Tianjin DaxueXuebao (ZiranKexueyuGongchengJishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:54 Issue:12:2021
DOI 10.17605/OSF.IO/ZB85E

FACTORS THAT AFFECT PRODUCTIVITY OF AIRCRAFT MAINTENANCE PERSONNEL AT KLIA2

MOHD HARRIDON and MUHAMAD FARIS AIMAN ZAHIDI
Aviation Fitness Cluster, Aerospace Department, Universiti Kuala Lumpur, Malaysian Institute of Aviation Technology, Lot 2891, Jalan Jenderam Hulu, Jenderam Hulu, 43800 Dengkil, Selangor, Malaysia
Corresponding Author: mdharridon@unikl.edu.my

ABSTRACT
Aircraft Maintenance is a process where human personnel maintain, repair, and overhaul aircraft and this process is intricate and requires the uttermost concentration in order to have aircraft which are safe and airworthy. A productive Aircraft Maintenance Personnel would ensure aircraft are maintained in a timely fashion and safe to be used. In this paper we explored the factors that affect the productivity of these maintenance workers via a 5 points Likert Scale.
Keywords: Aircraft Maintenance, human personnel maintain, human personnel repair, overhaul aircraft

1. Introduction

The biggest airport in Malaysia is the Kuala Lumpur International Airport (KLIA) which caters for domestic and international flights. KLIA is divided into 2 where the first is KLIA1 and the second is KLIA2. KLIA2 caters for operations of budget airlines. Maintenance works of aircraft at KLIA2 are actuated by Aircraft Maintenance Personnel. Safety is highly regarded in the Aviation Field and thus the maintenance of aircraft should be at an optimum level. Ensuring that requires maintenance personnel to be productive and we had explored the factors that affect the productivity of these maintenance workers.

According to Shepherd, the safety and fidelity of aircraft depends upon the human personnel that tinker and work upon these aircraft [1]. If these personnel are affected by numerous events or situations, their work quality or productivity would be degraded and hence reducing the integrity of the aircraft. Also according to Shepherd, deadlines which are deemed “stressful” contribute to the infringement of the works of these personnel [1].

Bruecker stipulated that the roster or the “shift work” of maintenance workers has also been the catalyst to degrade the productivity of the workers where workers may be dissatisfied with their roster [2]. Bruecker had introduced an algorithm to optimize the schedule of the aircraft maintenance workers in the hope of increasing the productivity at the selected maintenance company [2].

Aithal had stated that an employee’s productivity is affected by several factors whether it is internally or externally [3]. Aithal had listed several approaches to increase one’s productivity and an example would be to provide leverage for the employee to develop his or her capacity or could be paraphrased as bestowing the employee the roster which he or she feels comfortable.

Tianjin DaxueXuebao (ZiranKexueyuGongchengJishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:54 Issue:12:2021
DOI 10.17605/OSF.IO/ZB85E

Sharifzadeh had stipulated that there are scholarly articles that provided evidences which showed that a fit employee would be productive in his or her works [4]. Factors that affect the fitness of an individual would inherently also affect the individual's productivity. For example, sleep depravity affects the fitness of a human being where the human being could not perform well and thus decreasing his or her productivity.
Our paper measured the productivity of the Aircraft Maintenance Personnel using a 5 Points Likert Scale. According to Joshi, preferences or degrees of opinions could be quantified and represented by a Likert Scale where the scale offers individuals a systematic way to grade their opinions [5]. Joshi further reiterated that the scientific community had given verification upon the usage of the Likert Scale [5].
Nemoto agreed with Joshi where Nemoto stated that the Likert Scale is prominent in gathering vast information and providing a tool to measure opinions in ease [6]. Nemoto also spelled out the reliability of the Likert Scale where concrete comparison could be made among various variables [6].

2. Literature Review

Maintaining an aircraft is complex and requires workers that have skills and experiences. These 2 components would ensure productivity at the maintenance hangar is at the optimum but there are other factors that need to be taken into account. One such factor is the fitness of the maintenance personnel. Fatigue, according to Hobbs, is a factor that contributes to error in maintenance and fatigue is related to fitness [7]. It is thus imperative that we also identify the fitness factor that affect the productivity of the maintenance workers.
Drury pointed out that such investigation or identification is valid as maintaining an aircraft is akin to an intricate process or system where several components play a role in achieving the quest of making the aircraft airworthy without sacrificing safety. Drury supports the notion of systematically analyzing the factors that would contribute to the decline of the productivity of the aircraft workers [8].
Nogueira had indicated that aircraft maintenance personnel handled numerous objects during their chores and these objects were prominent in weight and eventually causes musculoskeletal disorders which affect their productivity [9]. We thus were in the right track for instigating this investigation as our results complemented previous researches and unearthed supplementary evidences.
Burton had investigated the association between fitness and productivity and he concluded there was an association where workers that are fit tend to produce higher amount of productivity in contrast to workers that are not fit [10]. The productivity factors that we had touched upon in our 5 Point Likert Scale were relevant to human fitness which is in lieu with the research by Burton.
Wattles in his study had determined that having a high degree of fitness enables an employee to retain a high degree of productivity [11]. Wattles had studied 143 employees to come out with this deduction where he measured cardiorespiratory endurance and muscular strength and their association with productivity [11].
Bernaards concluded that those with low level of fitness had produced low level of productivity where her study measured physical exercises and correlated them with

Tianjin DaxueXuebao (ZiranKexueyuGongchengJishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:54 Issue:12:2021
DOI 10.17605/OSF.IO/ZB85E

work productivity [12]. The productivity level was measured using Health and Performance Questionnaires (HPQ) which is somehow akin to our usage of Likert Scale.

The Likert Scale, as explained by Albaum, is a scale which could quantify one's attitude towards a subject [13]. The scale can also capture the intensity or the deepness of the opinion of the individual via points on a scale [13]. Our research captured this intensity with regards to the productivity statements posed to our respondents.

Lee had used the Likert Scale to show the differences in answers obtained in lieu with cultural differences of the respondents [14]. Lee posed questions pursuant to health and sense of coherence to 3 different groups with various cultural backgrounds (Chinese, Japanese, and American) and obtained patterns of answers which are different with regards to each culture [14]. This shows the adaptability of using Likert Scale in numerous situations and thus we opined the scale is suitable for the identification of productivity factors.

Boone mentioned that the Likert Scale is a good tool to quantify the answers given by respondents and provided means to perform analysis with ease [15]. There were also variations in the Likert Scale which is permissible and valid since the gist is still intact [15]. Our Likert Scale has 5 points which are extensively used by researchers worldwide and Boone also pointed out the extensive use of this 5 points scale [15].

3. Methodology

The methodology to gain the factors that affect the productivity is shown in Figure 1.

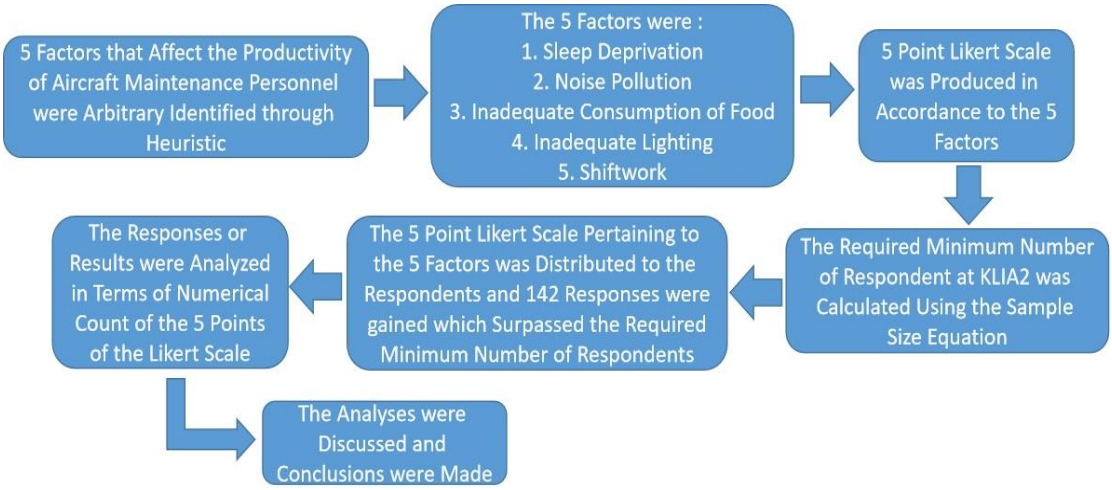

Figure 1. The Methodology to Gain the Factors that Affect the Productivity of Aircraft Maintenance Personnel at KLIA2

Based upon heuristics, we identified 5 factors that affect the productivity of Aircraft Maintenance Personnel. These factors were mostly human fitness factors that posed significant affect toward one's performance. The factors identified were: Sleep

Tianjin DaxueXuebao (ZiranKexueyuGongchengJishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:54 Issue:12:2021
DOI 10.17605/OSF.IO/ZB85E

Deprivation, Noise Pollution, Inadequate Consumption of Food, Inadequate Lighting, and Shiftwork.

Those with Sleep Deprivation are considered not fit at that particular time frame as their ability to be dynamic and mobile is compromised. For Noise Pollution, extreme decibels affect one's ability to concentrate which render the individual unfit at that particular moment. Individuals that consume inadequate amount of food, whether it is over eating or "under" eating, would feel uneasy performing tasks as they are bogged down in their physical movements. This is also considered unfit. At the work place, lighting which is inadequate posed a hindrance for workers to navigate effectively and it also constraint their accuracy. Shiftwork is the schedule that a worker has to endure and there are situations where the shiftworks were gruesome where workers spent time working continuously without much rest. This render the individual unfit to perform much of the tasks.

The 5 factors above cause one to be physically unfit and in turn degrade one's productivity as outlined earlier in the Literature Review Section. Based upon these 5 factors, we developed our 5 Point Likert Scale where statements in accordance to these 5 factors were posed to the respondents and the respondents had graded each statement with one of the followings: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. We had also calculated the required minimum number of respondents. Calculation was done using the Sample Size Equation where relevant values were inserted into the equation. The relevant values were: Population = 350, Confidence Level = 85%, and Margin of Error = 5%. Population here refers to the total number of Aircraft Maintenance Personnel at KLIA2. The calculation indicated that we required a minimum of 131 respondents. We however managed to gain 142 respondents which surpassed the minimum requirement.

The responses or results were then analyzed where the numerical count of Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree was noted. We then discussed the analyses and made conclusions upon the analyses.

4. Results

Figures 2, 3, 4, 5, and 6 show the results in graphical form.

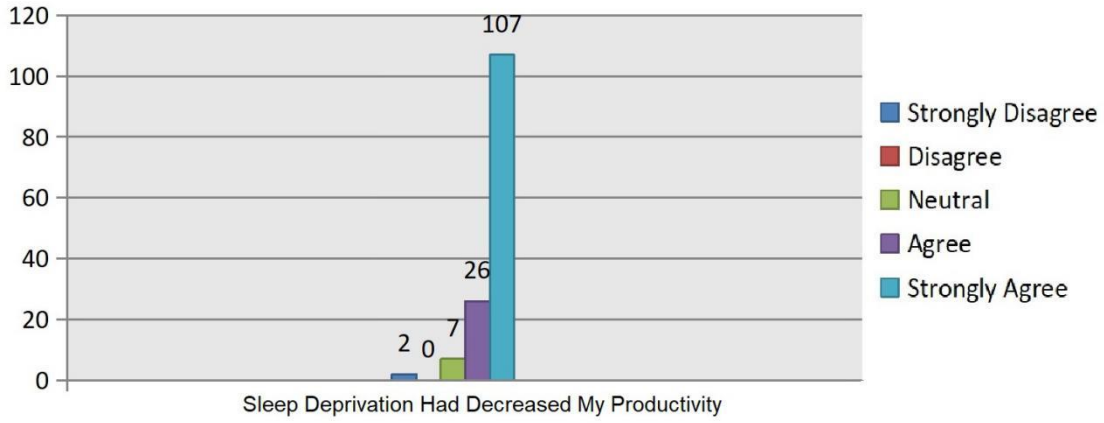

Figure 2. Likert Scale - Sleep Deprivation

Tianjin DaxueXuebao (ZiranKexueyuGongchengJishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:54 Issue:12:2021
DOI 10.17605/OSF.IO/ZB85E

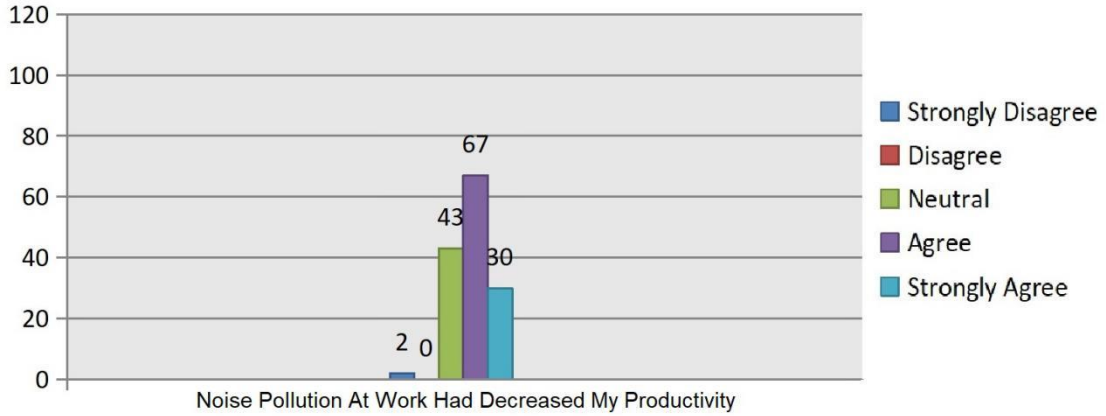

Figure 3. Likert Scale - Noise Pollution

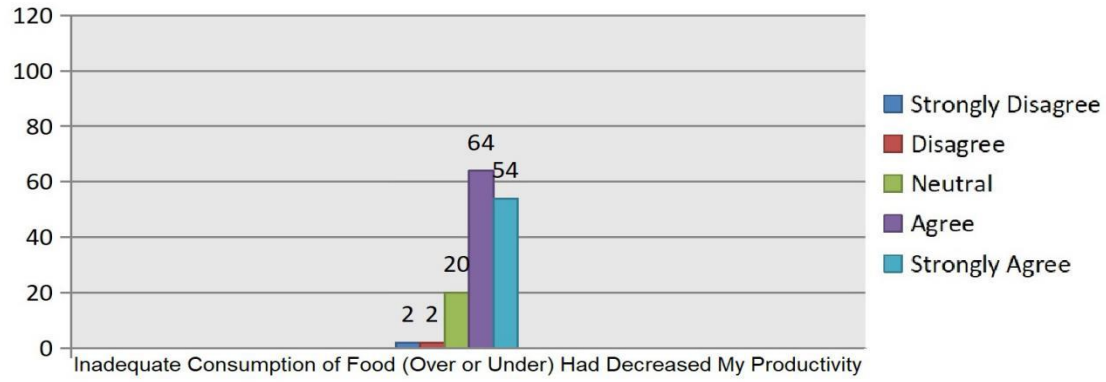

Figure 4. Likert Scale - Inadequate Consumption of Food

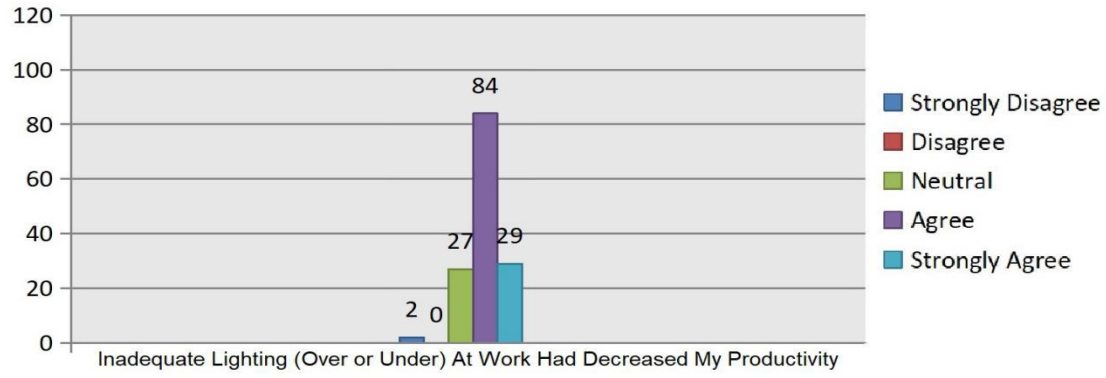

Figure 5. Likert Scale - Inadequate Lighting

Tianjin DaxueXuebao (ZiranKexueyuGongchengJishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:54 Issue:12:2021
DOI 10.17605/OSF.IO/ZB85E

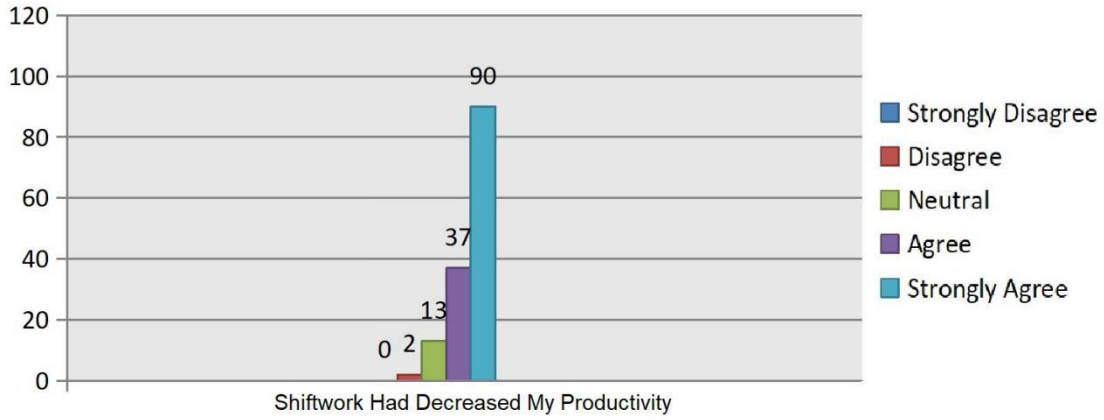

Figure 6. Likert Scale - Shiftwork

5. Discussion

It can be seen from Figure 2 that a majority of the respondents felt that sleep deprivation had affected their productivity at work. In fact 107 respondents were extremely vocal in stating that their work performance had declined due to erroneous sleep pattern. Only 2 maintenance workers indicated that they were not affected by the sleeping disorder.

Figure 3 showed 43 respondents had neutral inclination or opinion towards the issue of Noise Pollution. That represents 30.28% of the respondents which is quite a lot. However 97 respondents had agreed and extremely agreed that noise pollution is an issue that affected their productivity. This represents 68.31 % of the total respondents and thus we can safely say that a great number of respondents implied Noise Pollution as an issue that is detrimental to their performance and productivity.

In lieu with Figure 4, 118 respondents, which represent 83.1 % of the total respondents, had concurred that “inadequate consumption of food” was detrimental to their tasks or chores and subsequently affected their productivity. We are concern about this as this showed that the workers were perhaps actuating their tasks with empty stomachs or with stomachs which are fully expanded. This situations lead to workers being under energized or overly sleepy when performing their chores.

Figure 5 showed that majority of the Aircraft Maintenance Personnel were affected by inadequate lighting which had decreased their productivity. These 113 workers represent 79.58% of the total workers that had been interviewed. However 27 workers were undecided whether the insufficient lighting had affected their jobs or not. These 27 workers perhaps were not gravely affected by the lighting environment or perhaps had ignored this environmental deficiency.

Based upon Figure 6, Shiftwork is seemed to be an issue with the workers where it is deemed as a very strong factor that decreases the worker’s productivity. 127 personnel had agreed and strongly agreed with this. There were 2 workers that deemed shiftwork as not a nuisance and 13 workers were on the fence upon this issue. We postulated that these 15 workers were perhaps immune to the rigidity of the schedule and were brazen in their approaches toward the chores.

Tianjin DaxueXuebao (ZiranKexueyuGongchengJishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:54 Issue:12:2021
DOI 10.17605/OSF.IO/ZB85E

6. Conclusions

Peering at the results we concluded that the factors that decreases the productivity of the Aircraft Maintenance Workers were Sleep Deprivation, Noise Pollution, Inadequate Consumption of Food, Inadequate Lighting, and Shiftwork. We had presented these 5 factors to our respondents and a huge number of them or a majority had expressed their agreement upon these factors being the reasons behind their depressed productivity. Our 5 Point Likert Scale had managed to capture the sentiments of the aviation workers where we also offered options of neutrality to the workers in order to facilitate or represent their ambiguity. Our results could perhaps complement any rectification plan where the plan would plausibly increase the productivity of the Aircraft Maintenance Personnel at KLIA2.

References

[1] Shepherd, W.T., "Human Factors in the Maintenance and Inspection of Aircraft", Human Factors and Ergonomics Society Annual Meeting Proceedings, 34(16): 1167 - 1167, DOI: 10.1177/154193129003401616, October 1990.

[2] Bruecker, P.D., "A Tabu Search Heuristic for Building Aircraft Maintenance Personnel Rosters", SSRN Electronic Journal, January 2014, DOI: 10.2139/ssrn.2464033

[3] Aithal, P.S., "Theory A for Optimizing Human Productivity", IRA - International Journal of Management & Social Sciences, ISSN 2455-2267, 4(3), 526-535, DOI : 10.21013 / jmss.v4.n3.p2, September 2016.

[4] Sharifzadeh, M., "Does Fitness and Exercises Increase Productivity? Assessing Health, Fitness and Productivity Relationship", American Journal of Management, Volume 13 (1), 2013.

[5] Joshi, A., "LikertScale: Explored and Explained", British Journal of Applied Science & Technology, 7(4): 396-403, 2015, ISSN: 2231-0843, BJAST.2015.157.

[6] Nemoto, T., "Developing Likert-Scale Questionnaires", The Japan Association for Language Teaching (JALT) Conference Proceedings, JALT2013, Tokyo Japan, 2013.

[7] Hobbs, A., "Associations between Errors and Contributing Factors in Aircraft Maintenance", Human Factors: The Journal of the Human Factors and Ergonomics Society, June 1, 2003, DOI: 10.1518/hfes.45.2.186.27244.

[8] Drury, C.G., "Human Factors in Aviation Maintenance: Handbook of Aviation Human Factors", The National Academies of Sciences Engineering Medicine, 1999, pg 591 - 605, ISBN 0805816801.

[9] Nogueira, H.C., "Musculoskeletal Disorders and Psychosocial Risk Factors among Workers of the Aircraft Maintenance Industry", Work 41 (2012) 4801-4807, IOS Press, DOI: 10.3233/WOR-2012-0767-4801.

[10] Burton, W.N., "The Association of Health Status, Worksite Fitness Center Participation, and Two Measures of Productivity", Journal of Occupational and Environmental Medicine, April 2005, Volume 47, Issue 4, pg 343-351, DOI : 10.1097/01.jom.0000158719.57957.c6.

[11] Wattles, M.G., "The Relationship between Fitness Levels and Employee's Perceived Productivity, Job Satisfaction, and Absenteeism", Journal of Exercise Physiology, Volume 6, Number 1, February 2003, ISSN 1097-9751.

[12] Bernaards, C.M., "Physical Activity, Cardiorespiratory Fitness, and Body Mass Index in Relationship to Work Productivity and Sickness Absence in Computer Workers with Preexisting Neck and Upper Limb Symptoms", Journal of Occupational and Environmental Medicine, June 2007, Volume 49, Issue 6, pg 633-640, DOI : 10.1097 / JOM.0b013e318058202c.

Tianjin DaxueXuebao (ZiranKexueyuGongchengJishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:54 Issue:12:2021
DOI 10.17605/OSF.IO/ZB85E

[13] Albaum, G., “The Likert Scale Revisited”, International Journal of Market Research, March 1, 1997, Volume 39, Issue 2, pg 1-21, DOI : 10.1177/147078539703900202.

[14] Lee, J.W., “Cultural Differences in Responses to a Likert Scale”, Research in Nursing & Health, Wiley Online Library, 15th July 2002, DOI: 10.1002/nur.10041.

[15] Boone, H.N., “Analyzing Likert Data”, Journal of Extension, April 2012, Volume 50, Number 2, Article Number 2TOT2.