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ARTIFICIAL INTELLIGENCE AND INTELLECTUAL PROPERTY LAWS IN INDIA: AN EMPIRICAL STUDY

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ABSTRACT

In simple words, Intellectual Property Right is intangible creation of human mind. As we all know every one of us possess a talent with us, only few of them apply that talent for commercial use and gain out of it. Whether it is Bill Gates for Micro Soft, Copy Rights on books by famous authors, creating a logo, design, or a symbol which we call as "Trade Mark" developed by businessmen, geographical indication like Pochampalli famous for sarees, Kanchi for silk sarees, Mangalagiri for cotton dresses & sarees, Assam Tea, Bata for shoes and so on. There is no end for this, it is all the creation of a right by people among us, with the talent they have and make money out of it. The right created by the persons on the products, services should be protected to safeguard the efforts of its creators and benefit the society. Hence, Intellectual Property Rights (IPR) are legal rights which has been resulted from intellectual activity in business, trade, industry, science and other fields. The inventions and discovery by the human beings cannot be limited to one period or era. Since childhood, it is observed that video games, games in computer, then games and movies in cell phones today and the digitalization is taking us to get smart televisions, Alexa, Google Assistant. Very recent phenomenon is about "Artificial Intelligence" (AI). It is understood that this 'computer' is thriving AI. Hence, an attempt is made in this paper to correlate and emphasized the relevance of IPR in protecting the inventions or work that contributed to the emergence of AI.

Keywords

human mind, intellectual property rights, artificial intelligence, alexa and google assistant.

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1. INTRODUCTION

During end of 1980s, Indians started using the word computers quite often and few affordable companies, institutions and some individuals started using computers. As a child, I remember, our school management purchased computer and taken all the students and gave a demo class on that. I was thrilled to see the computer for the first time. Then it was followed by video games played in computers in the mid of 1990s. The thrill was not ended here, it was followed by Mobile phones in the millennium. Mobile phones started with messages and calls, then color phones with camera resulted in digitalized phones and today the entire world is digitalized and moving towards "Artificial Intelligence". It is the credit to be given to the human brain to continue his innovative thoughts and taking us towards an ultra-modern era, which is beyond our imagination.

Such intellectual thoughts and innovation should be given protection and any human innovation should be safeguarded for the benefit of society, for which regulation and statutory law should be implemented.

Hence, in this paper, the intellectual property laws and artificial intelligence both are correlated and analyzed the views of respondents on the emerging importance of AI and the role of IPR in protecting the AI in India.

CONCEPT OF INTELLECTUAL PROPERTY RIGHTS

Intellectual Property Right is an exclusive right granted by Government of India for protection of originality of work of the inventor. Intellectual Property Rights include Patents, Trade Marks, Logos, Symbols, Copy Rights, Information, Layout Design. Intellectual Property Right is to safeguard the assets created by the human brain, which are intangible in nature. They are converted into tangible usage for commercial purposes.

CONCEPT OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence, in simple terms can be defined as the "ability of a machine to mimic intelligent behavior. AI is that branch of computer science that aims to create "Intelligent Machines". These machines are programmed to "Think" like humans and mimic how a person acts and his mannerisms. AI aims at learning, reasoning and perception.

2. REVIEW OF LITERATURE

Computers coupled with human intelligence, have advanced to make decisions on their own. The ability of a computer system to take decision by itself came to be known as "Artificial Intelligence. The term 'AI' was formally coined by John McCarthy, a computer scientist at a conference in 1956¹.

According to McCarthy, it was the notion of a program, processing and acting on information, such that the result is parallel to how an intelligent person would respond in response to similar input².

It was this reliance and curiosity towards machines that AI projects were developed in a manner which allowed for the performance of tasks requiring human-like creativity³.

The results being rendered by the machine are an outcome of its own intelligence, or algorithms and commands. To tackle the same, Sir Alan Turing proposed a test called 'Turing-test'⁴.

In the words of Turing, an AI machine showed intelligence if the responses submitted by the same were distinguishable from real human responses. While this test worked for a couple of years, its application was restricted only to speech machines and certain quizzing purposes. The World Intellectual Property Organization (WIPO) identified the existence of AI and propounded three categories of AI, expert systems, perception systems and natural language systems⁵.

3. RESEARCH GAP

The above review of literature concluded that, the AI was recognized decades ago and the WIPO identified its existence and hence, the research gap bridges the linkage between AI and the role of IPR in protecting it.

4. STATEMENT OF THE PROBLEM

The statement of the problem focuses on the issues relating to IPR in safeguarding the AI and its usage to the society in a beneficial way in India. Today India is one among many developed countries, which global share in technology, business, trade and education. AI can make and take India further to grow and placed in a pivotal position in contributing to the world economy and becomes a self-sufficient country and a role model to many countries which are in developing stage.

5. OBJECTIVES OF THE STUDY

Based on the research gap and statement of the problem, the following objectives are taken for the purpose of the study:

1. To study the growing importance of Artificial Intelligence and Intellectual Property Laws in India.
2. To analyze the views of respondents on role of IPR in protecting Intangible Assets including AI.

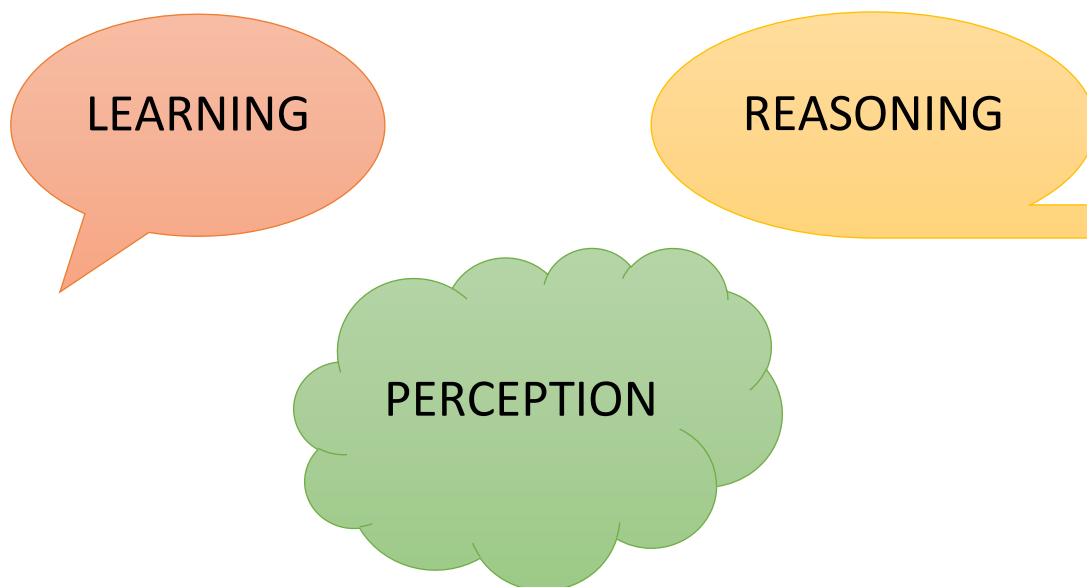
6. RESEARCH METHODOLOGY

1. Data Collection: Both Primary and Secondary Data is used for the purpose of research.
2. Sample Size: The sample size is 100, out of which 96 responded.
3. Sampling Method: Convenience Sampling
4. Primary Data Collection: Through questionnaire circulated in Google forms to the respondents.
5. Data Analysis Methods: Data is analyzed based on the responses given by the respondents – using Pie Diagrams & Bar Charts (percentage basis)

7. GROWING RELEVANCE OF ARTIFICIAL INTELLIGENCE AND THE ROLE OF IPR LAWS IN PROTECTING AI

Artificial Intelligence in simple terms can be defined as “the ability of a machine to mimic intelligent behavior. Artificial Intelligence is a branch of computer science that aims to create “intelligent machines”. These machines are programmed to ‘THINK’ like humans and mimic how a person act.

PRESENTATION 1: GOALS OF ARTIFICIAL INTELLIGENCE



The goals of AI, creative and the knowledge exhibited by the AI systems is clearly evident to the world and there is a concern regarding protection of AI in the minds of users, enforcing the rights in relation to intellectual property. Thus, we should explore more deliberative ends of copyright and patent laws in connection with AI systems

Now a days, there are machines which are highly creative that would be eligible for copyright protection if they are created by humans. Any invention, if it is unique in nature, when applied, or submitted, should be eligible to get registered. But here, the role of AI is such that it is either

- (i) augmented human life and enhance or extend human capabilities through a direct relationship between human interaction with AI or
- (ii) are autonomous, making decisions within a contextual solution space and are being employed by humans to serve them.

The inventorship issue also raises the question of who should be recorded as the owner of a patent involving an AI application. Humans will not accept AI as their equals and grant them the same rights and eventually work for them. In that sense, AI cannot own property. If it is taken that, AI is by human care takers, in this sense, AI is a ‘Hired Force’, all fruits of labor of AI will be owned by the human-based entity it works for.

In this regard, it is considered that powerful organizations have more resources to employ and develop AI that can generate patentable IP.

To answer these issues and the impact of AI on science and technology is still unfolding in a rapid rate and it is the time to bring awareness among the users on the application of AI and the protection of AI applications and the laws that should be generated to safeguard the interest of AI

The issues and questions are arising for IPR policy as a consequence of the advent of AI as its applications are in wide usage among the companies. For this purpose, a conversation was organized at WIPO in September, 2019 with the participation of Member States and the representatives of Commercial, Research and Non-Governmental Sectors.

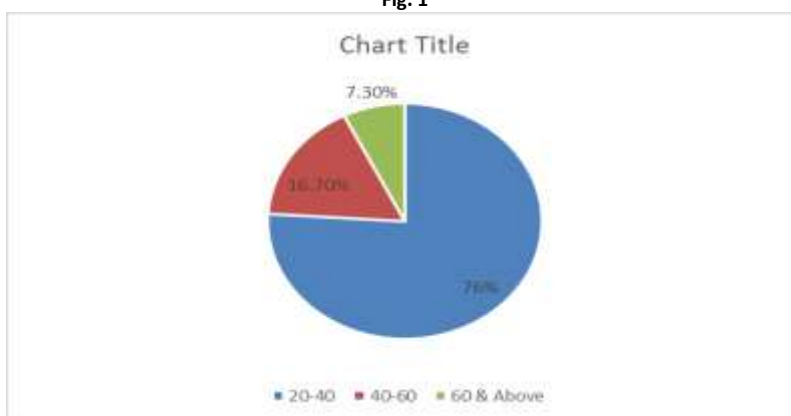
This paper focuses not only on the issues that are related to AI and IPR and the intervention of WIPO on its IP policy to protect AI, but also the views that are essential in drawing conclusion on the role of AI and IPR.

8. DATA ANALYSIS

DEMOGRAPHIC PROFILE OF 96 RESPONDENTS

1. Age of the Respondents

Fig. 1

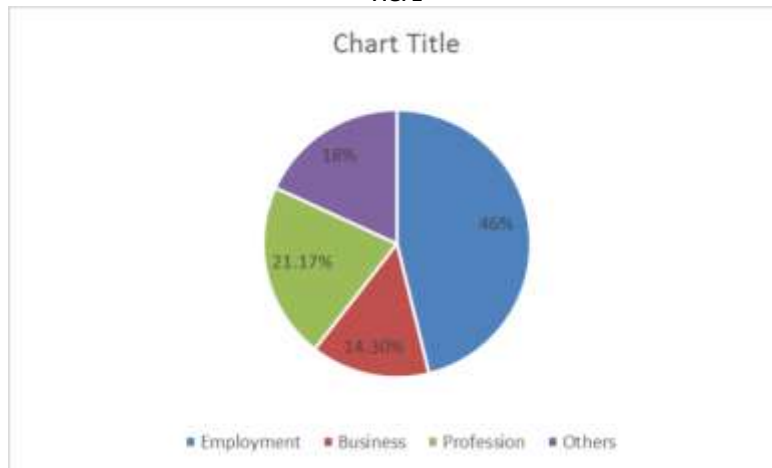


Source: Primary Data

From the above figure, it is observed that out of 96 respondents, 76% belong to the age group of 20-40, followed by 16.7%, 40-60 age group and remaining 7.3% belong to 60 & above age group.

2. Occupation of the Respondents

FIG. 2



Source: Primary Data

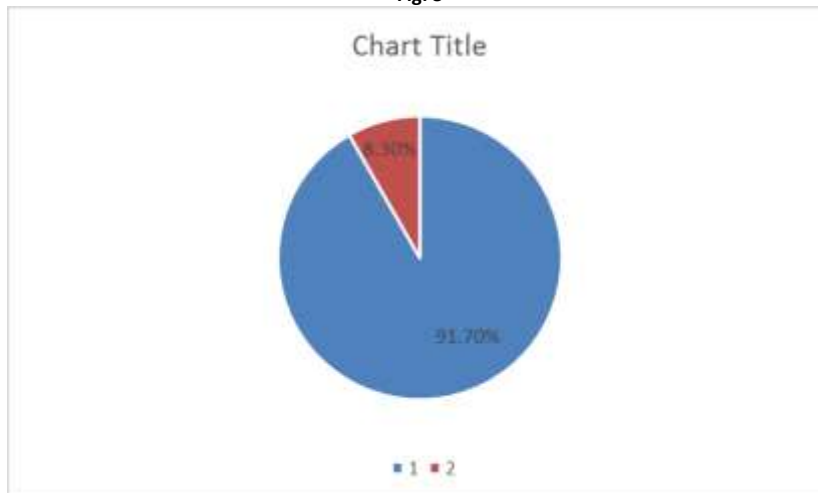
From the above figure, it is observed that, out of 96 respondents, 46% are from employment, followed by 14.3% from business, 21.7% from profession and 18% belong to others (students, home makers, retired persons).

DATA ANALYSIS

ON VIEWS OF 96 RESPONDENTS

3. Are you aware of the term Artificial Intelligence?

Fig. 3

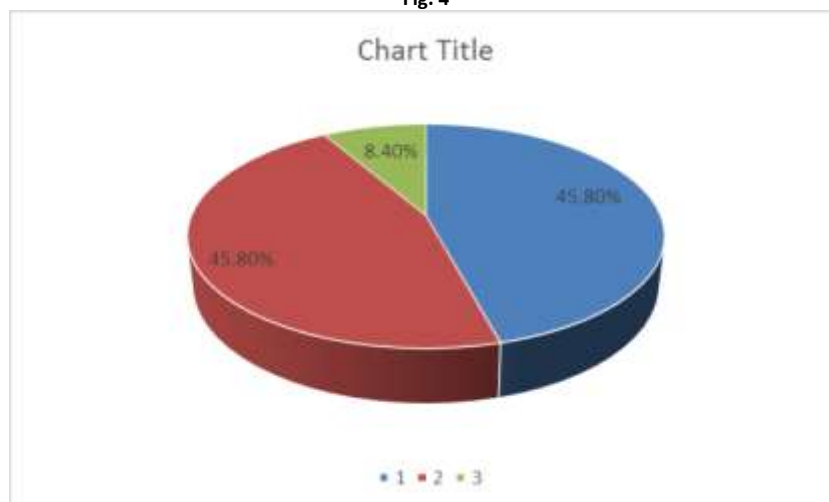


Primary Data

From the above figure, it is observed that out of 96 respondents, 91.7% are aware of the term Artificial Intelligence. 8.3% are unaware of the term.

4. Have you come across any programmes based on AI?

Fig. 4

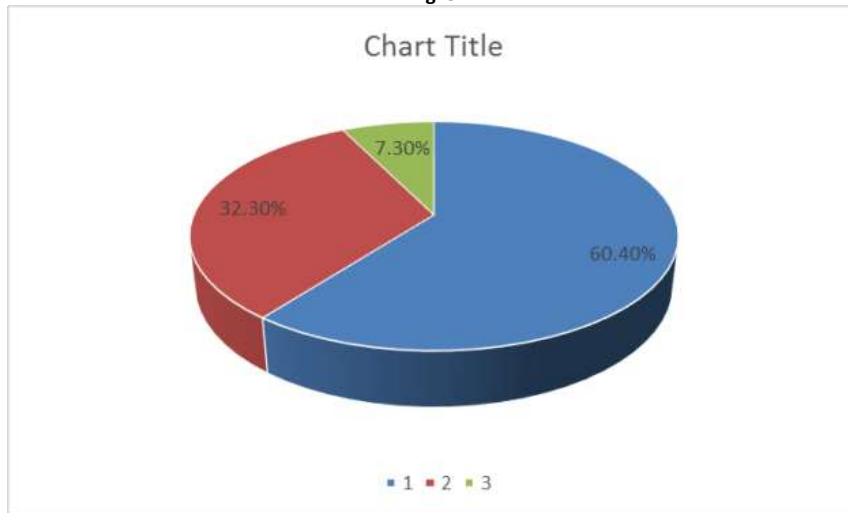


Source: Primary Data

From the above figure, it is opined that 45.8% respondents have come across programmes based on AI, whereas another group of 45.8% respondents have not come across any programmes based on AI. Remaining 8.4% are neutral.

5. Do you think that AI is going to through a challenge to the human intelligence in the near future?

Fig. 5

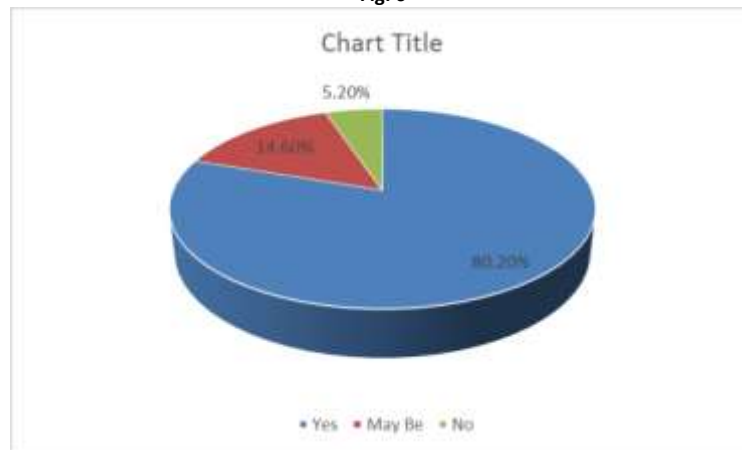


Source: Primary Data

From the above figure, it is observed that 60.40% of the respondents have opined that AI is going to through a challenge to the human intelligence in the near future.

6. Do you support the statement that, AI will bring tremendous changes in operations, processes and structure of both manufacturing and service sector in India?

Fig. 6

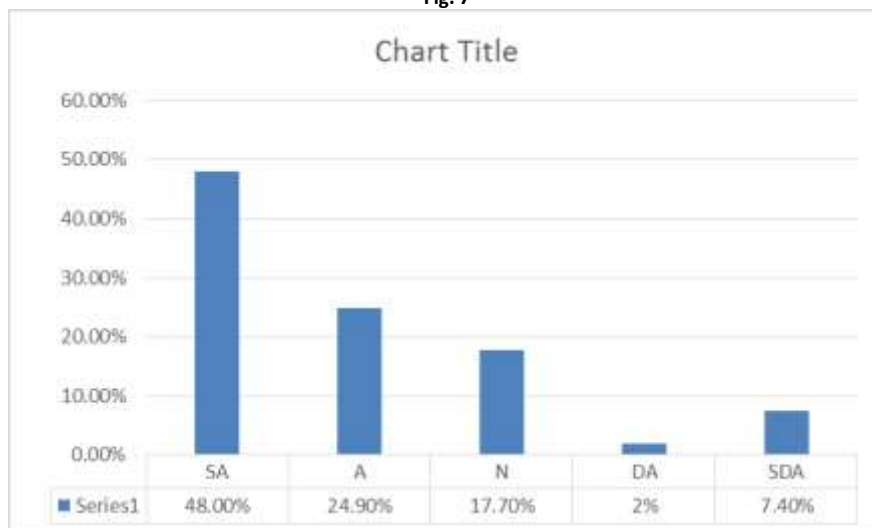


Source: Primary Data

From the above figure, it is emphasized that, 80.2% agree that AI will bring tremendous changes in operations, processes and structure of both manufacturing and service sector in India. 14.6% are neutral on this statement and remaining 5.2% not agreed with this statement.

7. AI should be used for the benefit of nation, for which it should be protected by IP Laws.

Fig. 7

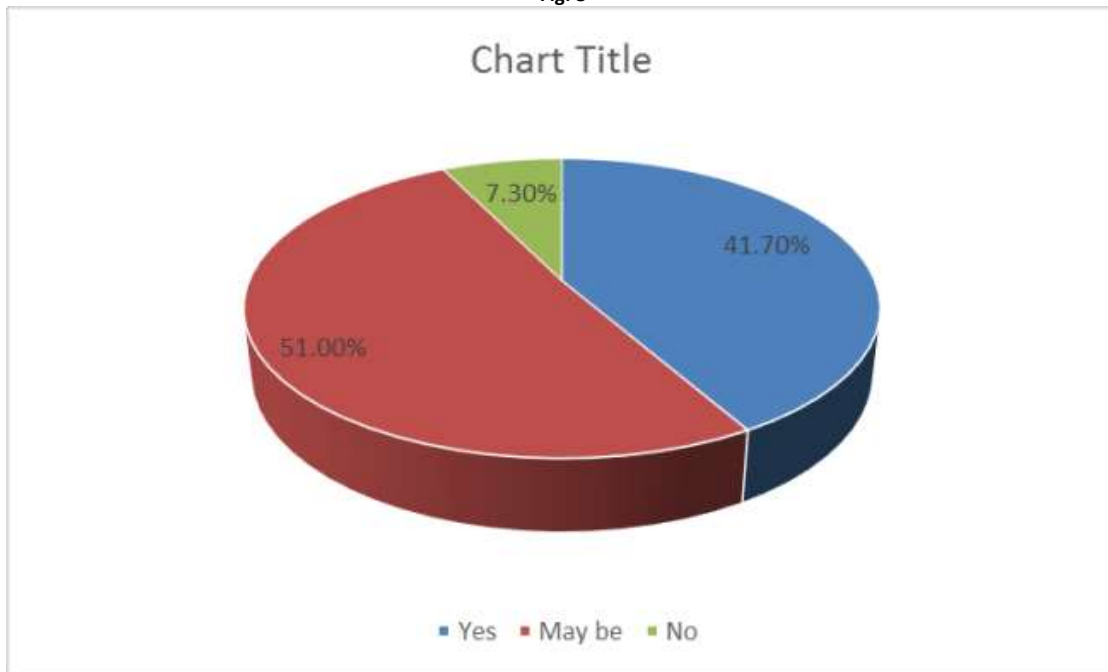


Source: Primary Data

From the above figure, it is emphasized that, 72.9% of the respondents agree with the statement, while 17% are neutral on this and remaining 9.4% did not agree with the statement.

8. The ownership of any intangible asset is the issue of IPR Laws.

Fig. 8

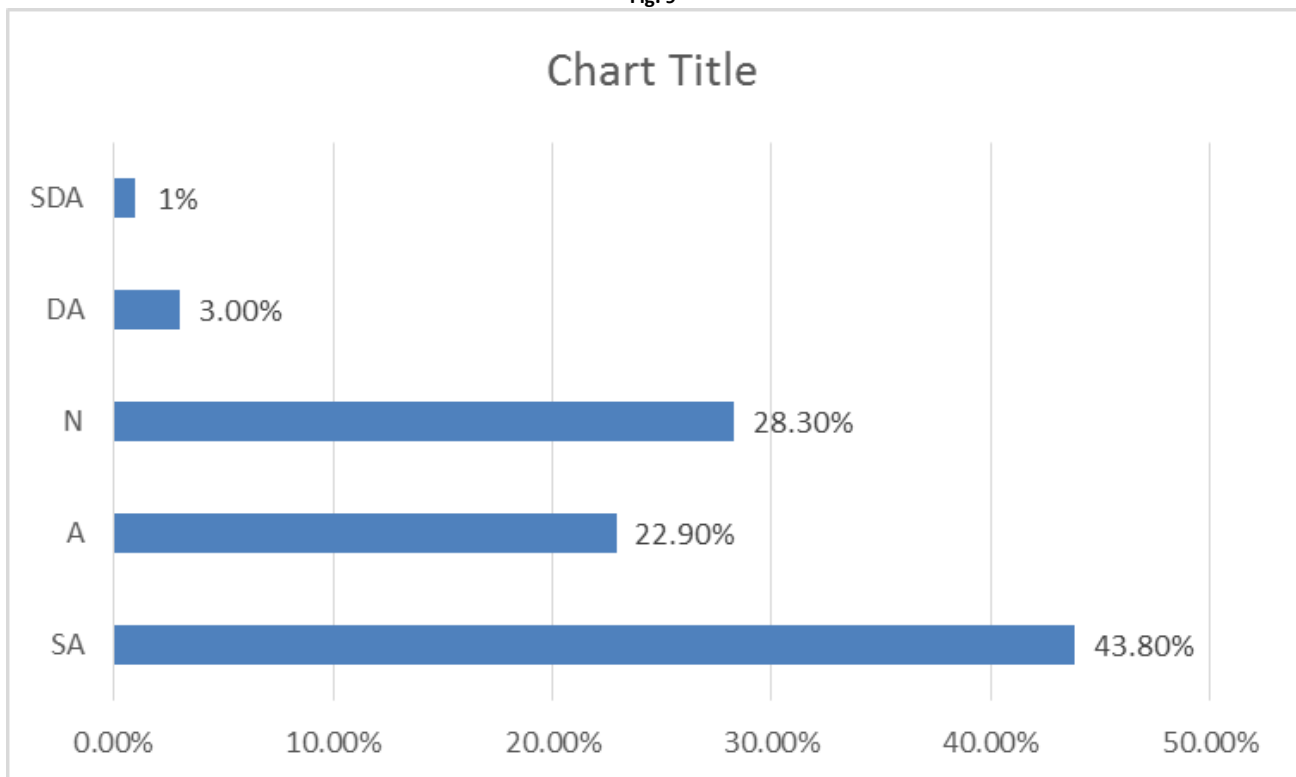


Source: Primary Data

From the above figure, it is observed that, 41.7% agree with this statement, while 51% are neutral on this statement and 7.3% did not agree with this statement.

9. The contribution of IPR Laws is necessary in Research and Innovation works in the present scenario.

Fig. 9

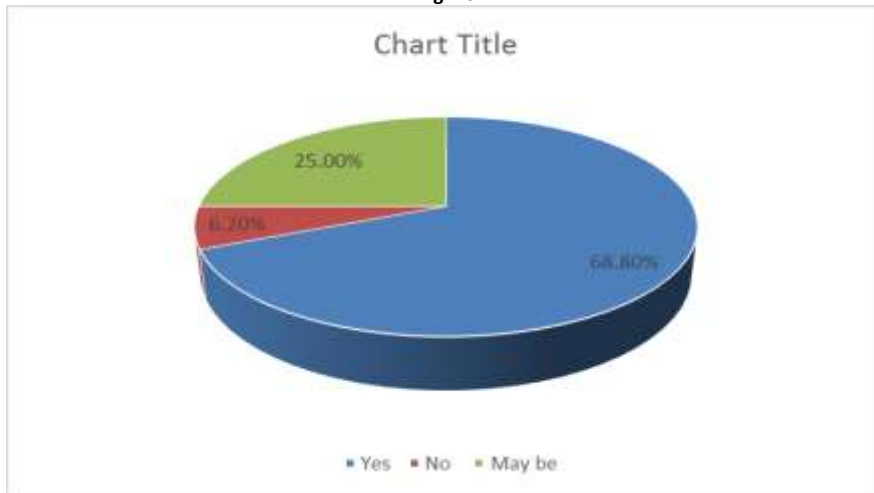


Source: Primary Data

From the above figure, it is opined that, 66.70% agree that contribution of IPR Laws is necessary in Research and Innovation works in the present scenario, 28.30% are neutral on this statement, while remaining 4% did not agree with this.

10. AI should be developed more and it should be under usage to generate a patent-able IP.

Fig. 10

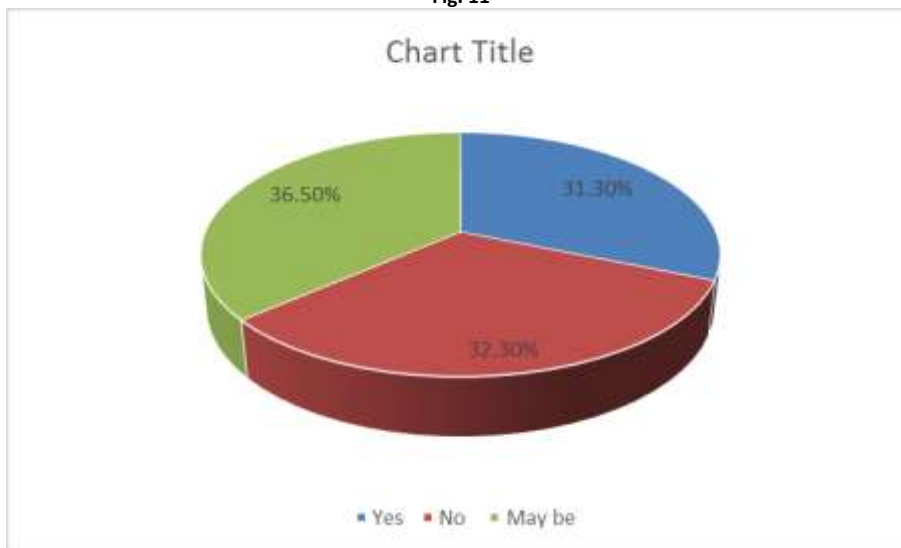


Source: Primary Data

From the above figure, it is emphasized that, 68.8% of the respondents agree that AI should be developed more and it should be under usage to generate a patent-able IP. 25% are neutral about this, while remaining 6.2% did not agree with this.

11. Are you aware that World Intellectual Property Organization is working on the aspects of AI that are specific to IPR Laws?

Fig. 11

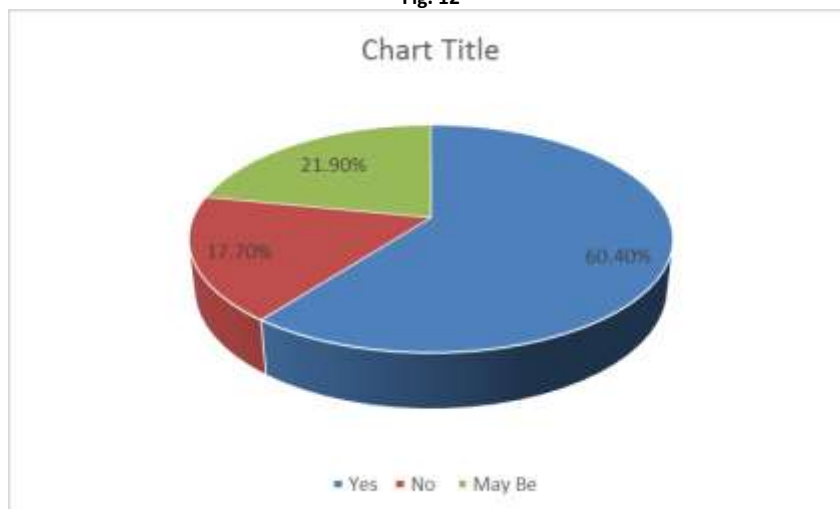


Source: Primary Data

From the above figure, it is emphasized that, 31.30% are aware that WIPO is working on the aspects of AI that are specific to IPR Laws. 32.30% are not aware with the same, while 36.5% are neutral on this statement.

12. Are you aware that, Government of India is promoting research in technology to address the ethical, bias and privacy issues of AI?

Fig. 12



Source: Primary Data

From the above figure, it is opined that, 60.4% of the respondents are aware that Government of India is promoting research in technology to address the ethical, bias and privacy issues of AI. 21.9% are neutral about this statement, while 17.7% are not aware of this.

9. KEY FINDINGS

Based on the data analysis and interpretation, the following findings are taken into consideration for the purpose of the study.

1. 76% of the respondents are of the age group between 20-40 years.
2. 46% of the respondents are employees.
3. 91% of the respondents are aware of the term 'AI'.
4. 45.8% of the respondents have come across the programmes based on AI.
5. 60.4% of the respondents opine that AI is going to through a challenge to the human intelligence in the near future.
6. 80.2% of the respondents agreed that AI is going to bring structural changes in manufacturing and service sectors in India.
7. 72.9% of the respondents emphasize that, AI should be used for the benefit of nation, for which it should be protected under IP Laws.
8. 41.7% of the respondents agree that, the ownership of any intangible asset is the issue of IPR Laws.
9. 66.7% of the respondents opine that, the contribution of IPR Laws is necessary in Research and Innovation works in the present scenario.
10. 68.8% of the respondents agree that, AI should be developed more and it should be under usage to generate a patent-able IP.
11. Only 31.3% of the respondents are aware that WIPO is working on the aspects of AI that are specific to IPR Laws, while 32.3% are not aware about the same.
12. 60.4% of the respondents are aware that, Government of India is promoting research in technology to address the ethical, bias and privacy issues of AI.

10. CONCLUSION

Based on the key findings, the followings conclusion is drawn on the study:

Availability of "**Information**" has become most common thing in the present era. Right from electronic age to today's digital era, information has contributed to world's growth, innovation, development and brought the countries and states closure to each other from business, education, residence, market view point. Sitting at once place today, we are able to meet people from any corner of the world. The virtual reality is taking its complete shape from time to time. Artificial Intelligence is contributing its applications and playing its role beyond digitalization characteristics.

From the respondent's views, it is evident that 91% of the people are aware of the 'AI' in the present era and the benefits we are going to derive from AI to our community is manifolds and hence the responsibility to protect its privacy, confidentiality is a major issue to be considered.

Intellectual Property Laws should introduce new provisions to protect the privacy of AI, as it is used by the companies for commercial purpose in specific and for the benefit of society in general.

WIPO is working on this to bring laws which are specific for AI. Hence, the usage of AI should take new dimensions in various sectors of economy, to take us a step ahead, on par with world's economy, who are already using AI as their tools to develop holistically.

11. SUGGESTIONS

Based on the conclusion, the following suggestions are given:

1. Usage of AI should be authenticated by the Government, so that provisionally all sectors can make use of it legally.
2. Legal provisions should be made, taking into account, the country's economic status, situation prevailing and the current trend, w.r.t AI.
3. The application of AI should be introduced in Defense for security purposes of our country.
4. Inclusion of AI should be made in the curriculum along with provisions of IPR to bring awareness among the student fraternity, as they are the persons leading tomorrow's nation.
5. Protection of all intangible assets should be part of IPR Laws for benefit of society in particular and for security purposes in general.

12. SCOPE FOR FURTHER RESEARCH

Innovation, Discovery, Usage of Equipment, modernizing our lives from time to time is a regular phenomenon of human race. This is giving scope to researchers from a long time. Yester year's Electronic Age, Computer era, Digitalization regime has given a scope for the researchers to explore new avenues in research. AI is not doubt is going to open the doors for research further enhancing the domain of researchers in the areas such as "Role of AI in the business", "AI – Its emerging importance in the growth and development of our economy" "AI- SWOT Analysis", "AI- Issues & Challenges w.r.t usage of its Applications" and so on.

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INFLUENCE OF PERFORMANCE APPRAISAL MANAGEMENT ON EMPLOYEES' PRODUCTIVITY: A CASE STUDY ON INDIAN PROFESSIONALS

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ABSTRACT

This research paper helps to understand the influence of performance appraisal on the productivity of the Indian professionals. Performance appraisal helps to evaluate the performance of an employee and thus improves their motivation, engagement, and productivity of employees. Employee engagement or productivity is a significant theme that gained consideration from HR experts and specialists in the recent times who call engagement as an eminent driver of organizational goal. Assorted definitions of the construct subsist in its theoretical foundations. This generates criticalities for measuring and its use when executing and rating strategies aimed at employee productivity. To depict this problem, our paper examines the current approaches to define and measure employee productivity and suggests a path forward towards a consensus as to its meaning and measurement. Performance appraisal is a regular look on the employees' performance and their overall contribution to a company. Representative commitment is significant for the accomplishment of authoritative destinations or objectives, and that profitability and exhibitions of associations are upgraded through the instrumentality of connected workforce, Performance examination framework is a huge segment that can empower associations accomplish worker proficiency. This examination shows an applied model, meaning a positive association between execution assessment purposes and laborers commitment. It shows an exhaustive audit of writing, this paper advocates that presentation evaluation positively affects worker duty, and that associations require to perceive how various workforces are influenced by various components of execution examination as this would encourage achievement of vital results, just as adequacy and commitment. The initial segment of the investigation is viewed as legitimate and observational, and in this manner can be tried further through assortment and examination of pertinent information by future analysts. The reason of this research paper is to find relations between PA fairness and employee productivity.

KEYWORDS

performance appraisal, satisfaction, influence, employee's productivity.

JEL CODES

J24, J33.

1. INTRODUCTION

At the moment we are living in a time of globalization, where change is guaranteed, and the administration of human investment is imperative for the accomplishment of an organization. As the firms encounter enormous competitions, they have recognized the significance of making their workforces completely connected with their occupation and the organizations. The fundamental objective of every business organization is to achieve its goals or objectives. There is a need to concentrate on performance assessment in order to achieve this. PA not only has a positive influence on the organization staff's performance (Bargozzi, 1980), but could also have a negative impact if poorly designed. Performance appraisal is directly linked to every business organization's success.

It is one of the most important instruments for motivating employees to work actively, effectively as well as effectively. Every employee in an organization is assigned certain roles and duties to play a role in the overall success of the organization. Performance appraisal helps to assess the performance of an employee and thus improves their motivation, engagement, and productivity of employees. In PA performance of employees is assessed by a supervisor or some form of judge who, through a set of measures, determines the performance of an employee, attaches a grade or rating to the assessment and then normally notifies the employee of his or her overall result.

Moreover, Performance evaluation is the most critical strategies of human resource management (HRM) and it has been revealed that the effective performance evaluation system is the effect of an important part of the effectiveness of employee's management of an organization in this regard, this paper looks into the effects of performance evaluation purposes on the commitment level of employees. Performance appraisal is essential because it helps to make sure that the employees will easily understand the system of the organization and managers will effectively put it into action. In particular, the appraisal system is established to support decisions on wage and salary increments, transfers, promotions, as well as to effectively communicate for assessment by reviewing their progress. Performance appraisal results are also used to discuss the personnel performance as well as progress in relation to objectives. In distinguishing efficient performers from inefficient performers, the PA method used must be sensitive.

In terms of the success and overall direction of an organization, employee performance plays an important role. Therefore, PA plays an important in the success of a business nowadays. Today, organizations use performance evaluation to increase efficiency as well as employee effectiveness at the place of work. Management is able to identify the need to motivate, set objectives and goals, train employees and provide performance feedback through performance appraisal.

Human Resource managers are responsible for maintaining a sound system for performance assessment. In order to achieve the necessary performance by performance assessment, the level of skills, knowledge and skills available to enhance the total productivity of employees must be used efficiently by the organization. In general, performance evaluation is now regarded as a critical management method. It assists management in setting goals, selecting and training the appropriate staff, and therefore leads to the achievement of the specified goal. It creates acceptable performance levels, and retain workers long enough to identify any discrepancies between real and expected results.

According to a study it is important to provide employees with proper, performance-based feedback. It is widely recognized that providing employees with feedback is a valuable concept that can encourage and allow self-development and thus can be important for the organization as a whole.

Each organization's output depends on how much as well as how well an employee's performance is assessed and evaluated. Moreover, appraisal procedure influences the productivity of employees, under fair working conditions. In this study we are concerned with the impact performance appraisal has on productivity of employees in the Indian Pvt. Sector.

1.1 MANAGEMENT BY OBJECTIVES

The aim is to improve an organization's performance by clearly defining the goals agreed by both management as well as employees. When employees have a say in goal setting as well as action plans, it promotes employee engagement and it also enables communication between management and employees, also it aligns goals across the organization. Employees are judged by their results at the end of the review period (quarterly or half-yearly, or annual). Success is rewarded with promotion or a wage increase, while failure can result in transfer or further training

1.2 360 DEGREE FEEDBACK

360 Degree Feedback is an arrangement or process in which feedback is provided to employees from anonymous people. they can be their colleagues, managers etc. This tool helps employees recognize their strengths as well as weaknesses and become more efficient.

1.3 ASSESSMENT CENTRE METHOD

This method allows staff to get a good overview of how others observe them and the influence it has on their performance. The main benefit of this method is that it will not only evaluate an individual's existing performance, but also anticipate their future job performance.

1.4 BEHAVIORALLY ANCHORED RATING SCALE(BARS)

To determine the hidden potential of staff, psychological assessments come in handy. This technique focuses on determining the future performance of an employee rather than their previous work. These assessments are used to analyze seven key components of the performance of an employee, such as, intellectual characteristics, leadership abilities, personality characteristics, interpersonal abilities, cognitive abilities, emotional quotient, and other abilities

1.5 HUMAN RESOURCE (COST) ACCOUNTING METHOD

The method of HRA analyzes the performance of an employee via the monetary benefits it provides to the company.

2. LITERATURE REVIEW

TABLE 1

| S. No | Author | Year | Name of the journal publisher | Title | Abstract | objectives | Major argument and methodology | Findings |
|-------|----------------|------|--|---|---|--|---|---|
| 1 | V.Karthikeyani | 2020 | International Journal of Innovative Research in Technology | The Effect of Performance Appraisal on Employee Motivation and Productivity | The focus of this study is to discover the impact of Performance assessment on the performance of employees and it also examines how motivation influences the relationship between performance appraisal and productivity of employees | To analyze as well as explore the connection between Performance appraisal and encouragement | The PA acts as a motivational tool for a worker in order to improve his productivity. The performance appraisal of an employee can serve as an incentive to enhance his productivity. Methodology: both primary as well as secondary data is used for the study. Personal interview was conducted for this purpose. | It is concluded in the study that there is a relation between PA system and motivation. Performance at work can be improved with the help of performance appraisal system. Evaluation of performance at regular intervals can lead to the motivation of employees. |
| 2 | Nyatsanga | 2019 | | An assessment of the impact of performance management on employee productivity. | The aim of the study was to evaluate the impact performance management has on the employee's productivity at the Public Works Ministry | The paper is guided by three goals: to assess the impact PA has on the productivity of employees, to evaluate the reward system's effectiveness on employee productivity and to analyze the effect performance feedback has on employee productivity | Methodology: random sampling technique is used in this. Questionnaires as well as face to face interviews was held to collect the data. SPSS was used for data analysis. | The results of the performance assessment suggested that the assessment led to improved productivity in the employee's performance. The results also indicated that the chances of it being repeated are high when good performance is recognized and rewarded and employees can also be rewarded in order to meet desired targets. |
| 3 | P. Hemalatha | 2019 | A Journal of Composition Theory | Effectiveness of Performance Appraisal on Employee Productivity in Sail, Salem | PA is important for measuring the performance of the workforce and also to ensure progress towards the achievement of the desired objectives as well as targets of the organization. the analysis investigates the impact of PA in SAIL, Salem, on employee productivity. | study the impact of performance appraisal on the productivity of employee in SAIL, Salem. | PA is a system to determine how well workers perform their work, is necessary to communicate that information to them in order to improve their performance. Methodology: primary as well as secondary data was used in this. 140 respondents were interviewed. For secondary data company records were gone through for that. | For employees to work better job satisfaction, employee retention etc needs to be addressed. It is possible to modify and monitor the PA system on a regular basis in order to encourage optimistic feedback from the staff. |

| | | | | | | | | |
|---|-----------------------------|------|---|--|---|---|---|---|
| 4 | Adedotun Onashile | 2017 | Seinajoki university of applied sciences. | Impact of performance appraisal on employee productivity | Studies have suggested employee's dissatisfaction towards their appraisal system which has impacted their performance. This paper talks about the impact that performance appraisal has on one's productivity in an organization. | The objective of this paper is to find the impact of performance appraisal on employee productivity in Uniliver Nigeria PLC and then providing recommendations on how to improve their appraisal system. | The paper talks about the absence of appraisal policies which has resulted in exploitation of employees by their employers. Therefore, performance system is used to find the limitations of both the employer as well as employee. Methodology: a quantitative survey was conducted involving 33 employees to find out the impact that performance appraisal has on employee productivity. | The finding tells us that performance appraisal helps to assess the behaviour, attitude, etc of the employee towards the organization. The study helped to find out the the current state of the appraisal system in uniliver Nigeria PLC. |
| 5 | Akinbode, Jinabhai, Lourens | 2013 | Mediterranean journal of social sciences | The influence performance appraisal policy has on employee performance: a case study of guaranty trust bank in Nigeria | The paper focusses how the performance appraisal policy has an impact on employee's performance in guaranty trust bank in Nigeria. The feedback reports received has also improved the employee performance. | The aim in this study was to find out the overall effectiveness of the performance appraisal policy in guaranty trust bank and also to find out the extent to which the bank's performance appraisal policy has contributed to employee performance | PA is a method by which the performance of employees is evaluated in terms of quantity, cost, time as well as quality. Performance appraisal helps to find the suitability for further training or promotion. The appraisal policy can have an effect on employee's motivation and their satisfaction levels. Its existence helps the employee know that the organization is interested in their performance and development, Methodology: a questionnaire was made and the target respondents were 150. The data was analyzed through SPSS. | It was revealed that the participation of employees in the appraisal system was quite high which resulted in job satisfaction and improved employee performance. Many respondents preferred performance appraisal policy to be used for career pathing. |
| 6 | Pearce and Porter | 2015 | Journal of applied psychology | Employee response to formal performance appraisal feedback | The study hypothesized that employee's attitude towards the performance appraisal system and organizational commitment can decrease for those who receive low ratings. Similarly, those receiving higher ratings their attitude towards performance appraisal and organizational commitment can increase. | To investigate the response of employees towards performance appraisal feedback. | Performance appraisal provides a full performance-based feedback to the employees. In this performance appraisal system was introduced in 2 companies. Methodology: data was obtained from a random sample. Ratings was provided for a year | The findings suggested that there was a negative feedback from those who received low ratings and a positive feedback from those who received higher ratings. |
| 7 | Singh and Rana | 2015 | International Journal of Science and Research | The Impact of Performance Appraisal on Organizational Commitment of Bank Employees | The study investigates the impact performance appraisal has on organizational commitment of employees from a public sector bank in Uttarakhand. Performance based payment practices and fairness in appraisal help in predicting the organizational commitment of the bank employees. | To investigate the impact of performance appraisal has on organizational commitment of employees from a public sector bank in Uttarakhand. | This study was conducted to bridge the research gap which was that very few studies had been conducted which predicted the impact of performance appraisal on commitment of bank employees. Methodology: a sample of 172 bank employees of 10 public sector banks was taken from 2 districts of Uttarakhand. | The study concludes that there is a significant impact of performance appraisal on the organizational commitment of the bank employees. Therefore, appraisal practices should be adopted by all these banks in order to raise the commitment level of the employees |

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|----|-----------------------------|------|--|--|---|---|--|---|
| 8 | ROSMI ZA BT AHMA D | 2015 | | Relationship Between Performance Appraisal and Employee Engagement Among Administrative Staff | the researcher conducted a study on University Utara Malaysia (UUM), a public university in Malaysia. In addition, this study also takes into account the level of employee engagement among employees in UUM and also does performance appraisal system has an impact on employee engagement | To identify the relationship between performance appraisal and employee satisfaction among administrative employees | Methodology: 400 questionnaires distributed to the administrative staff of UUM. Pearson Correlation analysis was used. | this research says that it is important for organizations to ensure performance evaluation is undertaken in an effective manner since it is part of one of the key human resource areas which may also contribute to high employee engagement among the employees of that organization. |
| 9 | Dr.A Sel- varasu | 2014 | International journal of managerial studies amd research | A Study about the Impact on Performance Appraisal on Employee's Engagement in An Organization. | It is said that having a high-performance workforce is quite essential for growth as well as survival | Measure en- gagement and its impact on fi- nancial results | Organisation effectively promote employee commitment and moral than those association who don't encourage employee engagement by performance criteria and rewarding them. It was found that incentives, pay offs and Quality of leaders on engagement which had potent connection with efficient engaging and motivating workers in the organization. Employees opinion surveys helped in nurturing high levels of employee commitment and motivation; this was good for organizations where workers opinion were put in use to bring about change. The performance appraisal concerns with what is expected from the employees in order to achieve the company's goal. It's an opportunity to review findings, generate feedback on how goals were obtained and confirm expectations. The good supervisors understand and they don't wait for survey to shape what employees do. For them engagement is not an once-a-year importance, and they equalize with the purpose of achieving the goal while maintain a healthy level. | The study concludes that reward structures, program etc. influence employee engagement which in turn has a positive effect on the finances of the company. |
| 10 | Malik Shahar- yar | 2014 | Journal of Resources Development and Management | Impact of Performance Appraisal on Employee Performance | PA has become one of the most critical and powerful methods that can help an organization to achieve its objectives by improving the efficiency as well as effectiveness of the workers. PA allows management to recognize the difference between desired and real performance of the employees. if any sort of deficiency arises it can be improved with training. | The objective of this case study is to show the importance of performance assessment in the Companies as well as the world of business. | The performance of the workforce is quite essential that the Department of Human Resources' ultimate objective is to achieve sustainable improvement in the performance of employees that they are given training, rewards etc. | It is concluded that a certain benchmark should be kept for the employees. The gap between actual as well as the benchmark performance may be due to some lack of knowledge of employees, Skills or attitude in the workplace towards the assigned job |

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|----|---------------------------|------|--|---|--|--|--|---|
| 11 | Omusebe, Gabriel, Douglas | 2013 | International journal of innovative research and development | Effects of Performance Appraisal on Employee Productivity: A Case Study of Mumias Sugar Company Limited | The study investigates the effect performance appraisal has on employee productivity in Mumias Sugar Company Limited. | To study the impact of performance appraisal on service quality and customer satisfaction. | Primary data was obtained through questionnaires and interviews. Also, secondary data was collected from the hr. department | The study concluded that there was a positive correlation between PA and service quality. Therefore, if PA is conducted well in an organization then there are chances that the service quality will improve. Also, there was a positive relation between the two variable PA and customer satisfaction too. |
| 12 | Liza Estino Daoanis | 2012 | International Journal of Economics and Management Sciences | Performance appraisal system: It's Implication to Employee Performance | PA helps to analyze and evaluate the contribution as well as the performance of an individual against organizational goals in order to identify individual strengths as well as opportunities in order to imply further improvements. The study evaluates the performance appraisal system of Nass Construction Company and the impact it has on employee performance. | The study evaluates the performance appraisal system of Nass Construction Company and the impact it has on employee performance in terms of responsibilities, skills as well as commitments. | The success for any organization depends on the quality as well as the characteristics of its employees. Employees are known to be the heart of the company. Methodology: qualitative as well as quantitative research was conducted. 55 respondents were selected for this process. Financial records of the company were also checked for this process. Finally, spss was used. | The study suggests that improvement in the appraisal system is required by giving certain motivational benefits to the employees |
| 13 | Todd Grubb | 2007 | Journal of Human Resource Education | Performance Appraisal Reappraised: It's Not All Positive | It is usually carried out with good intentions to monitor and enhance the efficiency of Individual personnel, and contribute to improved overall organizational performance, efficiency, and productivity. Sadly, it's an exercise in futility. | It examines why formal performance management and performance pay fail to meet their goals As elements of the performance improvement program of an organization, and why they are It should be repealed. | PA shows that in order to achieve benefits, individuals can change. In order to obtain more money, praise or a success, they may want to correct their performance. The belief that peoples want to be bribed and held hostage is acknowledged. It neglects The influence of intrinsic motivation, the theory that individuals essentially want to feel good They want to learn, develop and master their craft, which typically often includes learning about themselves. This implies winning the confidence of their colleagues too. Extrinsic motivation created by performance pay can reduce and decrease intrinsic motivation. Intrigue, doing the work itself | In this paper they've concluded that performance evaluation is rather desirable. But in fact, usually, it does It does not deliver the planned and anticipated outcomes and many workers hate it even Managers too. Indeed, this paper presents proof that performance assessment can decrease efficiency, satisfaction, and commitment of employees. it's a generalized, costly, ineffective workout. |

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|----|--------------------------|------|--|--|--|---|--|---|
| 14 | Josephine Wangari Kihama | 2019 | International Academic Journal of Human Resource and Business Administration | Performance Appraisal Feedback and Employee Productivity in Water and Sewerage Companies In Kiambu County, Kenya | This study sought to identify The impact performance evaluation system has on water and employee productivity within Kiambu County, sewerage companies in Kenya | To identify the impact of appraisal feedback on employee productivity of sewerage companies within Kiambu County, | Productivity is the final outcome of an organization's production process. In an association, Management is responsible for motivating their staff at all levels to elevate their levels of production, which helps to determine an organization's overall success. Methodology: a stratified sampling technique is used. Questionnaire was used for the same. | Appraisal feedback was given by their managers to employees. It was found by the organization that compared to criticism, positive and adequate feedback on performance is easy to share. It's revealed that in proving the execution of duties, feedback was not adequate and employees weren't interested in discussing their success with other individuals. |
| 15 | Brad Shuck | 2010 | | Employee Engagement and HRD: A Seminal Review of the Foundations | This a first exact research to recommend commitment as an indicator variable for the aim to turnover develop. Likewise gives proof that commitment may not be an indicator of the result variable optional exertion, a well-established belief. There is space for further advancement of commitment hypothesis in the HRD scene; be that as it may, the functional ramifications of creating or upgrading representative commitment in the working environment appears to be very clear | To find the historical development in engagement of employees | Surviving writing checked on all through this article features the kinds of builds representative commitment has announced associations with just as the fundamental framework in which commitment is constructed. The idea anyway stays in a condition of advancement. Following stages for commitment hypothesis and the idea of representative commitment depend entirely on the heading of developing exploration and the 12 eagerness of HRD scientists and experts to team up as accomplices just as the capacity to think past customary HRD limits, as recommended by researchers (Reio, 2009). As prove by this survey of writing, there exists a distinction, maybe a few separates, between the scholarly way to deal with worker commitment and the viable application and utility of the exploration. This doesn't anyway anticipate the eventual fate of the idea. Interestingly, this article has tried to recognize regions of distinction and shared trait, shortcoming and quality, just as inquiries for researchers and experts to consider for future system building | As a network of researchers, we should build up the mental fortitude to lead and assemble theoretical scaffolds that associate different networks of research and hypothesis incorporating with energetic, rising structures on which to manufacture our future. The idea of worker commitment is power experts which impact the world. |

| | | | | | | | | |
|----|------|------|--|--|--|--|--|---|
| 16 | Kahn | 1990 | International journal of innovative research and development | Manage Employee Engagement to Manage Performance | It is acknowledged that employee engagement has many different aspects in the organisation i.e. cognitive, emotional, and behavioral states. The employee engagement was defined how psychological and physical experiences of work/job, shape the process of occurring or not occurring during trade performances | Should engagement be there psychologically as well as physically when employees perform a role in the organisation | Author defines employee engagement as “the equalising of organization members’ selves to their work roles; in engagement, people work and express themselves while role performing”. The cognitive facet affect employees’ norms and values about the association, their superiors and working environments. The emotional purview of employees feels about each of these three factors and whether they possess either a positive or negative outlook towards the organisation and its superiors. The physical aspect means the physical zeal and energy of the employees to attain their tasks to achieve the goals of the organisation. Methodology Research is of empirical type. Information was gathered from 16 counselors, 9 men and 7 women, average age of 25.5 years. Method used are qualitative: observation, analysis of documents and very deep interview | It is was also acknowledged that employee engagement has many different aspects in the organisation i.e. cognitive, emotional, and behavioral states. The employee engagement was defined how psychological and physical experiences of work/job, shape the process of occurring or not occurring during trade performances. One of the first challenges showed is that there is no good definition of employee commitment which can be used universally. |
|----|------|------|--|--|--|--|--|---|

3. STATEMENT OF PROBLEM

Human Resource managers are responsible for maintaining a sound system for performance assessment. in order to achieve the necessary performance by performance assessment, the level of skills, knowledge and skills available to enhance the total productivity of employees must be used efficiently by the organization. in general, performance evaluation is now regarded as a critical management method. It assists management in setting goals, selecting and training the appropriate staff, and therefore leads to the achievement of the specified goal. It creates acceptable performance levels, and retain workers long enough to Identify any discrepancies between real and expected results.

According to a study it is important to provide employees with proper, performance-based feedback. It is widely recognized that providing employees with feedback is a valuable concept that can encourage and allow self-development and thus can be important for the organization as a whole.

Each organization’s output depends on how much as well as how well an employee’s performance is assessed and evaluated. Moreover, appraisal procedure influences the productivity of employees, under fair working conditions. In this study we are concerned with the impact performance appraisal has on productivity of employees in the Indian Pvt. Sector.

4. OBJECTIVES OF THE RESEARCH

1. To study the relationship between performance appraisal and employee productivity on Indian professionals with the help of secondary data (research papers etc.).
2. To understand the effect gender of the respondents has on their satisfaction with performance ratings.
3. To understand the effect of occupational sector of the respondents on the motivation level.

5. RESEARCH METHODOLOGY

For the purpose of research both primary as well as secondary data was needed.

5.1 Primary data: questionnaire was prepared because it is an easy way to collect information from the people. Sometimes it can be difficult because of the responses that we receive.

Sample size: 120 respondents

Target: Indian professionals

Tool: Regression is applied to know about the impact age and the organizational sector has on employee satisfaction.

Likert scale

It is one of the classic approaches for scaling responses in a survey. the **Likert scale** is a five and sometimes seven-point **scale** which is used to allow the individual to express how much they agree or disagree with a particular statement. It is named after the inventor “Renis Likert” who was a psychologist. When a respondent responds to a Likert scale questionnaire, he/she specifies his/her level of agreement or disagreement.

Its format is as follows

1. Agree
2. Neutral
3. Disagree

This scale helps to measure a positive or negative response of the respondent.

Afterwards an analysis was made which means arranging the raw data to draw an interpretation. In questionnaire analysis usually is done in the form of pie charts. Afterwards interpretation is then something that helps to draw the outcome of the analysis.

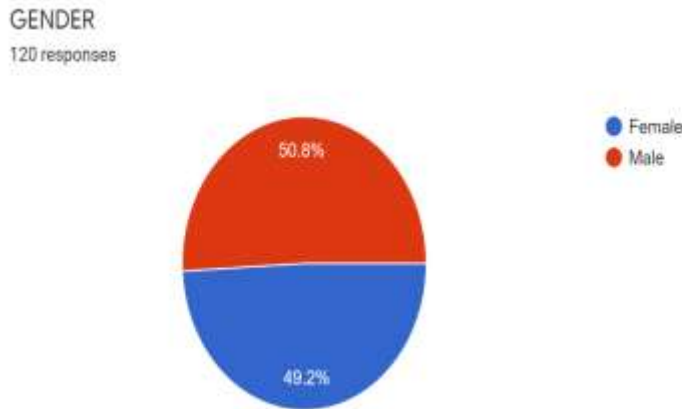
5.2 Secondary data: The data was collected through previous research papers, websites, books, magazines, newspaper etc. It is a data that is collected by someone else. I’ve also used secondary research data in my literature review and introduction as well.

Afterwards an analysis will be made which means arranging the raw data to draw an interpretation. In questionnaire analysis usually is done in the form of pie charts.

Afterwards interpretation is then something that helps to draw the outcome of the analysis.

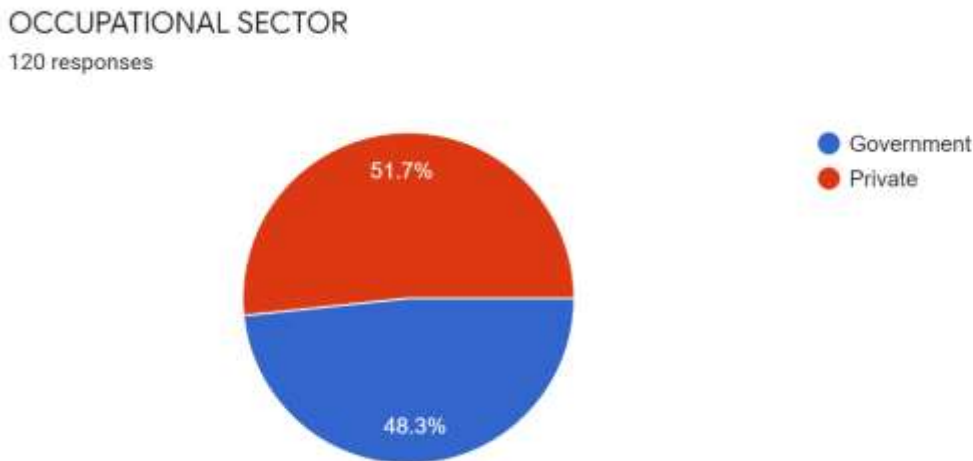
6. DATA ANALYSIS

CHART 6.1



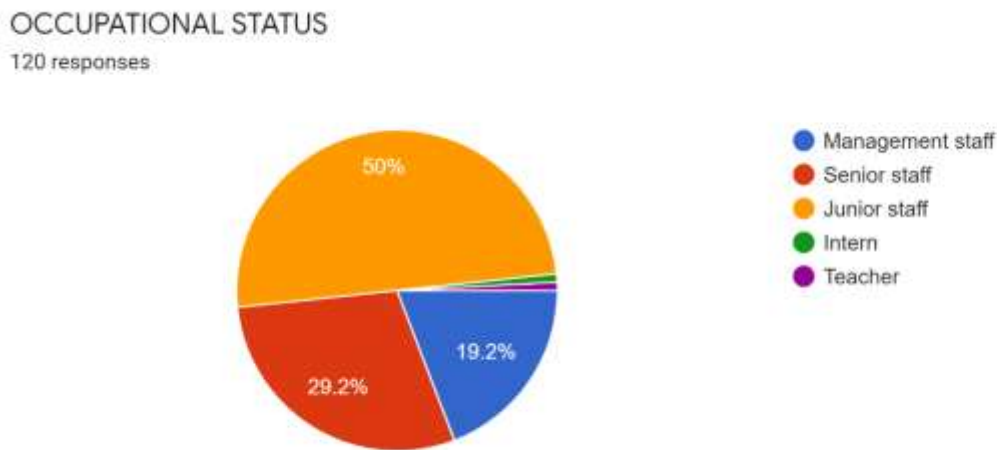
Out of the 120 respondents 61(50.8%) were male and 59 (49.2%) were women. Earlier Indian women were expected to take of their household after getting married and were not expected to work outside. But from the graph we can see times have changed and they have broken all stereotypes proving that they can multitask.

CHART 6.2



Among the respondents who've taken part in my survey 62 respondents are employed in the private sector and 58 respondents are employed in the government sector.

CHART 6.3

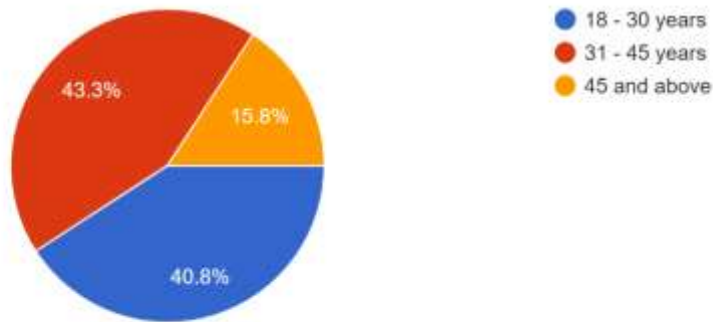


In the above graph 60 respondents are junior staff, 35 respondents are senior staff, 23 are management staff and the rest are others.

CHART 6.4

AGE

120 responses

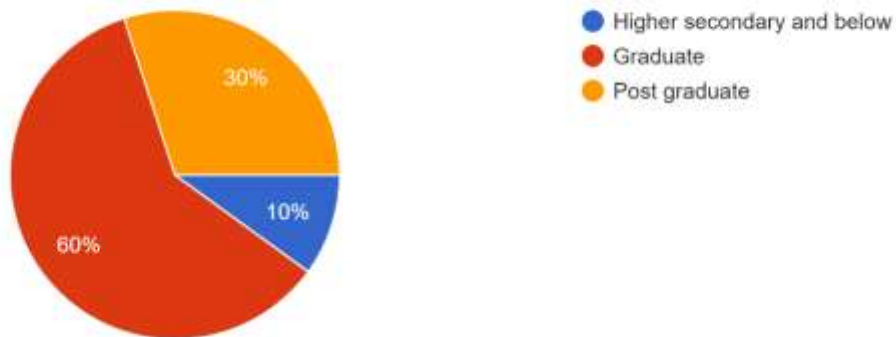


49 respondents are under the age group 18-30 years, 52 respondents are under the age group 31-45 years and the rest are 45 years and above.

CHART 6.5

QUALIFICATIONS

120 responses

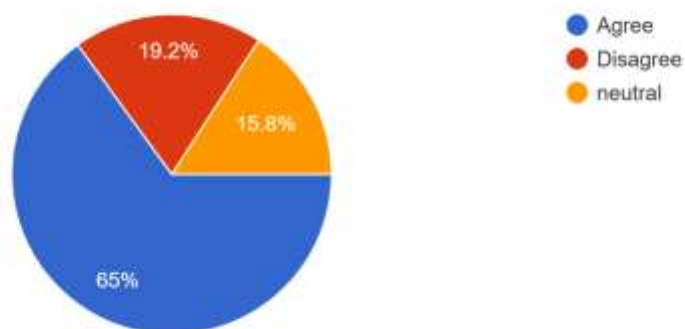


12 of my respondents are higher secondary level qualified, 72 of them are graduates and 36 of them are post graduates.

CHART 6.6

I am aware about the performance appraisal system in my organization

120 responses

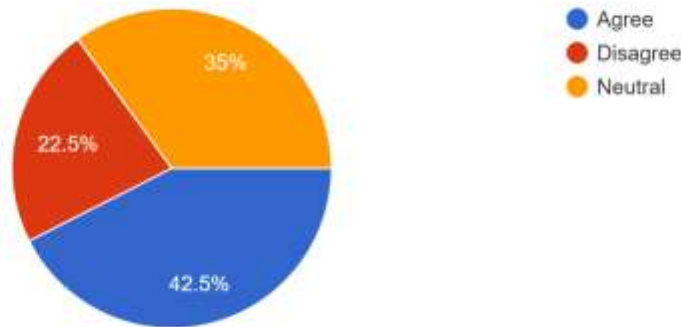


In the above graph only 65% respondents are aware about the PA system in their organization while rest aren't.

CHART 6.7

The current performance appraisal system of the organization is reliable as well as relevant

120 responses

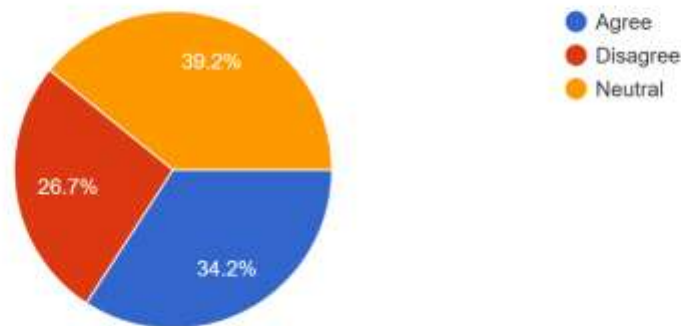


42.4% of the respondents think that the PA system in their organization is relevant while 22.5% don't think that it is relevant.

CHART 6.8

I am satisfied with the way I'm being evaluated and ranked

120 responses

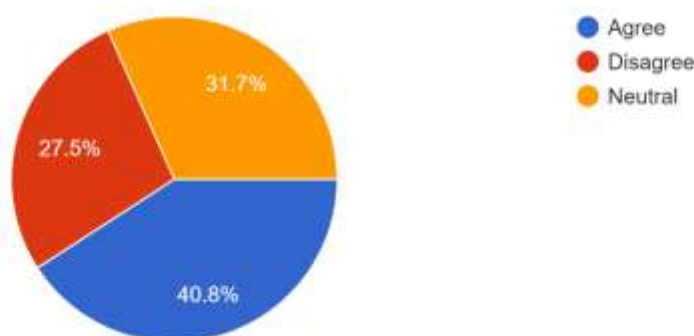


34.2% respondents are happy with the way they are being evaluated as well as ranked in the organization while 39.2% respondents are satisfied and dissatisfied at the same time.

CHART 6.9

The current appraisers are satisfactory

120 responses

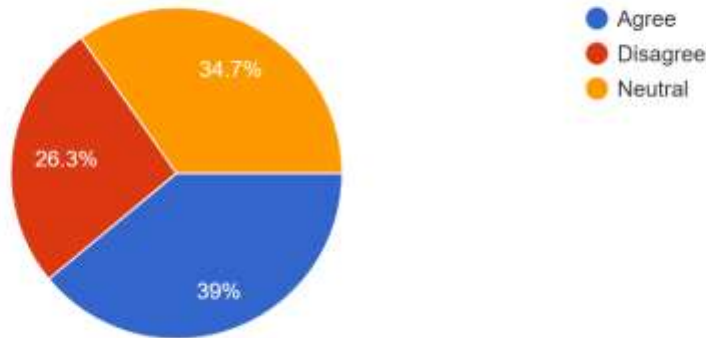


40.8% respondents are satisfied with their appraisers whereas 31.7% respondents are satisfied and dissatisfied at the same time. 27.5% respondents are completely dissatisfied with their appraisers.

CHART 6.10

If appraisal is removed in your organization, do you think performances will be affected

118 responses

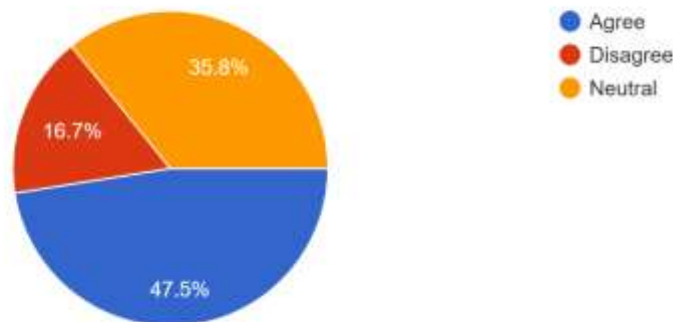


39% of the respondents think that performance can be affected if PA is removed from the organization and only 26.3% respondents disagree to the fact that performance will be affected if PA is removed from their organization.

CHART 6.11

The performance appraisal system has been designed to motivate the employees

120 responses

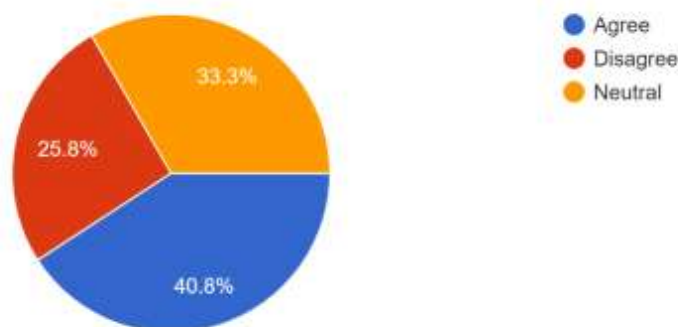


47.5% believe that PA system helps to motivate the employees whereas only 16.7% disagree that PA plays a role in motivating the employees.

CHART 6.12

Performance appraisal system identifies issues related to performance to improve the productivity level

120 responses

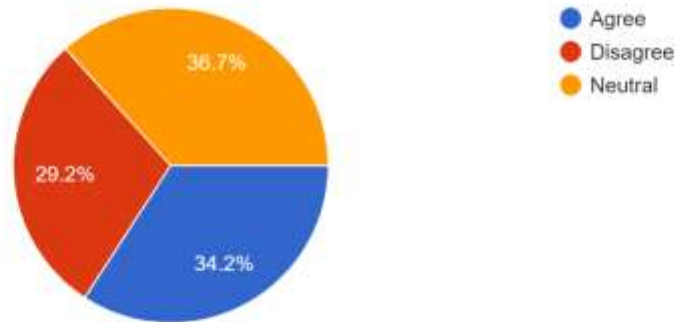


40.8% respondents agree that PA system helps to identify the issues that are related to performance in order to improve the productivity level.

CHART 6.13

Performance appraisal has an impact on my job performance

120 responses

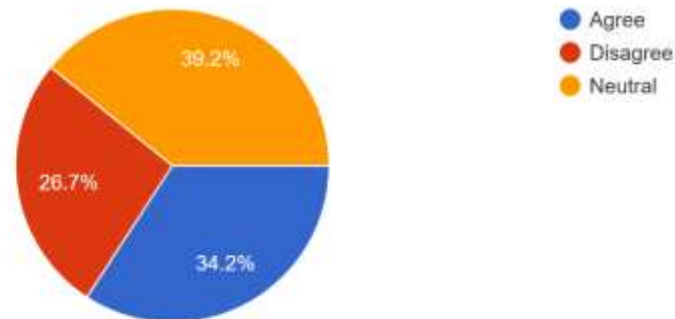


34.2% respondents agree that PA has an impact on their performance and 29.2% believe that PA has no impact on their performance. 36.7% respondents have a neutral opinion regarding this.

CHART 6.14

I am satisfied with my performance ratings

120 responses

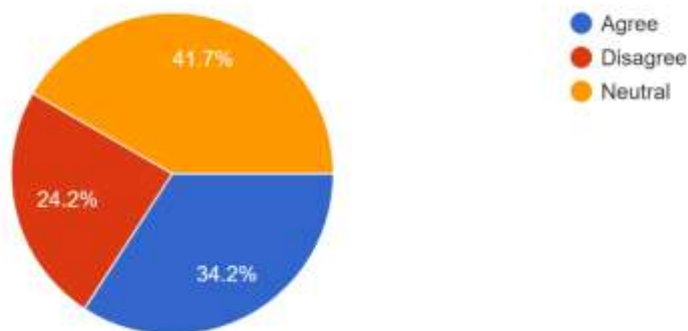


34.2% are satisfied by the way they are being evaluated in their organization whereas 26.7% respondents are dissatisfied by the way they are being evaluated.

CHART 6.15

I am rewarded according to my performance

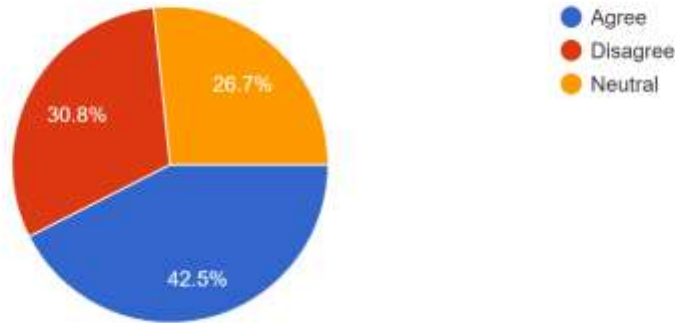
120 responses



34.2% feel that they are being awarded according to their performance whereas 24.2% feel that they aren't being rewarded according to their performance.

CHART 6.16

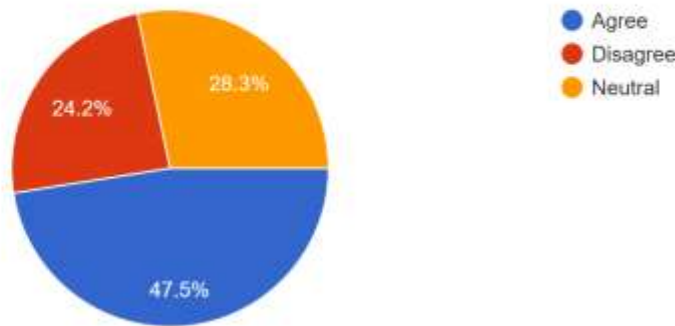
I am satisfied with my job
120 responses



42.5% respondents are satisfied with their job and 30.8% are dissatisfied with their jobs.

CHART 6.17

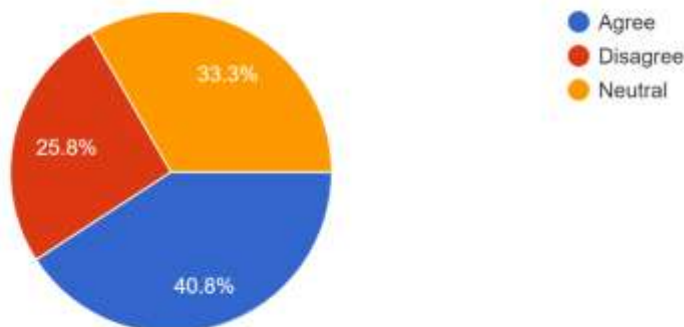
I feel a sense of belongingness with the organization
120 responses



47.5% have a sense of belongingness with the organization and 24.2% don't.

CHART 6.18

Performance appraisal system identifies issues related to performance to improve the productivity level
120 responses



Satisfaction with performance ratings is a dependent factor as its dependence upon the gender of the respondents.

TABLE 2: SUMMARY OUTPUT

| Regression Statistics | | | | | | | | |
|-----------------------|--------------|----------------|----------|----------|----------------|-----------|-------------|-------------|
| Multiple R | 0.271957 | | | | | | | |
| R Square | 0.073961 | | | | | | | |
| Adjusted R Square | 0.066046 | | | | | | | |
| Standard Error | 0.795565 | | | | | | | |
| Observations | 120 | | | | | | | |
| ANOVA | | | | | | | | |
| | df | SS | MS | F | Significance F | | | |
| Regression | 1 | 5.91438 | 5.91438 | 9.344547 | 0.002772 | | | |
| Residual | 118 | 74.05201 | 0.632923 | | | | | |
| Total | 119 | 79.96639 | | | | | | |
| | Coefficients | Standard Error | t Stat | P-value | Lower 95% | Upper 95% | Lower 95.0% | Upper 95.0% |
| Intercept | 1.176936 | 0.228945 | 5.140703 | 1.11E-06 | 0.723523 | 1.630349 | 0.723523 | 1.630349 |
| 2 | 0.446015 | 0.145905 | 3.056885 | 0.27716 | 0.157058 | 0.734972 | 0.157058 | 0.734972 |

The variability in the first table shows that the value of satisfaction is due to several factors out of which 7.39% is contributed by gender. The strength of the relationship is not strong between satisfaction level and gender.

As we can see in the second table the result is insignificant as far as statistics is concerned as p value is more than the significance level

Motivation due to PA system is a dependent factor as its dependence upon the occupational sector of the respondents.

TABLE 3: SUMMARY OUTPUT

| Regression Statistics | | | | | | | | |
|-----------------------|--------------|----------------|-------------|-------------|----------------|------------|-------------|-------------|
| Multiple R | 0.168259 | | | | | | | |
| R Square | 0.061963 | | | | | | | |
| Adjusted R Square | 0.043962 | | | | | | | |
| Standard Error | 0.883501 | | | | | | | |
| Observations | 120 | | | | | | | |
| ANOVA | | | | | | | | |
| | df | SS | MS | F | Significance F | | | |
| Regression | 1 | 7.021244886 | 7.021244886 | 8.994979834 | 0.003313541 | | | |
| Residual | 118 | 90.54655172 | 0.780573722 | | | | | |
| Total | 119 | 97.56779661 | | | | | | |
| | Coefficients | Standard Error | t Stat | P-value | Lower 95% | Upper 95% | Lower 95.0% | Upper 95.0% |
| Intercept | 1.162069 | 0.255922675 | 4.540703414 | 1.37976E-05 | 0.65518186 | 1.66895607 | 0.65518186 | 1.6689561 |
| sector | 0.487931 | 0.162689058 | 2.999163189 | 0.003313541 | 0.165704856 | 0.81015721 | 0.16570486 | 0.8101572 |

The variability in the first table shows that the value of satisfaction is due to several factors out of which 6.19% is contributed by gender. The strength of the relationship is not strong between motivation due to PA and occupational sector.

As we can see in the second table the result is insignificant as far as statistics is concerned as p value is more than the significance level.

FINDINGS, IMPLICATIONS AND FUTURE RESEARCH DIRECTION

The research shows how performance appraisal effects the productivity of employees. The findings according to certain researchers are as follows:

- There is a relation between PA system and motivation. Performance at work can be improved with the help of PA system. Assessment of performance at regular intervals can lead to the motivation of employees.
- That the assessment led to improved productivity in the employee’s performance. The results also indicated that the chances of productivity being repeated are high when good performance is recognized as well as rewarded and employees can also be rewarded when they meet the desired targets.
- PA even helps to assess the behavior as well as attitude of the employee towards the organization that they are working in
- When employees participate in the PA system of their organization then it usually results in job satisfaction as well as improved employee performance. Many respondents preferred PA policy to be used for career pathing as well.
- Organizational commitment of employees decreases to a level who receive negative feedback and low rating from their appraisers, similarly organizational commitment of employees increases to a level who receive positive feedback and high rating from their appraisers.
- Organizations should ensure that performance assessment is undertaken effectively since it is an important part of human resource areas which also contributes to high employee engagement among the employees of that organization.
- Reward and programs etc. influence employee engagement to a level which in turn has a positive influence on the finances of the company.
- If PA is conducted in a proper manner in an organization then there are chances that the service quality provided by the employees will improve. The study suggested that there is a positive correlation between PA and the service quality which will eventually lead to higher customer satisfaction. Therefore, there is a positive effect between PA and customer satisfaction.
- The findings from the research papers that we referred to showed how PA has an effect on the satisfaction and also the motivation level of employees due to which their productivity level is affected. Most of the research papers that were reviewed showed a positive impact between performance appraisal and employee productivity. There were quite few papers probably one or two papers that showed the negative impact performance appraisal has on employee productivity.
- In the above data analysis, we have tried to find out whether Satisfaction with performance ratings is dependent upon the gender of the respondents. The results stated that the strength of the relationship is not strong between satisfaction level and gender.
- Further we have tried to find out whether Motivation due to PA system is dependent upon the occupational sector of the respondents. The results stated that here also the strength of the relationship is not strong between motivation level and the organizational sector.

- As seen in the research paper only 120 respondents were taken due to which we may not be able to get the desired results as 120 respondents is nothing compared to the population which is in billions. So, the future researcher can take up more respondents in order to reach a generalized result. He/she can also try to apply some other tools such as correlation and also can use some other software if they are not comfortable with excel so that they can have a clear view of the difference that occurs in the result. Due to the restriction for the number of words to be used it was difficult to include everything, so the future researcher must take care of this from the very beginning.

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**EMPIRICAL INVESTIGATION: POWER CONSUMPTION DURING CORONAVIRUS (COVID-19) PANDEMIC
OUTBREAK WITH REFERENCE TO RESIDENTIAL SOCIETY**

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ABSTRACT

The Coronavirus COVID-19 was declared as a global pandemic and a public health emergency in January 2020. Lockdown was imposed all around the world. Lockdown was imposed on India nationwide for the first time on 25th March 2020. This lockdown forced many people to confine themselves to their apartments and houses, and to abandon their offices or workplaces, as they were allowed to work from home or they were laid off. Due to this the power sector was affected significantly. There were huge changes in the various sectors such as industrial, financial, agricultural, and residential. Some of the changes are load curve changes, demand and supply management, etc., specifically in the residential sector. This article attempts a study to find out the changes that have happened in the residential sector, through a questionnaire that has collected data from two hundred and twelve (212) respondents all over India during this lockdown using convenience sampling. Simple percentage analysis was incorporated along linear regression model and Analysis of Variance were applied to prove the impact of pandemic on energy consumption. The outputs obtained from these analyses were used to carry out the objective of the study.

KEYWORDS

COVID-19, pandemic, power consumption, residential sector.

JEL CODES

L94, Q54.

1. INTRODUCTION

As COVID-19 sweeps through the whole world, the electricity sector was deeply affected and faced with great challenges. Since governments around the globe executed several lockdown restrictions, electricity demand has dropped sharply while the load composition and daily load profile have also changed. The operation and control of the power system are affected by the change of load pattern. Voltage violation issues that are caused by reduced loads are met by the operators. Power stations that are operated by coal-fire and their utilities have run into financial problems. Investment projects are suspended, but long-term investments in the electricity sector and the future transition to renewables are expected to be largely unscathed [1]. Due to the increase in the outbreak of COVID 19, there were several restraints in the economy of the country and it was a reality check for us, as to where we stand as a country in terms of infrastructure and basic necessity services. As a result of the pandemic, electric power demand decreased which impacted a big blow to the electric power sector. There are many challenges yet to come for the sustainability of this sector in the future [2]. The energy industry needs high fixed costs in daily operations. The energy industry is closely related to daily life, providing electricity, energy, etc. So, the stability of the energy industry is important for the social and economic stability of a country. COVID had a negative impact on the energy industry. The industries were unable to cover up the expenses which resulted in poor corporate performance. A new strategy is much needed for post-pandemic [3]. There is a consistent need for power for households and for the people working from home along with basic health

care services and institutes. The Ministry of Home Affairs filed an Order inter alia giving the details about imposed restrictions. But, they said order provides the essential services with certain exceptions. There is a chance for big financial implication as there is a problem of liquidity [4].

2. LITERATURE REVIEW

The world came to a halt during the COVID-19 pandemic. This includes the business and industry sector also. This was a precautionary measure taken by the government in order to reduce the severity of the coronavirus. Elavarasan et al [5]. discuss the various ways in which power can be produced sustainably. Indian and global scenarios are taken into account and an extensive study has been conducted by Elavarasan et al [5]. using various journals, research papers, and third-party data [5]. Indian energy consumption was highly affected, it was in fact dropping down very quickly during the 1st lockdown and when the lockdown got relaxed and when the months rolled by, the energy consumption was able to recover, this was found out with the help of ARDL (Auto Regressive Distributed Lag) model which was proposed [6]. The IEA (International Energy Agency) observed a decrease in the demand for electricity. The IFC (International Finance Corporation) also observed a drop in the demand. Low oil price was predicted and which in turn will also result in the low price of natural gas that is indexed to oil. The economic activity is likely to pick up as time passes and there will be an increase in demand for industrial and commercial use of electricity [7].

In India the industrial and commercial sector departments utilize an approximate of 52% of electricity, domestic households consume around 24% and the agriculture sector consumes around 18%. Since the beginning of the nationwide lockdown, the daily power demand of India has decreased by 25 to 28% driven essentially by the factory and office shutdown and termination in the industrial and commercial sectors. The price during the lockdown on the platform was averagely approximated at Rs 2.40 per unit with supply bids outstripping the demand at the exchange. Confederation of Indian Industry (CII) has now proposed prolonging the debt servicing ban from three to six months, enhancing credit to the generators by Coal India for 30 to 45 days for coal extraction, and allowing deferment of payments of indirect taxes such as coal cess and electricity duty in order to ensure liquidity in the sector by minimizing the outflow of cash [8]. There are both harmful and positive effects of COVID outbreak to the environment, the renewable energy was also affected by this. There was a decrease in energy demand and the same goes for solar energy too. Environmental pollution decreased, but at the same time, it took a huge toll on the renewable energy sector which also prevented the investors from investing their money in this sector [9]. Numerous industries were affected by the COVID outbreak and the renewable energy sector is one of them. It was plummeting mainly because India imports most of the raw materials from China, which was highly affected by the virus during the initial days of lockdown, and the Indian law banned import and export from outside India. But it is relieving to know that our nation is leading the solar energy sector. But to gain an absolute advantage, we must get independent in terms of raw materials and should be able to solve internal problems that arise [10]. COVID has resulted in an increase in pollution and limitation in waste management. It also led to higher unemployment and poverty. The world energy demand declined so much in the first quarter of 2020 even though the demand for residential energy was increasing and the natural gas demand was decreasing. The impact of COVID on the environment, socio-economic issues, and energy sector were addressed [11]. Prices get decreased in the market, the power demand is very low and the last option available for us is to see if the costs are within the limits to ensure viability of operation. Improvement in the financial health of Distribution Company (discoms), availability of fuel at basic price to generators, restructuring of the power plants that have been impacted with debts, and purchase agreements for medium and long term power in the sector can help in reviving the power sector. It will take time for renewable energy to be used by the common public by taking into accounts the economic availability. Till then, coal will be our main source of fuel. Studies show that India's power consumption is going to increase gradually by the next decade [12].

Due to the COVID-19 pandemic, the companies, industries and governments are forced to make difficult choices between balancing citizen's safety and their economic sustenance. Firstly, the industry has to be ready for the post-COVID situation and plan accordingly. Secondly, the industry is going to come under unprecedented and novel scrutiny for its social and environmental, and governance criteria. Thirdly, this will be a great opportunity to establish how solar, hydro-power and wind coalesce together. Now is the time to showcase the great coordination through these hybrid focused projects such as pumped storage with wind or solar power and solar photovoltaic. Concurrently, these projects would establish to the world that the hydropower is the future and it can also be helpful in changing the climatic and economic environment. The role of the International Hydropower Association's (IHA) is to advance sustainable hydropower. The IHA is a cosmopolitan organization which strives to enhance the hydropower's image [13]. Kanitkar et al. [14] proposed a linear input output mode framework to determine the financial losses during the COVID-19 pandemic in India. The loss in the Indian economy and future losses in GDP has also been discussed. There was a huge fluctuation in the power demand during the pandemic. Economy wide influence of the energy and power sector was also explored. Due to this, the level of carbon emissions was also altered [14]. There was an increase in the consumption of electricity in the lockdown period as compared to the pre-lockdown period. As people spend more time at home, it is expected that residential electricity consumption will increase. An increase in summer temperatures and people spending more time at home during lockdown are the factors that contribute to an increase in residential electricity consumption. The magnitude of the increment varies with region and ownership of air-conditioners (AC) [15].

Discom dues have soared and overdue payments are increased during this lockdown period. In order to help power distribution companies, the Centre has rolled out a relief program to pay their dues to generators (gencos). By the end of the current fiscal year, it is said that these losses will increase even further due to lower demand [16]. Whilst the short-term impacts include significant reductions in the consumption of petroleum products by 20-30%, aviation turbine fuels being on the higher side at 30%, and the range of road transport fuels being on the lower side. In terms of electricity generation, the drop-in demand has impacted the coal generation the most, comparing the three weeks preceding the lockdown 25% drop in coal production has been seen contrasting to the increase of 9 to 11% with renewables and hydroelectricity. This in turn resulted in slight "greening" of electric supply with CO₂ emissions falling by 25% during the period on a per-unit basis. On the other hand, as the long-term effects of coronavirus are still unknown, a few impacts look likely. An economic impact instigated by coronavirus resulting in recession. If the government has to meet its ambitious 450GW of renewables then measures have to be taken to provide sufficient capital. An impact already seen as a 3GW solar project is delayed due to the trade restrictions of goods from China. The outbreak and lockdown undoubtedly represent a significant shock to India's energy system [17]. Houston - a new study indicates that by the end of 2025 COVID-19 crisis would likely diminish electricity usage by 65.2 TWh to 158.8 TWh or 1.6% to 4% reducing the need for baseload generation by 28 GW. The report projects that by the end of 2025, COVID-19 will have decreased annual power demand by 4 TWh to 47TWh in offices, by 111 to 193 TWh in the retail sector, and between zero and 33 TWh in the hospitality sector [18].

When we look at New York and Houston, the night sky light has so much of contrast when we compare it before and after Covid-19. In the case of Manhattan, the night city light was dimmed by 40% from the month February to April. Key finding mobility was proved to be a strong indicator of changes in electricity consumption from this research [19]. As Covid got widespread in African countries, they suffered a lot due to no access to reliable health systems and modern electricity. This made the African government head towards renewable energy sources for electricity. This pandemic added challenges to already existing challenges for electricity in Africa. The pandemic also helped them in knowing the importance of the reinforcement of sustainable energy sources. Covid definitely had a positive impact on the energy sector in Africa [20]. The energy sector was affected the most out of all sectors during the corona pandemic. Oil production and the fall and rise in demand for oil were discussed. A worldwide analysis based on oil was given such as which country had the upper hand and which country had the lower hand during the economic crisis. Since the investment/finance sector is also closely related to the energy sector, the finance sector also had a dramatic fall. Renewable energy was most welcomed during this time and they had a substantial development during the pandemic [21]. To reduce the severity of the coronavirus various countries initiated a lockdown. Similarly, India also had established a nationwide full lockdown. Due to this lockdown, there was a rise and drop in power demand in various sectors. Using artificial neural networks (ANN), machine learning algorithms, and electric load forecasting the electric consumption of Haryana is observed for a week and analyzed. ANN proved to have better prediction analysis compared to machine learning [22]. An assessment of the current economic situation is required at the high spatial granularity and in real-time to mitigate the economic impact while lessening the possibilities of transmission. A consumption model is designed and it is compared to the energy consumption and it explains 90% of the variation during normal times. All union territories and states have been affected differently, some suffered more damage than the others and in terms of electrical consumption some states doubled their consumption whereas some halved their consumption. This is due to the prevalence of COVID-19 infections, the share of manufacturing, and return migration [23].

The lockdown measures have caused a drop in the electricity demand in the countries affected by the pandemic resulting in a cut down of 25% energy demand per week in areas having full lockdown, -18% per week in areas having partial lockdown having a total impact of -6% energy demand worldwide. Lockdown has

also led to an increase in renewable energy by 10% and a decrease in nuclear energy by 28%, coal by 55%, gas by 35% including the cross-border exchanges in Germany, France, Italy, Spain when compared to the previous year [24]. Even before the COVID pandemic, India needed many necessary reforms on regulation, pricing, market design, and risk allocation. The load curves were affected at a large scale due to the shift in the behavioural pattern, such as work from home. The peak demand became lower by 25% due to the shutdown of many factories and industries and DISCOM (distribution companies) due to the pandemic lockdown across the country. This caused a major structural change in the Indian power system. If the planned reforms were implemented it would greatly improve the flexibility of the Indian electricity system [25]. The COVID pandemic has affected many countries and has made a major impact on every household all around the world. The lockdown that was mandatorily imposed upon the country's civilians to not leave their buildings has resulted in the rise of higher energy usage. This had led to a scarcity in energy supply. S.S.Qarnain et al., has identified all the factors that are responsible for the spike in energy consumption and tries to optimize the energy consumption. They used various approaches like a Multiple Criteria Decision Making (MCDM) methodologies based on Best Worst Method (BWM) and a Decision-Making Trial and Evaluation Laboratory (DEMATEL) methodology [26]. It is found that the banking sector has been affected deeply due to the COVID pandemic. It is also said that the electricity, supply, demand, and the power sector have contributed a significant amount to the CO₂ emissions during this pandemic lockdown. This paper analyses how the banking sector was affected during the pandemic and how has the power sector affected the banking sector [27].

During the pandemic, the commercial and industrial loads were shut down. As a result, the grid was also experiencing a sudden fall in the power demand. The sudden decrease in load demand had a major impact in the power sector in terms of reactive power management, voltage stability, reactive power management, and voltage security. The rise in electricity demand was also observed as the lockdown rules were gradually lifted. The COVID-19 pandemic had a significant impact on the Indian power system [28]. This paper discusses the mid to long-range impacts of the pandemic lockdown in the power sector. An extensive study was conducted and despite these studies, the pandemic has raised more questions regarding the future of the power system sector, like how the renewable energy sources will be integrated with the power systems and how the pandemic has affected this project. The main challenges faced by the power system sector during this pandemic have been addressed in this paper. Some of the problems are frequency deviation, electricity demand, and generation and load forecasting [29]. The impact of lockdown due to COVID on different aspects of environment widely in Indian background has been surveyed in this paper. Some future possible scenarios have also been analysed. The electricity demand decreased during the COVID lockdown. The rudiments like deforestation, adapting to renewable energy has been modified, although the investments regarding the setting up of renewable energy will be postponed for a short period of time [30].

Sustainability in energy is incorporated in order to get broader access in electricity, improvement in the efficiency of energy with low carbon renewables, and happen to get greater financing in cleaner technology. Wind, solar, hydropower, geothermal, ocean power and bio energy are the various types of renewable energy. Renewables are highly competitive with traditionally used energy sources. The share of renewable energy sources has risen drastically in the cooling, electricity, heating and transport sectors. Volatile and high energy rates and prices and the political geographic debate related to fossil fuels use will enhance the market accessibility and development for renewable energy by various governments. The whole world's interest towards sustainable development has increased and renewable energy consumption has also increased in recent times. The change from non-renewable to renewable energy is very much visible in China, Korea, Denmark, Bulgaria, Czech Republic, Greece, Netherlands, Portugal and Poland. In most of the countries, unemployment is reduced in the society which in turn affects the economy of the country positively. But it also had a negative impact in the these countries:- India (0.118), the United States (0.072), Israel (0.061), Ukraine (0.162) [31]. Manufacturing industry, which contributes almost 20% of the GDP, was adversely affected due to the outbreak of Coronavirus. The heinous effects of covid-19 on foreign direct investment (FDI) investments are foreseen to be peak in the energy, automotive, and airline industries. Due to the corona pandemic all around the world, the automobile, electronics, chemical and aircraft industries faced the scarcity of raw materials. After the lift of restrictions, the market is contemplated to be extremely cash-constricted and tight. This is because of the utmost qualms with respect to the need for the products of Ministry of Micro, Small and Medium Enterprises (MSME) or/and capability to provide the products to the market and resulting low or non-existing business income at the same time the expenses for energy, labour, rent and other business inputs will be facing the brunt [32].

The increased fossil fuel resources for power generation has led to greenhouse gas emissions and resulted in climate change. NAPCC (National Action Plan on Climate Change) works on climate change and its effects actively. Focus on solar, wind, and biogas energy production should be more in order to reduce our dependence on fossil fuel resources which will, in turn, decrease greenhouse gas emissions. The study by NAPCC has said that there is a considerable amount of contribution from the renewable energy side for power generation [33]. Due to the change in the lifestyle of people during the pandemic, there is a significant fluctuation in the energy consumption of both households and corporates. Due to the imbalance in the generation side and the consumer side, an idea for investing in oil developments has arisen. The cleaner generation always had an upper hand, but it increased very much since the demand got low. There is a focus on decreasing Carbon emission and decarbonized environment [34]. As the government imposed the lockdown there will be an adverse impact on all India electricity demand, where demand is expected to decline on a year-on-year basis during the lockdown period. Following the lockdown implemented by the Government of India, renewable power projects in solar segment are expected to face execution delays because of disruption in supply chain in India and labour availability [35]

3. RESEARCH METHODOLOGY

3.1. OBJECTIVES

1. To find out the impact of COVID 19 on electricity consumption at residential sector.
2. To measure the influence of demographic profile on the electricity consumption.

3.2. METHODOLOGY

The methodology incorporated for this study is descriptive research design. The primary data has been collected using a questionnaire and secondary data also used from various internet sources, journals and articles. The questionnaire prepared was aimed to identify characteristics, trends and frequencies. Due to pandemic situation the questionnaire was circulated using google forms collected data from two hundred and twelve (212) respondents all over India using convenience sampling. This ensures that the research carried out and the data obtained would be valid and reliable. Simple percentage data analysis was carried out using Microsoft Excel and MATLAB software was used to conduct regression and ANOVA data analysis. The results are presented and discussed.

4. DATA ANALYSIS AND INTERPRETATION

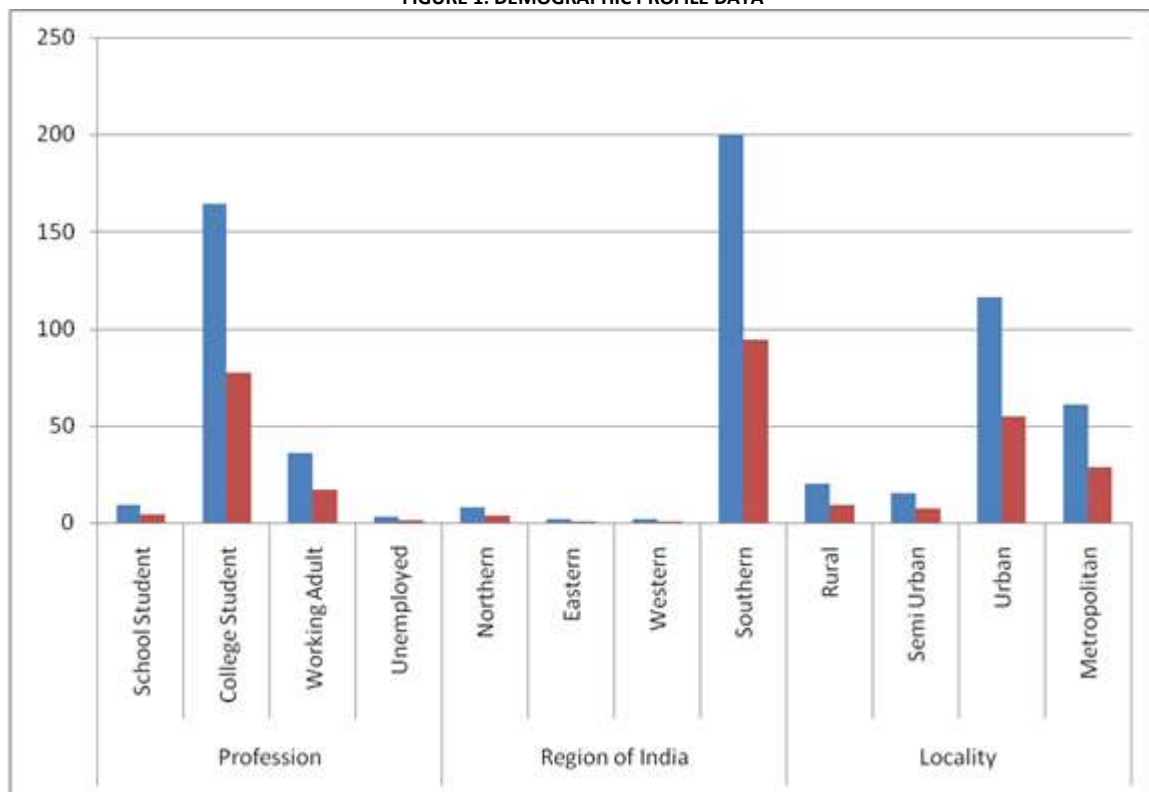
The data used in this study is collected using a pretested questionnaire from 212 respondents.

TABLE 1: DEMOGRAPHIC PROFILE

| Particulars | Classification | No. of. Respondents | Percentage |
|-----------------|-----------------|---------------------|------------|
| Profession | School Student | 9 | 4.2 |
| | College Student | 164 | 77.4 |
| | Working Adult | 36 | 17 |
| | Unemployed | 3 | 1.4 |
| Region of India | Northern | 8 | 3.8 |
| | Eastern | 2 | 0.9 |
| | Western | 2 | 0.9 |
| | Southern | 200 | 94.3 |
| Locality | Rural | 20 | 9.4 |
| | Semi Urban | 15 | 7.1 |
| | Urban | 116 | 54.7 |
| | Metropolitan | 61 | 28.8 |

Source: Primary data

FIGURE 1: DEMOGRAPHIC PROFILE DATA



Source: Primary data

Inference

From Table 1 and Figure 1, we can conclude that most of our respondents are college students (77.4%), majority of the respondents are from the southern sector of India (94.3%) and most of the respondents are also from urban (54.7%).

TABLE 2: PERCENTAGE ANALYSIS OF QUESTIONNAIRE

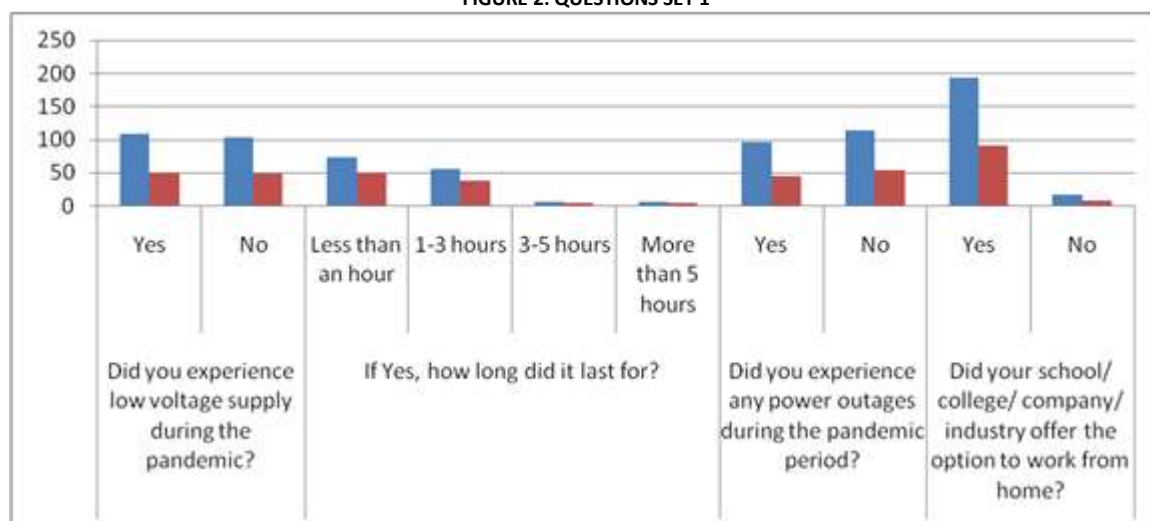
| Particulars | Options | No. of. Respondents | Percentage |
|---|---------------------|---------------------|-------------|
| Did you experience low voltage supply during the pandemic? | Yes | 109 | 51.4 |
| | No | 103 | 48.6 |
| If Yes, how long did it last for? | Less than an hour | 74 | 51.4 |
| | 1-3 hours | 56 | 38.9 |
| | 3-5 hours | 7 | 4.9 |
| | More than 5 hours | 7 | 4.9 |
| Did you experience any power outages during the pandemic period? | Yes | 97 | 45.8 |
| | No | 115 | 54.2 |
| Did your school/ college/ company/ industry offer the option to work from home? | Yes | 194 | 91.5 |
| | No | 18 | 8.5 |
| If yes, what was your comfort level studying/working from home on a scale of 1 to 5? | 1-least comfortable | 32 | 15.8 |
| | 2 | 32 | 15.8 |
| | 3 | 71 | 35.1 |
| | 4 | 34 | 16.8 |
| | 5-most comfortable | 33 | 16.3 |
| If no, did your company/ industry face power outages which gave some technical issues? | Yes | 58 | 37.7 |
| | No | 35 | 22.7 |
| | Not sure | 61 | 39.6 |
| Did the power fluctuation affect the efficiency of your work in your respective fields? | 1-least efficient | 32 | 15.1 |
| | 2 | 27 | 12.7 |
| | 3 | 83 | 39.2 |
| | 4 | 37 | 17.5 |
| | 5-most efficient | 33 | 15.6 |
| How often do you charge your gadgets? | Once a day | 54 | 25.5 |
| | Twice a day | 82 | 38.7 |
| | More than twice | 76 | 35.8 |
| How many rooms does your home have? | 2 | 46 | 21.7 |
| | 3 | 76 | 35.8 |
| | More than 4 | 90 | 42.5 |
| How many large essential appliances you have in your home? | Fridge | 68 | 32.1 |
| | Washing machine | 56 | 26.4 |
| | TV | 70 | 33 |
| | More than 3 | 168 | 79.2 |

| | | | |
|---|---------------------|-----|-------------|
| How many units of power have you consumed per month before the pandemic? | Less than 400 units | 47 | 22.2 |
| | 400 units | 25 | 11.8 |
| | 500 units | 37 | 17.5 |
| | More than 500units | 24 | 11.3 |
| | Not sure | 79 | 37.3 |
| How many units of power have you consumed per month during the pandemic? | Less than 400 units | 23 | 10.8 |
| | 400 units | 25 | 11.8 |
| | 500 units | 22 | 10.4 |
| | More than 500units | 54 | 25.5 |
| | Not sure | 88 | 41.5 |
| Did you notice any difference in your electricity bill before and after COVID-19? | Yes | 145 | 68.4 |
| | No | 29 | 13.7 |
| | Not sure | 38 | 17.9 |
| If yes, was there a spike in your electricity consumption? | Yes | 147 | 80.3 |
| | No | 36 | 19.7 |
| During this traumatic pandemic experience, did you feel the need of self-sustaining power sources like solar power or hydroelectricity? | Yes | 140 | 66 |
| | No | 30 | 14.2 |
| | Not sure | 42 | 19.8 |
| Did you have any alternate power supply during the pandemic? | Yes | 73 | 34.4 |
| | No | 139 | 65.6 |
| If yes, how did you fuel that power supply? | Battery | 69 | 32.5 |
| | Diesel | 13 | 6.1 |
| | Solar power | 17 | 8 |
| | N/A | 113 | 53.3 |
| Were you able to receive subsidies given by the government in order to reduce the electricity bill? | Yes | 31 | 14.6 |
| | No | 100 | 47.2 |
| | Not sure | 81 | 38.2 |
| Do you think that there was an imbalance in the energy sector during the pandemic? | Yes | 94 | 44.3 |
| | No | 31 | 14.6 |
| | Not sure | 87 | 41 |
| Do you think that the power demand was met? | Yes | 122 | 61.9 |
| | No | 75 | 38.1 |
| What are the sectors that you think were the most affected by the imbalance in energy/power sector? | Agricultural | 127 | 59.9 |
| | Financial | 69 | 32.5 |
| | Industrial | 130 | 61.3 |
| | Residential | 73 | 34.4 |

Source: Primary data

Table 2, depicts the percentage analysis of the questionnaire. It is explained below in the form of bar graphs.

FIGURE 2: QUESTIONS SET 1

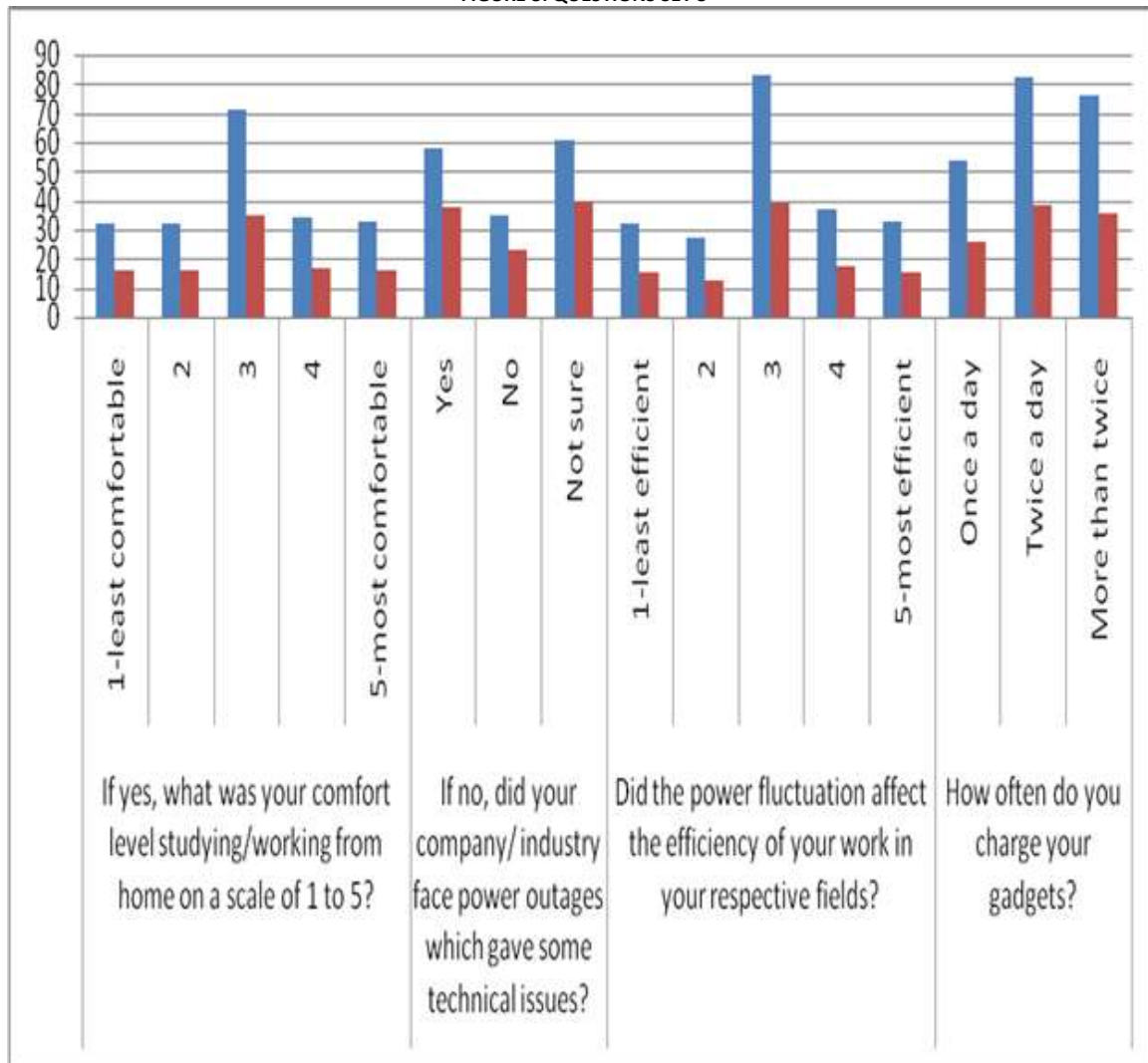


Source: Primary data

Inference

From the above chart, Figure 2 we can infer that 51.4% of the respondents have agreed that they have experienced a low voltage supply during the pandemic. 51.4% of the respondents have also answered that the low voltage supply lasted for only less than an hour. 54.2% of the respondents did not experience any power outages during the pandemic, indicating there was uninterrupted power supply for more than half of the respondents. 91.5% of the respondents were offered online mode of study or work from home option for safety purposes, this can indicate the increased consumption of electricity in the residential sector.

FIGURE 3: QUESTIONS SET 3

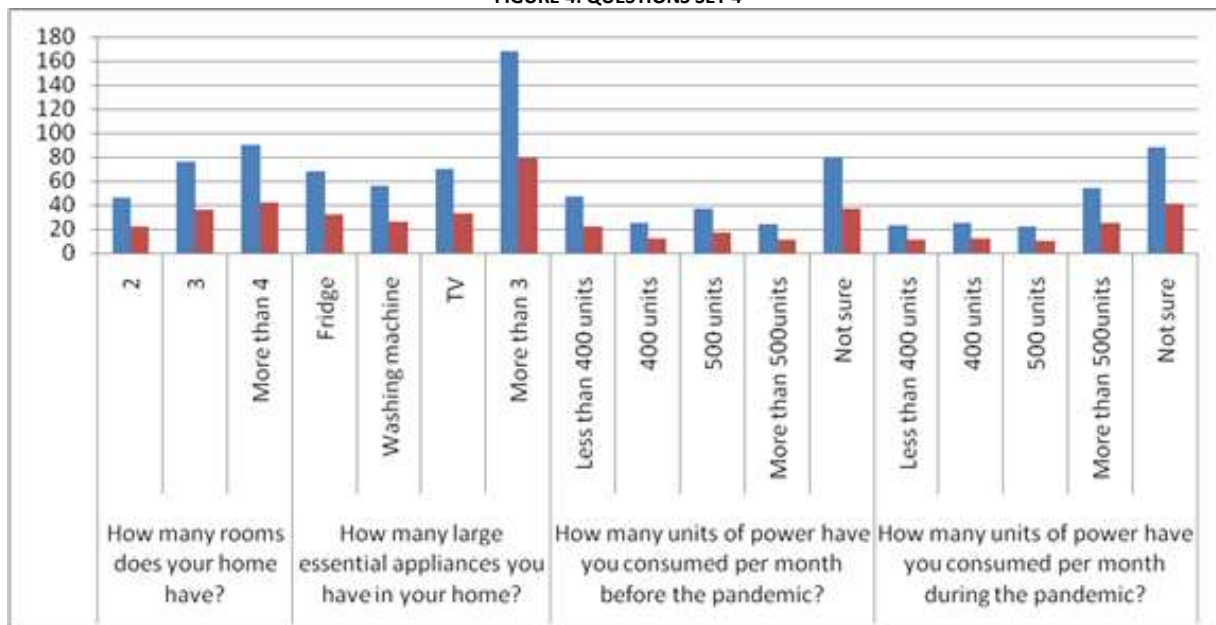


Source: Primary data

Inference

From the above, Figure 3 chart we can infer that 35.1% of the respondents have indicated that their comfort level during work from home or online classes was similar to their day to day life before the pandemic. 37.7% of the respondents stated that they faced technical issues due to power outages in their company. 39.2% of the respondents felt that the power fluctuation did not affect their efficiency in their respective workplaces. 38.7% of respondents have said that they charge their gadgets twice a day.

FIGURE 4: QUESTIONS SET 4

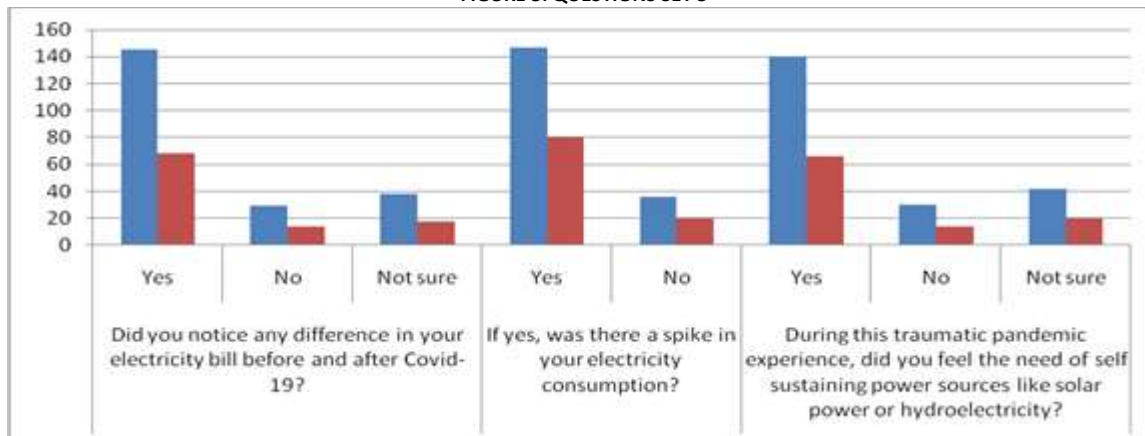


Source: Primary data

Inference

From the above chart, Figure 4 we can infer that 42.5% of the respondents have more than 4 rooms in their home. 79.2% of the respondents have more than 3 large essential appliances in their home. 22.2% of the respondents consumed less than 400 units of power before the pandemic lockdown. 25.5% of the respondents consumed more than 500 units of power during the pandemic lockdown.

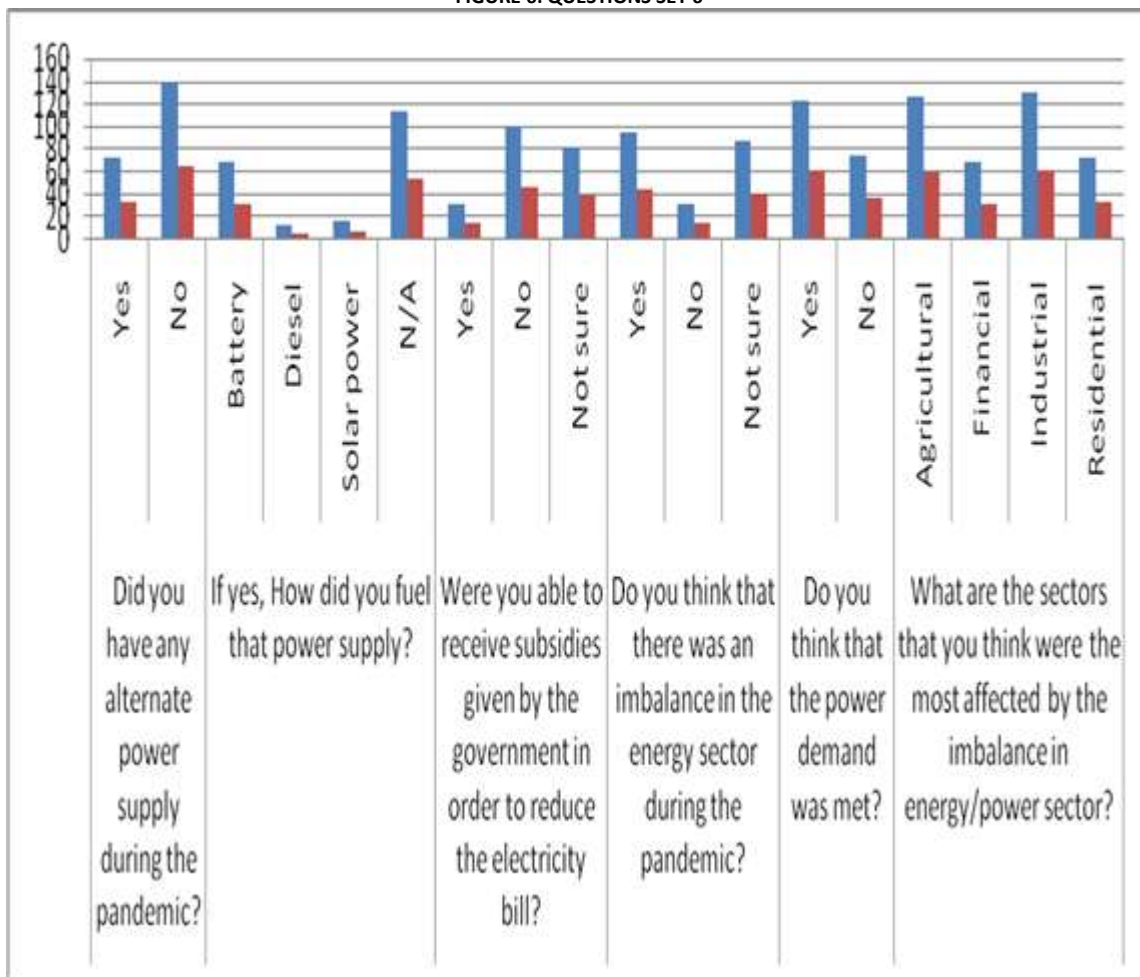
FIGURE 5: QUESTIONS SET 5



Inference

From the above chart, Figure 5 we can infer that 68.4% of the respondents noticed a difference in their electricity bill. 80.3% of the respondents have observed a spike in their electricity consumption. 66% of the respondents felt a need to have self-sustaining power sources during the pandemic lockdown.

FIGURE 6: QUESTIONS SET 6



Source: Primary data

Inference

From the above chart, Figure 6 we can infer that 65.6% of the respondents did not have any alternate power supply during the pandemic lockdown. 47.2% of the respondents said that they were not able to receive any subsidies from the government during the lockdown, this indicates that India suffered economically since the government had denied the subsidies due to safety measures. 44.3% of the respondents thought that there was an imbalance in the energy sector during the pandemic although 61.9% of the respondents thought the power demand was met. We can also infer that agricultural and industrial sector were the most affected sector in this pandemic.

5. RESULTS AND DISCUSSION

A linear regression fit model is incorporated using MATLAB software for the data obtained and the calculations and results are presented.

TABLE 3: ESTIMATED COEFFICIENTS

| | Estimate | SE | tStat | pValue |
|------------------------------|-----------|----------|-----------|------------|
| Intercept | 264.2 | 37.137 | 7.1141 | 1.8071e-11 |
| Gadget | -0.090877 | 6.7339 | -0.013495 | 0.98925 |
| Rooms | -11.327 | 7.079 | -1.6001 | 0.11111 |
| Appliances | 14.655 | 5.9063 | 2.4812 | 0.01389 |
| Units before pandemic | 0.50556 | 0.057851 | 8.739 | 8.0712e-16 |
| Powernew = 440.3227 494.1158 | | | | |

Source: Primary data

A linear regression model is implemented for these data values and the units of electric power consumed during the pandemic lockdown is predicted using four input parameters. Powernew is the predicted output. As seen in Table 3, we can see that the predicted output is within range (i.e, 200-600).

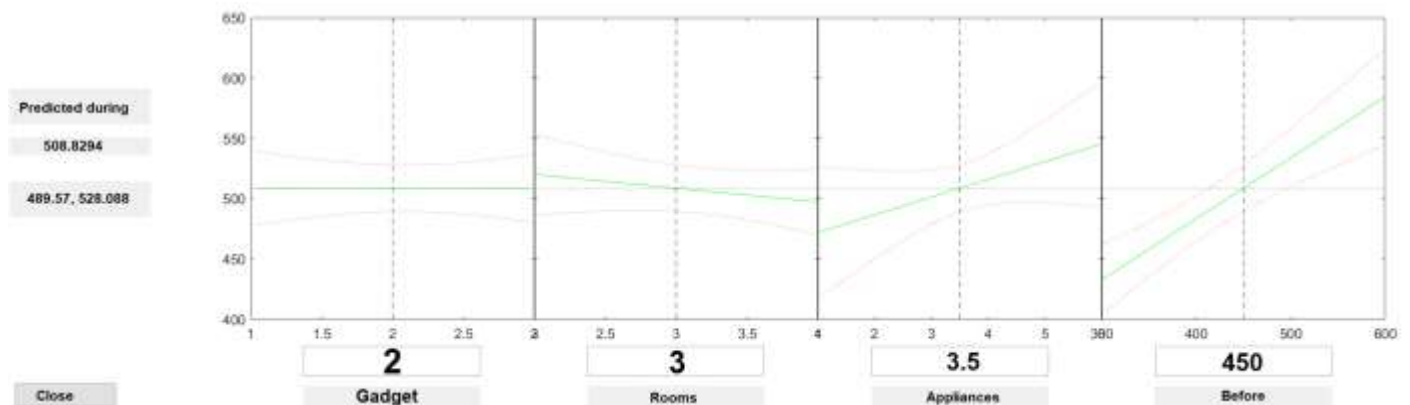
TABLE 4: ANOVA TABLE 1

| | SumSq | DF | MeanSq | F | pValue |
|-----------------------|------------|-----|------------|------------|------------|
| Gadget | 1.0455 | 1 | 1.0455 | 0.00018213 | 0.98925 |
| Rooms | 14697 | 1 | 14697 | 2.5602 | 0.11111 |
| Appliances | 35341 | 1 | 35341 | 6.1564 | 0.01389 |
| Units before pandemic | 4.3841e+05 | 1 | 4.3841e+05 | 76.37 | 8.0712e-16 |
| Error | 1.1883e+06 | 207 | 5740.5 | | |

Source: Primary data

ANOVA is implemented and the results are presented, as shown in Table 4.

FIGURE 7: PREDICTION SLICE GRAPH



Source: Primary data

The prediction slice graph is shown in Figure 7.

ANOVA

Ho: There is no significant difference between the location and electricity consumption.

H1: There is a significant difference between the location and electricity consumption.

TABLE 5: ANOVA TABLE 2

| Location and Electricity Consumption | F | P value (Sig.) | Results |
|---|-------|----------------|-----------------|
| What was your comfort level studying/working from home on a scale of 1 to 5? | .131 | .941 | Not significant |
| Did the power fluctuation affect the efficiency of your work in your respective fields? | 2.842 | .040 | Significant |

Source: Primary data

Inference

From the table 5 it is inferred that the p value is more than table value at 5% level of significance in case of comfort level studying/working from home on a scale of 1 to 5. The null hypothesis is accepted. Therefore, it is inferred that there is no significant difference between location and comfort level. However, the p value is less than table value at 5% level of significance in case of power fluctuation affects the efficiency of your work in your respective fields. The null hypothesis is rejected. Hence there is significant difference between location and power fluctuation affect the efficiency of your work in your respective fields.

6. CONCLUSION

The study shows that there was an increase in electricity consumption in the residential sector and a decrease in electricity consumption in the industrial sector. This has caused a change in daily load curves and a fluctuation in the demand and supply curve resulting in the imbalance of the power sector. Although the demand for power was more, it was met by the power sector as they used various methodologies to restrict the losses and novel ideas were implemented to forecast the demand for power during the lockdown. Many renewable energy sources have come into play during this lockdown and it is also predicted by various researchers that renewable energy sources will be a great contributor in the future of power sector.

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