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Bharatiya Vidya Bhavan
Institute of Management Science

About Bharatiya Vidya Bhavan Institute of Management Science, Kolkata

Bharatiya Vidya Bhavan Institute of Management Science, Kolkata, India, was started in the year 2000 under the aegis of Bharatiya Vidya Bhavan as a promising B-School under Maulana Abul Kalam Azad University of Technology (MAKAUT). Our MBA program is affiliated with the MAKAUT and is approved by the All India Council for Technical Education (AICTE), Ministry of Human Resource Development, Govt. of India and Department of Higher Education (Technical Education), Govt. of West Bengal. The Institute conducts a 2-year MBA program on a regular basis.

The 1st and 2nd semesters contain core subjects. In the 3rd and 4th semesters, students have to specialize in a particular field of management. At present, we offer a specialization in four areas: Marketing, Human Resources, Finance and Business Analytics. Dual specialization is now offered to make the students better equipped to handle the ever-changing business scenario. Students are required to select three courses from one area (Major Specialization) and one course from a different area (Minor Specialization).

MBA students of our Institute continued to perform the best in the University, securing top positions consistently. The students are functional in the industry with pride, displaying a commendable performance. Our teaching focuses on providing that cutting edge for industrial assignments through seminars, industry visits, case studies and interactive sessions with industry stalwarts.

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Contents

From The Desk of Editor

Strategic Fusion of Western and Indian Management Thought

Management as a discipline has its roots in the Industrial Revolution from about 1760 to 1840 AD (As per Julian & Gregorian calendar). The urge to make time and cost-efficient goods has given birth to the era of machine-led productions instead of much human intervention. This new knowledge has been enriched further by advanced scientific research and inventions. The principles and experiments of Henry Fayol, Chester Bernard, Elton Mayo, George Dantzig, W Edwards Deming, George Homans, Herbert Simon, Peter Drucker and many more have developed and shaped modern management. The western world has used its skill and influence to capture resources all around the world, succeeded to a large extent and dominated the field of management for years.

On the other hand, the eastern demography, which has once been greatly influenced by westernization, has taken a relook at its capacity and conceptualized the crossover of the western ethos of the machine-led economy to the eastern doctrine of empathy-led management. One of the prominent examples of this approach is a new course which has been designed by Darden Professor Jay Bourgeois on 'Strategic Intuition and Eastern Philosophy.'

All over the world, in management education, there is a surge in understanding different philosophies like Hindu, Shinto, Confucian, Buddhist, Islam, etc., and to align and strengthen their global outlook towards management practices. A sloka from Bhagavad Gita, which is widely admired as a repository of karma and life management, says –

न मे पार्थास्ति कर्तव्यं त्रिषु लोकेषु किंचन ।
नानवाप्तमवाप्तव्यं वर्त एव च कर्मणि ॥ (3: 22)

From the management perspective, the shloka advises not to be looking for others to give us work when we have finished doing what we were doing or when we have nothing to do. We should take independent initiatives by self-picking what to do for the organization when assigned work is completed. Post covid world has seen the adieu of conventional practices and welcoming of New-Normal. The shloka is much pertinent to this surgency.

Indian economy is moving towards achieving excellence and the world is slowly acknowledging the fact.

Although predominantly an agrarian outset, Indian industries are now practising the fusion of innovation and social philosophy in all three sectors of the economy. This onset is not sudden. We can trace it back to the Gandhian era. In the words of J.C. Kumarappa in his book 'Gandhian Economic Thought,' the economy of India lies in the general philosophy of life. It is a way of life, as he elaborated and proposed that the enterprising stage should have a balancing of rights with duties. Agri-based economic practices can be pursued with a vision of making a self-sufficient economy. In modern words, we can call it the foundation of 'Atmanirbhar Bharat.' A surge in the tech-based agricultural solution is the testimony of the modern-day application of those Gandhian thoughts. Even some western countries are also borrowing modern Agri techniques, such as organic farming, genetically modified farming, vertical farming, etc, from India by appreciating the thought process.

This showcases the importance of the strategic fusion of western and eastern management practices. B-Schools of India can leverage this method and empower their vision.

I thank and welcome the readers of Vol 7 (combined issue) of the BIMS Journal of Management. May your reverence enrich the path of our scholastic effort.

Best regards
Dr. S P Mohapatra, Editor-in-Chief – BIMS Journal of Management
Principal, Bharatiya Vidya Bhavan Institute of Management Science, Kolkata

Employees Attitude towards Team Leaders: A Study on I T. Companies in Bangalore, India

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Abstract:
In today's fast-developing world, many industries are growing rapidly. One of the fastest-developing industries is the I.T. Industry. The present study will try to identify the factors that influence the perception of the employees towards the attitude of the team leaders. A team leader is responsible in every way to extract work from their subordinate employees. However, at the same time, it is their responsibility to keep them satisfied and happy so that they will remain loyal to the companies they work for. If the team manager is incompetent, the subordinates will bear the brunt of heavy stress, eventually resulting in a complete loss of efficiency. However, if the team leader is efficient and competent, they might help the subordinate employees escape depression and maintain their efficiency as long as they are employed. Therefore, the role of the team leader becomes paramount in maintaining the efficiency of the employees in the field of I.T. The type of research is descriptive. For the present kind of research, 384 samples are the minimum number, but for the sake of accuracy, the researcher has targeted 500 sample respondents from Bangalore city. Out of 500 filled questionnaires, only 430 respondents were found to be completed. However, respondents were selected by snowball method from the non-probability technique. Previous studies in the field focused on the problems in the I.T. Industry, but not many of them focused on the role of the team leader. The present research is trying to fill that gap by focusing on the role of the team leader. It has provided some suggestions, too, such as the necessity to treat all the employees equally and so on, separately for the employee, team leader and the company.

Keywords: *Perception management, team leader role, job factors, compensation factors, environmental factors*

1. Introduction

The present study begins by analyzing the various facilities and equipment available in a company that might have an effect on the employees. The study tries to find out if these facilities help the employees have a positive or negative impact on either decreasing or increasing their depression.

Similarly, there are other problems like the constant threat of losing the job, ever-increasing competition from the new graduates who are coming out of the colleges every year, the ever-growing technology in the field, the constant pressure from employers to not only deliver the products within the time limit but also make them satisfactory, to maintain the work-life balance, to maintain the personal well-being, both physically and mentally, etc. These are some of the problems that might lead to depression among the employees and can create a negative perception of the team leader and the company.

2. Objectives of the Study

- To study the demographical profile of the I.T. Employees in Bangalore
- To analyze the I.T. employees' perception and level of satisfaction towards their organizational factors
- To evaluate the I.T. employees' perception of their team leaders' attitude

3. Data Analysis and Interpretation

Particulars	Frequency	Percent
Gender		
Male	252	58.6
Female	178	41.4
Age (in Years)		
Below 30 years	68	15.8
30 - 40 years	131	30.5
40 - 50 years	163	37.9
Above 50 years	68	15.8
Marital Status		
Married	166	38.6
Bachelor	218	50.7
Widow / Legally separated	46	10.7
Educational Qualification		
U.G	225	52.3
P.G	161	37.4
ITI / Diploma	44	10.2
Monthly Salary		
Up to 40,000	108	25.1
40001–80,000	180	41.9
Above 80,000	142	33.0
Total	**430**	**100.0**

Table 1: The Profile of Individual Gender, Age, Marital Status, Educational Qualification and Monthly Salary
Source: Primary Data

The above table explains the profile of gender, individual age, marital status, education and monthly salary of the respondents.

Among the 430 respondents, the majority, representing 58.6% of the total respondents, are male, and the remaining 41.4% are female.

Among the 430 respondents, 37.9% are from the age group of 40 to 50 yrs, 30.5% are between the age group of 30 and 40, 15.8% are below the age group of 30 yrs, and the remaining 15.8% respondents are above the age group of 50 yrs.

Of all the 430 respondents, 50.7% are bachelors, 38.6% are married, and the remaining 10.7% are legally separated.

Of all the 430 respondents, 52.3% of the respondents are undergraduates, 37.4% of the respondents are post-graduates, and the remaining 10.2% of the respondents have finished ITI/Diploma.

Of all the 430 respondents, the majority (41.9%) of them have a monthly salary between Rs.40,000 and 80,000, 33.0% of them have a monthly salary above 80000, and the rest, 25.1 percent, earn up to Rs.40,000 on a monthly basis.

Particulars	Frequency	Percent
Occupation Category		
Contract/Temporary	172	40.0
Permanent	258	60.0
Experience (IN Years)		
Below 5 years	103	24.0
5–10 years	167	38.8
10–20 years	129	30.0
above 20 years	31	7.2
Designation		
Software Tester	94	21.9
Software Developer	137	31.9
Technical Writer	78	18.1
Support Engineer	121	28.1
Total	**430**	**100.0**

Table 2: The Profile of Individual Occupation, Experience andDesignation
Source: Primary Data

The above-mentioned table explains the occupation, experience and designation of the respondents.

Of all the 430 respondents, 60% are permanent and the rest, 40%, are either in contract or temporary workers.

Of the total 430 respondents, 38.8% have 5 to 10 yrs of experience, 30% have experience of 10 to 20 years, 24% have less than five years of experience, and the rest 7.2% have experience of 20 years and more.

On calculating all the 430 respondents, 31.9% are software developers, 28.1% are technical writers, 21.9% are software testers, and the remaining 18.1 are support engineers.

3.1. Explanatory Factor Analysis for Employees' Satisfaction on Organizational Factors in IT Companies

Factor analysis is a data reduction technique that can reduce the number of items by grouping them. By examining the content of the items in each group, one can determine the structure or composition of each group, thereby giving a better explanation of the data.

It is important to note that factor analysis is not used to predict or explain the relationship between different sets of variables, nor is it used to determine group differences. The goal is to explain the underlying structure or composition of the data. Therefore, we are dealing only with one set of variables.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.910
Bartlett's Test of Sphericity	Approx. Chi-Square	6364.171
	df	105
	Sig.	0.000

Table 3: KMO and Bartlett's Test

Rotated Component Matrix[a]					
	Component				
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Communalities**
Pay leave facilities	.882	.210	.194	.125	.788
Hygiene work facilities	.853	.220	.155	.192	.881
Travel facilities	.841	.188	.176	.169	.825
Recreation facilities	.831	.252	.182	.109	.807
Company Image	.233	.859	.229	.208	.803
Role Clarity	.248	.853	.188	.191	.876
Work Climate	.261	.848	.269	.184	.800
Training & Development	.229	.781	.262	.262	.837
Supervisor Ratings	.217	.203	.874	.169	.895

Rotated Component Matrix[a]					
	Component				
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Communalities**
Performance Appraisal System	.132	.136	.856	.135	.929
Participative Management	.174	.271	.810	.216	.887
Grievance Redressal	.218	.294	.802	.218	.887
Job Security	.167	.202	.208	.904	.894
Compensation Benefits	.140	.198	.202	.892	.862
Recognition and Motivation	.228	.288	.220	.839	.800
Cronbach's Alpha	0.96	0.96	0.94	0.92	
Eigen value	8.067	1.823	1.524	1.355	
% of Variance	53.777	12.150	10.162	9.036	
Total % of Variance	85.12				

Table 4: Rotated Component Matrix Table
Source: Primary Data

The KMO and Bartlett's Test displays the results for interpreting the adequacy of data for factor analysis. Kaiser-Meyer-Olkin (KMO) is a measure of sampling adequacy and its value should be greater than 0.6 for the sample to be adequate for undertaking factor analysis. Also, the p-value of Bartlett's test is .000 (less than .005). Thus, the hypothesis that the correlation matrix is an identity matrix can be rejected. The correlation matrix has significant correlations among at least some of the variables, and hence, factor analysis can be undertaken using this dataset.

The communalities column presents the communality of each variable (i.e., the proportion of variance in each variable accounted for by the common factors). In using the principal component method for factor extraction, it is possible to compute as many factors as there are variables. When all factors are included in the solution, all of the variances of each variable are accounted for by the common factors. Thus, the proportion of variance accounted for by the common factors, or the communality of a variable, is 1 for all the variables.

The Total Variance Explained rows present the number of column factors extracted, the eigenvalues associated with these factors, the percentage of total variance accounted for by each factor, and the cumulative percentage of total variance accounted for by the factors. Four factors were retained for rotation using the criterion of retaining only factors with eigenvalues of 1 or greater than that. These four factors accounted for 53.77%, 12.15%, 10.162% and 9.036 of the total variance, respectively, for a total of 85.123%.

In the Rotated Components Matrix, each number represents the partial correlation coefficient between the variable and the rotated component. These coefficients help in identifying the components. All the variables that have large factor loadings for a given component define the component.

The variables constituting component 1 are:

- Pay leave facilities
- Hygiene work facilities
- Travel facilities
- Recreation facilities

The variables constituting component 2 are:

- Company Image
- Role Clarity
- Work Climate
- Training & Development

The variables constituting component 3 are:

- Supervisor Ratings
- Performance Appraisal System
- Participative Management
- Grievance Redressal

The variables constituting component 4 are:

- Job Security
- Compensation Benefits

- Recognition and Motivation

The result of principal Component Analysis reveals that there are four organizational factors:

- Environmental factor
- Job factor
- Leadership role
- Compensation factor

Thus, I.T. industry employees are focusing on these four organizational factors for their job satisfaction.

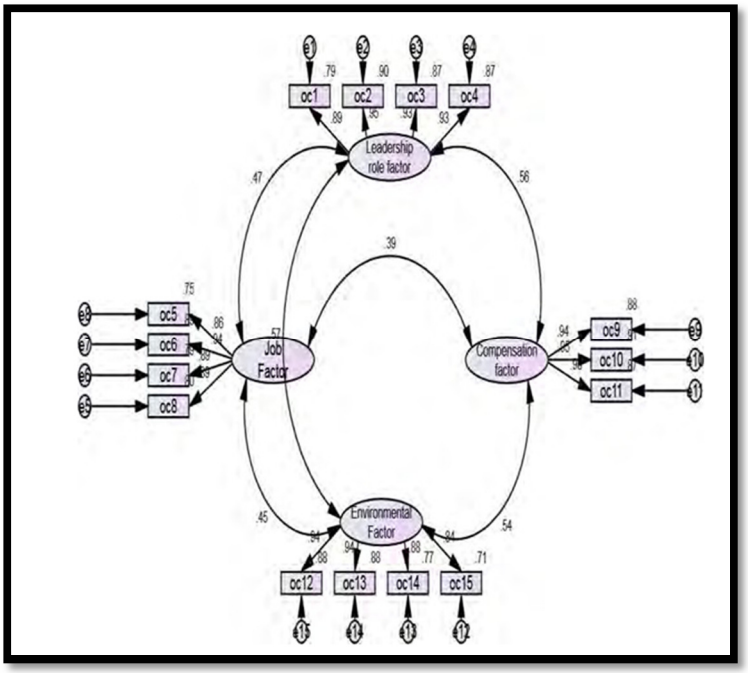

Figure 1: Confirmatory Factor Analysis for the Employees' Satisfaction with Organizational Factors in I.T. Industry

3.2. Measurement Model

Indices	Value	Suggested Value
CMIN	164/84 = 1.956	< 5
P Value	0.32	> 0.05 (Hair et al,1998)
GFI	0.892	> 0.80(Hair et al, 2006)
AGFI	0.846	> 0.80 (Hair et al, 2008)
CFI	0.892	> 0.80 (Hair et al,2008)
RMSEA	0.047	< 0.05 (Hair et al,2006)

Table 5: Model Fit Summary

A confirmatory factor analysis has been performed based on data from 430 I.T. employees. Maximum likelihood estimation was chosen because data were normally distributed. Normality and linearity were checked to evaluate the assumptions of multivariate. Cutoff Criteria for Several Fit Indexes Shorthand General rule for acceptable fit if data are continuous.

The parameters are estimated by maximum likelihood (ML) methods rather than by ordinary least squares (OLS) methods. OLS methods minimize the squared deviations between values of the criterion variable and those predicted by the model. ML (an iterative procedure) attempts to maximize the likelihood that obtained values of the criterion variable will be correctly predicted.

GFI, the goodness of fit index, indicates that the proportion of the variance in the sample variance-co-variance matrix is accounted for by the model. This should exceed 0.8 for a good model. For the saturated model, it will be a perfect 1. AGFI (Adjusted GFI) is an alternate GFI index in which the value of the index is adjusted for the number of parameters in the model. The fewer the number of parameters in the model relative to the number of data points (variances and co-variances in the sample variance-co-variance matrix), the closer the AGFI will be to the GFI. The PGFI (Parsimony GFI) is an index adjusted to reward simple models and penalize models in which a few paths have been deleted. Note that for our data, the PGFI is larger for the independence model than for our tested model.

PRATIO is the ratio of how many paths dropped to how many could have dropped. The Parsimony Normed Fit Index (PNFI) is the product of NFI and PRATIO, and PCFI is the product of the CFI and PRATIO. The PNFI and PCFI are intended to reward those whose models are parsimonious. The Root Mean Square Error of Approximation (RMSEA) estimates the lack of fit compared to the saturated model. RMSEA of .05 or less indicates a good fit, and .08 or less indicates an adequate fit. PCLOSE is the p-value testing the null that RMSEA is not greater than 0.05. Chi-square $\chi 2$ Ratio of 164 (df, 84) is useful for nested models/model trimming. We hypothesized a two-factor model to be confirmed in the measurement portion of the model. There were no missing data. The Goodness of fit index (GFI) = 0.892 and the RMSEA = .047. Those values indicate a good fit between the model and the observed data.

The goodness-of-fit test statistics are displayed below.

The Chi-square test statistic is significant at 0.05, which suggests that the model fitting is a good fit. The root mean square error of approximation (RMSEA) is 0.047, which reveals lesser error status; it indicates a good fit. Goodness of Fit Index (0.892) and Adjusted Goodness of Fit Index (.846) are larger than 0.8, which again reflects a good fit. No modifications have been made.

			Estimate	**Item reliability**	**AVE**	**Delta**	**CR**
oc1	<---	Leader	0.887	0.787	0.856 (85.6%)	0.213	0.96
oc2	<---	Leader	0.949	0.901		0.099	
oc3	<---	Leader	0.932	0.869		0.131	
oc4	<---	Leader	0.932	0.869		0.131	
oc8	<---	Job	0.895	0.801	0.804	0.199	0.94
oc7	<---	Job	0.887	0.787		0.213	
			Estimate	Item reliability		Delta	
oc6	<---	Job	0.942	0.887		0.113	
oc5	<---	Job	0.863	0.745		0.255	
oc9	<---	compensation	0.94	0.884		0.116	
oc10	<---	compensation	0.953	0.908		0.092	
oc11	<---	compensation	0.932	0.869		0.131	
oc15	<---	environment	0.843	0.711		0.289	
oc14	<---	environment	0.879	0.773		0.227	
oc13	<---	environment	0.941	0.885		0.115	
oc12	<---	environment	0.936	0.876		0.124	

Table 6: Average Variance Extracted and Construct Reliability

3.3. Average Variance Extracted

A good rule of thumb is that an AVE of 0.5 or higher indicates adequate convergent validity. On the other hand, an AVE of less than 0.5 indicates that, on average, there is more error remaining in the items than there is variance explained by the latent factor structure you have imposed on the measure.

3.4. Construct Reliability

The rule of thumb for a construct reliability estimate is that a CR of 0.7 or higher suggests good reliability. Reliability between 0.6 and 0.7 may be acceptable, provided other indicators of a model's construct validity are good. High construct reliability indicates that internal consistency exists. This means all the measures are consistently representing something.

	Leadership Role	Job Factors	Compensation Factors	Environmental Factors
Leadership Role	0.8562			
Job Factors	0.222	0.80498		
Compensation Factors	0.314	0.15	0.88681	
Environmental Factors	0.32	0.2	0.295	0.81122

Table 7: Discriminant Validity

All Variance Extracted (AVE) estimates in the above table are larger than the corresponding squared inter-construct correlation estimates (SIC). This means the indicators have more in common with the construct they are associated with than they do with other constructs.

4. Summary of Findings, Suggestions and Conclusion

4.1. Findings

- All variance extracted (AVE) estimates are larger than the corresponding squared inter-construct correlation estimates (SIC). This means the indicators have more in common with the construct they are associated with than they do with other constructs.
- The findings were received through the conducted Mann-Whitney U test. Here the researcher has separated the employees under gender basis and analyzed their satisfaction level and vital factors which have created their influence on it. Amidst the male and female employees, the researcher analyzed the impact of satisfactory factors on them.
- The four satisfactory factors: compensation factors, job factors, organization factors and leadership role factors, received a p-value of .000, which is lesser than 0.05 and it defines the existing statistically mean significant difference. The environmental factor is the one and only factor with a p-value of .010. Hence, here all of the satisfactory factors with their p-value, which is less than 0.05, bring out the prevailing statistically significant difference.
- Overall table and findings can be consummated that, the male employees are much more satisfied than the female employees. Hence, the required steps are very important to achieve the zeal satisfactory level.

4.2. Suggestions

4.2.1. For the Companies

The first and foremost factor that influences the depression level of an employee is the monetary benefits they get for the work they render. Therefore, on the part of the company, it is necessary to provide compensation benefits in a fair manner. The compensation benefits can be properly distributed based on their workload and experience. While recruiting a new employee, the companies can make sure that the compensation benefit paid to the new employee is on par with the already existing employees or slightly above but not a lot higher than the existing employees.

The second factor that an employee expects from a company is job security. The I.T. industry is notorious for its lack of job security. Whenever the company faces any economic loss, it is directly thrust upon the employees and they throw the employees out of their jobs to maintain their economic status. Therefore, if I.T. companies can provide some kind of job security, it can greatly reduce the depression level of the employees.

4.2.2. For the Team Leader

From the part of a team leader, they may follow certain practices to keep in check the depression level of the employees. The first and foremost thing a leader can have is equality. They may treat all their team members equally so that none of them have an inferiority or superiority complex. If any of the employees feel that they are not treated on par with their other employees, they might lose interest in the company that they are working for, or their depression level might increase. Therefore, it is the team leader's job to make sure all the employees are treated equally.

Workload is an important factor that can give rise to depression among the employees. A good team leader can make sure that the work is evenly distributed among the team members and no one is burdened with heavy work while

others are enjoying leisurely.

A team leader is requested to submit a report regarding their team members before the performance appraisal is done by the company. The team leader may be very careful while submitting this report. Moreover, if any of the team members is making any mistakes, then the mistakes should be highlighted immediately so that the employee can rectify them. The team leader should not wait until the performance appraisal to highlight the problems and mistakes of the team members. This might end up as a fault-finding act rather than a performance-increasing act.

4.2.3. For the Employees

In order to avoid depression, the employees on their part should also follow some habits and activities; they cannot wait for either the company or the team leader. In order to avoid lifestyle-related diseases, employees can make sure that they do not sit for a long stretch at a time. They may make it a habit to have some kind of movement every half an hour so that there is no monotony in their working habit.

Waking up early in the morning and going to bed early is a good habit that everyone may follow, especially the I.T. employees. Having a sound sleep at night without any stress or disturbances from the modern equipment, such as the mobile phones, can greatly help employees reduce their depression level.

The employees may ensure they spend quality time with their family members. Spending time with the family and having some happy time either in their home or going for a tour or excursion along with their family members can reduce their depression levels considerably.

If the work that you do does not make you happy or satisfied, then it is time for the employee to either find ways to make it interesting or find a new job. One of the major reasons for depression is doing a job that is not interesting to the employee and they may, at any cost, try to avoid it.

5. Conclusion

In the present context, the world economy is mostly based on the field of information technology. Various companies, including the world's richest person, rely on information technology. This has led to an enormous increase in the emergence of I.T. companies that cater to the technological need of the world. Though it started in the Silicon Valley of America, it later spread worldwide. There are many I.T. hubs in India, and Bangalore is among them. For an industry with such a vast presence throughout the world, the necessity to keep its employees happy is paramount. When the workers are happy and content, they will work hard for the overall improvement of the industry. However, if the workers are not happy and depressed, then it is a bad sign for the industry. Therefore, it is necessary for the researchers to analyze the various problems they face that can lead to depression and provide solutions to rectify those problems.

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Protection of Environment Pollution, Biodiversity Loss and Ecological Disaster Using nWSN-Enabled G-IoT in Smart World

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***Abstract**:*
India is a vast country with 1.40 Billion population, 3.28 Million Square Km of geographical area and approx. 2.4% of the world's total surface area, with 18% world's population. India is a growing economy and the fourth largest energy consumer after China, the USA and Japan. One of the many consequences of the increased economic activity that accompanies urbanization, particularly vehicle use, electricity generation and industrial production, is the deterioration of air quality. According to World Health Organization (WHO), global air quality guidelines concentration of conventional air pollutants, including particulates (PM 2.5 and PM 10), Ozone gas (O3), Nitrogen dioxide (NO2), Carbon monoxide (CO), sulfur dioxide (SO2), and as a result, air toxics are rising in the cities. As per the recent report of Indian Council of Medical Research (ICMR), currently, in India, one out of eight unnatural deaths is caused due to environmental pollution, with particular reference to air/traffic pollution. This is a serious concern for all of us. The current techno-legal and socio-economic research sheds light on the practical applicability of electronic nose (e-Nose) feasibility of a Next Generation Nanostructured Wireless Sensor Network System (n-WSN) as G-IoT application for the effective protection of industrial hazards gaseous like as volatile organic compound (VOC) emissions measurement, ecological disaster and forest fire prevention and management.

***Keywords:** H2S, CO, GIoT, nWSN, industrial emissions, biodiversity loss, e-Nose, techno-legal*

1. Introduction

Due to the current turbulence in the global economic, demographic, socio-economic and ecological context, governments, local administrative authorities, researchers, commercial companies, and even individuals have to recognize the importance of the resources contained in the forest environment not only from the perspective of the biodiversity and industry and the human health and lives but also from the point of view of the economic resources which forests enclose. Therefore, any major threat posed to this essential component of the environment should be identified, studied and fought through the most efficient and modern economic policies and technological means. Among them, the most dangerous phenomena, which jeopardize forests, are represented by forest fires and industrial gaseous emissions. A forest fire is any form of unrestrained fire that erupts in a forested area. Forest fires have proven to be a massive form of destruction for humankind, especially when not countered through appropriate measures and strategies. The most important measures for fighting forest fires and industrial gaseous emissions are:

- Prevention,
- Prediction and
- Suppression

2. Background and Context

The application categorization is based on gaseous pollutants released from the industries. Calibration and transfer methodologies have been discussed to enhance the applicability of electronic nose (e-Nose) and electronic tongue (e-Tongue) and electronic vision (e-Vision) systems.

This new solution for forest fire monitoring and protection could be targeted at both public and private organizations which are located in regions where fires represent a threat. After a broad socio-economic and technical examination, the research will show that this type of G-IoT system can offer an efficient approach for reducing economic and biodiversity loss while helping to prevent human rights and casualties and vision to sustainable development goal (SDG) in a smart world.

Olfaction is one of the five major human senses (vision, hearing, olfaction, taste, and touch). The sense of smell is the most mysterious and complex sense; a particular smell can trigger a series of memories in people. In 2004, Axel and Buck won the Nobel Prize in Physiology or Medicine for their research on "odorant receptors and the organization of the olfactory system" [1], which shows the interest and value of the research on olfaction. Artificial olfaction, also called an electronic nose (e-nose), is a biomimetic olfactory system [2] that can replace well-trained experts in dangerous work or surpass the limits of their abilities. Recently, artificial olfaction has been developed for numerous industry applications [3], such as indoor air-quality monitoring, medical care, customs security, food quality control, environmental quality monitoring, military applications, hazardous gas detection, medical diagnosis [4], psychoanalysis, agriculture, pharmaceuticals, to name but a few [5]. The biological nose is an obvious choice for such applications. However, there are some disadvantages to having human beings perform these tasks due to a variety of reasons, such as fatigue, infections, mental state, subjectivity, exposure to hazardous materials, individual variables, etc., and generally, it is socio-economically and technically unfeasible to invest a large amount of money in training for tasks that last a relatively short time. The earliest artificial olfaction device can be traced back to 1961 when Moncrieff proposed a mechanical artificial nose. The first electronic nose was developed by Wilkens, Hatman, and Buck in 1964 [6].

2.1. Sources and Chemical Properties of Methane(CH_4)

In nature, methane (CH4) is produced by the anaerobic bacterial decomposition of vegetable matter underwater (where it is sometimes called marsh gas or swamp gas). Methane is colourless, odourless gas that occurs abundantly in nature and as a product of certain human activities. Methane is the simplest member of the paraffin series of hydrocarbons and is among the most potent greenhouse gases. Wetlands are the major natural source of methane produced in this way. Other important natural sources of Methane include termites due to digestive processes, volcanoes, vents in the ocean floor, and methane hydrate deposits that occur along continental margins and beneath Antarctic ice and Arctic permafrost. Methane also is the chief constituent of natural gas, which contains from 50 to 90 percent methane (depending on the source) and occurs as a component of firedamp or flammable gas along coal seams. Methane, in general, is very stable, but mixtures of methane and air, with methane content between 5 and 14 percent by volume, are explosive. Explosions of such mixtures have been frequent in coal mines and collieries and have been the cause of many mine disasters. Methane is lighter than air, having a specific gravity of 0.554. It is only slightly soluble in water. It burns readily in air, forming carbon dioxide and water vapour; the flame is pale, slightly luminous, and very hot.

2.2. Environmental Challenges, Constitution and National Policies

To address these environmental challenges in coordination with the state governments, the central government has identified and targeted 17 highly polluting industries and 24 environmental problem areas. The chemical and engineering industries are at the top of the government's list since they are the major contributors to air, water, and waste pollution. These industries include integrated iron and steel plants, non-ferrous metallurgical, pharmaceutical and petrochemical complexes, fertilizers and pesticide plants, thermal power plants, textiles, pulp and paper and tanneries units.

India took a bold step to include environmental protection rights and duties in its constitution. The constitution of India specifies that the State shall endeavour to protect and improve the environment and safeguard the natural resources of the country. According to the constitution, it is the fundamental duty of every citizen of India to protect and improve the natural environment and to have compassion for living creatures. By raising environmental concerns to the constitutional level, India has provided its citizens with a powerful policy tool to protect the environment.

2.2.1. National Policies

In addition to the constitutional mandate, India has a number of national policies governing environmental management, including the National Policy on Pollution Amendment (NPPA, 1992) and the National Conservation Strategy and Policy Statement on Environment and Development (NCS/PSED, 1992). While these national policies are not judicially enforceable, they serve as guiding principles for the central and state governments to follow.

The NPPA encourages using economic instruments to complement traditional command and control approaches to pollution abatement. To integrate environmental considerations into decision-making at all levels, the policy adopts the following guiding principles:

- Prevention of pollution at source
- Adoption of best available technology
- The polluter pays principle and
- Public participation in decision making.

The NCS/PSED provides an overarching policy framework on environmental management, including the conservation of natural resources and economic development. Key instruments for promoting environmental change include conducting environmental impact assessments, developing educational campaigns, and ensuring public participation. As the nodal agency, the Ministry of Environment and Forests (MOEF) is responsible for implementing the NPPA and the NCS / PSED.

3. Methods and Experiments

3.1. Nano-structured Sensor-based Electronic Nose (e-Nose)

Olfaction is one of the five major human senses (vision, hearing, smell, taste, and touch). The sense of smell is the most mysterious and complex sense; a particular smell can trigger a series of memories in people. A typical and prototype nano-structured electronic nose (e-Nose) is on lines parallel to the human nasal system working in coordination with the brain. Figure 1 shows a comparison of the sense of smell and taste with artificial senses. Whenever the ortho-nasal pathway sniffs a compound, it reaches the olfactory epithelium located in the upper nasal cavity. There the interactions of odorants with the appropriate chemosensory receptors take place, and the olfactory neurons of different classes produce electrical stimuli, which are transmitted to the brain [6]. A pattern recognition process assisted by the memory then takes place using all the data to identify, classify, or perform a hedonic analysis. Evidence shows that a single olfactory neuron responds to several odorants and that each odorant is sensed by multiple olfactory neurons. On similar lines to a human nose, electronic nose functions using an array of sensors. After sensing the aroma, the sensor array generates a pattern based on the type of smell. Further, the patterns obtained are trained to interpret and distinguish between various odours and odorants and to recognize new patterns [7]. A design and diagram comparing the fundamental analogies between the human nasal system (biological olfaction) and an electronic nose (artificial olfaction) flow chart is shown in figure 2, comparing the basic analogies:

- Between biological olfaction, human nasal system and artificial olfaction,
- Block diagram of our prototype n-WSN with G-IoT supported electronic nose (e-Nose) as artificial senses

3.2. Prototype Nano-structure Wireless SensorNetwork System (n-WSN) as G-IoT Applications

The main goal of this techno-legal and socio-economic research is to evaluate the feasibility of a Next Generation Nano-structure Wireless Sensor Network System (n- WSN) as a G-IoT application for forest fire and industrial emissions monitoring and protection in the smart world. Although there has been immense development of more sensitive and selective nano-structure sensor arrays and Artificial Intelligent (AI) enabling advanced data mining technology, there have been limited reports on the applications of electronic nose (e-Nose) for the measurement of industrial emissions and forest fire protection. The current techno-legal research sheds light on the practical applicability of e-Nose for effective industrial order and gaseous emissions measurement.

3.3. Environmental Monitoring Using n-WSN Electronic Nose (e-Nose)

Electronic senses, namely electronic nose (e-Nose) and electronic tongue (e-Tongue), can be successfully used for

monitoring environmental pollution. There is a need to develop devices capable of evaluating the state of the environment rapidly or even in real-time, without supervision and at a relatively low cost. Electronic noses and tongues show promise in this regard and find application in monitoring the quality of water and atmospheric air [7]. The analysis of atmospheric air can be performed in several ways. One can, for example, measure the concentration of several pre-defined substances or analyze the air holistically. Both these tasks can be performed using sensor systems. One of the first investigations in this area was performed in the first half of 1990s [8]. In it, a device equipped with CP sensors was used to analyze an aqueous solution of ethanol, diacetyl and dimethyl sulphide. An electronic nose was also used to measure the concentration of nitric oxide, methane and carbon monoxide at 500-2000 ppm concentrations. It is important to note that while using e- Noses to determine particular substances, there can occur interferences caused by the presence of other chemical compounds. A research has shown that while determining hydrogen sulphide and nitrogen dioxide in a mixture containing carbon dioxide and water vapour, the presence of humidity and CO2 had a significant impact on the sensor's response signal. However, it was possible to properly identify the components of the gaseous mixture using discriminant factor analysis [9]. It is possible to use the electronic nose to determine certain Volatile Organic Compounds (VOCs) at a very low concentration level (ppm level), even below the threshold limit value (TLV). That was the case with benzene, methanol, ethanol, toluene and acetone, determined below TLV using a device equipped with Metal Oxide Semiconductor (MOS) sensors. Sensor drift poses a significant problem, leading to high measurement uncertainties. In most recent applications, nWSN-based G-IoT-enabled e-Noses are being mounted on mobile robots. However, because of insufficiently advanced models of VOC and hazardous gas distribution, this technology is yet to find real-life applications. Another important application of e-Noses is odour classification and odour intensity evaluation. Currently, the golden standard in the determination of odour nuisance is dynamic olfactometry [10].

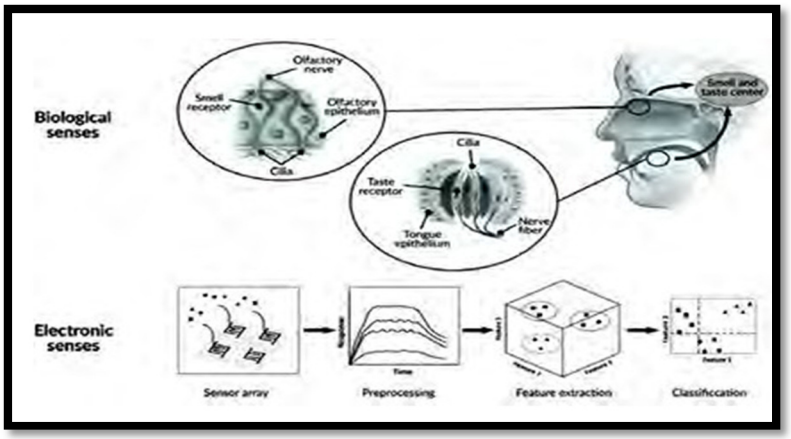


Figure 1

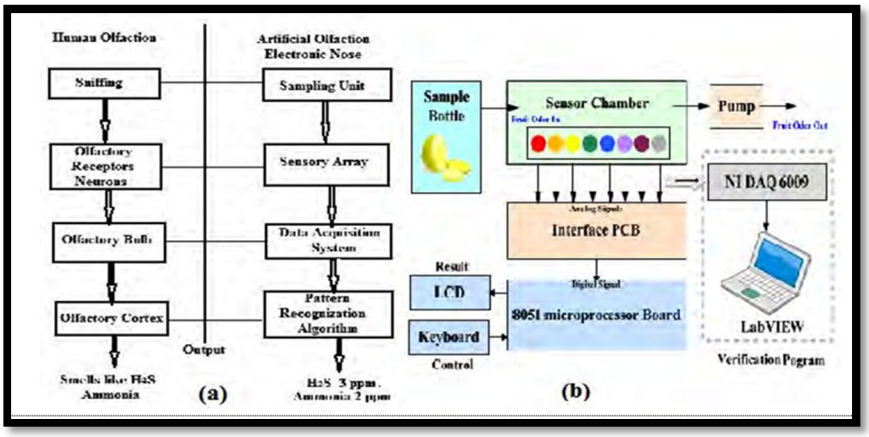


Figure 2: Comparing the Basic Analogies (a) between Biological Olfaction, Human Nasal System and ArtificialOlfaction, (b) Block Diagram of Our Prototype n-WSN Electronic Nose (e-Nose) as Artificial Senses

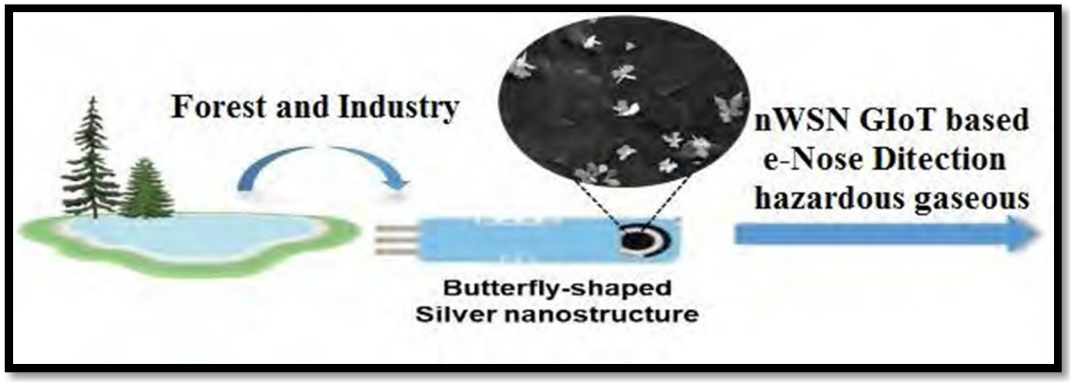


Figure 3: A Robust and Remote-Controlled Silver Doped Nano-structured Wireless Sensor Network (Ag- dopednWSN) Butterfly-shaped Green IoT-based for Concurrent Quantification of VOCs Caused for Industrial Emissions Hazards and Forest Fire Gaseous Protection

Place and Types of Sample	Analysis Process	Data Analysis Method [Ref.]
Air samples from composting plants, printing houses, sewage treatment plants, recycling plants, settlers	Water vapor, flammable gases, toxic gases, solvents	PCA, LDA
Samples of air from the sewage treatment plant and wetland cattle field and farmhouse	CO, NO_2, CH_4, VOC like (benzene,toluene, m-xylene)	PCA, FCM
Indoor air samples from duck and pigs farms	H_2S, NO_2, SO_2, CH_4, VOC	KNN, SVM
Samples of indoor air from cars and internal air samples	CO, NO_2, ammonia, VOC like benzene,toluene, formaldehyde	PCA, PNN, SVM,KNN

Table 1: Application of Nano-structured e-Noses in Data Analysis of VOCs Caused for Industrial Emissions Hazards and Forest Fire Gaseous Protection

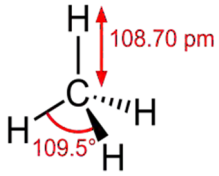
4. Data Analysis Methods

The dataset obtained with the use of our prototype n-WSN electronic nose (e-Nose) as artificial senses contains the response signals of each sensor and usually is very complex. Analysis of this type of data is considerably more difficult than in the case of a device equipped with only one sensor. For that reason, the first step of data processing is usually meant to decrease the dimensionality of the dataset. Table 1: Application of Nano-structured e-Noses in analysis of VOCs caused for Industrial emissions hazards and forest fire gaseous**.** Doing this whilst retaining as much significant information as possible is one of the key challenges in statistical data processing, as the results of data analysis should lead to reliable and repeatable results. Chemometric methods used for data processing utilize pattern recognition. Information contained in the sensor's response signal is compared with reference data. The basic steps of data analysis are as follows [11]:

- Pre-processing,
- Selection of variables,
- Classification,
- Decision-making

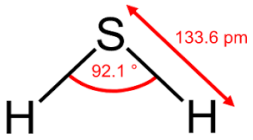
Preliminary analysis (pre-processing) is used to smoothen the signal and average sensor responses and to filter the background noise [12]. Table 2: Chemical structure and properties of VOCs caused for Industrial emissions and forest fire gases. Nowadays, a computer is a well-known device and is available at every step. Perhaps the appropriate adaptation of artificial senses to the needs of the average user with researchers will launch the next generation in the field of our prototype n-WSN electronic nose (e-Nose) as artificial senses. Industrial Pollution, Biodiversity loss and Ecological disaster Protection using nWSN- enabled G-IoT supported e-Nose in Smart World. Figure 3: A robust and remote-controlled Silver doped Nano-structured Wireless Sensor Network (Ag doped nWSN) Butterfly-shaped Green IoT based on

Concurrent Quantification of VOCs caused for Industrial emissions hazards and forest fire gaseous protection [13].



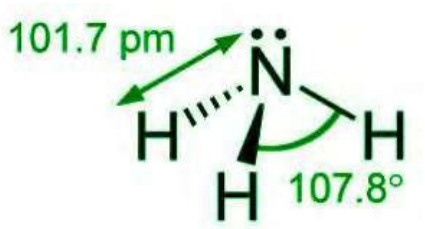
Methane

Properties	Values
Molecular formula	CH_4
Molar mass	16.043 g mol^{-1}
Density	0.657 kg/L at 25°C
Boiling point	−161.50°C
Solubility in water	Slightly soluble
Odour	Colourless, paraffin groups

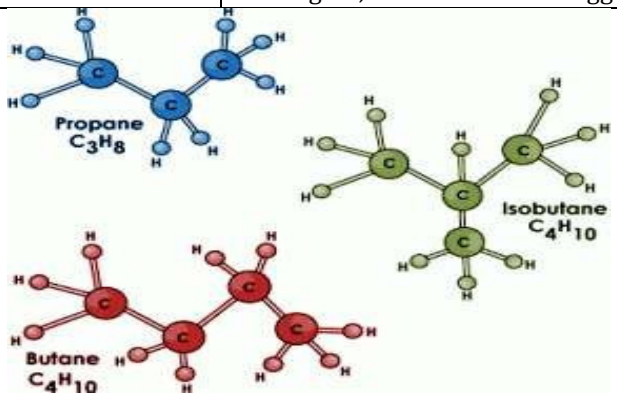


Hydrogen sulfide

Properties	Values
Molecular formula	H_2S
Molar mass	34.08 g mol^{-1}
Density	1.363 g/L
Boiling point	−60 °C (−76 °F)
Solubility in water	4.0 g/l (at 20 °C)
Odour	Pungent, like that of rotten eggs



Ammonia



LPG = (n-butane + iso-butane + propane)

Properties	Values
Molecular formula	NH_3
Molar mass	17.03 g mol^{-1}
Density	0.86 kg/L at 25°C
Boiling point	34.34 °C (14 °F)
Solubility in water	Highly soluble, Colourless,
Odour	strong and pungent gas

Properties	Values
Molecular formula	C4H10+C3H8+C4H10
Molar mass	44.1 g mol^{-1}
Density	2.009 kg/L at 15°C
Boiling point	-42.25 °C to 42.04 °C
Solubility in water	Partially in hot water
Odour	Colourless, awfully flammable

Table 2: Chemical Structure and Properties of VOCs Caused for Industrial Emissions and Forest Fire Gases

5. Procedures and Measurements

Figure 4(a) shows a block diagram of the prototyped nWSN with G-IoT enable n-Nose system, comprising a sensor array, an interface printed circuit board (PCB), and a microcontroller (µC) board embedded with a pattern recognition algorithm, as well as a verification program. Sensor responses pass through a data acquisition card (DAQ) to a laptop with a self-developed Lab-VIEW program for the purpose of verifying the function of the portable e-Nose system [14]. Figure 4(b) shows a block diagram of the array consisting of eight sensors, the Interface PCB includes eight Interface Processing Circuits (IPCs), an eight-to-one multiplexer (MUX), and an 8-bit analog-to-digital converter (ADC). The eight interface processing circuits are connected to the eight sensors, which actively adapt the circuit to a preset baseline voltage. The multiplexer reduces the need for multiple ADCs by scanning the eight channels and choosing one channel at a time. The ADC converts sensor data into a digital form for data processing. Figure 4(b) shows a block diagram of the interface PCB and Figure 4(c) shows the basic architecture of the Interface Processing Circuit (IPC), which operates in one of the two following modes:

6. Experimentation

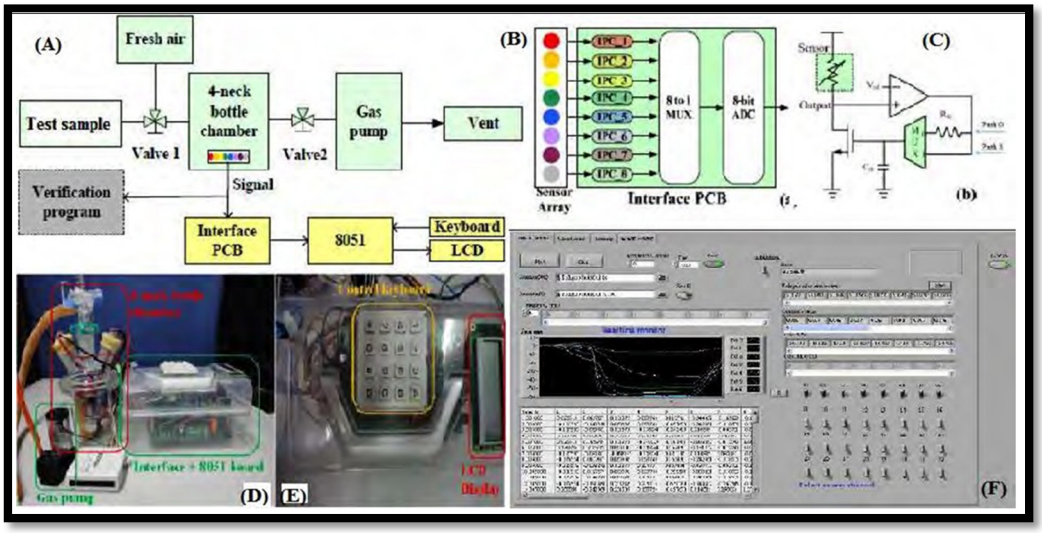


Figure 4: Experimental Apparatus (A) Hazardous Gas Sensing Setup for the Prototype N-WSN with G-IoT Enable E-Nose System; (B) Block Diagram of the Interface PCB; (C) Basic Architecture of the IPC; (D) 4-Neck Bottle Chamber, Gas Pump, Interface Circuit, and the G-IoT Based Microcontroller (Mc) Board; (E) Control Keyboard and LCD Display; (F) The Data Acquisition Interface

6.1. Adaptation Mode

In this mode, the circuit adjusts its operating point to a preset baseline voltage. The multiplexer chooses path "1" in figure 4(c) to equalize the output voltage with the reference voltage Vref, which is set as the baseline value prior to sensing odours.

In this mode, the NMOS transistor operates as a variable current source. At the end of the adaptation mode, the circuit enters the sensing mode, the gate voltage of the transistor becomes stable, and the transistor operates as a constant current source. After completing the adaptation mode, the nWSN G-IoT enable e-Nose system is ready to accept input gas [15].

6.2. Sensing Mode

In this mode, the circuit is ready for sensing. The multiplexer chooses path "0" in figure 4(c) to form a negative feedback loop, which establishes the sensor resistance of the n-WSN e-Nose. Due to a large time constant Ra and Rg, the sensor resistance of the n- WSN e-Nose can be maintained for a long enough time, compared with the sensor response time. As a result, the IPC responds to the sensor while tuning out background signals, which is similar to the process performed by biological noses. In this mode, variations in the sensor resistance are translated to a change in output voltage, which is fed into an ADC through an eight-to-one MUX, whereupon, the ADC output is sent to the AI-based G- IoT-enabled n-WSN e-Noses are electrical resistance modulated sensing devices containing a sensor array capable of producing a digital fingerprint of volatile organic compounds released from any source [16].

The responses of the test hazardous gases have been calculated using the equation (1):

$$Response(R) = \left[\frac{(R_a - R_g)}{R_a}\right] \times 100\% \qquad (1)$$

Where: Ra denotes the resistance in air and Rg is the resistance in the presence of a test gas. The response of the material is examined with VOC (NH3, H2S, CH4, LPG) in the temperature range of 20–30°C, and the sensitivity and response have been observed to be quite appreciable.

The sensitivity and recovery of the test hazardous gases have been calculated using the equation (2):

$$\text{Recovery}\% = \frac{C_{Foundbycalibrationplot}}{C_{Added}} \times 100 \qquad (2)$$

7. Results and Discussions

Users can read and classify odours through the classification interface, which implements six different data analysis methods algorithms, including nearest neighbor (NN), K-nearest neighbor (KNN), support vector machine (SVM), principle component analysis with the nearest neighbor (PNN), principle component analysis with K-nearest neighbor (PKNN), and principle component analysis (PCA) with support vector machine (PSVM). Performing six different algorithms simultaneously enables the user to investigate and compare the efficiency and accuracy of each of the algorithms. The classification results, the "smell print," and PCA and LDA plots are also shown on the interface in figure 6(a). Environmental hazardous gases from industry emission gaseous sensing patterns of (a) Hydrogen Sulphide (H2S), (b) Ammonia (NH3), (c) LPG, and forest fire caused (d) Methane (CH4) were used to test in the prototype nWSN based G-IoT enable n-Nose as artificial senses. The data regarding the gaseous odours were collected over a three-day span. On the first day, five different samples of each gaseous were collected. The average response of the five samples was used as the odour signature for that hazardous gaseous. Figure 5(a-d) shows the resulting patterns for testing the odour of the hazardous gaseous samples. The magnitude of each axis indicates the resistance change ratio (ΔR/R) in each sensor when reaching equilibrium.

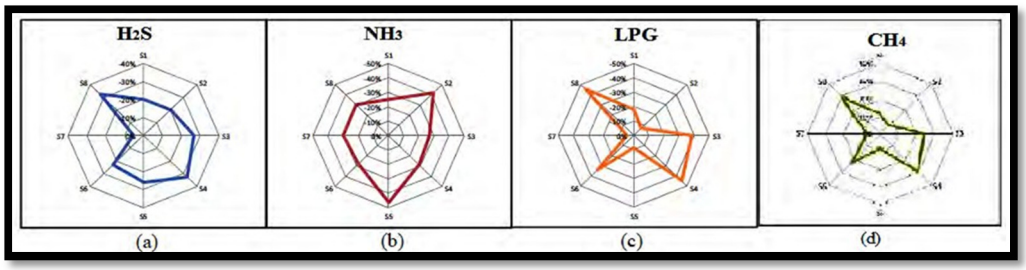


Figure 5: Shows the Resulting Patterns for Testing the Odour of the Hazardous Gaseous Samples for (a) Hydrogen Sulphide (H_2S), (b) Ammonia (NH_3), (c) LPG, and Forest Fire Caused (d) Methane (CH_4). The Magnitude of EachAxis Indicates the Resistance Change Ratio (ΔR/R) in Each Sensor When Reaching Equilibrium

Between the second day and the third day, two series of experiments were conducted. Five different places samples of each industry and forest were collected in morning, noon and evening. For the duration of the experiment, the temperature was 20–30 ºC. Table 3: Summary of sensitivity and average accuracy is more than 93.10 percent of classification results of the hazardous gaseous samples for (a) Hydrogen Sulphide (H2S), (b) Ammonia (NH3), (c) LPG and (d) Methane (CH4) for the six data analysis algorithms used in the verification software [17].

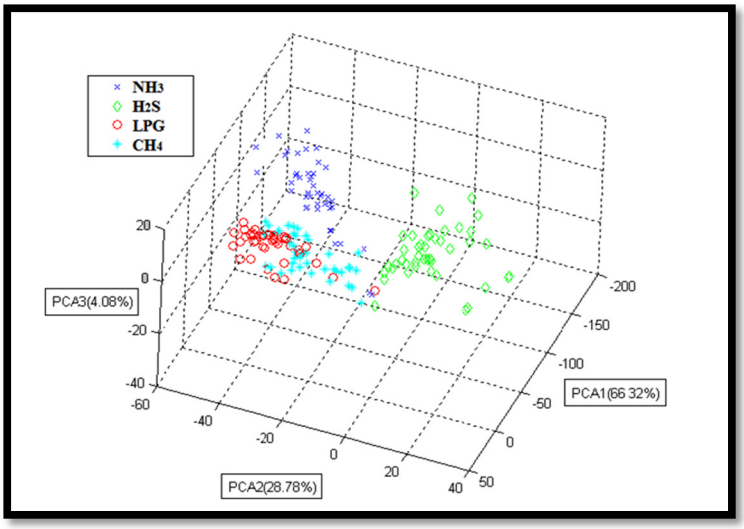


Figure 6: Shows a Three-Dimensional Projection of the PCA Results of All Data Analysis Clustering PointsRegarding the Odour of Hazardous VOC Gaseous

VOC Gaseous	PCA	LDA	FCM	PNN	KNN	SVM
NH_3	36/38	37/38	37/40	38/39	35/37	38/38
H_2S	33/38	33/38	36/38	37/40	36/40	35/40
LPG	34/36	36/40	36/38	34/36	34/36	33/36
CH_4	19/20	20/22	19/20	20/22	20/21	18/19
TOTAL	122/132	126/138	128/136	129/137	125/134	124/133
ACCURACY (%)	92.42	91.30	94.11	94.20	93.30	93.23
AVG. ACCURACY	93.10 (%)					

Table 3: Summarized Industrial Hazardous Gaseous Sensing Pattern of (a) Hydrogen Sulphide (H_2S), (b)Ammonia (NH_3), (c) LPG and (d) Methane (CH_4). Odour Classification Result for the Six Data Analysis and Clustering Algorithms

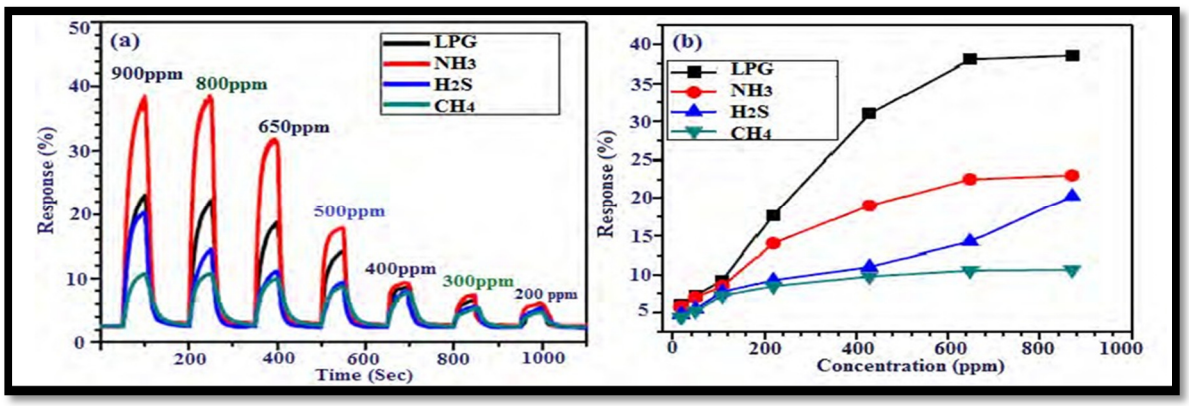


*Figure 7 (a-b): Response of N-WSN Sensors as a Function of Time with **(a)** Different Concentrations And **(b)** Response (%) of Vocs Caused for Industrial Emissions and Forest Fire Gases*

8. Conclusion and Future Endeavors

We have developed a prototype of a portable electronic nose (e-Nose) comprising an interface PCB and a digital microprocessor board. We also developed and tested KNN classification algorithms. A parallel verification program was developed to verify the functions and the algorithms of the system. The prototype has been tested with three complex industrial emission gaseous odors, namely, (a) Hydrogen Sulphide (H2S), (b) Ammonia (NH3), and (c) LPG and Methane

(CH4), also known as natural gas for protection of unwanted forest fire and ecological disaster. The prototype of the proposed portable n-WSN E-Nose system and the verification software achieved a classification accuracy in excess of 95%. This E-Nose prototype **Nano-structure Wireless Sensor Network System (n-WSN) as a G-IoT e-Nose application** is highly suitable for implementation as a portable system. G-IoT-supported e-Noses are electrical resistance-modulated sensing devices containing a sensor array capable of producing a digital fingerprint of volatile organic compounds released from any source. Conductive polymer sensor arrays take advantage of differential responses of different conducting plastics (within each sensor) to various chemical species in the sample headspace by producing a unique electronic aroma signature pattern (EASP) specific to the analyte mixture [18]. The response of each sensor is based on the collective effect of the entire mixture of components in the headspace on electrical resistance changes generated by the adsorption of analyte to the sensor. New developments include integrated systems, the use of molecular beacons and nano-sensor production. These should ensure even more rapid and specific detection. The potential development of this technology, coupled with remote data acquisition and central processing powered by hybrid artificial intelligence systems, could make this appreciated worldwide [19].

9. Advantages from the above Results

9.1. Human Rights, Forest Wildlife and Biodiversity

In human rights 3.0, the "gushers" of data and unprecedented computing power for processing it have made it possible for engineers to create artificial intelligence based on "deep learning," that is, digital neural networks in which computers can learn from data the way that babies learn from the environment around them, starting with little knowledge and then acquiring proficiency and familiarity as they interact with new environments [20]. Deep learning, machine learning, and other disruptive technologies of automated data processing pose different kinds of risks to rights-based societies, often through initiatives intended to make justice more efficient. Software engineers, with their inclinations toward appropriate vulgarity, commonly refer to this problem as "shit in, shit out." In AI circles and in the literature, it is also referred to as "garbage in, garbage out."

9.2. Early Warning (EW) and Risk Assessment

United Nations Environment Programme catalogues **wildfires** - and therefore, forest fires - as ongoing and rapid/sudden-onset environmental threats (UNEP, 2012). Forest fires create a hazard to lives and properties and are often connected to secondary effects such as landslides, erosion, and changes in water quality [21]; therefore, the UNEP considers that **early warning systems** are of great importance for preventing or limiting environmental and economic damages. **Early Warning (EW)** is defined as "the provision of timely and effective information, through identified institutions, that allows individuals exposed to hazard to take action to avoid or reduce their risk and prepare for effective response" (UN, 2006). It implies the combination of four main elements according to the United Nations' International Strategy for Disaster Reduction – (ISDR):

- **Risk Knowledge and Risk Assessment,**
- **Monitoring and Predicting -** in order to provide appropriate estimates of the potential risk encountered by communities, economies and the environment,
- **Disseminating Information** - through electronic communication systems in the form of reliable, synthetic and simple warning messages.
- **Response** - according to appropriate action plans.

Nevertheless, extant research on EW emphasizes predictions are not useful. However, unless they are translated into a warning and action plan, the public can understand and unless the information reaches the public in a timely manner. When monitoring and predicting systems are associated with communication systems and response plans, they are considered early warning systems (Glantz, 2003).

India's Biodiversity Act (2002) envisages the establishment of a National Biodiversity Authority for discharging the statutory powers provided for under the legislation. The chief concerns of the 1992 Convention on Biological Diversity are conservation of biological diversity, sustainable utilization of its components and equitable sharing of benefits. Thus, the last two and half decades have seen two important international instruments, the 1992 Convention on Biological Diversity and the 1993 Agreement on Trade-Related Intellectual Property Rights (TRIPS Agreement), as part of

World Trade Organization (WTO) and are in force. Most of the TRIPS Agreement members are parties to the 1992 Convention. India is the party to both of these instruments [21]. There are many interrelated provisions and diametrically opposite rights and obligations under these instruments. The two main overlapping areas in these Conventions are protection and access to biological and genetic resources. Article 27(1) provides that patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application. However, members may also exclude from patentability of diagnostic, therapeutic and surgical methods for the treatment of humans or animals, plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, members shall provide for the protection of plant varieties either by patents, an effective sui generis system, or any combination thereof. Thus, Article 27(2) provides thus: "Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect public order or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law." In fact [23], Article 8(j) of the 1993 TRIPS Agreement authorizes its members, in formulating or amending their national laws and regulations to "adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological developments," provided such measures are consistent with other 1993 TRIPS Agreement provisions [22, 24].

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Assessment of a Relationship between Tourists' Perception on Tourism and Demographic and Socio-economic Factors of Tourists: A Questionnaire-Based Survey

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Abstract:
The present study was attempted to identify the relationship between tourist's perception of tourism development and demographic and socio-economic factors of tourists, an analysis based on a questionnaire survey of the urban people who visited the local tourist spots. The survey was done through a questionnaire, which was assessed through random sampling of 117 participants from urban cities. The results indicated that the demographic and socio-economic parameters, such as education, gender, age, occupation, family income and locality, are significantly associated with stay category, hospitality services and stay tenure. However, in some exceptions, education is significantly associated with tour preferences and frequency, and age is significantly associated with sources of information. In conclusion, demo-socio factors of tourists influenced the tourists' perception to enhance tourism activities. Moreover, young age, males, higher education, sound family income and computer literate participants are now eager to travel to interesting places.

Keywords: *Tourist's perception, tourism development, questionnaire survey, urban people, influence of demographic and socio-economic status*

1. Introduction

It is observed that the outbound tourists to India are four times more than the inbound tourists, and in turn, the government has decided to take steps to improve the numbers (India Tourism Statistics, 2012; India Tourism Statistics 2015, 2016). The Ministry of Tourism has enunciated the fact of identifying, diversifying, and developing the upcoming niche products of the tourism industry, which is enumerated to overcome the aspect of seasonality to promote the sub-continent as 365 days of destination.

According to Das Mahapatra and Patra (2017), long-duration stays by tourists depend upon better hospitality in the tourist sector. Although major research works have been conducted on tourist spots and the development of the tourism industry (Haber & Lerner, 1999; Kozak & Rimminyton, 2000; Chou, 2014; Jaswal, 2014; Fraj et al., 2015; Das Mahapatra & Patra, 2017), limited works in India have observed the influence of demographic and socio-economic factors on the tourism development (Mieczkowski, 1990; Collin & Tisdell, 2002; Ma et al., 2018; Mkwizu, 2018a, 2018b; Kara & Mkwizu, 2020). Collin & Tisdell (2002) found that demographic factors have a key role in influencing visitors' involvement in tourism activities along with the selection of vacation destinations. In earlier studies, several demographic and socio-economic factors, such as age, gender, family life cycle, education, income and nationality, were commonly used by investigators (Ma et al., 2018; Mkwizu, 2018a, 2018b). These variables are considered accurate in describing tourism marketing and predicting travel behaviour patterns (Weaver & Oppermann, 2000). On the other hand, socio-economic concerns of tourism have resulted in the influence and costs of visitors, which encouraged economic activity and created additional business income, employment, and government revenues in the tourist region (Dwyer et al., 2006). Generally, the development of tourism in the region primarily pursues economic growth controlled by the state of the country through the regulation of the negative social and environmental impact of tourism.

The present study attempted to identify the relationship between tourists' perception of tourism development and demographic and socio-economic factors of tourists, an analysis based on a questionnaire survey of the urban people who visited the local tourist spots.

2. Materials and Methods

2.1. Survey Area

The present research was based on an individual family survey of the local people in the urban area of Kolkata, India. The total sample size of about 117 participants visited nearby tourist spots such as Diamond Harbour, Bakkhali, and Sagar Island & Mousuni Island in West Bengal.

2.2. Survey Questionnaire

The survey was done through a questionnaire, which was assessed by random sampling of 117 people. The present study was utilized as a questionnaire in which a lot of information can be gathered from many people in a short duration, which is a low-cost research method. The survey was carried out from August 2021 to July 2022. Among participants, demographic and socio-economic status, such as age, gender, locality, education and family income, were known. Tourists' opinion regarding tourism developments was surveyed among participants.

2.3. Statistical Analysis

All the data were studied through statistical analysis by using SPPS tool with special reference to Chi-square test for determining the level of significance at $P<0.05$ of a relationship between tourism development perception and demographic and socio-economic factors of tourists.

2.4. Results

Table 1 describes the frequency distribution of the demographic and socio-economic status of the participants. The present study shows that about 85.5% of the participants were of the age group of 21-30 years, and about 73.5% of them were males. Of the participants who visited the above-mentioned tourist spots, the majority (96.6%) were from Kolkata. Maximum respondents (85.5%) were employed and minimum (14.5%) were engaged in business. In the case of education, a maximum (58.1%) number of participants were graduates, followed by post-graduation (27.4%). 68.4% of the participants had the highest family income between 5.0–7.5 Lakhs per annum.

AGE GROUPS (YEARS)	**Frequency**	**Percent**
21-30	100	85.5
31-40	8	6.8
41-50	9	7.7
Total	117	100.0
GENDER	**Frequency**	**Percent**
FEMALE	31	26.5
MALE	86	73.5
Total	117	100.0
LOCALITY	**Frequency**	**Percent**
KOLKATA	113	96.6
NEW DELHI	4	3.4
Total	117	100.0
OCCUPATION	**Frequency**	**Percent**
SERVICE	100	85.5
BUSINESS	17	14.5
Total	117	100.0
EDUCATION	**Frequency**	**Percent**
BACHELORS	68	58.1
MASTERS	32	27.4
PH.D	3	2.6
PROFESSIONAL	14	12.0
Total	117	100.0

FAMILY INCOME	Frequency	Percent
≤5 LAKH	7	6.0
5.7.5 LAKH	80	68.4
7.5 - 10 LAKH	22	18.8
>10 LAKH	8	6.8
Total	117	100.0

Table 1: Frequency Distribution of Demographic and Socio-economic Status

Table 2 describes the frequency distribution of tourists' perceptions regarding tourism development. In the present study, half of the participants (about 54.7%) preferred a self-analyzed tour. Maximum participants (about 46.2%) visited tourist spots in a year, followed by once in six months (43.6%). The majority of participants preferred budget hotel (77.8%).

A maximum number of participants (about 58.1%) preferred food and ambience as hospitality services, and about 69.2% of respondents replied to the tenure for one week. Regarding the tourist spot information, the maximum number of participants (about 65.0%) gathered information from the Internet.

WHAT KIND OF TOUR YOU PREFER	Frequency	Percent
Self-analysed	64	54.7
Packaged tour	53	45.3
Total	117	100.0
FREQUENCY OF TOUR	**Frequency**	**Percent**
Monthly once	12	10.3
Once in six months	51	43.6
Yearly once	54	46.2
Total	117	100.0
CATEGORY OF STAY	**Frequency**	**Percent**
Homestay	22	18.8
Budget hotel	91	77.8
Star category	4	3.4
Total	117	100.0
MOST FAVORITE HOSPITALITY SERVICES	**Frequency**	**Percent**
Food	22	18.8
Ambience	27	23.1
All of these	68	58.1
Total	117	100.0
TENURE OF STAY	**Frequency**	**Percent**
A week	81	69.2
Weekend	22	18.8
Fortnight	14	12.0
Total	117	100.0
SOURCE OF INFORMATION	**Frequency**	**Percent**
Internet	76	65.0
Word of mouth	35	29.9
Other advertisement	6	5.1
Total	117	100.0

Table 2: Frequency Distribution of Tourist's Perception Regarding Tourism Development

Table 3 evaluates the association between demographic and socio-economic status and what kind of tour you prefer. Education is significantly (P=0.033) associated with tour preferences.

		Age Groups (Years)					Pearson Chi-Square	P-value
		21-30	31-40	41-50	Total		0.22	0.896
What kindof tour youprefer	Self-analyzed (%)	54.0	62.5	55.6	54.7			
	Packaged Tour(%)	46.0	37.5	44.4	45.3			
	Total (%)	100.0	100.0	100.0	100.0			
		Gender						
			Female	Male	Total		0.00	0.986
	Self-analyzed (%)		54.8	54.7	54.7			
	Packaged Tour (%)		45.2	45.3	45.3			
	Total (%)		100.0	100.0	100.0			
		Locality						
			Kolkata	Delhi	Total		0.04	0.848
	Self-analyzed (%)		54.9	50.0	54.7			
	Packaged Tour (%)		45.1	50.0	45.3			
	Total		100.0	100.0	100.0			
		Occupation						
			Service	Business	Total		0.02	0.875
	Self-analyzed (%)		55.0	52.9	54.7			
	Packaged tour (%)		45.0	47.1	45.3			
	Total (%)		100.0	100.0	100.0			
		Education						
		Bachelors	Masters	Ph.D.	Professional	Total		
	Self-analyzed(%)	58.8	62.5	0.0	28.6	54.7	8.73	0.033
	Packaged Tour (%)	41.2	37.5	100.0	71.4	45.3		
	Total (%)	100.0	100.0	100.0	100.0	100.0		
		Family Income						
		≤5 Lakh	5.7.5 Lakh	7.5 - 10 Lakh	>10 Lakh	Total		
	Self-analyzed(%)	28.6	58.8	59.1	25.0	54.7	5.48	0.140
	Packaged Tour (%)	71.4	41.3	40.9	75.0	45.3		
	Total (%)	100.0	100.0	100.0	100.0	100.0		

Table 3: Chi-square Results on Demographic and Socio-economic Status and What Kind of Tour You Prefer

Table 4 evaluates the association between demographic and socio-economic status and the frequency of tours. The education is significantly (P=0.005) associated with tour frequency.

		Age Groups (Years)					Pearson Chi-Square	P-value
		21-30	31-40	41-50	Total		2.85	0.583
Frequency of Tour	Monthly once (%)	12.0	0.0	0.0	10.3			
	Once in six months (%)	44.0	37.5	44.4	43.6			
	Yearly once (%)	44.0	62.5	55.6	46.2			
	Total (%)	100.0	100.0	100.0	100.0			
		Gender						
			Female	Male	Total		0.89	0.640
	Monthly once (%)		6.5	11.6	10.3			
	Once in six months (%)		41.9	44.2	43.6			
	Yearly once (%)		51.6	44.2	46.2			
	Total (%)		100.0	100.0	100.0			
		Locality						
			Kolkata	Delhi	Total		5.36	0.069
	Monthly once (%)		10.6	0.0	10.3			
	Once in six months (%)		41.6	100.0	43.6			
	Yearly once (%)		47.8	0.0	46.2			
	Total (%)		100.0	100.0	100.0			
		Occupation						
			Service	Business	Total		4.28	0.117
	Monthly once (%)		10.0	11.8	10.3			
	Once in six months (%)		40.0	64.7	43.6			
	Yearly once (%)		50.0	23.5	46.2			
	Total (%)		100.0	100.0	100.0			
		Education						
		Bachelors	Masters	Ph.D	Professional	Total		
	Monthly once (%)	11.8	0.0	0.0	28.6	10.3	18.7	0.005
	Once in six months (%)	50.0	37.5	100.0	14.3	43.6		
	Yearly once (%)	38.2	62.5	0.0	57.1	46.2		
	Total	100.0	100.0	100.0	100.0	100.0		
		Family Income						
		≤5 Lakh	5.7.5 Lakh	7.5 - 10 Lakh	>10 Lakh	Total		
	Monthly once (%)	0.0	10.0	13.6	12.5	10.3	7.61	0.268
	Once in six months (%)	28.6	50.0	22.7	50.0	43.6		
	Yearly once (%)	71.4	40.0	63.6	37.5	46.2		
	Total (%)	100.0	100.0	100.0	100.0	100.0		

Table 4: Chi-square Results on Demographic and Socio-economic Status and Frequency of Tour

Table 5 evaluates the association between demographic and socioeconomic status and category of stay, all the parameters such as age, gender, locality, occupation, education and family income are significantly (P=0.000, 0.002, 0.000, 0.032, 0.011 and 0.000) associated with category of stay.

		Age Groups (Years)					Pearson Chi-Square	P-value
		21-30	31-40	41-50	Total		52.49	0.000
Category of stay	Homestay (%)	20.0	0.0	22.2	18.8			
	Budget hotel (%)	80.0	100.0	33.3	77.8			
	Star category (%)	0.0	0.0	44.4	3.4			
	Total (%)	100.0	100.0	100.0	100.0			
		Gender						
			Female	Male	Total		12.96	0.002
	Homestay (%)		9.7	22.1	18.8			
	Budget hotel (%)		77.4	77.9	77.8			
	Star category (%)		12.9	0.0	3.4			
	Total (%)		100.0	100.0	100.0			
		Locality						
			Kolkata	Delhi	Total		117.0	0.000
	Homestay (%)		19.5	0.0	18.8			
	Budget hotel (%)		80.5	0.0	77.8			
	Star category (%)		0.0	100.0	3.4			
	Total (%)		100.0	100.0	100.0			
		Occupation						
			Service	Business	Total		6.89	0.032
	Homestay (%)		15.0	41.2	18.8			
	Budget hotel (%)		81.0	58.8	77.8			
	Star category (%)		4.0	0.0	3.4			
	Total (%)		100.0	100.0	100.0			
		Education						
		Bachelors	Masters	Ph.D	Professional	Total		
	Homestay (%)	20.6	25.0	0.0	0.0	18.8	16.65	0.011
	Budget hotel (%)	79.4	62.5	100.0	100.0	77.8		
	Star category (%)	0.0	12.5	0.0	0.0	3.4		
	Total	100.0	100.0	100.0	100.0	100.0		
		Family Income						
		≤5 Lakh	5.7.5 Lakh	7.5 - 10 Lakh	>10 Lakh	Total		
	Homestay (%)	14.3	22.5	4.5	25.0	18.8	61.51	0.000
	Budget hotel (%)	85.7	77.5	95.5	25.0	77.8		
	Star category (%)	0.0	0.0	0.0	50.0	3.4		
	Total (%)	100.0	100.0	100.0	100.0	100.0		

Table 5: Chi-square Results on Demographic and Socio-economic Status and Category of Stay

Table 6 evaluates the association between demographic and socioeconomic status and most favourite hospitality services, the gender and education are significantly (P=0.037 and P=0.003) associated with most favourite hospitality services.

		Age Groups (Years)					Pearson Chi-Square	P-value
		21-30	31-40	41-50	Total		3.824	0.511
Most favourite hospitality services	Food (%)	20.0	0.0	22.2	18.8			
	Ambience (%)	21.0	37.5	33.3	23.1			
	All of these (%)	59.0	62.5	44.4	58.1			
	Total (%)	100.0	100.0	100.0	100.0			
		Gender						
			Female	Male	Total		6.57	0.037
	Food (%)		22.6	17.4	18.8			
	Ambience (%)		6.5	29.1	23.1			
	All of these (%)		71.0	53.5	58.1			
	Total (%)		100.0	100.0	100.0			
		Locality						
			Kolkata	Delhi	Total		2.98	0.225
	Food (%)		19.5	0.0	18.8			
	Ambience (%)		23.9	0.0	23.1			
	All of these (%)		56.6	100.0	58.1			
	Total (%)		100.0	100.0	100.0			
		Occupation						
			Service	Business	Total		0.018	0.991
	Food (%)		19.0	17.6	18.8			
	Ambience (%)		23.0	23.5	23.1			
	All of these (%)		58.0	58.8	58.1			
	Total (%)		100.0	100.0	100.0			
		Education						
		Bachelors	Masters	Ph.D	Professional	Total		
	Food (%)	23.5	18.8	0.0	0.0	18.8	19.67	0.003
	Ambience (%)	16.2	34.4	100.0	14.3	23.1		
	All of these (%)	60.3	46.9	0.0	85.7	58.1		
	Total	100.0	100.0	100.0	100.0	100.0		
		Family Income						
		≤5 Lakh	5.7.5 Lakh	7.5 - 10 Lakh	>10 Lakh	Total		
	Food (%)	28.6%	20.0%	9.1%	25.0%	18.8%	6.61	0.359
	Ambience (%)	42.9%	23.8%	22.7%	0.0%	23.1%		
	All of these (%)	28.6%	56.3%	68.2%	75.0%	58.1%		
	Total (%)	100.0%	100.0%	100.0%	100.0%	100.0%		

Table 6: Chi Square Results on Demographic and Socio-economic Status and Most Favourite Hospitality Services

Table 7 evaluates the association between demographic and socio-economic status and tenure of stay. The age, locality, education and family income are significantly (P=0.032, 0.000, 0.000 and 0.017) associated with the tenure of stay.

		Age Groups (Years)					Pearson Chi-Square	P-value
		21-30	31-40	41-50	Total		10.54	0.032
Tenure Of stay	A week (%)	71.0	62.5	55.6	69.2			
	Weekend (%)	18.0	0.0	44.4	18.8			
	Fortnight (%)	11.0	37.5	0.0	12.0			
	Total (%)	100.0	100.0	100.0	100.0			
		Gender						
			Female	Male	Total		5.52	0.063
	A week (%)		61.3	72.1	69.2			
	Weekend (%)		32.3	14.0	18.8			
	Fortnight (%)		6.5	14.0	12.0			
	Total (%)		100.0	100.0	100.0			
		Locality						
			Kolkata	Delhi	Total		17.88	0.000
	A week (%)		71.7	0.0	69.2			
	Weekend (%)		15.9	100.0	18.8			
	Fortnight (%)		12.4	0.0	12.0			
	Total (%)		100.0	100.0	100.0			
		Occupation						
			Service	Business	Total		0.296	0.863
	A week (%)		70.0	64.7	69.2			
	Weekend (%)		18.0	23.5	18.8			
	Fortnight (%)		12.0	11.8	12.0			
	Total (%)		100.0	100.0	100.0			
		Education						
		Bachelors	Masters	Ph.D	Professional	Total		
	A week (%)	75.0	68.8	0.0	57.1	69.2	29.45	0.000
	Weekend (%)	14.7	18.8	0.0	42.9	18.8		
	Fortnight (%)	10.3	12.5	100.0	0.0	12.0		
	Total	100.0	100.0	100.0	100.0	100.0		
		Family Income						
		≤5 Lakh	5.7.5 Lakh	7.5 - 10 Lakh	>10 Lakh	Total		
	A week (%)	85.7	71.3	68.2	37.5	69.2	15.47	0.017
	Weekend (%)	0.0	13.8	27.3	62.5	18.8		
	Fortnight (%)	14.3	15.0	4.5	0.0	12.0		
	Total (%)	100.0	100.0	100.0	100.0	100.0		

Table 7: Chi Square Results on Demographic and Socio-economic Status and Tenure of Stay

Table 8 evaluates the association between demographic and socio-economic status and sources of information. The age and gender are significantly (P=0.000 and 0.000) associated with sources of information.

		Age Groups (Years)					Pearson Chi-Square	P-value
		21-30	31-40	41-50	Total		20.28	0.000
Sources ofinformation	Internet (%)	67.0	25.0	77.8	65.0			
	Word of mouth (%)	30.0	37.5	22.2	29.9			
	Advertisement (%)	3.0	37.5	0.0	5.1			
	Total (%)	100.0	100.0	100.0	100.0			
		Gender						
			Female	Male	Total		17.81	0.000
	Internet (%)		51.6	69.8	65.0			
	Word of mouth (%)		29.0	30.2	29.9			
	Advertisement (%)		19.4	0.0	5.1			
	Total (%)		100.0	100.0	100.0			
		Locality						
			Kolkata	Delhi	Total		2.234	0.327
	Internet (%)		63.7	100.0	65.0			
	Word of mouth (%)		31.0	0.0	29.9			
	Advertisement (%)		5.3	0.0	5.1			
	Total (%)		100.0	100.0	100.0			
		Occupation						
			Service	Business	Total		4.87	0.088
	Internet (%)		61.0	88.2	65.0			
	Word of mouth (%)		33.0	11.8	29.9			
	Advertisement (%)		6.0	0.0	5.1			
	Total (%)		100.0	100.0	100.0			

Table 8: Chi-Square Results on Demographic and Socio-economic Status and Sources of Information

3. Discussion

In the present study, the maximum number of participants (about 85.5%) was of the age group of 21-30 years. In a recent study report by Singal in 2021, it was mentioned that younger people (about 56%) who were in the age group of 18-30 years were the most eager to travel to tourist places in India. In another study, a similarity was found in which the maximum number of tourists (about 56.6%) were in the age group of 20-30 years (Li et al., 2017), while Porutiu et al. (2021) reported that 79.4% of the respondents were in the age group of 18-30. In this study, higher males (about 73.5%) were recorded, which is supported by Li et al. (2017), while in contrast, Porutiu et al. (2021) reported higher females (67.8%) of Romania who visited maximum in rural tourist areas.

Of the participants who visited the above-mentioned tourist spots, the majority (96.6%) were from Kolkata, which means local people enhanced the tourism development, as reported by Sinclair-Maragh (2017) in the study of Jamaica tourism.

In the case of education, the maximum (58.1%) number of participants were graduates, followed by post-graduation (27.4%), which is supported by Li et al. (2017), where it is observed that visitors (about 48.8%) were graduates. In the present study, 85.5% of the respondents were employed, and the minimum (14.5%) were engaged in business, which is supported by Porutiu et al. (2021). The highest family income of 68.4% was between 5.0-7.5 Lakhs per annum, which means economically sound people visited the tourist spots (Li et al., 2017).

In the present study, half of the participants (about 54.7%) preferred self-analyzed tours to satisfy themselves. According to Ting et al. (2013), tourists' satisfaction depends on the information quality. However, the evaluation of

tourists' satisfaction is a complicated phenomenon challenging the tourism business because of tourists' complex perceptual screens on experiencing tourism quality (Majeed et al., 2018).

Maximum participants of about 46.2% visited tourist spots in a year followed by once in six months (43.6%). According to Porutiu et al. (2021), they found that tourists preferred to visit rural destinations on weekends (48.3%) or during the holidays (52.7%) due to summer holidays.

The majority of participants preferred budget hotels (77.8%), and a maximum number of them (about 58.1%) preferred food and ambience as hospitality services, which is supported by Porutiu et al. (2021) where they observed that tourists preferred a less organized form of tourism and are actively involved in arranging the daily program (foods, ambience, etc.). They also noticed that the percentage of those that booked a room in a guesthouse was higher in the case of tourists travelling with children compared to those travelling without children (55.5%). The main type of accommodation mentioned by the tourists was the chalet-like house (66.7%). At the same time, an essential segment of the respondents (more than 35%) declared that they used to stay in their second residency during their visits to rural destinations.

About 69.2% respondents replied to the tenure for one week, which is supported by an earlier study by Saayman & Slabbert (2004) in which maximum (35.0%) length of stay was 4 to 7 days in Kruger National Park, South Africa.

Regarding the tourist spot information, the maximum number of participants (about 65.0%) gathered information from the Internet in the present study. According to evidence from the earlier study by Dewnarain et al. (2019), the source of information regarding tourist spots, tourists gathered information from different online channels, such as social media, websites, and e-blogs.

In the present study, education is significantly associated with tour preferences (P=0.033), frequency of tour (P=0.005), category of stay (P=0.011), most favourite hospitality services (P=0.003), tenure of stay (P=0.000). In the present study, gender is significantly associated with the category of stay (0.002), most favourite hospitality services (P=0.037), and the tenure of stay (P=0.000). In the present study, age is significantly associated with the category of stay (P=0.000), the tenure of stay (P=0.032), and sources of information (P=0.000). In the present study, locality, occupation, and family income are significantly associated with the category of stay (P=0.000, P=0.032, and P=0.000), while locality and family income are significantly associated with the tenure of stay (P=0.000, and P=0.017).

In these regards, Almeida (2020) reported that socio-demographic factors, viz. gender and income, were significantly associated with tourists' behaviour. It was mentioned that the education level of participants has a negligible impact (Almeida, 2020). But it is a contradictory result related to the present study. This may be due to different parameters of tourists' perceptions used in the study.

According to Majeed et al. (2020), the higher quality of tourism services related to reliability and completeness of the information may deliver satisfaction to online information-seeking tourists, which is supported by the present study.

4. Conclusion

The present study indicated that demographic and socio-economic factors of tourists influenced the tourists' perception to enhance tourism activities. Moreover, young age, males, higher education, sound family income and computer-literate participants are now eager to travel to interesting places with proper food and ambience rather than places with a dearth of hospitality. The variance in demography and socio-economic factors are significantly associated with tourists' perception, which enhances visiting for a repeated time in the same place and helps develop tourism industries.

5. Conflict of Interest

There is no conflict of interest.

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A Study on the Effect of Sleep Deprivation on the Efficacy & Motivation of Non-Clinical Employees of Corporate Hospital Based in Kolkata

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1. What Is Sleep?

Sleep is a condition of body and mind that typically recurs for several hours every night. In this condition, the nervous system is relatively inactive, the eyes are closed, the postural muscles are relaxed, and consciousness is practically suspended.

Nerve-signaling chemicals called neurotransmitters control whether we are asleep or awake by acting on different groups of nerve cells, or neurons, in the brain. Neurons in the brainstem, which connects the brain with the spinal cord, produce neurotransmitters such as serotonin and Nor-epinephrine that keep some parts of the brain active while we are awake. Other neurons at the base of the brain begin signaling when we fall asleep. These neurons appear to 'switch off' the signals that keep us awake. Research also suggests that a chemical called adenosine builds up in our blood while we are awake and causes drowsiness. This chemical gradually breaks down while we sleep.

2. What Is Sleep Deprivation?

Sleep deprivation is a general term to describe a state caused by inadequate quantity or quality of sleep, including voluntary or involuntary sleeplessness. It is a common phenomenon nowadays caused due to several factors like increasing working hours, working at night time, etc.

3. Effects of Sleep Deprivation

Sleep deprivation negatively affects your mental abilities and emotional state. You may feel more impatient or prone to mood swings. It can also compromise decision-making processes and creativity.

Prolonged sleep deprivation can lead to the following complications:

- Impulsive Behavior
- Anxiety
- Depression
- Paranoia
- Suicidal Thoughts
- High Blood Pressure
- Diabetes
- Heart Problems
- Immunity Problems

Sleep issues are more prevalent in healthcare workers than in other industries. Sleep loss in healthcare workers also manifests in different forms. In the COVID-19 Pandemic, the problems of sleep deprivation among healthcare workers have become more prevalent and it is acting as a major de-motivating factor for the same.

4. Objective of the Study

- To find out whether sleep deprivation has any effect on the behavior of healthcare employees or not
- To analyze the level of influence of sleep deprivation on the efficacy of healthcare employees
- To establish whether sleep deprivation is a de-motivating factor or a hygiene factor in healthcare sector

- To determine the correlation analyzing factor between point number 1, 2 & 3

5. Significance of the Study

This study focuses on establishing the relationship between sleep deprivation and the quality of service provided by a healthcare employee. As healthcare sector is an emergency service sector, it involves round-the-clock duty hours, which may lead to sleep deprivation. This sleep deprivation may affect the physical and social activity of a human being. Our study signifies whether this factor acts as a hygiene factor or motivating factor for healthcare employees as they are 24*7 service providers.

6. Limitations of the Study

The major limitations of the study are:

6.1. Cost Limitation

There was a cost limitation. This means we could not offer the respondents any gifts or monetary incentives to answer the questionnaire. This might have resulted in certain prospective respondents choosing not to respond to the questionnaire. This might not have motivated respondents to take a chance to give their opinions.

6.2. Time Limitation

There are two types of time limitations faced during the study. The study was done for a period of eight weeks. Hence, the results would reflect the impact of the time constraint. The insights of the employees were observed during the period of the study. A more extensive study conducted over a larger period or during a special period, like when there were higher numbers of issues, can include insights from employees over a broader period and bring further depth into the research.

7. Review of Literature

7.1. Sleep Deprivation: Impact on Cognitive Performance

Paula Alhola[1] and Päivi Polo-Kantola[2]

The negative effect of both acute total and chronic partial SD on attention and working memory is supported by existing literature. Total SD impairs a range of other cognitive functions as well. In partial SD, a more thorough evaluation of higher cognitive functions is needed. Furthermore, the effects of SD have not been thoroughly compared among some essential sub-populations.

7.2. Effects of Sleep Deprivation on Performance: A Meta-Analysis

Pilcher JJ, Huffcutt AI Sleep. 1996 May; 19(4): 318-26

A meta-analysis provides support for that: A total SD of less than 45 h deteriorated performance more severely in complex tasks with a long duration than in simple and short tasks. Based on this, it is probably necessary to make a distinction between mere attention effort and more general motivation. Although attention effort reflects motivational aspects in performance, motivation, in a broader sense, can be considered a long-term process such as achieving a previously set goal, e.g., completing a study protocol. If one has already invested a great deal of time and effort in participation, motivation to follow through may be increased.

7.3. The Effects of 72 Hours of Sleep Loss on Psychological Variables

Mikulincer M, Babkoff H, Caspy T, Sing HBr J Psychol. 1989 May; 80 (Pt 2)():145-62

Different aspects of motivation were investigated in a study with 72 h SD, where the subjects evaluated both motivations to perform the tasks and motivation to carry out leisure activities. Cognitive tasks were repeated every two hours. Performance motivation decreased only during the second night of SD, whereas leisure motivation decreased from the second day until the end of the study on the third day. The authors concluded that the subjects were more motivated to complete experimental testing than to enjoy leisure activities because by performing the tasks, they could advance the completion of the study. The researchers suggested that the increased motivation towards the tasks on the third day

reflected the 'end spurt effect' caused by the anticipation of sleep.

It has been suggested that the self-evaluation of cognitive performance is impaired by SD. During 36 h SD, the subjects became more confident that their answers were correct as the wakefulness continued.

7.4. The Cumulative Cost of Additional Wakefulness: Dose-Response Effects on Neuro-behavioral Functions and Sleep Physiology from Chronic Sleep Restriction and Total Sleep Deprivation.

Van Dongen HP, Maislin G, Mullington JM, et al.Sleep. 2003a; 26:117–26

According to the well-controlled studies, the less sleep obtained due to sleep restriction, the more cognitive performance is impaired.

7.5. Age, Performance and Sleep Deprivation

Philip P, Taillard J, Sagaspe P, Valtat C, Sanchez- Ortuno M, Moore N, Charles A, Bioulac B J Sleep Res. 2004 Jun; 13(2):105-10

Chronic sleep restriction may cause long-term changes in brain functions that are not reversible during short adaptation and baseline periods in sleep laboratory studies. Even though subjects of certain studies were instructed to maintain a regular 8-hour sleep schedule for 3–5 days, this may not be enough to erase the previous 'sleep debt.'

8. Research Methodology

A simple descriptive study was conducted with the help of a questionnaire & simple observation method to collect Primary Data from 5 Corporate Hospitals in Kolkata.

Permission for Data Collection was taken from the Patient service department comprising Wards, Admission & Discharge Department of 5 corporate hospitals based in Kolkata.

8.1. Tools Used

Two previously developed and validated instruments addressing the effects of sleep deprivation on employee performance & motivation and their social behavior were used.

- A validated questionnaire was used to collect data to assess the status of employee motivation & social behavior of the employees doing night shifts on a regular basis.
- A simple observation method using a checklist was used to collect data for Time Motion Analysis to do a comparative analysis of employee efficacy during the night shift and other shifts.

Confidentiality has been maintained as per the organizational policy. The identity of the samples and the hospitals under study was not disclosed to maintain confidentiality. The sample size is 100.

9. Statistical Methods Used

Statistical techniques used in this study SPSS, software for analysis, is used to analyze the collected data and the results are interpreted with care and caution. Pie & bar charts and tables are prepared so that the collected data is fully utilized. Correlation analysis is done. The data collected with the questionnaire as an instrument is entered in Excel for analysis purposes and tabulated below.

10. Data Analysis & Interpretation

10.1. Data Analysis Based on Employee Survey with Pre-Approved Questionnaire

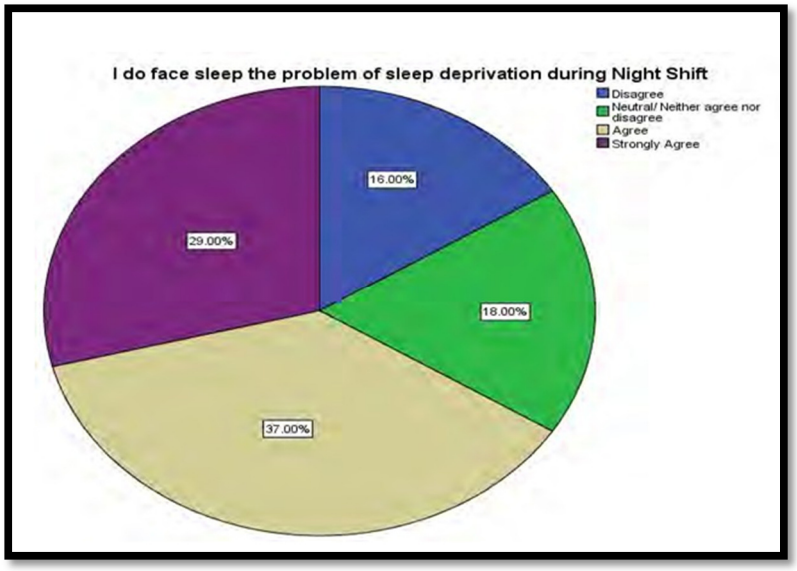

Figure 1

Findings: 37% of the population agrees and 29% strongly agrees that they face problem of sleep deprivation due to night shift.

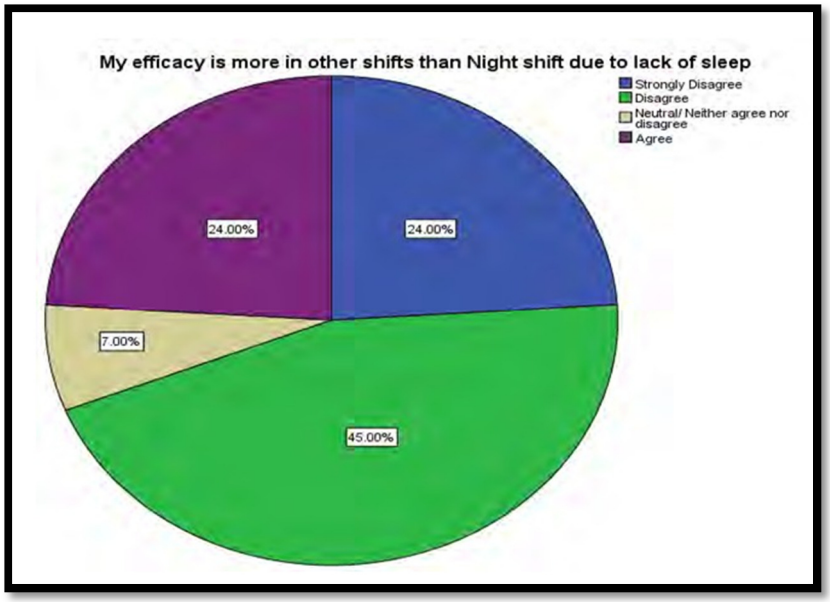

Figure 2

Findings: 45% of employees disagree and 24% strongly disagree that due to lack of sleep, efficacy decreases.

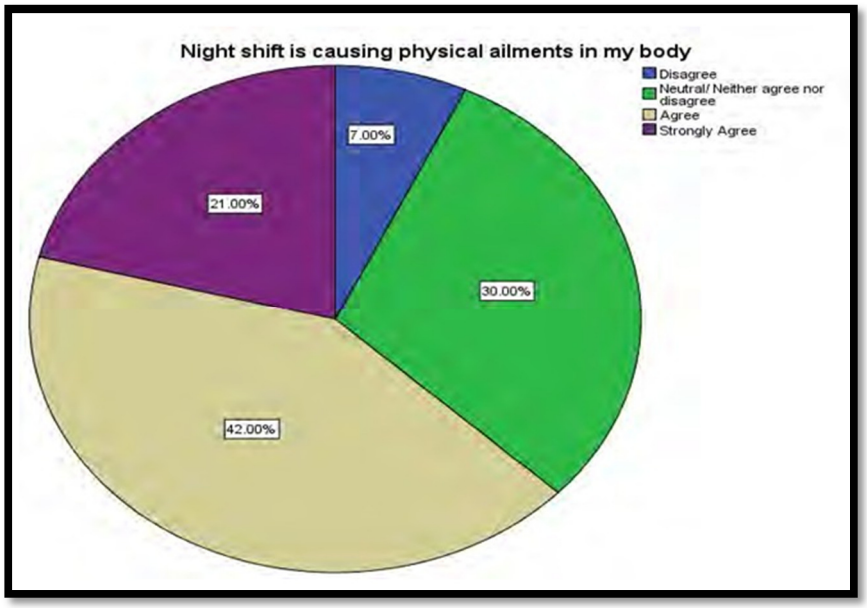

Figure 3

Findings: 63% of employees under this study have agreed that they have beensuffering from different ailments due to night shift.

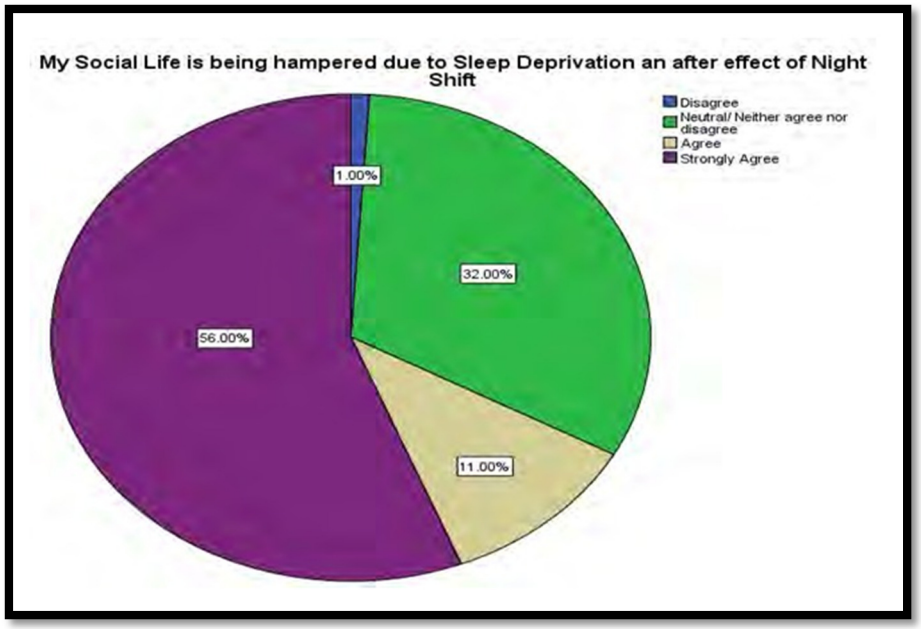

Figure 4

Findings: The social life of 67% of employees is being affected due to night shift.

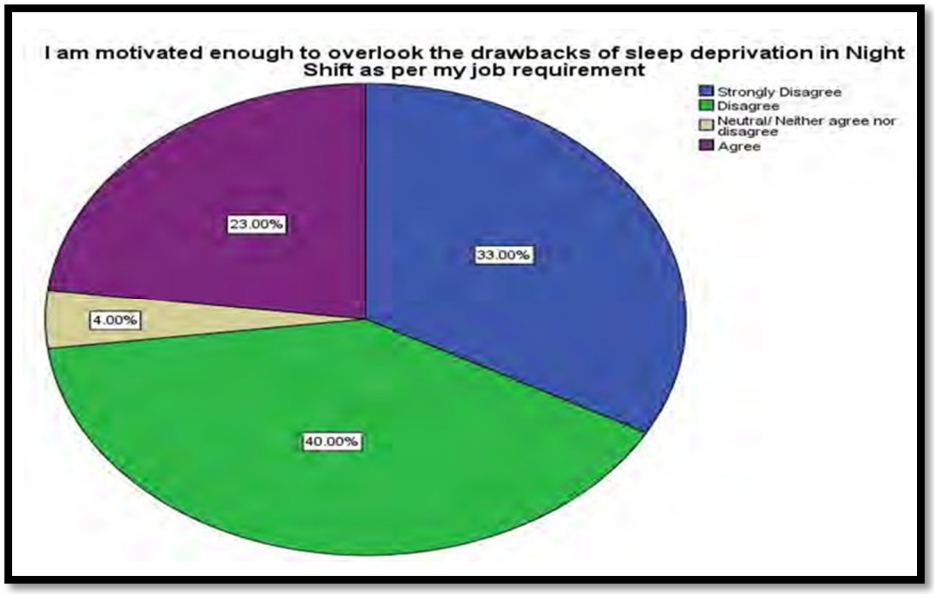

Figure 5

Findings: 73% of the employees are not motivated enough to overlook the negative impact of sleep deprivation as per their job requirements.

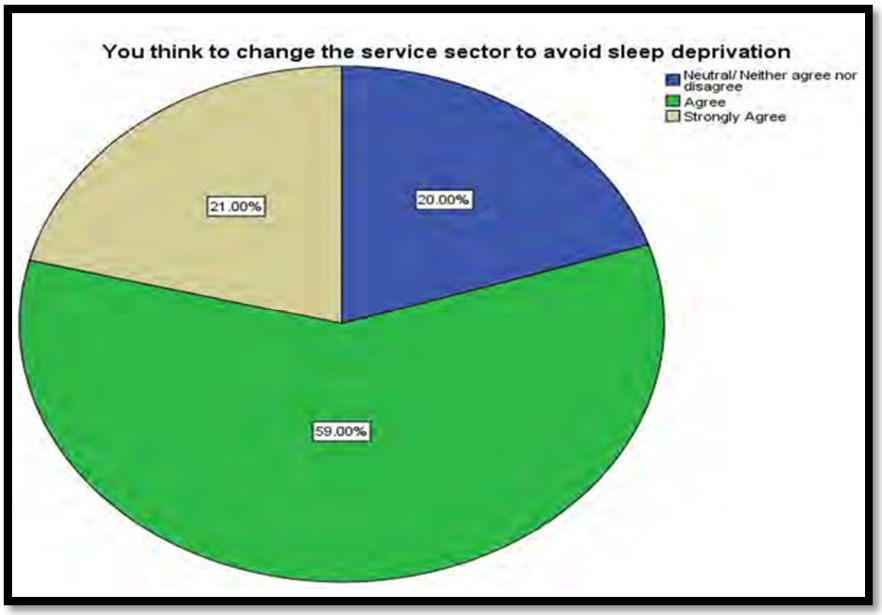

Figure 6

Findings: 59% of the population under the study wants to change the service sector to avoid night shift.

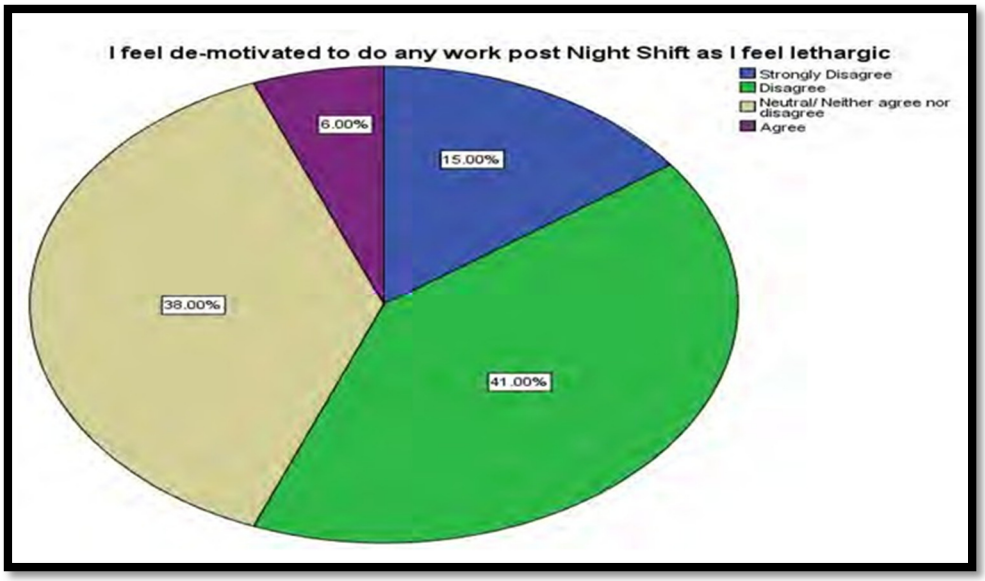

Figure 7

Findings: 41% of the population under the study does not feel lethargic or de-motivated to do any work post-night shift.

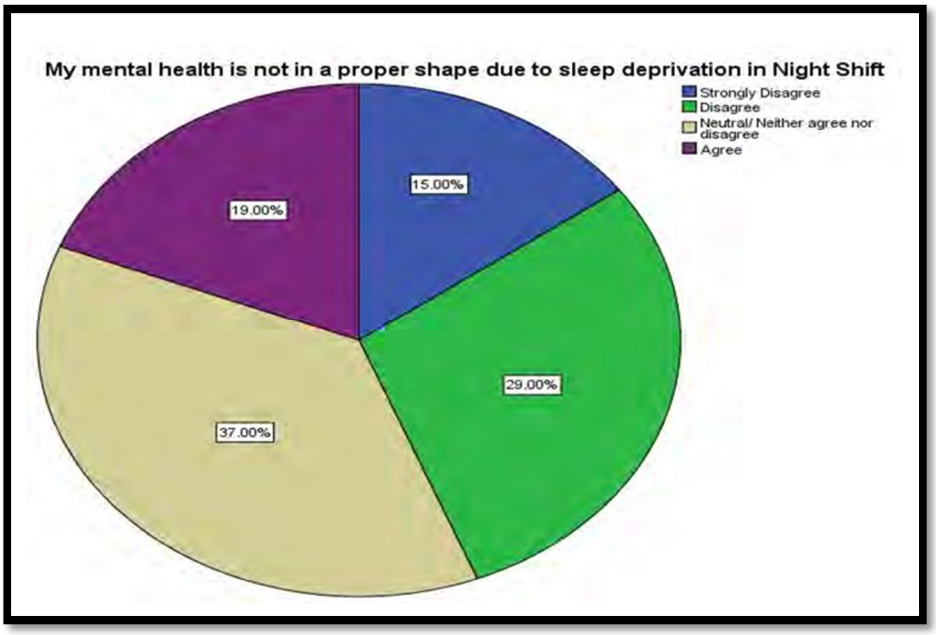

Figure 8

Findings: 37% of the population under the study has a neutral opinion regarding the effect of sleep deprivation on mental health.

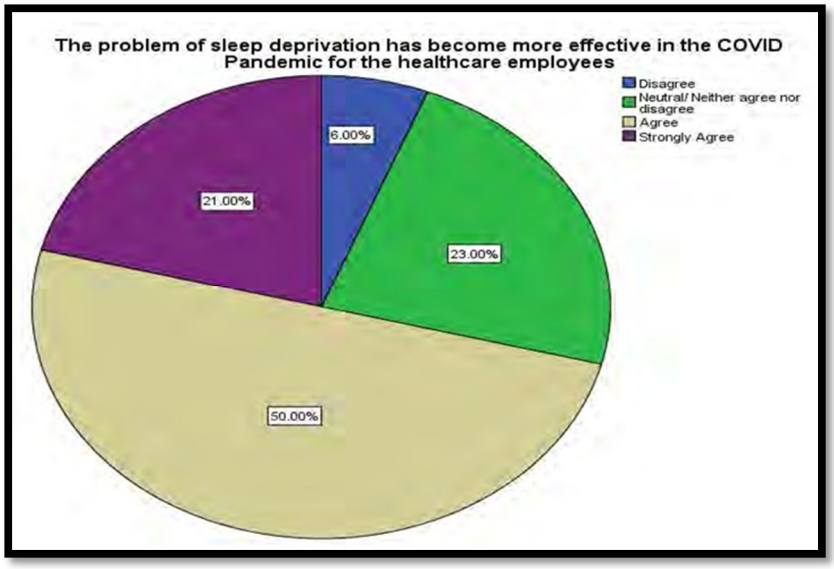

Figure 9

Findings: 50% of the population in the study agrees that the consequence of sleep deprivation has increased in the COVID Pandemic situation.

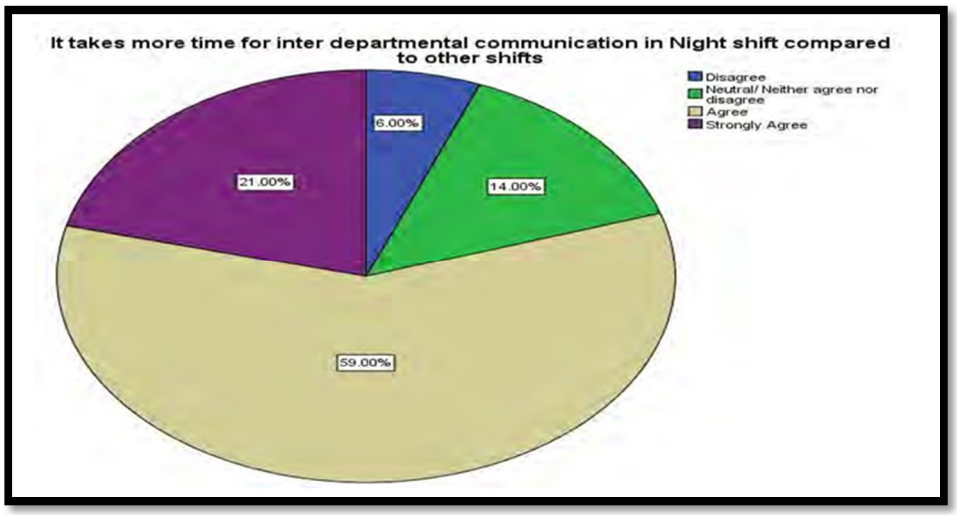

Figure 10

Findings: 59% of the population agrees that interdepartmental communication becomes less effective on the night shift than the other shifts.

CROSSTAB My Efficacy Is More in Other Shifts than Night Shift Due to Lack of Sleep *I Do Face the Problem of Sleep Deprivation during Night Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation during Night Shift				
			Disagree	Neutral/ Neitheragree nor disagree	Agree	Strongly Agree	Total
My efficacy is more in other shifts than Night shift due to lack of sleep	Strongly Disagree	Count	0	1	2	21	24
		% within I do face sleep the problem ofsleep deprivation during Night Shift	0.0%	5.6%	5.4%	72.4%	24.0%
	Disagree	Count	0	12	33	0	45
		% within I do face sleep the problem of sleep deprivation during Night Shift	0.0%	66.7%	89.2%	0.0%	45.0%
	Neutral/ Neither agree nor disagree	Count	1	4	2	0	7
		% within I do face sleep the problem ofsleep deprivation during Night Shift	6.3%	22.2%	5.4%	0.0%	7.0%
	Agree	Count	15	1	0	8	24
		% within I do face sleep the problem ofsleep deprivation during Night Shift	93.8%	5.6%	0.0%	27.6%	24.0%
Total		Count	16	18	37	29	100
		% within I do face sleep the problem ofsleep deprivation during Night Shift	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	130.383	9	0.000				

Table 1

Night shift is causing physical ailments in my body * I do face sleep the problem of sleep deprivation during Night Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation during Night Shift				Total
			Disagree	Neutral/ Neither agree nor disagree	Agree	Strongly Agree	
Night shift is causing physical ailments in my body	Disagree	Count	6	0	1	0	7
		% within I do facesleep the problem of sleep deprivation during Night Shift	37.5%	0.0%	2.7%	0.0%	7.0%
	Neutral/ Neither agree nor disagree	Count	10	6	14	0	30
		% within I do facesleep the problem of sleep deprivation during Night Shift	62.5%	33.3%	37.8 %	0.0%	30.0%
	Agree	Count	0	12	22	8	42
		% within I do facesleep the problem of sleep deprivation during Night Shift	0.0%	66.7%	59.5 %	27.6%	42.0%
	Strongly Agree	Count	0	0	0	21	21
		% within I do facesleep the problem of sleep deprivation during Night Shift	0.0%	0.0%	0.0%	72.4%	21.0%
Total		Count	16	18	37	29	100
		% within I do facesleep the problem of sleep deprivation during Night Shift	100.0%	100.0%	100. %	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	105.548	9	0.000				

Table 2

My Social Life is being hampered due to Sleep Deprivation an after effect of Night Shift *I do face the problem of sleep deprivation during Night Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation during NightShift				Total
			Disagree	Neutral/ Neither agree nor disagree	Agree	Strongly Agree	
My Social Life isbeing hampered due to Sleep Deprivation an after effect of Night Shift	Disagree	Count	0	1	0	0	1
		% within I do facesleep the problem of sleep deprivation duringNight Shift	0.0%	5.6%	0.0%	0.0%	1.0%
	Neutral/ Neither agree nor disagree	Count	15	16	1	0	32
		% within I do facesleep the problem of sleep deprivation duringNight Shift	93.8%	88.9%	2.7%	0.0%	32.0%
	Agree	Count	1	1	9	0	11
		% within I do facesleep the problem of sleep deprivation duringNight Shift	6.3%	5.6%	24.3%	0.0%	11.0%
	Strongly Agree	Count	0	0	27	29	56
		% within I do facesleep the problem of sleep deprivation duringNight Shift	0.0%	0.0%	73.0%	100.0%	56.0%
Total		Count	16	18	37	29	100
		% within I do facesleep the problem of sleep deprivation duringNight Shift	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	101.974	9	0.000				

Table 3

I am motivated enough to overlook the drawbacks of sleep deprivation in Night Shift as per my job requirement *I do face the problem of sleep deprivation during Night Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation duringNight Shift				
			Disagree	Neutral/ Neither agree nor disagree	Agree	Strongly Agree	Total
I am motivated enough to overlook the drawbacks of sleep deprivation in Night Shift as per my job requirement	Strongly Disagree	Count	0	12	0	21	33
		% within I do facesleep the problem of sleep deprivation duringNight Shift	0.0%	66.7%	0.0%	72.4%	33.0%
	Disagree	Count	1	2	37	0	40
		% within I do facesleep the problem of sleep deprivation duringNight Shift	6.3%	11.1%	100.0%	0.0%	40.0%
	Neutral/ Neither agree nor disagree	Count	0	4	0	0	4
		% within I do facesleep the problem of sleep deprivation duringNight Shift	0.0%	22.2%	0.0%	0.0%	4.0%
	Agree	Count	15	0	0	8	23
		% within I do facesleep the problem of sleep deprivation duringNight Shift	93.8 %	0.0%	0.0%	27.6%	23.0%
Total		Count	16	18	37	29	100
		% within I do facesleep the problem of sleep deprivation duringNight Shift	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	156.494	9	0.000				

Table 4

You think to change the service sector to avoid sleep deprivation * I do face the problem of sleep deprivation duringNight Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation duringNight Shift				Total
			Disagree	Neutral/ Neither agree nor disagree	Agree	Strongly Agree	
You think to change the servicesector to avoid sleep deprivation	Neutral/ Neither agree nor disagree	Count	15	4	1	0	20
		% within I do face sleep the problem of sleep deprivation during Night Shift	93.8%	22.2%	2.7%	0.0%	20.0%
	Agree	Count	1	14	36	8	59
		% within I do face sleep the problem of sleep deprivation during Night Shift	6.3%	77.8%	97.3%	27.6%	59.0%
	Strongly Agree	Count	0	0	0	21	21
		% within I do face sleep the problem of sleep deprivation during Night Shift	0.0%	0.0%	0.0%	72.4%	21.0%
Total		Count	16	18	37	29	100
		% within I do face sleep the problem of sleep deprivation during Night Shift	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	128.976	6	0.000				

Table 5

I feel de-motivated to do any work post Night Shift as I feel lethargic * I do face the problem of sleep deprivation duringNight Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation during Night Shift				
			Disagree	Neutral/ Neitheragree nor disagree	Agree	Strongly Agree	Total
I feel de-motivatedto do any work post Night Shift asI feel lethargic	Strongly Disagree	Count	15	0	0	0	15
		% within I do face sleep the problem ofsleep deprivation during Night Shift	93.8%	0.0%	0.0%	0.0%	15.0%
	Disagree	Count	0	0	33	8	41
		% within I do face sleep the problem ofsleep deprivation during Night Shift	0.0%	0.0%	89.2%	27.6%	41.0%
	Neutral/ Neither agree nor disagree	Count	0	16	1	21	38
		% within I do face sleep the problem ofsleep deprivation during Night Shift	0.0%	88.9%	2.7%	72.4%	38.0%
	Agree	Count	1	2	3	0	6
		% within I do face sleep the problem ofsleep deprivation during Night Shift	6.3%	11.1%	8.1%	0.0%	6.0%
Total		Count	16	18	37	29	100
		% within I do face sleep the problem of sleep deprivation during Night Shift	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	157.235	9	0.000				

Table 6

My mental health is not in a proper shape due to sleep deprivation in Night Shift *I do face the problem of sleep deprivation during Night Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation during Night Shift				
			Disagree	Neutral/ Neitheragree nor disagree	Agree	Strongly Agree	Total
My mental health isnot in a proper shape due to sleep deprivation in Night Shift	Strongly Disagree	Count	15	0	0	0	15
		% within I do face sleep the problem ofsleep deprivation during Night Shift	93.8%	0.0%	0.0%	0.0%	15.0%
	Disagree	Count	0	0	24	5	29
		% within I do face sleep the problem ofsleep deprivation during Night Shift	0.0%	0.0%	64.9%	17.2%	29.0%
	Neutral/ Neither agree nor disagree	Count	0	17	1	19	37
		% within I do face sleep the problem ofsleep deprivation during Night Shift	0.0%	94.4%	2.7%	65.5%	37.0%
	Agree	Count	1	1	12	5	19
		% within I do face sleep the problem ofsleep deprivation during Night Shift	6.3%	5.6%	32.4%	17.2%	19.0%
Total		Count	16	18	37	29	100
		% within I do face sleep the problem ofsleep deprivation during Night Shift	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	153.157	9	0.000				

Table 7

The problem of sleep deprivation has become more effective in the COVID Pandemic for the healthcare employees *I do face sleep the problem of sleep deprivation during Night Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation duringNight Shift				Total
			Disagree	Neutral/ Neither agreenor disagree	Agree	Strongly Agree	
The problem of sleep deprivation has become more effective in the COVID Pandemicfor the healthcare employees	Disagree	Count	6	0	0	0	6
		% within I do facesleep the problem of sleep deprivation during Night Shift	37.5%	0.0%	0.0%	0.0%	6.0%
	Neutral/ Neither agree nor disagree	Count	9	6	7	1	23
		% within I do facesleep the problem of sleep deprivation during Night Shift	56.3%	33.3%	18.9%	3.4%	23.0%
	Agree	Count	1	12	30	7	50
		% within I do facesleep the problem of sleep deprivation during Night Shift	6.3%	66.7%	81.1%	24.1%	50.0%
	Strongly Agree	Count	0	0	0	21	21
		% within I do facesleep the problem of sleep deprivation during Night Shift	0.0%	0.0%	0.0%	72.4%	21.0%
Total		Count	16	18	37	29	100
		% within I do facesleep the problem of sleep deprivation during Night Shift	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	114.681	9	0.000				

Table 8

It takes more time for inter departmental communication in Night shift compared to other shifts *I do face sleep the problem of sleep deprivation during Night Shift							
Crosstab							
			I do face sleep the problem of sleep deprivation during Night Shift				Total
			Disagree	Neutral/ Neither agree nor disagree	Agree	Strongly Agree	
It takes more time forinter departmental communication in Night shift comparedto other shifts	Disagree	Count	6	0	0	0	6
		% within I do face sleep the problem of sleep deprivation during Night Shift	37.5%	0.0%	0.0%	0.0%	6.0%
	Neutral/ Neither agreenor disagree	Count	9	4	1	0	14
		% within I do face sleep the problem of sleep deprivation during Night Shift	56.3%	22.2 %	2.7%	0.0%	14.0%
	Agree	Count	1	14	36	8	59
		% within I do face sleep the problem of sleep deprivation during Night Shift	6.3%	77.8%	97.3%	27.6%	59.0%
	Strongly Agree	Count	0	0	0	21	21
		% within I do face sleep the problem of sleep deprivation during Night Shift	0.0%	0.0%	0.0%	72.4%	21.0%
Total		Count	16	18	37	29	100
		% within I do face sleep the problem of sleep deprivation during Night Shift	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	p Value				
Pearson Chi-Square	134.287	9	0.000				

Table 9

11. Correlation Analysis

			I do facetheproblem of sleep deprivation during Night Shift	My efficacy is more in other shifts than Night shift due to lack ofsleep	Night shift is causingphysical ailments in mybody	My Social Life is being hamper-ed due to Sleep Depriva-tion an	I am motivated enoughto overlook the drawbacks of sleepdeprivation in Night Shift as per my job	You think to change the service sector to avoidsleep depriva-tion	I feel de- motiv ated todo any work post Night Shift as I feel	My mental health isnot in a proper shape due to sleep deprivation in Night Shift	The problem of sleep deprivation has become more effective in the COVID Pandemicfor the healthcare	It takes more time for inter departmental communication in Nightshift compared toother shifts
Spearman's rho	I do face sleep the problem ofsleep deprivationduring Night Shift	Correlation Coefficient	1.000	-0.588	0.749	0.844	-0.409	0.833	0.352	0.403	0.769	0.835
		p Value		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	My efficacy is more in other shiftsthan Night shift due tolack of sleep	Correlation Coefficient	-0.588	1.000	-0.716	-0.437	0.856	-0.810	-0.601	-0.421	-0.764	-0.812
		p Value	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Night shiftis causing physical ailments inmy body	Correlation Coefficient	0.749	-0.716	1.000	0.506	-0.713	0.861	0.499	0.496	0.799	0.870
		p Value	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
	My Social Life is being hampered due to Sleep Deprivationan after effect of Night Shift	Correlation Coefficient	0.844	-0.437	0.506	1.000	-0.238	0.669	0.042	0.185	0.557	0.668
		p Value	0.000	0.000	0.000		0.017	0.000	0.679	0.066	0.000	0.000
	I am motivated enough tooverlook the	Correlation Coefficient	-0.409	0.856	-0.713	-0.238	1.000	-0.795	-0.745	-0.505	-0.728	-0.796
		p Value	0.000	0.000	0.000	0.017		0.000	0.000	0.000	0.000	0.000

			I do facetheproblem of sleep deprivation during Night Shift	My efficacy is more in other shifts than Night shift due to lack ofsleep	Night shift is causingphysical ailments in mybody	My Social Life is being hamper-ed due to Sleep Deprivation an after effect of Night Shift	I am motivated enoughto overlook the drawbacks of sleepdeprivation in Night Shift as per my job require-ment	You think to change the service sector to avoidsleep depriva- tion	I feel de- motiv ated todo anywork post Night Shift as I feel lethar- gic	My mental health isnot in a proper shape due to sleep deprivation in Night Shift	The problem of sleep deprivation has become more effective in the COVID Pandemicfor the healthcareemployees	It takes more time for inter departmental communication in Nightshift compared to other shifts
Spearman's rho	I do face sleep the problem ofsleep deprivationduring Night Shift	Correlation Coefficient	1.000	-0.588	0.749	0.844	-0.409	0.833	0.352	0.403	0.769	0.835
		p Value		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	My efficacy is more in other shiftsthan Night shift due tolack of sleep	Correlation Coefficient	-0.588	1.000	-0.716	-0.437	0.856	-0.810	-0.601	-0.421	-0.764	-0.812
		p Value	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Night shiftis causing physical ailments inmy body	Correlation Coefficient	0.749	-0.716	1.000	0.506	-0.713	0.861	0.499	0.496	0.799	0.870
		p Value	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
	My Social Life is being hampered due to Sleep Deprivationan after effect of Night Shift	Correlation Coefficient	0.844	-0.437	0.506	1.000	-0.238	0.669	0.042	0.185	0.557	0.668
		p Value	0.000	0.000	0.000		0.017	0.000	0.679	0.066	0.000	0.000
	I am motivated enough to overlook the	Correlation Coefficient	-0.409	0.856	-0.713	-0.238	1.000	-0.795	-0.745	-0.505	-0.728	-0.796
		p Value	0.000	0.000	0.000	0.017		0.000	0.000	0.000	0.000	0.000

Table 10

A time motion study was conducted. Data were collected through direct observation method.

Delay in Response Time of the Non-Clinical Staff in Night Shift & Other Shifts

Standard response time: 3 minutes

SHIFT	NO. OF OBSERVATION	NO. OF RESPONSE WITHIN 3 MINUTES	NO. OF RESPONSE WITHIN 4 -15 MINUTES	NO. OF NO RESPONSE
NIGHT SHIFT	100	35	55	10
MORNING AND DAY SHIFT	100	70	27	3

Table 11

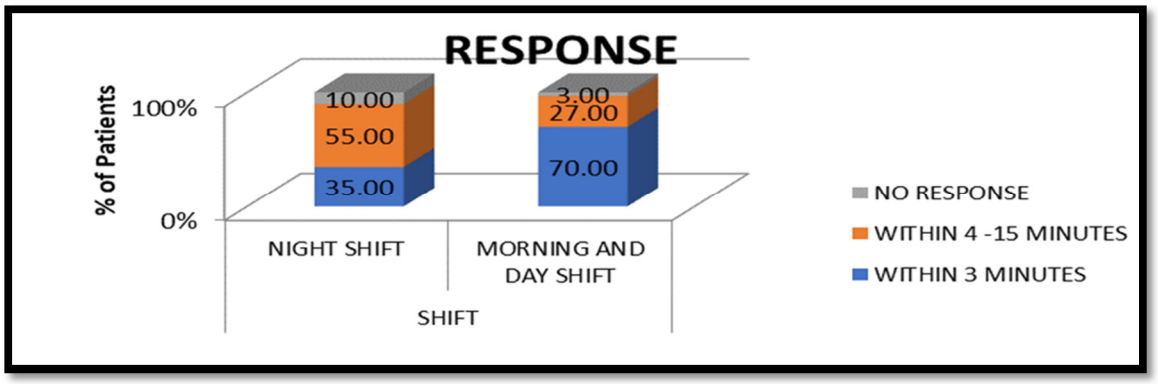

Figure 11

Crosstab

			SHIFT	
			NIGHT SHIFT	MORNING AND DAY SHIFT
RESPONSE	WITHIN 3 MINUTES	Count	35	70
		% within SHIFT	35.0%	70.0%
	WITHIN 4 - 15MINUTES	Count	55	27
		% within SHIFT	55.0%	27.0%
	NO RESPONSE	Count	10	3
		% within SHIFT	10.0%	3.0%
Total		Count	100	100
		% within SHIFT	100.0%	100.0%

Table 12

Chi-Square Tests			
	Value	df	p Value
Pearson Chi-Square	24.997	2	<0.001

Table 13

Delay in Inter-Departmental Communication in Night Shift and Other Shifts
Standard communication time: 5 minutes

SHIFT	NO. OF OBSERVATION	NO. OF COMMUNICATION WITHIN 5 MINUTES	NO. OF COMMUNICATION WITHIN 6-15 MINUTES	NO. OF NO COMMUNICATION
NIGHT SHIFT	100	26	72	2
MORNING AND DAYSHIFT	100	83	17	6

Table 14

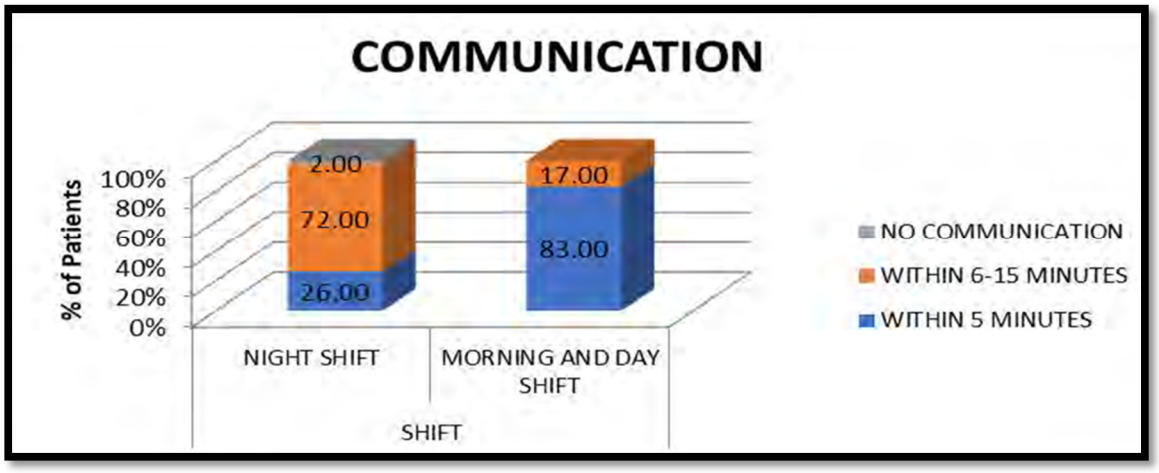

Figure 12

			SHIFT	
			NIGHT SHIFT	MORNING AND DAY SHIFT
COMMUNICATION	WITHIN 5 MINUTES	Count	26	83
		% withinSHIFT	26.0%	83.0%
	WITHIN 6-15 MINUTES	Count	72	17
		% within SHIFT	72.0%	17.0%
	NO COMMUNICATION	Count	2	0
		% withinSHIFT	2.0%	0.0%
Total		Count	100	100
		% withinSHIFT	100.0%	100.0%

Table 15

Chi-Square Tests			
	Value	df	p Value
Pearson Chi-Square	65.796	2	<0.001

Table 16

Delay in Non-Clinical Procedures in Night Shift & Other Shifts
Standard procedure time admission & discharge: 15 minutes
Standard procedure time for bed transfer: 3 hrs

SHIFT	NO. OF OBSERVATION	NO. OF ADMISSION TAKING > 15 MINUTES	NO. OF DISCHARGE TAKING > 15 MINUTES	NO. OF BED TRANSFER TAKING > 3hrs
NIGHT SHIFT	100	15	20	18
MORNING & DAY SHIFT	100	10	13	11
	p Value	0.284	0.180	0.158
	Significance	Not Significant	Not Significant	Not Significant

Table 17

12. Findings

In the above context, the following findings can be inferred:

- Lack of sleep can fundamentally hinder employees' ability to perform at their peak and cause other damaging physical and emotional stability.
- Trying to do a job responsibly while sleeping can significantly impact job performance.
- Chronic sleep deprivation can have even more drastic consequences, including an increased risk of obesity, cardiopathy, cognitive decline, and dementia.
- Sleep loss can make it more difficult to take care of focus, attention, and vigilance.
- The employees could be de-motivated because of their hampered social life, which may accelerate the employee turnover rate.
- Employees who are sleep-deprived also are more likely to commit errors and omissions, partially thanks to increased reaction times.
- Sleep deprivation, which results in impaired reaction times, may mean missing very important telephony or not responding quickly in conversation.

13. Suggestion

- Employees performing regular night shifts should be counselled regularly so that their levels of motivation remain constant.
- Health check-ups at regular intervals should be arranged for the employees performing night shifts to combat the ailments associated with sleep deprivation.
- Some perks might be provided to the employees while performing night shift.
- The employees should not be put on Night Shift at a stretch.

14. Conclusion

Trying to do a job responsibly while sleeping can significantly impact job performance. If sleep is not adequate, it forces the body to work sub-optimally. Neurons within the brain become overworked, impairing thinking, slowing physical reactions, and leaving people feeling emotionally drained. These short-term side effects of sleep deprivation can affect at large.

Lack of sleep also encompasses a profound impact on employees' feelings and moods. Several more dramatic psychological effects of sleeplessness include paranoia, hallucinations, mania, and cognitive state, which might prove hugely detrimental to health.

More subtle effects of poor sleep can prove challenging in an organizational environment. Teamwork and communication play a significant role in hospital environments and are vital to professional success. A great number of survey respondents in the researcher's sleep-related research found the interpersonal aspects of their role especially difficult when tired.

The frayed nerves, moodiness, and lack of focus related to a sleep deficit can put a giant strain on the key social relationships fostered within the workplace.

Feeling drowsy and trying to remain awake takes lots of psychic energy, making it harder to remain focused on long tasks and people that need concentration. This decrease in focus is also associated with the impact of micro sleeps, which are momentary (0.5 -15 seconds) episodes of non-responsiveness that cause lapses in attention.

This suggests that tired employees take longer to react in critical situations and should be more likely to form a blunder.

Working while sleeping can leave people feeling more irritable, angry, and susceptible to stress. In stressful or negative situations, emotional reactions are amplified, resulting in overreacting at inappropriate times. Stress and irritability felt during the workday can then carry over into home life, making it harder to go to sleep. Over time, chronic sleep loss increases the chance of more serious mental state conditions, like anxiety and depression, which will make being productive at work even more difficult.

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Agriculture, Energy and Environment Management in Sustainable Smart World by Green IoT Applications

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Abstract:
Agriculture and energy play a vital role in India's economy and sustainable development goals (SDGs). More than 60% of rural households depend on agriculture as their principal means of livelihood. Agriculture, energy, along with fisheries and forestry, are among the largest contributors to the Gross Domestic Product (GDP). The agriculture sector in India is expected to generate better momentum in the next few years due to increased Government initiatives and plans in agricultural infrastructure such as irrigation facilities, warehousing and cold storage, better marketing process and introduction of advanced technologies. Despite its interconnected nature, Affordable and Clean Energy is the goal most closely related to the energy system. In this scenario, Green Internet of Things (G- IoTs) facilitate the creation of smart spaces by converting existing environments into sensor-rich data-centric Cyber-Physical Systems (CPSs) with an increasing degree of automation, giving rise to Fourth Industrial Revolution, known as Industry 4.0 for Smart Health Care. Environmental pollution is a global problem of modern industrial civilization. Thus, the numerous applications of G-IoT are economically, environmentally and socially sustainable, preserving natural resources and improving human health, providing effective insight into research in the field of ICT enabling G-IoT.

Keywords: *SDG, GDP, G-IoT, energy harvesting, smart world, cyber-physical systems*

1. Introduction

The Sustainable Development Goals (SDGs) are a set of 17 interconnected goals adopted by the 193 member countries of the United Nations General Assembly in 2015. According to the United Nations, the SDGs are a "universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere." The 17 goals listed below are part of the 2030 Agenda for Sustainable Development and are intended to be achieved globally by 2030.

Internet of Things (IoTs) is a revolutionizing technology that aims to create an environment-friendly ecosystem of connected objects and embedded devices and provide ubiquitous connectivity between trillions of not only smart devices but also simple sensors and actuators.

Although recent advancements in the miniaturization of devices with higher computational capabilities and ultra-low power communication technologies have enabled the vast deployment of sensors and actuators everywhere, such an evolution calls for fundamental changes in hardware design, software, network architecture, data analytics, data storage and power sources [1]. **Green IoT** (G-IoT) is the newest manifestation of developed sustainable manufacturing industry and trade practices [2]. The decision surrounding whether or not to implement **G-IoT** strategies, policies, and tools provides compelling challenges for organizations. While practitioners have been highly interested in this topic for a while, there is also an emergent interest in this topic among academicians, researchers and pupils [3-4].

1	No Poverty	7	Affordable and Clean Energy	13	Climate Action
2	Zero Hunger	8	Decent Work and Economic Growth	14	Life Below Water
3	Good Health and Well-being	9	Industry, Innovation, and Infrastructure	15	Life On Land
4	Quality Education	10	Reducing Inequality	16	Peace, Justice, and Strong Institutions
5	Gender Equality	11	Sustainable Cities and Communities	17	Partnerships for the Goals
6	Clean Water and Sanitation	12	Responsible Consumption and Production		

Table 1: The 17 Sustainable Development Goals (SDGs)

Nowadays, sufficient plant productivity in agriculture is hard to imagine without fertilizers. At the same time, ecological situation and extensive environmental damage, which can be related to agricultural land use practices, do not permit further exploitation of chemical fertilizers without additional regulation. The concepts of smart farming together with Green Internet of Things (G- IoTs) are supposed to contribute to the solving of these problems. Based on the information provided by various chemical and physical sensors analyzing sustainable and green environmental features, computer systems can generate decisions about appropriate actions to be done [5]. This approach is really promising for proper and precise adjustment of fertilization since it provides an opportunity to take into account many parameters like temperature, soil moisture, and macro- and micro-nutrient contents. The implementation of such an approach requires the application of appropriate sensors yielding information on soil nutrients in a timely manner. Currently, most of the methods of soil nutrient quantification rely on time-consuming and laborious chemical analysis methods that can only be performed in specialized laboratories.

Moreover, these analytical procedures require certain chemicals and involvement of well-trained personnel. Thus, normally these techniques cannot be employed in the field conditions [6]. Therefore, smart fertilizer applications demand convenient analytical tools for fast nutrient quantification in soils. The main soil nutrients are nitrogen (N), phosphorus (P) and potassium (K) [5- 6]. Each of the macro-nutrients has its own role in plant formation:

- Nitrogen is an important element in forming the amino acids, N-based (purine or pyrimidine) and is used for regulation functions.
- Phosphorus is a part of nucleic acids and membrane lipids.
- Potassium is involved in the maintenance of plant homeostasis, transport, signaling and metabolic processes.

All three mentioned nutrients are involved in different processes and have to be available from the soil. However, even if added to the soil, they can be lost due to the leaching and volatilization; they can be removed from the field during harvesting or may have low availability (like phosphorus). These issues can be corrected by the application of fertilizers. However, it should not be redundant [5, 7].

Substantial technological growth of photovoltaic systems has occurred worldwide in recent years, enhancing the availability of electric energy in an environment-friendly way. **G-IoT** is one of the emerging technologies with great potential to apply in the area of renewable energy, especially in solar PV cells. Maximum power production is the general criterion for any solar PV cell. The Maximum Power Point Tracking (MPPT) technique maximizes the energy production of PV cells during partial shading conditions [8]. Thus, the overall efficiency of the photovoltaic energy production system is increased. Numerous techniques have been proposed during the last decade for implementing the maximum power point tracking process in a photovoltaic system. This article proposed a novel idea of interfacing a **G-IoT** system with a PV cell in partial shading conditions and applied the MPPT method to analyze and demonstrate their performance features [1, 4].

2. Agriculture and Environment Management

The Government of India has come up with a set of regulatory policies and mitigation strategies to control pollution in our country. Environment pollution has become a global issue since the middle of the last century, while the problems are more compounded in a developing country of huge population density. Hence, to control pollution, knowledge of the level of pollution and the nature of pollutants both in spatial and temporal domains is very important. Electronics sensing technology is a perfect choice here for rapid monitoring of air, soil and water pollutants, whereas ICT technologies can play their role in capturing, storing, analyzing and disseminating the acquired information [5, 7]

2.1. Soil Samples

Twenty soil samples were collected in various geographical locations over West Bengal, India. Soil was generally medium-textured: sandy loam, silt loam or clay loam. The grain size distribution was highly variable, with silt loam being the dominant textural class. The sampling was performed in the following way:

- Five sub-samples were taken within 1 m2 of the soil and thoroughly mixed to get a representative sample, which was further used in this study.
- At each sample site, about 1.0–1.5 kg of surface soil from a depth of 0–10 cm was collected.
  Collected samples were kept in sealed packages for further analysis in the laboratory.

2.2. Analysis of Soil Samples

The standard analysis of the soil samples was performed in "Soil, Water and Manure Testing Laboratory" of Vivekananda Institute of Biotechnology according to the certified methods. The following parameters were estimated:

- Electrical conductivity,
- pH,
- Organic carbon,
- Nitrogen,
- Phosphorus and
- Potassium contents

All reagents were analytical grade or higher. Nitrogen content was estimated after distillation of the soil with an alkaline potassium permanganate solution. The phosphorus in the acidic soils was quantified by Olsen's method and the alkaline gray method. The content of potassium was determined by flame photometry. Spectral measurements were performed on Systronics Flame Photometer 128. Results of nitrogen, phosphorus and potassium measurements were presented in kg/Ha and were recalculated to mg/kg with respect to individual components. Besides NPK, pH, Electrical Conductivity (EC) and Organic Carbon (OC) were also evaluated in the soil samples. Electrical conductivity and pH were measured by Systronic EC Meter (Model Systronics μ Conductivity Meter 306) and Systronic pH Meter with glass electrode (Systronics μ pH Meter 361). The determination of OC was based on the Walkley-Black chromic acid wet oxidation method.

2.3. Soil Sample Preparation for Multi-Sensor Analysis

We aimed at the simplest possible procedure of sample treatment to come closer to a practically feasible analytical procedure. Therefore, just distilled water was used as an extracting agent, while acids, complex extraction systems or individual extracting agents for particular analytes were not considered. Optimization of the extracting procedure was performed according to a two-level full factorial design with a central point. The extraction time and amount of the sample were optimized. The description of the procedure is given in Supplementary Materials. Based on these results, the following protocol was employed for sample preparation. 25 g of the soil was dried in the air for 24 hrs, crushed with a pounder and sieved through 1 mm mesh. 10 g of the obtained particulate matter was mixed with 100 ml of distilled water for 5 mins. The liquid part of the soil-water mixture was transferred by direct decantation of the supernatant fluid to the Teflon cell for potentiometric measurements.

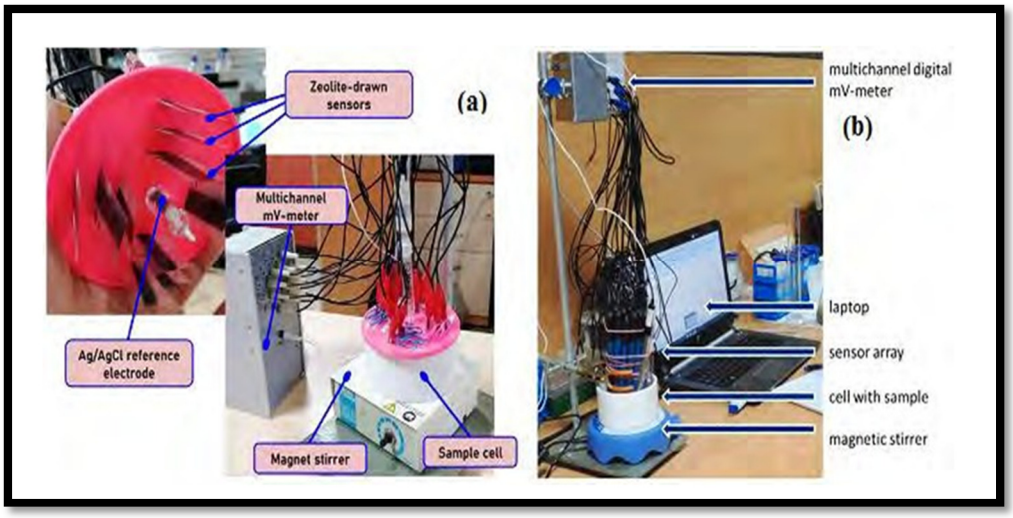

Figure 1: Multi-Sensors Set-up Known as Electronic Tongue
(a) Experimental Set-up, (b) Data Processing [9-10]

The following parameters of the 'measured vs predicted' plot are characteristic of a calibration model: offset, slope and squared correlation coefficient (R2). The last two are indicative of fitting quality between calibration and validation points. Both parameters have to be close to unity. Root Mean Square Error (RMSE) is calculated in concentration units and describes the predictability of the model. Since the number of samples was rather small for independent validation of the calibration model, full cross-validation was used. In such a case, the model is built with (m-1) samples, where 'm' is the total number of samples in the set. Then the soil quality parameter is predicted for the excluded sample. The procedure is repeated for each sample. The Root Mean Squared Error of the Cross-Validation (RMSECV) is calculated according to the equation:

$$RMSECV = \sqrt{\frac{\sum (v_i^{pred} - v_i^{real})^2}{m}} \quad \text{---------- (1)}$$

3. Energy and Environment Management

Rapidly increasing population, meeting the growing energy demand is one of the foremost challenges for today's world. Total energy consumption on the earth is increasing by leaps and bounds compared to previous decades. The large rate of consumption of fossil fuels is inversely proportional to its life expectancy. As fossil fuel sources are limited, there is a need to find alternatives to fulfill the load demand. During the past few decades, renewable energy sources have emerged as an alternative source to produce electricity all over the world. Solar photovoltaic (PV) technology received remarkable attention due to its non-polluting, high availability and high potential features [8]. However, the solar PV system suffers from two main challenges:

- The energy conversion efficiency of a PV system is not more than 16% or 17%, especially when the irradiation level is less than the Standard Test Condition (STC) and
- The power generated from the PV system continuously varies with the atmospheric condition [13]

Moreover, the characteristic of the PV array is non-linear; thus, the current and voltage vary with the irradiation and temperature. On the I-V and P-V curves, there is a point that is a unique characteristic and is termed the maximum Power Point. At this point, the whole PV system (array, converter, inverter, etc.) operates at its maximum efficiency and tries to obtain maximum generated power. Thus, the most important part of harnessing the solar energy is to track the maximum power point of the solar PV system. To achieve maximum efficiency, it is necessary to locate the system at MPPT. Solar panel efficiency is also decreased by the various factors like shadowing, dust and dirt, snow, bird droppings, etc. Shadowing is one of the biggest concerns that decreases about half of the efficiency of the PV panels according to the place where the solar panels are mounted. Hence, some mechanism system is needed with respect to increasing the output of solar panels PV and maximizing more and more amount of solar energy and getting it converted into electrical

energy. In a solar PV module a number of solar cells form an array of solar panels which are connected to a load. To maximize the power and to minimize the wastage of power, an MPPT controller is connected between the load and PV panel.

This system also prevents premature battery failure. For this reason, MPPT is the most practicable way to increase the efficiency of a solar panel. However, extracting solar energy from the sun is a very difficult task due to limited efficiency and increasing cost of solar cells. The efficiency is affected by factors including solar radiance, temperature of module and load impedance.

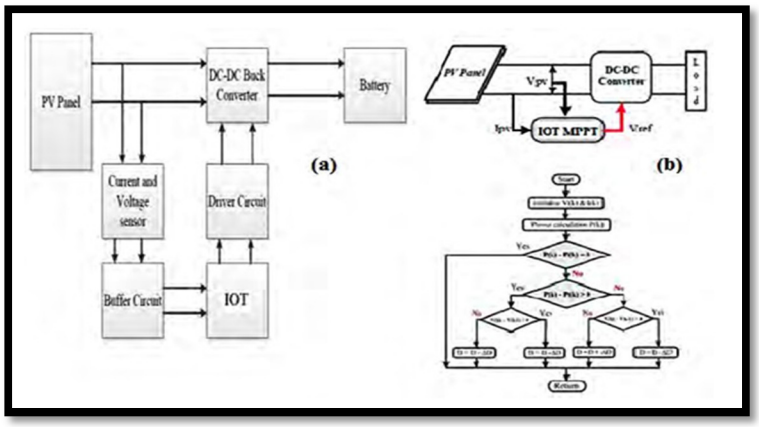

Figure 2: (a) Block Diagram of MPPT Solar System, (b)Flowchart of IoT MPPT

In this paper, a novel technique for efficiently extracting maximum power from photovoltaic (PV) panels is presented using the IoT system to ensure global power optimization for PV generators irrespective of the irradiance conditions. Individual MPPTs have been implemented and the results of comparative analysis studied for with and without IoT systems are depicted.

Solar System is depicted in figure 2. PV generation systems used an IoT-based controller connected between PV and load [12, 13]. A charge controller continuously maintains the charging voltage on the batteries and provides constant voltage. An IoT-based method has been implemented to extract maximum power from the photovoltaic solar panels' operation [14].

3.1. IoT-Based MPPT

The PV panels are placed on the top of the building or house to track the intensity of the sun. The tradition is that the PV panels are fixed according to the latitude angle of the specific country. In a few cases, humans manually try to relocate the solar tracker module towards the direction of the sun based on the upcoming season. To obtain the most effective and maximized output, the PV panels should be at 90-degree perpendicular to the sun or light-emitting source [8]. As the sun rotates all through the day and all over the year, there is a demand to make a solar panel tracking mechanism that controls the solar panel (PV) with the changing direction of the sun. Solar tracking system, which is used to trace the sun's movement, has increased the efficiency of solar panels between 30 and 60% compared to fixed tracking systems [13]. Under the situations of shading and discharged batteries, IoT can be efficiently utilized to extract maximum power by MPTT. The main components in an IoT-based MPPT configuration include a solar panel, an IoT controller system, a server, a cloud, a battery, and an inverter. MPPT is calculated on the server and sends the output to the PV module through the controller via G-IoT cloud. With the change in sunlight intensity, the load characteristic of the PV system under consideration changes to keep the output power maximum by these methods.

The maximum power is tracked by controlling the output voltage, sensing the output current and increasing both the output current and output voltage simultaneously [8, 13]. The maximum power is:

$$VMPP \approx [KOCVOC] \text{ ---------- (2)}$$

Where KOC is a proportional constant value and varies between 0.79 & 0.92 and can be obtained by analyzing the

solar PV system under various ranges of solar irradiation saved in the server. The method uses 76% of VOC as VREF (reference value) and tries to achieve MPP. The VOC is measured by the open circuit of the solar PV system at the load side for very less time. A series switch is placed in between the solar array and the converter to measure VOC. Finally, with the help of the above equation, the VMPP is measured [14]. Figure 2(b) shows the flowchart of the method.

4. Results and Discussion

4.1. Green Agriculture Sustainable

The RMSE of cross-validation describes the accuracy of the quantitative determination of a parameter. This characteristic is linked to the number of samples in calibration and validation sets, representatively of the samples and variation ranges of parameters. In the studied soils, the content of macronutrients varied in a wide range and, in some cases, the difference between calibration and validation of the model is rather high due to a limited variability of the target values in the sample set. One would expect that a multi-sensor system would produce smaller RMSEs in a sample set comprising soils with closer compositions. This supposition is confirmed by the reasonable values of correlation coefficients for all inorganic nutrients. In general, all the components of the NPK index can be quantified with precision which is sufficient for a simple and fast evaluation method. In this way, quantification of N is possible with an RMSE of 50 mg/kg in the range of 60–426 mg/kg. It must be pointed out that RMSE is a cumulative estimate of the prediction precision and, for the large dynamic ranges, may give apparently high values since both the error in low content and high content parts of the calibration are averaged.

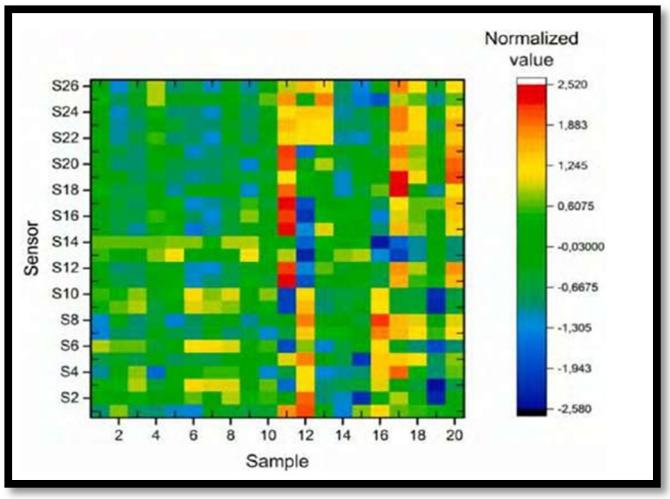

Figure 3: Sensor Responses in the Aqueous Soil Extracts

The aqueous soil extracts were analyzed with a potentiometric multi-sensor system and the responses of the sensor array were recorded. Figure 3 shows a graphical representation of the mean centred and scaled with standard deviation responses of the sensor readings encoded with colors. As an example, one can see that samples # 6 and 7 have similar values of NPK and the sensors demonstrate similar responses in these extracts. Meanwhile, samples #11 and 12 have a large difference in the composition and it can be seen from the color in figure 3. It can be seen that each sample is described with its own individual color pattern resulting from different chemical compositions of the samples as assessed by the sensors of the array. Sensor potentials of the multi-sensor system in soil samples were related to the results of traditional chemical analysis. Parameters of the corresponding Partial Least Square regression (PLS) models are summarized in table 2. Nitrogen, potassium, phosphorus, pH, conductivity and organic carbon were evaluated in soil samples. An example of the typical view of the 'measured vs. predicted' plot for PLS model intended for nitrogen quantification is shown in figure 3. The correlation between organic carbon content in the soils measured with Walkley-Black method and the response of the multi-sensor system was poor (corresponding $R2 < 0.5$). It means that this parameter cannot be reliably evaluated by the system, but OC can be determined by optical sensors. The sensors of the array demonstrated stable response, which was in good agreement with conductivity and pH measured in the laboratory.

The correlation with conductivity (R2) was equal to 0.86, while the one with pH was even better and equal to 0.95.

Analyte	Range, Units		Slope	Offset	R^2	RMSE	LV*
pH	4.70 -7.92	cal val	0.97 0.96	0.18 0.30	0.97 0.95	0.17 0.2	3
EC	0.10-2.60; dSm^{-1}	cal val	0.99 0.77	0.01 0.06	0.99 0.86	0.07 0.25	7
OC	0.14–1.93; %	cal val	0.30 0.22	0.59 0.66	0.30 0.24	0.42 0.46	1
N	60–426; mg/kg	cal val	0.86 0.74	40.51 6.33	0.71 0.96	32 50	6
P	35–574; mg/kg	cal val	0.96 0.78	6.33 39.75	0.96 0.75	29 79	8
K	72–705; mg/kg	cal val	0.79 0.69	64.76 93.77	0.79 0.66	81 110	4

Table 2: Parameters of PLS Models for pH, EC, OC and Soil Nutrients

4.2. Green and Clean Energy Sustainable

This paper proposed and implemented an IOT-based MPPT technique to get better efficiency and more power from the PV Solar module. Real-time data with and without IoT is measured. The experiment was conducted in the summer season. The experimental data for the summer season without IoT (Case-1) and with IoT (Case-2) is given in table 3.

Sr. No	Time in Hrs	Case 1 (Without IOT)			Case 2 (With IOT)		
		V(V)	I(A)	P(W)	V(V)	I(A)	P(W)
1	7:00 AM	10.80	0.70	7.56	14.80	0.90	13.32
2	8:00 AM	10.70	1.00	10.7	14.60	1.20	17.52
3	9:00 AM	11.10	1.20	13.32	14.70	1.30	19.11
4	10:00 AM	11.30	1.20	13.56	15.20	1.40	21.28
5	11:00 AM	11.40	1.22	13.908	15.70	1.50	23.55
6	12:00 PM	11.50	1.30	14.95	16.00	1.60	25.6
7	1:00 PM	12.00	1.35	16.2	16.30	1.70	27.71
8	2:00 PM	12.80	1.42	18.176	16.80	1.75	29.4
9	3:00 PM	12.20	1.36	16.592	16.20	1.71	27.702
10	4:00 PM	11.40	1.25	14.25	15.80	1.62	25.596

Table 3: Real-Time Data for with and without IoT in Summer Season

Data analysis for 'with IoT' and 'without IoT' is depicted in figure 4. From the figure, it is clearly visible that the power has been increased after introducing the Green IoT-based MPPT method. The experimental data for the summer season without IoT (Case-1) and with IoT (Case-2) is given in table 3.

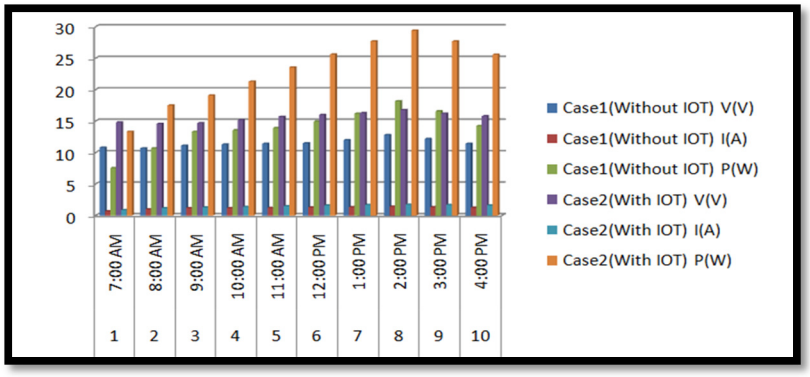

Figure 4: Real Time Data Analysis of PV Power, with and Without

5. Conclusion

A multi-sensor system known as electronic tongue (e-tongue), basically IoT-enabled devices, was proposed for Green and sustainable agriculture one-shot simultaneous quantification of three main nutrients responsible for the soil fertility N, P and K. It was shown that the system is capable of quantitative estimation of the NPK, as well as pH and conductivity in the soil samples. The suggested potentiometric multi-sensor system known as electronic tongue can be applied to determine soluble charged species in water and for parameters correlated with the concentration of such components. The main advantage of the proposed approach is the fast and simple procedure. The analysis can be easily performed in the field and it does not require any chemicals. Renewable energy sources, also called non-conventional types of energy are continuously replenished by natural processes. The system is the right solution for clean energy production. In this work, a novel advanced MPPT technique for solar PV application has been discussed. Techniques are explored, focusing on different parameters. This whole system constitutes an efficient way to abstract all the desired light power and make the best use of it. This Green IoT-based affordable and clean energy system can fully utilize the characteristics of the proposed MPPT method for PV panels to extract the maximum power from solar energy sources. This method can quickly and accurately track the maximum power output of a PV cell system. Comparative analysis based on real-time data is presented. All these features are required for selecting the appropriate MPPT for a particular application. The efficiency of the total system depends on the algorithm run in the server. The PV grid can provide reliable, high quality and more efficient power to consumers.

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A Study on Electronic Insurance Service in Urban Areas in India

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Abstract:

In this globally dynamic business scenario, it is vital for any marketer to contemplate and grapple with any kind of opportunity which one can translate into an exceptionally superior service offering than his competitive counterpart. The evolution in the trend of insurance is e-insurance. Many insurance companies in India have their own independent websites catering to mediation services at a very low price. Despite lucrative offers, e-insurance in India has not been able to capture much attention of the public in general. The share of e- insurance in business largely depends upon consumer wants, inclination, preferences and usage, which in turn depend on other demographic variables such as age, gender, income, occupation, and education. This study highlights the influence of demographic variables on the e-insurance sector in India. It is found in the study that there is a significant impact of gender, educational qualification, income and occupation on the reason, like saving, investment, risk and protection tax benefit and children education and marriage to purchase e- insurance products.

Keywords: *Online insurance, consumer behavior, life insurance, demographic variables*

1. Introduction

The exploding apotheosis of the Internet and social media has made the term 'Digital' an indispensable part of life for many consumers across the globe. This trend is expanding exponentially and changing all the diversified sectors. The insurance industry around the world is no exception. The insurance industry in India and abroad has undertaken profound changes during the last decade.

Internationally, insurance has a high percentage of consumers using the Internet to research or/and to buy as compared to other product categories. In the United States, the digital impact in the case of motor insurance has already touched a high benchmark, while in the United Kingdom, a moderate percentage of consumers who had been surveyed bought their policies through the Internet.

In India, the insurance sector is experiencing major change due to digitalization. Trend analysis in Google search queries related to insurance in India has shown that there has been exponential growth since 2008, 6 times in the case of motor insurance, 4 times in the case of health insurance and 4.5 times in the case of life insurance. The market of online insurance in India is already exceeded the amount of 700 crore rupees. Seeing this trend in the online insurance industry in India, it is expected to maintain its high growth trajectory over the next few years.

Until 1999, there was no private insurance player in India except Life Insurance Corporation (LIC). The insurance industry in India consists of only two insurers, LIC and General Insurance Corporation (GIC). The government then introduced the Insurance Regulatory and Development Authority Act in 1999, thereby de-regulating the insurance sector and allowing private companies to participate. Furthermore, foreign investment was also permitted, which was capped at 26% holding in the Indian insurance companies. Global players then rushed into the market and collaborated with Indian insurance players for both life and non-life segment. Today there are 26 life insurers and 21 non-insurers and 1 reinsurer operating in the country.

Regardless of all the developments, most Indians do not have life insurance coverage, while health insurance and non-life insurance coverage in India are also below international standards. The premium collected from life insurance policies sold in India as against Gross Domestic Product (GDP) is 4.1%. It is lower than the developed market level of 6-9%. However, the e- insurance sector has not made much progress in the urban sector as expected. There is still a number of opportunities available waiting to be tapped. The present paper highlights the impact of demographic variables on the

e-insurance sector in urban India. The study focuses that there is an impact of gender, educational qualification, income and occupation on the reasons like saving, investment, risk protection, tax benefit, retirement benefit and children's education and marriage to purchase insurance products.

2. Review of Literature

According to Banan (2009), the fundamentally information-intensive nature of the insurance product will eventually make full e-business treatment a workable option provided that efficiencies do materialize and are passed on to consumers. According to Sapa (2010), Information and Communication Technology (ICT) application may have a positive impact on a company's supply chain and its relations with business partners or it may give the possibility of providing new services or creating new distribution channels for a company. According to Dasgupta (2002), online insurance requires replacing traditional methods with online processes analogous to those in e-commerce. According to Karthi (2002), Insurance companies are offering better values to customers in e-insurance than in conventional marketing methods. According to David (2006), most Indians are willing to pay one percent of their income or more for health insurance.

3. Objective of the Study

The objective of this research paper is to assess the impact of educational qualification, occupation, income and gender on the reasons like investment, saving, risk protection, tax benefit and retirement benefit to purchase e- insurance products in urban areas in India.

4. Research Methodology

The present study is empirical in nature. The primary data were collected using a structured questionnaire from urban consumers of Patna region of Bihar, and a sample of 100 respondents was selected. The secondary data were collected from various journals, magazines, and websites. The collected data was then analyzed and interpreted with the help of statistical tools such as the percentage method and Chi-square test.

The following hypotheses have been formulated on the basis of objectives:

- H01: Stimuli that encourage the customers to purchase insurance products are independent of gender.
- H02: Stimuli that encourage the customers to purchase insurance products are independent of qualification.
- H03: Stimuli that encourage the customers to purchase insurance products are independent of income.
- H04: Stimuli that encourage the customers to purchase insurance products are independent of occupation.

5. Results and Discussions

Insurance companies are constantly working to know all those factors that influence the demand for insurance products by customers. In this process, they design and redesign to innovate such a product that is saleable in the market. To do this, they are continuously involved in market research to understand why the customer is encouraged to show his/her preference for insurance products. The present paper highlights the impact of demographic variables on e-insurance sector in urban India. The study focuses on the impact of gender, educational qualification, income and occupation on the reasons, like investment, saving risk protection, tax benefit, retirement benefit and children's education and marriage to purchase insurance products. The results obtained through analysis are tabulated in Tables 1-8.

5.1. Inference (Tables 1 and 2)

The majority of the male, as well as female respondents consider long-term saving as the most important stimuli that encourage them to purchase insurance products. The male respondents consider risk protection as the least essential stimuli, whereas female respondents consider risk protection and tax benefit as the least important stimuli.

Table 2 tests the hypothesis H01 at 5% significance level. The significance (p) = 0.078, which is >0.05. Thus, the Chi-square value is significant, which leads us to accept the null hypothesis.

Thus, the modified hypothesis is: "stimuli that encourage the customers to purchase insurance products are independent of gender."

5.2. Inference (Tables 3 and 4)

The illiterate respondents are indifferent to the various stimuli that encourage them to purchase insurance products. Metric and graduate respondents consider long-term saving as the most important factor. However, they differ on other less important stimuli.

Table 4 tests the hypothesis H02 at 5% significance level. The significance (p) = 0.001, which is <0.05. Thus, the Chi-square value is significant, which leads us to reject the null hypothesis.

Thus, the modified hypothesis is: "stimuli that encourage the customers to purchase insurance products are dependent on qualification."

5.3. Inference (Tables 5 and 6)

The majority of the respondents in less than 1 lakh and 1- 2 lakh consider long-term saving as the most important stimuli that encourages them to purchase insurance products. The respondents in 2-3 lakh income categories consider long-term saving and investment as the most important stimuli, whereas respondents in above 3 lakh income category consider tax benefits as the most important stimuli.

Table 6 tests the hypothesis H03 at 5% significance level. The significance (p) = 0.007, which is <0.05. Thus, the Chi-square value is significant, which leads us to reject the null hypothesis. Thus, the modified hypothesis is: "stimuli that encourage the customers to purchase insurance products are dependent on income."

Gender	Stimulus						
	Long term saving	Investment	Risk protection	Children education and marriage	Tax benefit	Retirement benefit	Total
Male							
n	22	12	6	7	10	6	63
%	34.92	19.04	9.52	11.11	15.87	9.52	
Female							
n	14	7	2	6	2	6	37
%	37.83	18.91	5.40	16.21	5.40	16.21	

Table 1: Stimuli That Encourage Customers to Purchase Insurance Products on Basis of Gender

Value	Degree of Freedom	Asymp. sig. (2-sided)
38.72	5	0.078

Table 2: Chi-square Test

Qualification	Stimulus						
	Long term saving	Investment	Risk protection	Children education and marriage	Tax benefit	Retiremen tbenefit	Total
Illiterate							
n	0	0	0	0	0	0	0
%	0	0	0	0	0	0	
Up to metric							
n	4	3	2	1	1	1	12
%	33.33	25	16.66	8.33	8.33	8.33	
Up to graduate							
n	27	12	4	8	6	8	65
%	41.53	18.46	6.15	12.30	9.23	12.30	
Above graduate							
n	5	4	2	4	5	3	23
%	21.73	17.39	8.69	17.39	21.73	13.04	

Table 3: Stimuli That Encourage Customers to Purchase Insurance Products on Basis of Qualification

Value	Degree of Freedom	Asymp. Sig. (2-sided)
34.12	15	0.001

Table 4: Chi-square Test

Income	Stimulus						
	Long term saving	Investment	Risk protection	Children education and marriage	Tax benefit	Retirement benefit	Total
<1 lakh							
n	12	4	3	4	0	4	27
%	44.44	14.81	11.11	14.81	0	14.81	
1-2 lakh							
n	7	2	1	2	0	1	13
%	53.84	15.38	7.69	15.38	0	7.69	
2-3 lakh							
n	12	11	2	4	5	6	40
%	30	27.5	5	10	12.5	15	
Above 3 lakh							
n	5	2	2	3	7	1	20
%	25	10	10	15	35	5	

Table 5: Stimuli That Encourage Customers to Purchase Insurance Products on the Basis of Income

Value	Degree of Freedom	Asymp. sig. (2-sided)
32.58	15	0.007

Table 6: Chi-square Test

5.4. Inference (Tables 7 and 8)

The majority of the respondents in government service, private sector and self-employed consider long-term saving as the most important stimuli that encourage them to purchase insurance products. Other respondents consider children's education and marriage as the most important stimuli.

Table 8 tests the hypothesis H04 at 5% significance level. The significance (p) = 0.038, which is <0.05. Thus, the Chi-square value is significant, which leads us to reject the null hypothesis.

Thus, the modified hypothesis is: "stimuli that encourage the customers to purchase insurance products are dependent on occupation."

Occupation	Stimulus						
	Long term saving	Investment	Risk protection	Children education and marriage	Tax benefit	Retirement benefit	Total
Government service							
n	8	2	1	4	4	1	20
%	40	10	5	20	20	5	
Private sector							
n	14	12	3	3	5	9	46
%	30.43	26.08	6.521	6.52	10.86	19.56	
Self employed							
n	12	3	2	3	1	1	22
%	54.54	13.63	9.09	13.63	4.54	4.54	
Others							
n	2	2	2	3	2	1	12
%	16.66	16.66	16.66	25	16.66	8.33	

Table 7: Stimuli That Encourage Customers to Purchase Insurance Products on Basis of Occupation

Value	Degree of Freedom	Asymp. sig. (2-sided)
42.68	15	0.038

Table 8: Chi-square Test

6. Conclusion

It may be concluded from the study that the stimuli on the demand of the urban people for insurance products are saving,

investment and children's education and marriage purpose is most. The stimuli that encourage urban customers to buy the product are highly influenced by their demographic factors. It is found by the study that there is an impact of gender, educational qualification, income and occupation on the reasons such as saving, investment, risk protection, tax benefit, retirement benefit and children's education and marriage to purchase e-insurance products. Therefore, to attract customers on a long-term basis and sell their products, insurance companies have to frame their strategies after studying the impact of demographic factors on the stimuli.

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