj} \times 2 + JC_{li} \times 1 + JC_{nj} \times 0$$

here, JC_{hj} = Number of SAAOs response as 'high' to the *j*th item of job control

JC_{mj} = Number of SAAOs response as 'moderate' to the *j*th item of job control

JC_{lj} = Number of SAAOs response as 'little' to the *j*th item of job control

JC_{nj} = Number of SAAOs response as 'not at all' to the *j*th item of job control, and

j = Specific item of the job control

The JCI_j of the selected 16 items could range from 0 (0×71 SAAOs =0) to 213 (3×71 SAAOs = 213), where 0 indicates that the respective item ranked the least considering the JCI and 213 indicates the respective item ranked the top considering the JCI. Based on these scores, the item-wise rank orders of job control were determined.

Perceived Organizational Support Index (POSI)

The perceived organizational support index for the selected five items was computed using the following formula:

$$\text{Perceived Organizational Support Index } (POSI_k) = POS_{hk} \times 3 + POS_{mk} \times 2 + POS_{lk} \times 1 + POS_{nk} \times 0$$

here, POS_{hk} = Number of SAAOs response as 'high' to the *k*th item of perceived organizational support

POS_{mk} = Number of SAAOs response as 'moderate' to the *k*th item of perceived organizational support

POS_{lk} = Number of SAAOs response as 'little' to the *k*th item of perceived organizational support

POS_{nk} = Number of SAAOs response as 'not at all' to the *k*th item of perceived organizational support, and

k = Specific item of the perceived organizational support

The $POSI_k$ of the selected five items could range from 0 (0×71 SAAOs =0) to 213 (3×71 SAAOs = 213), where 0 indicates that the respective item ranked the least considering the POSI and 213 indicates the respective item ranked the top considering the POSI. Based on these scores, the item-wise rank orders of perceived organizational support were determined.

Perceived Colleagues' Support Index (PCSI)

The perceived colleagues' support index for the selected five items was computed using the following formula:

$$\text{Perceived Colleagues' Support Index } (PCSI_w) = PCS_{hw} \times 3 + PCS_{mw} \times 2 + PCS_{lw} \times 1 + PCS_{nw} \times 0$$

here, PCS_{hw} = Number of SAAOs response as 'high' to the *w*th item of perceived colleagues' support

PCS_{mw} = Number of SAAOs response as 'moderate' to the *w*th item of perceived colleagues' support

PCS_{lw} = Number of SAAOs response as 'little' to the *w*th item of perceived colleagues' support

PCS_{nw} = Number of SAAOs response as 'not at all' to the *w*th item of perceived colleagues' support, and

w = Specific item of the perceived colleagues' support

The $PCSI_w$ of the selected five items could range from 0 (0×71 SAAOs = 0) to 213 (3×71 SAAOs = 213), where 0 indicates that the respective item ranked the least considering the PCSI and 213 indicates the respective item ranked the top considering the PCSI. Based on these scores, the item-wise rank orders of perceived colleagues' support were determined.

3.6.1.13.8 Ranking of the dimensions of the work design

The Work Design Dimension Index for Job Demands ($WDDI_{JD}$), Work Design Dimension Index for Job Control ($WDDI_{JC}$), Work Design Dimension Index for Perceived Organizational Support ($WDDI_{POS}$), and Work Design Dimension Index for Perceived Colleagues' Support ($WDDI_{PCS}$) were considered to find out the dimension-wise rankings of the work design. The measurement technique of the dimension-wise indices was as follows:

Work Design Dimension Index for Job Demands ($WDDI_{JD}$)

The Work Design Dimension Index for Job Demands ($WDDI_{JD}$) was calculated considering the following formula:

Work Design Dimension Index for Job Demands ($WDDI_{JD}$) = Sum of JDIs/Σi

here, Sum of JDIs = Sum of indices of the 15 items of job demands, and

Σi = Sum of number of items of the job demands

The $WDDI_{JD}$ could range from 0 {(0×15÷15) = 0} to 213 {(213×15÷15) = 213}, where 0 indicates that the respective dimension ranked the least and 213 indicates the respective dimension ranked the top considering the four WDDIs. Based on these scores, the dimension-wise rank orders of work design were determined.

Work Design Dimension Index for Job Control ($WDDI_{JC}$)

The Work Design Dimension Index for Job Control ($WDDI_{JC}$) was calculated using this formula:

Work Design Dimension Index for Job Control ($WDDI_{JC}$) = Sum of JCIs/Σj

here, Sum of JCIs = Sum of indices of 16 items of job control, and

Σj = Sum of number of items of the job control

The $WDDI_{JC}$ could range from 0 {(0×15÷15) = 0} to 213 {(213×15÷15) = 213}, where 0 indicates that the respective dimension ranked the least and 213 indicates the respective dimension ranked the top considering the four WDDIs. Based on these scores, the dimension-wise rank orders of work design were determined.

Work Design Dimension Index for Perceived Organizational Support (WDDI$_{POS}$)

The Work Design Dimension Index for Perceived Organizational Support (WDDI$_{POS}$) was calculated considering the following formula:

Work Design Dimension Index for Perceived Organizational Support (WDDI$_{POS}$) = Sum of POSIs/Σk

here, Sum of POSIs = Sum of indices of 5 items of perceived organizational support, and

Σk = Sum of number of items of the perceived organizational support

The WDDI$_{POS}$ could range from 0 {(0×15÷15) = 0} to 213 {(213×15÷15) = 213}, where 0 indicates that the respective dimension ranked the least while 213 indicates the respective dimension ranked the top considering the four WDDIs. Based on these scores, the dimension-wise rank orders of work design were determined.

Work Design Dimension Index for Perceived Colleagues' Support (WDDI$_{PCS}$)

The Work Design Dimension Index for Perceived Colleagues' Support (WDDI$_{PCS}$) was calculated considering the following formula:

WDDI$_{PCS}$ = Sum of PCSIs/Σw

here, Sum of PCSIs = Sum of indices of 5 items of perceived colleagues' support, and

Σw = Sum of number of items of the perceived colleagues' support

The WDDI$_{PCS}$ could range from 0 {(0×15÷15) = 0} to 213 {(213×15÷15) = 213}, where 0 indicates that the respective dimension ranked the least but 213 indicates the respective dimension ranked the top considering the four WDDIs. Based on these scores, the dimension-wise rank orders of work design were determined.

3.6.1.13.9 Overall work design

The work design was considered using the four dimensions: job demands, job control, perceived organizational support, and perceived colleagues' support. The overall work design score of a respondent was calculated using the following equation:

Overall Work Design = Total job demands score + Total job control score + Total perceived organizational support score + Total perceived colleagues' support score

The overall work design score of the SAAOs could range from 0 to 123, where 0 indicates the poorest level of the work design, while 123 indicates the highest level of the work design. This variable appears in item number 13 of the interview schedule (Appendix A).

3.6.2. Measurement of the dependent variable

The job performance of the SAAOs was the dependent variable in this study. The job performance assesses whether a person performs his/her job well. Academic job performance study as part of organizational psychology also forms a part of human resource management. Performance is an important criterion for organizational outcomes and success. The variable appears in item number 14 of the interview schedule (Appendix A). Various measures of job performance have been used over the past decades (Campbell et al., 1990; Viswesvaran et al., 1996, etc.). For example, rating scales, job knowledge tests, hands-on job samples, and archival records have been used to assess job performance (Campbell et al., 1990). From these options of measurement, performance ratings (e.g., peer ratings and supervisor ratings) are the most frequent ways of measuring job performance (Viswesvaran et al., 1996). "objective" criteria, such as sales figures and production records, are often requested. Several studies have focused on the degree of convergence across various sources of performance ratings (Conway & Huffcutt, 1997; Harris & Schaubroeck, 1988; Mabe & West, 1982; Viswesvaran et al., 1996). The researcher used three rating sources (i.e., self, supervisor, and farmers) to measure job performance. The items of job performance were selected using item collection, and judge rating procedure which is given in the following sections.

3.6.2.1 Item collection: After a thorough consultation, searching of relevant literature, and discussion with experts, the items were collected to measure the job performance of the SAAOs. The items found similar were not considered during the collection of items. Finally, the 18 job performance items were selected and sent to the judges for Judge rating.

3.6.2.2 Judges' ratings of the job performance scale

The items of job performance were sent to 50 experts to rate the items. A letter was also sent to the experts from the Supervisor of the Study (Appendix D) with a request to rate the items with a scale of 1-5 (1 for the least appropriate and 5 for the most appropriate ones). But out of the 50, 29 experts made their opinions. Based on the ratings of those 29, the average appropriateness of each of the items was measured with the following formula:

$$AAS = (\Sigma ASJ)/N$$

here, AAS = Average Appropriateness Score

ASJ = Appropriateness Score given by the individual judges, and

N = Number of Judges (here, it is 29)

Afterward, the AASs for each of the items were determined and the items having AASs > 2.50 out of 5, (i.e., more than the average) were selected (Ahamed, 2017). Based on the results of the AASs, it was decided to include all the items with slight modifications as suggested by some of the judges in the scale for the interview schedule. The average

appropriateness scores of all the items are given in Appendix F. After correction and modification following the AAS and comments of the judges, the variable was finalized along with 10 items. The measurement technique of the job performance of SAAOs is given here:

3.6.2.3 Measurement of the overall job performance

A four-point rating scale, viz., 'excellent', 'good', 'fair', and 'unsatisfactory' was used for the measurement along with the scores assigned as 1 for 'unsatisfactory', 2 for 'fair', 3 for 'good', and 4 for 'excellent', respectively. The job performance score was computed for each respondent on the basis of his/her extent of performance with 10 selected items.

As the job performance was measured by combining the scores on the self-rating (assessment by the SAAO himself), supervisor's perception rating (assessment by the AEO, AAO, or/and UAO), and perception rating by the client systems (assessment by the farmers), the same scale was used for all the SAAOs, one respective supervisor for each of the SAAO and two respective farmers for each SAAO. The overall job performance score of the SAAOs was calculated using the following equation:

$$JPS = \Sigma(JPS_{SAAO}+JPS_{Authority}+(MJPS_{Farmer})$$

here, JPS= Overall job performance score of the SAAOs

JPS_{SAAO} = Job performance score of the SAAO rated by himself/herself

$JPS_{Authority}$ = Job performance score of the SAAO rated by his/her authority

$MJPS_{Farmer}$ = Mean of job performance score of the SAAO rated by two farmers

= (Job performance score rated by farmer 1+ by farmer 2)/2

Thus, the overall job performance score of the SAAOs could range from 30 (10+10+10 = 30) to 120 [{40+40+(40+40)/2} = 120], where 30 indicates the lowest level of job performance, whereas 120 indicates the highest level of performance.

3.6.2.4 Ranking of the items of the job performance

Ten items were considered to measure the job performance of the SAAOs. A Performance Index (PI) was calculated for the SAAOs based on the Self-Performance Index (SPI), Authority Evaluated Performance Index (AEPI), and Farmer Evaluated Performance Index (FEPI) were calculated. Then, the Overall Performance Index (OPI) was obtained by combining all these three indices. The equation of OPI is given here:

$$\text{Overall Performance Index } (OPI_p) = (SPI_{ps} + AEPI_{pa} + FEPI_{pf}) \div 3$$

here, SPI_{ps} = Self Performance Index

$AEPI_{pa}$ = Authority Evaluated Performance Index

$FEPI_{pf}$ = Farmer Evaluated Performance Index

p = Specific item of the job performance

s = Response of SAAO

a = Response of SAAO's respective authority, and

f = Response of SAAO's respective farmer.

Self-Performance Index (SPI_{ps}) = $SP_{phs}\times3+SP_{pms}\times2+SP_{pls}\times1+SP_{pns}\times0$

here, SP_{phs} = Number of SAAOs response as 'high' to the pth item of job performance

SP_{pms} = Number of SAAOs response as 'moderate' to the pth item of job performance

SP_{pls} = Number of SAAOs response as 'little' to the pth item of job performance

SP_{pns} = Number of SAAOs response as 'not at all' to the pth item of job performance

The Self-Performance Index (SPI_{ps}) of the selected 10 items could range from 71 {(1×71 SAAOs) = 71} to 284 {(4×71 SAAOs) = 284}, where 71 indicates that the respective item ranked the least considering the SPI_{ps} and 284 indicates the respective item ranked the top considering the SPI_{ps}.

Authority Evaluated Performance Index ($AEPI_{pa}$) = $AEP_{pha}\times3+AEP_{pma}\times2+AEP_{pla}\times1+AEP_{pna}\times0$

here, AEP_{pha} = Number of Authority response as 'high' to the pth item of job performance

AEP_{pma} = Number of Authority response as 'moderate' to the pth item of job performance

AEP_{pla} = Number of Authority response as 'little' to the pth item of job performance

AEP_{pna} = Number of Authority response as 'not at all' to the pth item of job performance.

The Authority Evaluated Performance Index ($AEPI_{pa}$) of the selected 10 items could range from 71 {(1×71 authorities) = 71} to 284 {(4×71 authorities) = 284}, where 71 indicates that the respective item ranked the least considering the $AEPI_{pa}$ and 284 indicates the respective item ranked the top considering the $AEPI_{pa}$.

Farmer Evaluated Performance Index ($FEPI_{pf}$) = {All Farmer Evaluated Performance Index ($AFEPI_{pfn}$)}/2

here, $AFEPI_{pfn}$ = All farmers (71+71=142) evaluated performance index the pth item of job performance.

All Farmers Evaluated Performance Index ($AFEPI_{pfn}$) = $FEP_{phf}\times3+FEP_{pmf}\times2+FEP_{plf}\times1+FEP_{pnf}\times0$

here, FEP_{phf} = Number of farmer response as 'high' to the pth item of job performance

FEP_{pmf} = Number of farmer response as 'moderate' to the pth item of job performance

FEP_{plf} = Number of farmer response as 'little' to the pth item of job performance

FEP_{pnf} = Number of farmer response as 'not at all' to the pth item of job performance

n = 1, 2 (as 2 farmers were interviewed for each SAAO).

The Farmers Evaluated Performance Index ($FEPI_{pf}$) of the selected 10 items could range from 71 {(1×142 farmers)÷2 = 71} to 284 {(4×142 farmers)÷2 = 284}, where 71 indicates that the respective item ranked the least considering the $FEPI_{pa}$ and 284 indicates the respective item ranked the top considering the $FEPI_{pa}$.

The Overall Performance Index (OPI_p) for a specific item of job performance could range from 71 {(71+71+71)÷3 = 71} to 284 {(284+284+284÷3 = 284}, where 71 indicates that the respective item ranked the least considering the OPI_p and 284 indicates the respective item ranked the top considering the OPI_p.

3.7 Challenges for Improving the Work Design and the Job Performance

The SAAOs in the study area faced some challenges which are needed to be taken into active consideration for improving their performance and working conditions. The researcher gained experience during the pre-testing of the questionnaire regarding some common challenges faced by the SAAOs before data collection. The researcher divided the challenges into two issues: the first one of which was i) challenges for improving work design, and the second one was ii) challenges for improving job performance. A 4-point rating scale was used to measure the responses of the respondents to each of the challenges. To get the score of each challenge, four options: 'high', 'medium', 'low', and 'not required' were assigned by the scores of 3, 2, l, and 0, respectively. For ranking the challenges, the Challenges in the Work Design Index (CWDI) were computed using this formula:

Challenges in Work Design Index ($CWDI_c$) = CW_{ch}×3+CW_{cm}×2+CW_{cl}×1+CW_{cn}×0

here, CW_{ch} = Number of respondents with 'high' response

CW_{cm} = Number of respondents with 'medium' response

CW_{cl} = Number of respondents with 'low' response

CW_{cn} = Number of respondents with 'not required' response, and

c = Specific challenge

The challenges score could range from 0 to 213, where 0 indicates no challenge faced, but 213 indicates the highest extent of the challenge faced for the specific challenge of the work design.

In the same way, for ranking the challenges, the Challenges in Job Performance Index (CJPI) was computed using this formula:

Challenges in Job Performance Index ($CJPI_c$) = $CJ_{ch}\times3+CJ_{cm}\times2+CJ_{cl}\times1+CJ_{cn}\times0$

here, CJ_{ch} = Number of respondents with 'high' response

CJ_{cm} = Number of respondents with 'medium' response

CJ_{cl} = Number of respondents with 'low' response

CJ_{cn} = Number of respondents with 'not required' response, and

c = Specific challenge.

The challenges score could range from 0 to 213, where 0 indicates no challenge faced, and 213 indicates the highest extent of the challenge faced for the specific challenge of the job performance. The item appears in number 15 of the interview schedule (Appendix A).

3.8 Data Processing and Analyses

Various steps taken in processing and the analysis of the collected data are given here:

3.8.1 Compilation of the data

After completion of the field survey, the data from all the interview schedules were coded, compiled, tabulated, and analyzed in accordance with the objectives of the study. In this process, all the responses in the interview schedule were given numerical coded values. The qualitative data were converted into quantitative ones using suitable scoring techniques whenever and wherever necessary. The responses to the questions in the interview schedules were transferred to the SPSS program (Statistical Package for Social Sciences) (version 23) for statistical analyses.

3.8.2 Categorization of the data

For describing the different characteristics, the respondents were classified into characteristics-wise respective categories. These characteristics-wise categories were developed by considering the nature of the data distribution, general understanding prevailing in the social system, and possible scores system.

3.8.3 Statistical techniques

The computer software SPSS, and Microsoft Excel were used to analyze the data. Descriptive statistical measures, e.g., frequency, range, mean, percentage distribution, standard deviation, rank order, categories, and indices were used to describe and interpret the data. However, graphs and tables were used to present most of the results obtained. To determine the effect of work design on job performance was examined by the (i) measures of

association, and (ii) linear fitted line in a scattered plot. The contingency table along with Pearson's Chi-square and Cramer's V was estimated to determine the association between the work design and job performance. The scattered plotting of the work design and job performance along with the linear fitted line was also estimated to verify the association. To examine the influences of the selected characteristics of the SAAOs on their job performance, the job performance of the SAAOs was considered as the dependent variable (y) while the 13 selected characteristics of the SAAOs: viz., age (X_1), additional education (X_2), family size (X_3), annual family income (X_4), service tenure (X_5), job facilities (X_6), professional training need (X_7), managerial orientation (X_8), psychological strain (X_9), affective commitment (X_{10}), self-efficacy (X_{11}), job satisfaction (X_{12}), and work design (X_{13}) were used as the independent variables. The influences of the 13 selected characteristics (independent variables) of the SAAOs on their job performance (dependent variable) was determined through the following steps (Naher et al., 2011):

Step-1. Correlation analysis was done to determine the relationships between the selected characteristics of the SAAOs to their job performance.

Step-2. Linear multiple regression model with the independent variables that were found significant in Step 1 (i.e., in correlation analysis) to determine the contributions of these variables on the dependent variable.

Step-3. A stepwise regression model with significant independent variables in Step 2 to avoid the problem of multicollinearity and to determine the unique contribution of these variables to the dependent variable.

Step-4. Path analysis with the significant independent variables in Step 3 to explore the direct and indirect effects of the independent variables on their job performance.

3.8.3.1 Correlation analysis

Correlation is a statistical measure that expresses the extent to which two variables are related (meaning whether those change together at a constant rate). It's a common tool for describing simple relationships without making any statement about the cause and the effect. The relationship might be linear or non-linear (monotonic). Both Pearson's correlation coefficient and Spearman's rank correlation coefficient were used for measuring the correlation but the difference between those lies in the kind of analysis. The Pearson's correlation evaluates the linear relationship between two continuous variables, whereas the Spearman's rank correlation evaluates the monotonic relationship. Both correlation coefficients were estimated and compared in order to find the significantly related variables regardless of their distributions.

3.8.3.2 Multiple linear regression

The multiple linear regression models describe the relationship between a dependent variable and more than one independent variable. The goal is to find the best-fitting straight line that minimizes the sum of squared residuals of the linear regression model. The least squares method is the most common one used to fit a regression line (Bardsiri et al., 2014; Jorgensen, 2004; Montgomery et al., 2012; Shepperd & MacDonell, 2012). The multiple linear regression model is defined as follows:

$$y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots + \beta p X_{ip} + \varepsilon_i,\ i = 1, \ldots n.$$

here y_i is the dependent variable,

X_{i1}.. X_{ip} are independent variables (predictors),

β_0 is an intercept,

$\beta_1 \ldots\ldots$ βp are regression coefficients, and

The value of ε_i represents the error residuals.

The model is designed as a matrix, where each row represents a data point. The variables found significant in correlation analysis are included in the multiple linear regression model and the assumptions of the model are subjected to assessment.

Multiple linear regression assumptions

There are a number of assumptions that should be assessed before performing any multiple linear regression analysis. Those are:

- The dependent variable (the variable of interest) needs to be using a continuous scale.
- There are two or more independent variables that can be measured using either continuous or categorical means.
- The three or more variables of interest should have a linear relationship, which one can check using a scatterplot of residuals with the predicted values.
- The data should have homoscedasticity. In other words, the line of best fit is not dissimilar as the data points move across the line in a positive or negative direction. Moreover, the homoscedasticity can be checked by producing standardized residual plots against the standardized predicted values.
- The data should not have two or more independent variables which are highly correlated. This is called multicollinearity which can be checked using the Variance Inflation Factor (VIF values). The high VIF indicates that the associated independent variable is highly collinear with the other variables in the model concerned.
- There should be no spurious outliers.

- The residuals (errors) should be approximately normally distributed. This can be checked by a histogram (with a superimposed normal curve) and by plotting the standardized residuals using either a P-P Plot, or a Normal Q-Q Plot.

Assessing the assumptions and detection of outlier(s) of multiple linear regression

The job performance is the dependent variable, and the six significant independent variables obtained from correlation analysis are: additional education, job facilities, managerial orientation, self-efficacy, job satisfaction, and work design. The results of the assumptions checking and detection of outlier(s) are given here:

Assumption 1: Linear relationship between dependent and independent variables

When the multiple linear regression analysis was done, the assumption was that the relationship between the response variable (dependent variable) and the predictors (independent variable) is linear. If this assumption is violated, the linear regression will try to fit a straight line to data that does not follow a straight line. The bivariate plot of the predicted value against residuals can help the researcher infer whether the predictors' relationship to the outcome is linear. The scatterplot of the standardized predicted value of job performance on the independent variables against the standardized residuals is given in Figure 3.3.

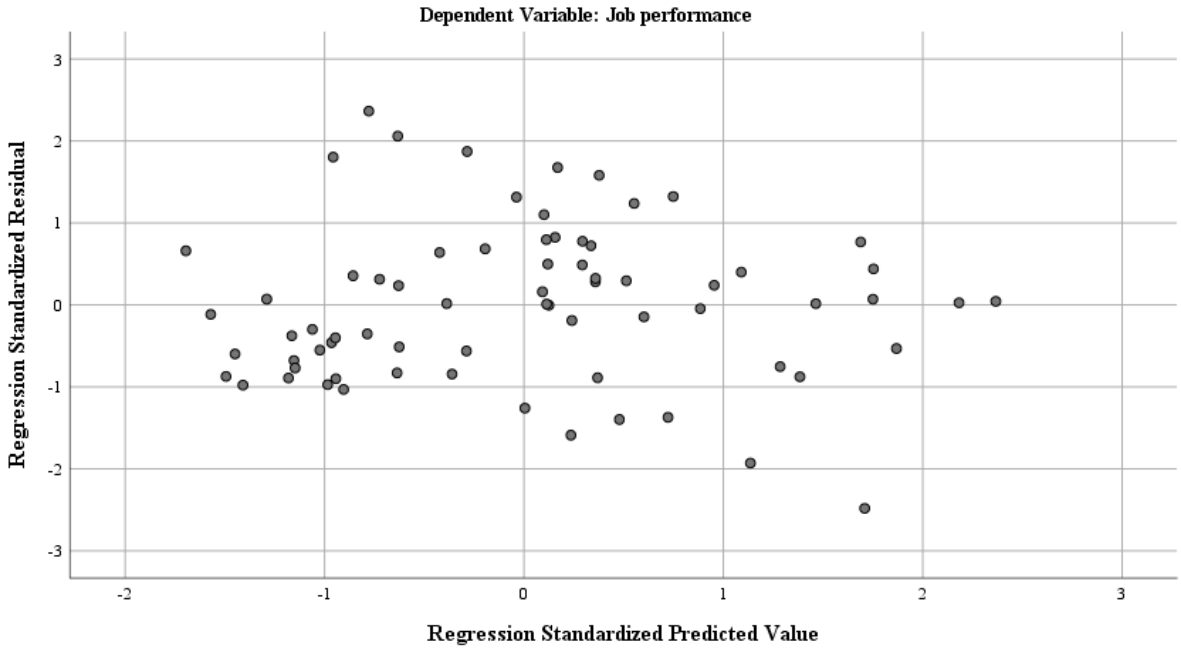

Figure 3.3 The scatterplot of the standardized predicted value of job performance on independent variables against the standardized residuals

The fitting of a non-linear best-fit line known as the Loess Curve through the scatterplot is given in Figure 3.4 to check if any nonlinearity can be detected.

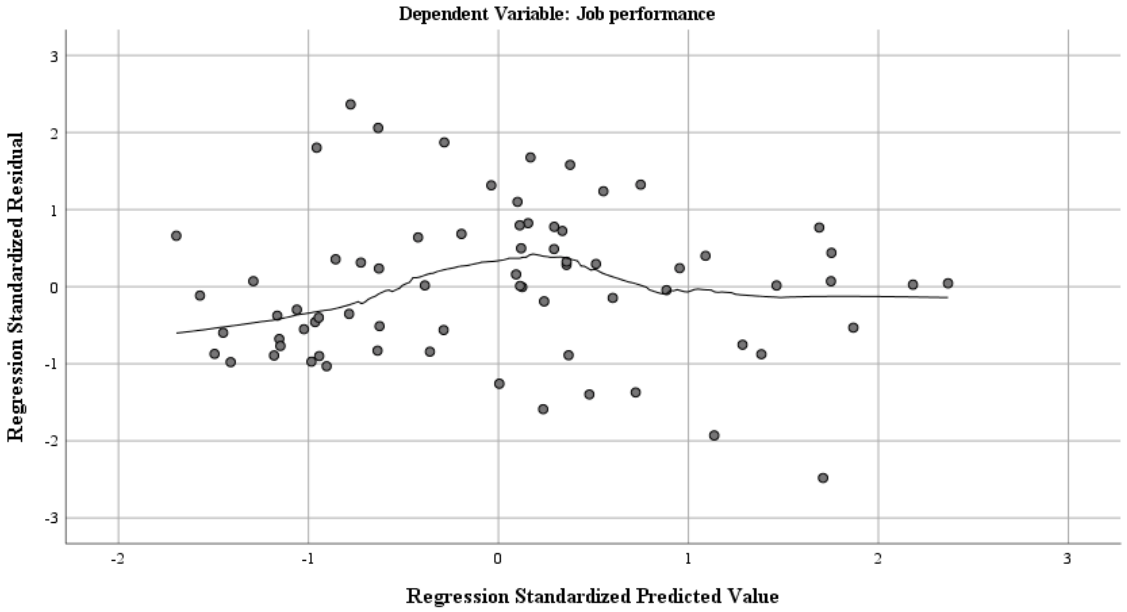

Figure 3.4 The scatterplot of the standardized predicted value of job performance on independent variables against the standardized residuals with the fitted loess curve

From the Loess curve (Figure 3.4), it appears that the relationship of the standardized predicted to residuals is roughly linear around zero. So, it can be concluded that the relationship between the response variable and the predictors is linear around zero since the residuals seem to be randomly scattered around zero. The fitting of a linear best-fit line through the scatterplot is given in Figure 3.5.

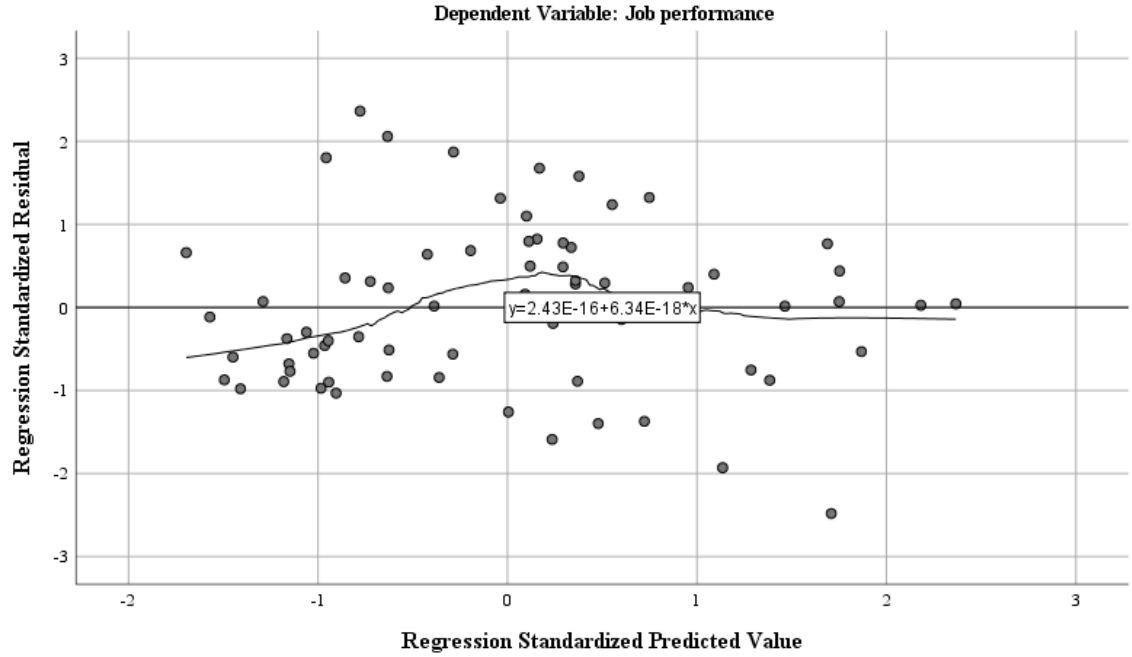

Figure 3.5 The scatterplot of the standardized predicted value of job performance on independent variables against the standardized residuals with the fitted straight-line

Fitting the linear curve through the scatterplot will show the linear straight-line fitted through zero, confirming that the relationship between the response variable and the predictors is linear.

Assumption 2: Homoscedasticity - the residual is constant

Another assumption of the ordinary least square regression is that the variance of the residuals is homogeneous across the levels of the predicted values, also known as homoscedasticity. If the model is well-fitted, there should be no pattern to the residuals plotted against the fitted values. If the variance of the residuals is non-constant, then the residual variance is claimed to be heteroscedastic. The classical linear regression model (CLRM) assumes that the error term u_i in the regression model has homoscedasticity (equal variance) across the observations, denoted by σ^2, that is, $var(e_i)=\sigma^2$. However, if the assumption of the homoscedasticity, or the equal variance, is not satisfied, there is the problem of heteroskedasticity, or unequal variance, denoted by σ^2_i, that is, $var(e_i)=\sigma^2_i$. Just as for assessing the linearity, a commonly used graphical method uses the residual versus fitted plot (Figure 3.5). It can be noted that there is some heteroskedasticity as the lower values of the standardized predicted values tend to have lower variance around zero. But this problem is not considered here as it does not cause bias in the coefficient estimates. So, it makes those less precise; and lower precision increases the likelihood that the coefficient estimates are further from the correct population value.

Assumption 3: Residuals are normally distributed

The residuals of the multiple linear regression should follow the normal distribution. Once the residuals from the model is obtained, that is relatively easy to test using either a P-P plot, a Q-Q plot, or a histogram. In linear regression, a common misconception is that the outcome has to be normally distributed, but the assumption is that the residuals are normally distributed (Uyanik & Guler, 2013). It is important to meet this assumption for the p-values for the t-tests to be valid. The normality of the residuals - assessment is model dependent, meaning that, that can be changed if more predictors are added. The normal probability plot (specifically the P-P plot) was fitted to check the normality given in Figure 3.6.

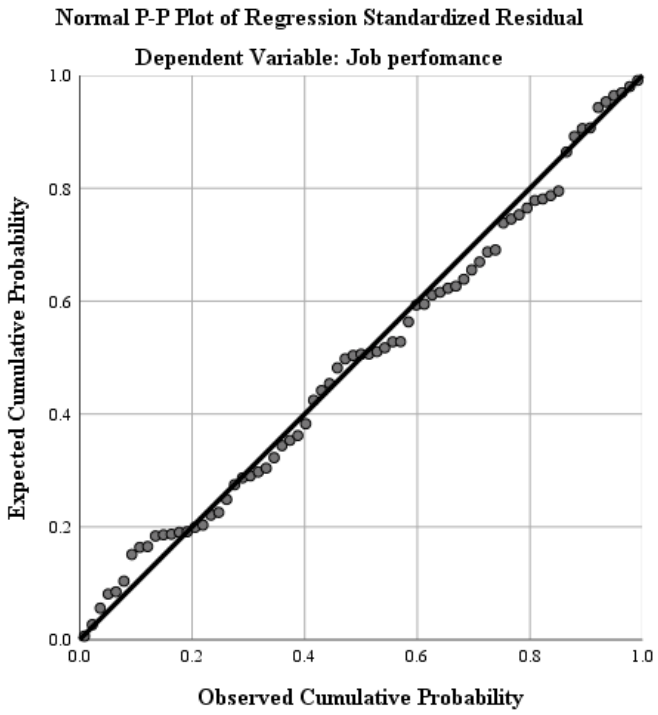

Figure 3.6 Normal P-P plot of the regression standardized residual

In addition, more commonly noted is the Q-Q plot, which compares the observed quantile with the theoretical quantile of a normal distribution. The Q-Q plots are better if it is wanted to compare with a family of distributions that vary on location and scale; it is also more sensitive to the tail distributions. The normal quartile-quartile plot (more specifically Q-Q plot) was fitted to check the normality is given in Figure 3.7.

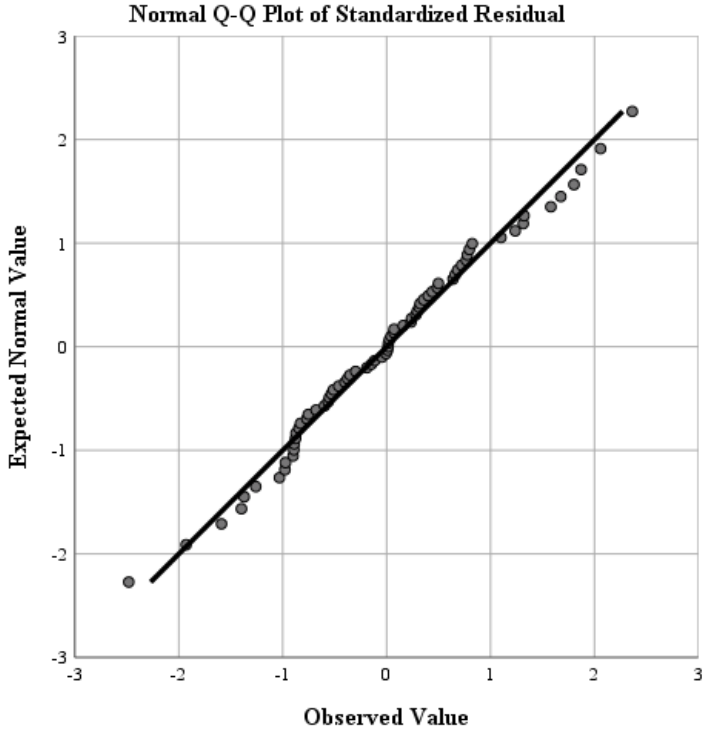

Figure 3.7 Normal Q-Q plot of the regression standardized residual

Both the plots of Figures 3.6 and 3.7 (the P-P and Q-Q plots, respectively) show the points more or less follow the straight line and it can be seen although there are some deviations, those generally follow the straight line, indicating that the residuals are normally distributed. However, the histogram of the regression standardized residual of job performance confirms the normal distribution of the residuals (Figure 3.8).

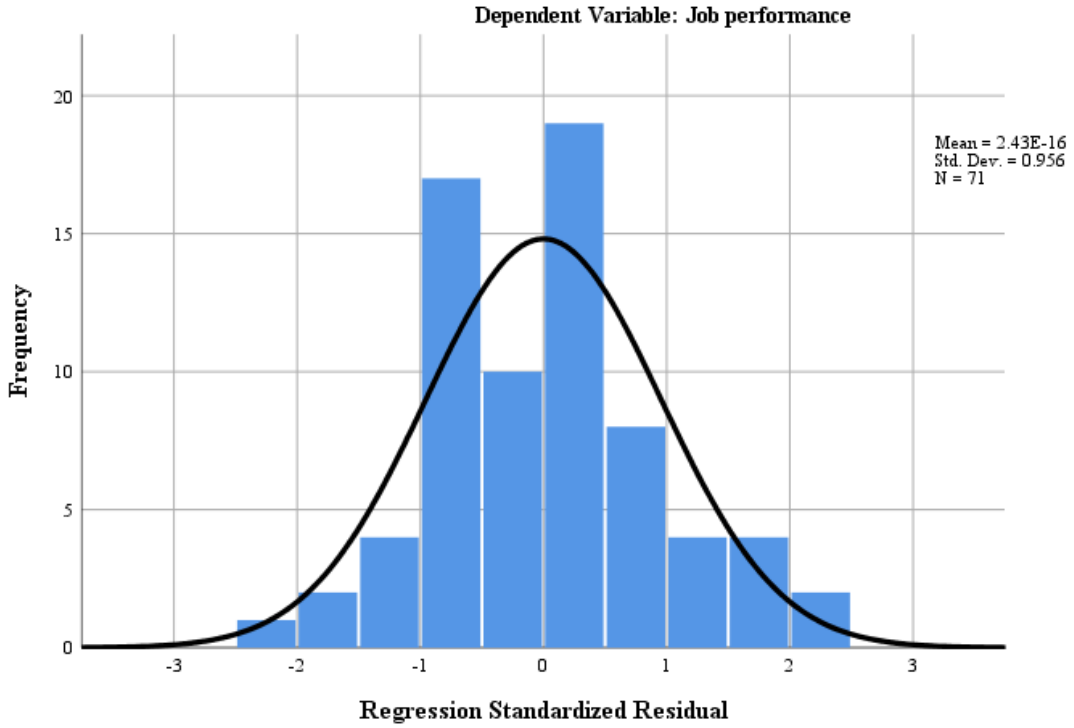

Figure 3.8 Histogram of the regression standardized residual

Assumption 4: Absence of multicollinearity between independent variables

When there is a perfect linear relationship among the predictors (independent variables), the estimates for a regression model cannot be uniquely computed. In that situation, the collinearity might arise, implying that two variables are linear combinations of one another. When more than two variables are involved in that phenomenon, it is often called multicollinearity, although the two terms are often used interchangeably. Nonetheless, the primary concern is that as the degree of multicollinearity increases, the coefficient estimates become unstable and the standard errors for the coefficients can get wildly inflated, and it can cause problems while fitting and interpreting the regression model. If the correlation is greater than 0.8 indicating that the variables are multicollinear, that will not be ideal (Uyanik & Guler, 2013). The correlation matrix of the predictors to check the multicollinearity is given in Table 3.3.

Table 3.3 Correlation matrix for the predictors of the multiple linear regression model

Predictor	X_2	X_6	X_8	X_{11}	X_{12}	X_{13}	Job performance
X_2	1.000						0.548
X_6	0.309	1.000					0.525
X_8	0.321	0.333	1.000				0.332
X_{11}	0.411	0.298	0.358	1.000			0.339
X_{12}	0.405	0.370	0.315	0.424	1.000		0.648
X_{13}	0.553	0.505	0.471	0.613	0.744	1.000	0.719

Note: X_2 =Additional education, X_6 = Job facilities, X_8 = Managerial orientation, X_{11} = Self-efficacy, X_{12} = Job satisfaction, X_{13} = Work design

The results of Table 3.3 indicate that all the correlation coefficients between the predictors are less than 0.8; so, it can be claimed that, none of the predictors are multicollinear. Additionally, it is wanted to know that the predictor variables are correlated with the outcome variable at a value greater than 0.3. Now we look at the functioning outcome variable and all the values are more than 0.3 thus it met the assumption.

In addition, the Variance Inflation Factor (VIF) and Tolerance are two closely related statistics to diagnose collinearity in multiple regression. Those are based on the *R*-squared value obtained by regressing a predictor on all of the other predictors in the analysis. The value for the VIF starts at 1 but has no upper limit. A general rule of thumb for interpreting the VIFs is as follows:

A value of 1 indicates no correlation between a given predictor variable and any other predictor variables in that model. But any value between 1 and 5 indicates a moderate correlation existed between a given predictor variable and other predictor variables in that model, but this is often not severe enough to require attention. And when the value is greater than 5, that indicates a potentially severe correlation between a given predictor variable and other predictor variables in that model (Shrestha, 2020). In this case, the coefficient estimates and p-values in the regression output are likely unreliable. The VIF and Tolerance values of the multiple regression model are given in Table 3.4.

Table 3.4 The collinearity statistics of the multiple regression model

Predictor	Collinearity Statistics	
	VIF	Tolerance
Additional education	1.468	0.681
Job facilities	1.366	0.732
Managerial orientation	1.329	0.753
Self-efficacy	1.641	0.609
Job satisfaction	2.254	0.444
Work design	3.810	0.262

The results of Table 3.4 indicates that none of the VIF values for the predictor variables in the regression model are greater than 5, which pointed out that, the multicollinearity will not be a problem in the regression model. Similarly, Tolerance is used in applied regression analysis to assess the levels of multicollinearity. The tolerance measures how much beta coefficients are affected by other predictor variables in a model. Smaller values of tolerance denote higher levels of multicollinearity. The tolerance is associated with each independent variable and ranges from 0 to 1. Generally, a tolerance below 0.25 indicates that the multicollinearity might exist, and further investigation is required, and when tolerance is lower than 0.1, there is significant multicollinearity that needs to be corrected (Elsayed, 2021). The regression model clarifies that none of the independent variables had a tolerance value of less than 0.25. That phenomenon indicates that multicollinearity will not be a problem in the regression model.

Detection of outlier: Unusual and influential data

A single observation that is substantially different from all other observations can make a large difference in the regression analysis results. If a single observation (or a small group of observations) substantially changes the results, which needs to be investigated further. In linear regression, an outlier is an observation with a large residual. In other words, it is an observation whose dependent-variable value is unusual given its values on the predictor variables. An outlier may indicate a sample peculiarity or may indicate a data entry error or other problems. So, to detect the outlier, the scattered plot was made with the regression standardized residual on the Y-axis and the regression standardized predicted value on the X-axis. The scatterplot is given in Figure 3.9.

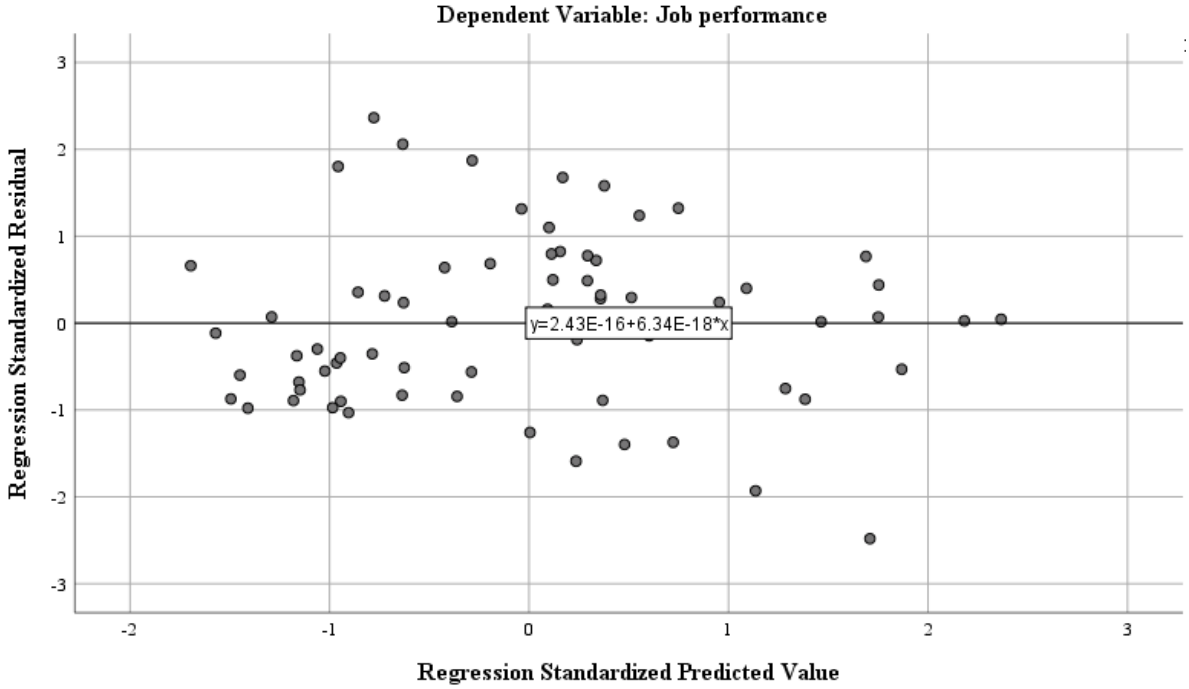

Figure 3.9 The scatterplot of the standardized predicted value against the standardized residuals for the detection of an outlier

The Figure 4.7 indicates that none of the points fall outside of negative 3 to positive 3, either one of the X or Y axis. So, in this case, there is a good shape as none of the points fall outside of the range of -3 to +3. Similar observations can be found considering the residual descriptive statistics, the standard residual range is -2.482 to 2.364 (Table 3.5), which is within the range of -3 to +3. Some deem an observation with a standardized residual larger than 3 (in absolute value) to be an outlier (Cook, 1977).

Table 3.5 Descriptive statistics of the residuals of the multiple regression model

Descriptive	Minimum	Maximum	Mean	Standard Deviation
Residual	-30.025	28.603	0.000	11.569
Standard Residual	-2.482	2.364	0.000	0.956
Deleted Residual	-33.646	30.666	0.013	12.826
Cook's Distance	0.000	0.119	0.016	0.025

Cook's distance is the scaled change in the fitted values, which is useful for identifying outliers in the X values (observations for predictor variables). Cook's distance shows the influence of each observation on the fitted response values. It is used in regression analysis to find influential outliers in a set of predictor variables. In other words, it's a way to identify points that negatively affect the regression model. The measurement is a combination of each

observation's leverage and residual values; the higher is the leverage and residuals, the higher is the Cook's distance. Cook's distance is considered high if it is greater than 0.5 and extreme if it is greater than 1 (Cook, 1977). The results from Table 3.5 indicate that the range of the Cook's Distance is 0.000 to 0.119 which is less than 0.5 indicating the absence of an influential outlier in the model.

As all the assumptions are met to some extent, and there is no outlier in the distribution of data, the multiple linear regression model can be considered for the estimation of the contribution of the significant variables in the model.

3.8.3.3 Stepwise multiple regression model

In the case of the multiple independent variables, for reaching an optimum model of prediction, it is appropriate to use stepwise regression (Bardsiri et al., 2014; Jorgensen, 2004; Shepperd & MacDonell, 2012). The stepwise regression is a method that iteratively examines the statistical significance of each independent variable in a linear regression model. This is an appropriate analysis when there are many variables and it is also important to identify a useful subset of the predictors. The stepwise regression technique aims to maximize the estimation power using the minimum number of independent variables. The stepwise regression is a combination of the forward and the backward selections which involves an automatic process for selecting the independent variables and can be briefly described as follows:

(i) A starting model is set, which contains predefined terms;
(ii) The limits for the final model is set, i.e., what type of model is needed, whether the linear terms are used, squared terms, or vice versa;
(iii) The evaluation threshold is set (in this case, this is whether the Sum of Squared Errors (SSE) has significantly decreased);
(iv) After adding or removing the terms, the model is retested; and
(v) The stepwise regression is to be halted when no further estimation improvement occurs.

There is a modification of forward selection such that, after each step in which a variable is added, all the candidate variables in the model are checked to note whether their significance has been reduced below a specified tolerance threshold. Forward selection starts without any variables in the model and then iterates to add each variable. When a non-significant variable is found, it is removed from the model. The Backward selection works similarly but removes variables when those are found to be non-significant. Therefore, the stepwise regression requires two significance levels: the first for adding variables, and the second one for

removing variables. In this study, the forward selection approach was considered which started with nothing but adds each new variable incrementally, testing for statistical significance.

3.8.3.4 Path analysis

In the present study, the Karl Pearson Product Moment correlation test, the linear multiple regression, and the stepwise multiple regression were conducted. However, it was impossible to find the direct and indirect effects separately through these tests. But, in the path analysis, it was possible to get both the direct and the indirect effects separately. The Path Analysis is a causal modeling approach to exploring the correlations within a defined network. This analysis, a precursor to any subset of structural equation modeling - is a method to discern and assess the effects of a set of variables acting on a specified outcome via multiple causal pathways.

The Path coefficient is simply a standardized partial regression coefficient. As such measures, one variable's direct influence upon another can be estimated. It permits the separation of the correlation coefficient into components of the direct and the indirect effects (Dewey & Lu, 1959). This allows the direct effect of an independent variable and its indirect effect through other variables on the dependent variable (Sasmal & Chakrabarty, 1978).

The direct effect of an independent variable on the dependent variable is the standardized beta coefficient (value of 'β' of the regression analysis) of the respective independent variable whereas the following formula measures the indirect effect of an independent variable through a channeled variable:

$$e = \Sigma br.$$

here, e = Total indirect effect of an independent variable

b = Direct effect of the Variable through which indirect effect is channeled

r = Correlation coefficient between respective independent variables and variables through which indirect effect is channeled.

The Path coefficient analysis was employed in order to obtain a clear understanding of the direct and the indirect effects of the selected independent variables. This analysis was done involving the significant variables of the final model of the step-wise multiple regression analysis.

3.9 Hypothesis

A hypothesis is a tentative answer to the research question or a statement of the relationships among the variables that a researcher intends to study. According to Kerlinger (1973), a hypothesis is a conjectural statement of the relation between the variables concerned. Hypotheses are always in declarative sentence form and those are related, either generally or specifically from variables to variables. In a broad sense, hypotheses are divided into two categories: (a) Research hypothesis, and (b) Null-hypothesis.

3.9.1 Research hypothesis (H_a)

The following research hypothesis was put forward to test the contribution/effect of the selected characteristics of the SAAOs to/on their job performance. The research hypothesis was: "Thirteen selected characteristics of the SAAOs have significant contributions and effect to/on their job performance."

3.9.2 Null hypothesis (H_o)

The aforesaid research hypothesis was converted into the null hypothesis for testing the study's conceptual model. The major hypothesis formulated for testing the study's conceptual model is presented here: "There is no contribution and effect of the following selected characteristics of the respondent SAAOs to/on their job performance."

The selected characteristics of the respondent SAAOs considered in this study were:
Age, additional education, family size, annual family income, service tenure, job facilities, professional training need, managerial orientation, psychological strain, affective commitment, self-efficacy, job satisfaction, and work design (job demands, job control, perceived organizational support, perceived colleague's support).