YOGA FOR PROMOTION OF HUMAN HEALTH AND VALUES IN SCHOOL CHILDREN

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ABSTRACT

Yoga is a healthy way of life, originated in India. Now it is believed to be a form of science accepted all over the world. The western culture also is accepting it as a healthy form of scientific exercise. Moreover, along with rising 'physical activity', the real sense of values is found generally missing among today's human society. Yoga works as a tool for Modification of Behaviour, Emotion & Personality. Patanjala Yoga explains the real significance of emotional intelligence by way of complete cessation of modification of mind. Thus, Yoga forms a bridge between body, mind and spirit. Since its practices smoothly coordinate the functions of the bones, muscles, blood, brain etc., the improvement of improve health and fitness is justifiably possible. Moreover, Yoga trains the human mind in such a way so that it helps to modifying proper attitude, behaviour and values.

***Keywords**: Yoga, Human Health, Fitness, School Children, Education.*

Introduction

Today's science and technology although lead towards human excellence contributing more luxurious life with mechanical dependence and material gain with economic prosperity, the ultimate result seems to be social inequality, horrendous wars, atomic devastation, and of late, ecological crisis. Gradually, our society has become the victim of tremendous stress and strain that, in fact, leads towards grave health complications and moral diminutions. In fact, one of the reasons behind such health complication is improper implementation of physical activity that elevates the status of '*physical inactivity*' in our education systems. This, in recent days, causes poor status of health and fitness so that the students are akin to suffers from different health hazards.

Yoga is a healthy way of life, originated in India. Now it is believed to be a form of science accepted all over the world. The western culture also is accepting it as a healthy form of scientific exercise. Although the origin of yoga is obscure, it has a long tradition. In course of time, various schools of yoga developed. The major schools of yoga are Jnana yoga, Bhakti yoga, Karma yoga and Raja yoga. These schools of yoga advocate particular type of methodology which includes a variety of systematised practices of yoga depending on their particular approach. However, all these are leading to the common goal of self realization and integration of body and mind.

Moreover, along with rising *'physical activity'*, ***the real sense of values is found generally missing*** among today's human society. Additionally, in recent days, there is ***no character-based*** education available so far. This, in turn, indicates that the cultivation of values is neglected. As a result, our modern educational system seems to fail to integrate a homeostatic development body, mind and spirit. Therefore, there is a need of yoga for promoting both health related fitness and values.

Relevance of Yoga for enhancing Fitness factors

Every human being requires a good level of ***muscular fitness*** to sit or stand comfortably in every sphere of life. In fact, proper muscular fitness level is essential for maintaining a good

posture so as to prevent postural defects. However, a survey research on Kendriya Vidyalaya students reveals that about 40.3% students ***failed in muscular fitness test*** (Gharote & Ganguly, 1975). Further, different controlled experiments (Gharote, 1976; Gharote, Ganguly & Moorthy, 1976; Moorthy, 1982) indicate that Yoga intervention helps the school children to improve muscular fitness.

Body flexibility depends upon the coordinated function of joints and muscles. Literature reveals that aging reduces flexibility, which in turn causes musculo-skeletal problems by disintegrating the functions of muscles and joints. Such a poor state of flexibility is seen among the urban school children. Various researches indicate that Yoga practices help for significant improvement in flexibility level (Moorthy, 1982; Govindarajulu, Gannadeepam & Bera, 2003).

Coordinated functional ability of heart and lungs signifies the cardiovascular efficiency. Many research reports in developed countries indicate that today's school students are more inclined towards obesity which affects their overall cardiovascular functions. Here we can think of Yoga. The research literature revealed that regular practice of Yoga (both short term and long term) are helpful in improving cardiovascular functions of school students (Ganguly, 1981; Ganguly, 1989; Govindarajulu, Gannadeepam & Bera, 2003; Mishra, Tripathi & Bera, 2003).

Further, body composition is indicative of one's organic functions. For example, excessive body fat indicates improper functioning of one's heart and one becomes hypertensive generally. Kaivalyadhama Laboratory conducted ample of researches in this direction. The findings of our controlled study support that Yoga contributes to reduce excessive body fat not only among school students (Bera & Ganguly, 1990) but also in obese patients (Bera, *et al*., 2003; Gharote, 1977) in increasing body density (Bera, Rajapurkar, Ganguly, 1993). A direct controlled study (Bera, 1993) reveals that Yoga training helps to keep the body composition of school students under control.

A good level of physical fitness does not signify that the person is healthy. Therefore, AAHPERD (*American Alliance of Health, Physical Education, Recreation and Dance*) has developed the concept of "*Health related Fitness."* Our researches on school children have revealed that Yoga practices help not only to improve overall physical fitness (Gharote, 1976a, 1976b, 1979, 1987), but also responsible for better level of "*Health related Fitness"* (Ganguly, Gharote & Bera, 2003).

Relevance of Yoga for inculcating Human Health and Values

After much research, Larry Dossey concludes that, around 1950, scientific medicine transcended the mechanistic approach of physical medicine and entered the era of ***mind-body medicine***. The scientific basis of mind-body medicine resides in psychoneuroimmunology. There is now ample evidence to show that depression and despair impair the function of the immune system, while peace, love, hope and joy enhance immuno-competence. **Yoga** is of great relevance to mind-body medicine because of the way it looks at life. The yogic view of life is the best prescription ever written for lasting peace and joy, which promote health.

Emotion is a *Rajas guna of Prakriti*, which is responsible for many types of disease. Psychophysiologically, emotions act upon our body through hypothalamus which controls ANS (Autonomic Nervous System) and the endocrine systems. Negative emotions like anger, fear, greed, jealousy give rise to ***somatic illness*** where on the other help positive emotions like love, compassion, friendship, affection etc. give the strength to combat the stress. Yoga plays a vital role as the ***ancient Indian healing art***, which brings harmony in body and mind. It is very rational and scientific method by which a state of equilibrium in mind and body is achieved. Self-perfection or state of divinity is yoga. The yogic concept refers to

the working of body and mind for a homeostatic mechanism, which contributes to a balanced integrated functioning in both external and internal stimulants.

Yoga helps to enrich health through accurate perception, appropriate feelings and precise actions with increasing pleasure, power, prosperity and profoundity, perception, feelings and actions, which have been also expressed by terms *Cognition, Affection and Conation* respectively. In traditional parlance, this is called fulfillment of four *Purusharthas*, viz., *Dharma, Artha, Kaama, and Moksha.* Thus, Yoga works for better health in increasing an appropriate satisfaction of physical, instinctual, emotional, intellectual needs and fulfillment and happiness arising from it.

Value Education is a comprehensive process. In its full range of connotation, it covers the entire domain of learning, cognitive, affective and psychomotor and includes knowledge, understanding and appreciation of our culture, moral, aesthetic and spiritual values i.e. the values springing from our nationalistic aspirations and universal perceptions. Thus, value education is a process of education which involves working on the total personality of the individual keeping in view all aspects of personality development, the intellectual, social and emotional, will and character (Education in Values, N.C.E.R.T., 1992, pp.22-30). In this context, ***Yoga itself is a System of Value Education***. The humane values viz., honesty, tolerance, justice, self-control, compassion, freedom etc enable man for self-control than other animals, so that he cultivates certain ideals, which are available in plenty in Yoga - a rich cultural heritage of India. Since an ultimate value does not change fundamentally, all these ideals remained unchanged in Yoga.

The Indian concept of education is more inclined towards spiritual development, receiving knowledge and disciplining the mind as well. Swami Vivekananda viewed education as "***manifestation of divine perfection already existing in man***." He said, we want that education by which character is formed, strength of mind is increased, and the intellect expounded and by which one can stand on one's own feet.

In the light of the above goal of education, it becomes relevant to assign the role to Yoga to fulfill this goal.

Yoga, the ancient treasure of our nation has stood the test of time. The various definitions of Yoga, - "***Yoga Karmasu Kausalam***," "***Yoga Samatvam uchyate,***" "***Yoga citta vritti Nirodha***," etc. teach us-

- What we should derive from life; and
- What should we give to others

In modern time, the education is much inclined towards Western bent of "***Learn only to earn***." But education can't become only the source to livelihood, because human life has more precious and gracious purpose. The value-based education leads us steadily towards that purpose. The basic ***Sanskaras*** of *Ahimsa, Satya, Asteya, Aparigraha, and Bramhamacharya* form the foundation of values which are the part of Ashtanga Yoga. The ***Yama- Niyama*** concept, if deeply rooted in ***early primary education*** would mould the soil to the desired shape at the right time. The *Asanas, Pranayamas, Kriyas, Bandhas, Mudras* are not only beneficial for body but also for the mind. This indicates that healthy mind resides in healthy body. Similarly, an integration of body, mind and spirit through yoga helps to develop one's personality.

The Ancient Science and Art of Yoga is the real, time tested, comprehensive, long-term solution to all human problems. The greatest advantage of Yoga lies in the fact that it addresses human problems at individual and collective levels. It helps create harmony within the person and the society in which he lives. It integrates body, mind, intellect, emotions and spirit, which bring harmony, happiness & peace.

Yoga works as a ***tool for Modification of Behaviour, Emotion & Personality***. Patanjala Yoga explains the real significance of emotional intelligence by way of complete cessation of modification of mind (Karambelkar, 1984). In fact, yoga practices work at the visceral and the emotional level in following psycho-physiological principles and tackles functional disturbances of the neuro-vegitative system, attitudinal and emotional domains of human personality.

Relaxative asanas work for *chitta vishranti* i.e. tranquility and peace. Corrective asanas develop stability, steadiness and lightness of the body. Emphasis on relaxation, taking help of gravity, ensures eternal effects of tackling mento-emotional states. Asanas, Bandhas, Mudras, Kriyas and Pranayamas may have beneficial effects on autonomic nervous system, brain and the mind. Along with yoga practices, yogic diet comprising simple vegetable proteins, low in salt content and moderately rich in cereals, vegetables and fruits and adequate minerals and vitamins seem to have been prescribed for better health. Such type of food influences the awareness and overall feeling, thinking, being and behavior. Yoga aims at improving the emotional control in overcoming imbalance. Yoga ultimately enriches our emotions, value systems and attitude to life as a whole and influences our personality.

Conclusion

Yoga forms a bridge between body, mind and spirit. Since its practices smoothly coordinate the functions of the bones, muscles, blood, brain etc., the improvement of improve health and fitness is justifiably possible. Moreover, Yoga trains the human mind in such a way so that it helps to modifying proper attitude, behaviour and values.

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CONTRIBUTION OF EXPERIMENTAL DESIGN AND MULTI RESPONSE OPTIMIZATION TECHNIQUES TO OPTIMIZE DIESEL ENGINE DESIGN AND OPERATING VARIABLES

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ABSTRACT

The current work considers the role of experimental design and multi response optimization techniques in optimizing the diesel engine design and operating variables to control the exhaust emissions and improve the performance and combustion characteristics as the above said variables are found to be significant. The research work carried out by various researchers in the recent years have been considered for reviewing their efforts and meaningful suggestions towards optimizing both the design and operating variables to achieve a reasonable control over the exhaust emissions without giving up the engine performance. The experimental design methods such as Taguchi's OA and RSM is found to have more adoption by many authors for preparing the experimental design layout to conduct experiments to understand their effect over the performance, combustion and emission characteristics of the fuel used. In addition to the experimental design, the experimental data is further analyzed through ANOVA for significant parameter identification through p-test at a confidence interval of 95% and Multi response optimization techniques such as Principal Component Analysis, Grey Relation Analysis, Multi Objective Pareto Optimization has been considered for effective identification of Optimized parameter settings.

***Keywords**: ANOVA, Grey Relational Analysis, Taguchi Orthogonal Array, Response Surface Methodology.*

Introduction

The efforts towards the control and reduction of IC engine exhaust emissions have become a common concern from the day of IC Engine invention. Researchers, Scientists and Engine designers always consider about controlling and reducing the harmful pollutants that are released to the environment as one of the majorobjective in addition to other objectives considered. The pollution from IC engines are harmful to the environment and also induces potential threat to the health of human beings by creating fatal and harmful diseases. The

numerous advantages connected with diesel engines such as low operating cost, high efficiency, durability and reliability make them more preferred one to use in automotives and in other applications. As it has many advantages which make them better for usage they became the power centre for commercial transportation and off road industrial vehicles.. Adverse problems that arise due to the emissions come out from the diesel engines such as pollution, climatic change and several health problems such as lung damage, respiratory problems, cancer and diabetes. All this issues make the emissions coming out of diesel engines as a seriously considerable issue for researchers, scientists and engineers. Pollutants exhausted from diesel engine may be classified as exhaust pollutant emissions and after treatment emission control technologies. Carbon Monoxide, Hydrocarbon, Particulate Matter and Nitrogen Oxides and those emissions can be controlled through the application of effective systems like DOC, DPF and SCR [1]. DOC controls CO, and HC emissions, DPF controls the emission of PM

and SCR has the ability to control and reduce NOx emissions. The major contributor of the renowned world threat global warming is carbon dioxide which has reached around 40,000 MMTA at present. The various emissions that has been released to the environment that pollutes the atmosphere and human health are tabulated in Table 1 .Most of the authors concerned about controlling or reducing the emissions from diesel engines has also concerned about the performance characteristics of the diesel engine as an important objective.

Table 1 Diesel Engine Emissions

S.No	Emission Characteristics
1	Carbon Mono Oxide (CO)
2	Carbon Dioxide (CO_2)
3	Oxides of Nitrogen (NO_x)
4	Unburnt HydroCarbon (UHC)
5	Soot Particles
6	Particulate Matter (PM)

The major performance related characteristics or parameters related to the operation of the diesel engine which is also considered together with emissions control has been tabulated in Table 2.

Table 2 Performance Characteristics Of Diesel Engine Under Consideration For Optimization

S.No	Performance Characteristics
1	Brake Mean Effective Pressure
2	Brake Power
3	Brake Specific Fuel Consumption
4	Brake Thermal Efficiency
5	Brake Torque
6	Effective Efficiency
7	Effective Power
8	Specific Fuel Consumption

Table 3 Combustion Characteristics of Diesel Engine

S.No	Combustion Characteristics
1	Exhaust Gas Temperature
2	Heat Release
3	Igniton Delay
4	Peak Pressure

The different combustion characteristics considered in case of diesel engine are tabulated in Table 3 .The emission control of diesel engines has been done by varying the diesel fuel with other biodiesel based fuels by making a blend with diesel fuel as one of the parameter to evaluate the emission and performance of the engine. Around 364 different edible and non edible oils are available to act as direct or blended fuel for diesel engine. The Table 4 represents the different fuels considered by various researchers in the present study for the evaluation of characteristics .such as emission, performance and combustion.

Table 4 Various Fuel Blends With Diesel

S.No	Fuel Blends
1	Argemone Mexicana Biodiesel
2	Biodiesel Methanol Blend
3	Butanol

4	Cassia Tora Methyl Ester
5	Corn Oil Methyl Ester
6	Cotton Seed Oil
7	Ethanol
8	Honge Oil - Ethanol Blend
9	Methanol
10	n-Butanol
11	Polanga
12	Pongamia Methyl Ester
13	Pongamia Pinnata Oil
14	Water in Diesel Emulsion Fuel

The operation of DE consists various design and operating variables which has a significant impact over the performance, combustion and emission characteristics as an individual or in combination with other. The various design and operating variables considered by different authors has been tabulated in Table 5.

Table 5 Diesel Engine Design and Operating Variables

S.No	Design and Operating Variables
1	Air Fuel Ratio
2	Blending Fuel Ratio (%)
3	Compression Ratio (CR)
4	Engine Size
5	Exhaust Gas Recirculation Ratio (EGRR)
6	Injection Pressure (Bar)
7	Injection Timing (Before TDC in Degrees)
8	Intake Temperature and Pressure of Air
9	Load (Kg)
10	Speed (RPM)
11	Type of Blending Fuel
12	Type of Combustion Chamber

Design of Experiments

Experimental Design is the branch of statistics that has sequence of actions related to a research work. The actions include creating a plan, conducting experimental trails, analyzing the observed experimental data, and interpreting the tests results to evaluate the factors that control the value of a parameter or group of parameters. DOE acts as a potential data collection and analysis tool that can be used for creating valid experimental designs. It allows for multiple input factors to be manipulated, determining their effect on a desired output (response). Rajkumar et.al [2] has analyzed the performance and exhaust emission characteristics of a dual fuel engine by adopting RSM using Sardine Fish Oil Methyl Ester blend (SFOME) to the Thermal cracked Cashew Shell Nut Liquid T-CSNL blend by simultaneously considering the brake thermal efficiency (BTE), the brake specific fuel consumption (BSFC), carbon monoxide (CO), hydrocarbon (HC), and nitrogen oxide (NOx) emissions as response variables. The authors have concluded that RSM methodology is efficient in optimizing the variables considered for optimization.

Multi Response Optimization

Multi Response Optimization is a field of study which has a main goal to find the optimal setting of input variables to achieve a desired output with several responses together. An optimized parameter setting of input variable may be advantageous over a single quality

characteristic and the same may provide a detrimental result with other response variables in mono response optimization. The output characteristics may have different attributes such as Lager the better, Smaller the better and Nominal the better which can be combined together in the multi response optimization problem. Multi Response Optimization involves simultaneous optimization of several variables which are connected to a same problem and techniques such as Grey Relational analysis, Desirability Function analysis, Part, Assignment of weights method , Principal Component analysis , TOPSIS . It generally converts a multi response involved problem into a single response problem where the optimized parameter setting obtained ensures the desired output characteristic of individual variables. Seyed Mohamamd Safieddin Ardebili et.al [3] has utilized both RSM and desirability function analysis to optimize the input parameters such as fuel blending ratio and engine load to optimize the performance and emission characteristics of a bio-based fuel oil–petrol blends fuels in water cooled spark ignition engine. The percentage of error between experimental and predicted value is found to be 4%.

Literature Survey

Vezir Ayhan et.al [4] have conducted study on optimizing the factors influencing the engine performance based parameters such as effective power , effective efficiency , Specific Fuel Consumption and Nox,CO, HC, CO_2,Smoke emissions from a diesel engine which uses biodiesel and EGR technique. The authors have considered the different proportion of corn oil ethyl ester blends with diesel fuel such as (0%, 10%, 20% and 50%), EGR ratios (0,10,15 and 20) on a direct injection (DI) diesel engine at variable loads (40%, 60%, 80% and 100%) and speed values (1600 rpm - minimum and 2400 rpm – maximum) as the controlling variables for their study using Taguchi method . The controlling variables are varied to four levels and Taguchi's L16 Orthogonal array was preferred for identifying the optimum parameter combination which reduces the Nox emissions and improves the performance. The experimental values obtained further converted in to higher the better signal to noise ratio values are considered for the parameters such as effective power, effective efficiency and smaller the better signal to noise ratio values are considered for Specific fuel consumption and emission characteristics. The parameter that are significant over effective power are engine load and changes in speed .In case of effective efficiency and SFC blended fuels are found to be less effective. The optimum results for effective power were obtained at full load condition, in 20% blended fuel, without the application of EGR and at maximum speed. The optimum results for SFC and effective efficiency were obtained at 80% load, 10% fuel blend, EGR and minimum speed conditions. . The best results in terms of NO emissions were determined at 40% partial load, without any blending, 20% EGR ratio and maximum speed. The best results for smoke emissions were obtained at 40% partial load, B10 fuel, no EGR applied and at 1600 rpm. HC and CO emission optimal values were determined at 40% partial load, 50% blended fuel, with no EGR and minimum speed. The optimum values of CO_2 emissions were determined at 40% partial load, diesel fuel, no EGR applied and 1600 rpm.The authors have concluded that the use of taguchi method reduces the experimental time and cost by 70% and the confidence intervals used for the experiments are between 95% and 99%.

R. Sathish Kumar and K. Sureshkumar [5] has analysed the experimental data obtained from the taguchi based L_9 orthonal array experimental design prepared by considering the input parameters such as fuel blending, ratio of blending, CR and injection timing for four different objective functions namely enhancement of BTE , reducing BSFC , oxides

of nitrogen emission and unburnt hydrocarbon emission using GRA. Methanol, ethanol and butanol have been used for blending with diesel with blending ratios ranging between 20% - 40%. The compression ratio of 14, 16, 18 and injection timing 20, 23, 26 are considered. The authors have conducted the experimental work in a kirloskar made single cylinder four stroke direct injection VCR engine coupled with an eddy current dynamometer. The experimental results are further evaluated through grey relational analysis and the optimum parameter combination is identified. The authors have identified the optimized combination of parameters which satisfies the objective functions in together is found to be butanol as blending fuel, maximum blending ratio, CR of 16:1 and injection timing of 26 CA before TDC. The authors have validated the optimum combination by conducting confirmation experiments with a minimum of 3 trials.

Yashvir Singh et,al [6] has conducted experiments in diesel engine by employing cassia tora methyl esters fuel blends in a 4 stroke direct injection diesel engine to study for the improvement of performance and emission characteristics by using RSM at a speed of 1500 rpm. The authors have considered the four input parameters such as engine load, (20%,40%, 60%, 80% and 100%)injection timing (15^{o}bTDC, 19^{o}bTDC, 23^{o}bTDC, 27^{o}bTDC, and 31^{o}bTDC.), injection pressure (160, 180, 200, 220 and 240), and blend percentage (B0, B10, B20, B30, and B40) to optimize the outputs such as BTE , Unburnt HC and Nox emissions and the experimental matrix is prepared by central composite design using Minitab software which gives a total of 31experiments.The experimental values of output parameters are further analysed through regression analysis. The models for predicting the values of outputs are created and the authors have stated that the operating parameters such as injection pressure should be high and the injection timing should be low for increased thermal efficiency. The authors have identified the best combination of input parameters is at 15°bTDC injection timing of fuel, 221 bar injection pressure of fuel, 40 % mixing of cassia tora with diesel, and 47% engine load which results in maximum BTE and minimum UHC and NOx emissions of the engine.

Yashvir Singh et.al [7] reported about the optimization for performance enhancement and reduction in emission characteristics of single cylinder diesel engine fuelled with pongamia methyl esters. The authors have conducted 31 experiments as per RSM – CCRD by considering fuel injection pressure, fuel injection timing, pongamia based biodiesel blends, and engine load were considered as input parameters for the optimization of Brake thermal efficiency, unburnt hydrocarbon, and NOx emission. The output parameter brake thermal efficiency need to be improved by reducing the values of engine emissions with respect to the input parameter combinations. The experimental design matrix is prepared using Minitab software and response plots have been generated. The mathematical model for the output parameters have been obtained and checked for its validation with the experimental values The authors have reported that the optimum conditions to achieve the desired results may be obtained by selecting optimum operating variables of the engine at load of 0. 53.13 with injection pressure 196.36 bar at injection timing of 15° bTDC, and a polanga methyl ester blend of 40% with diesel. The experimental values are treated using ANOVA to know their contribution at a confidence interval of 95%.The error percentage is found to be within 5%.

M. Krishnamoorthi et.al [8] investigated the performance and emission characteristics of direct injection compression ignition engine fueled with diesel/aegle marmelos oil/diethyl ether blends by varying the compression ratio,

injection pressure and injection timing. The authors have done the experimental trials through response surface methodology with a total of 81 experiments under the aspect of optimizing the input parameters to achieve an enhancement in performance and reduction in the engine exhaust emissions. The authors have stated that blend used ith diesel is the only categorical factor included as the input parameter and the other parameters are found to be numerical values. The authors have considered the Brake specific fuel consumption as the performance characteristics which need to be reduced, Brake thermal efficiency to get maximized and the engine emissions such as HC, CO, smoke opacity and Nox emissions to be reduced. The authors have analyzed the experimental data through ANOVA and desirability function analysis is considered for obtaining the optimized parameter for the desired outputs. The authors have reported about the optimum setting.

Naushad Ahamad Ansari et.al [9] has studied about the usage of polanga biodiesel as fuel in diesel engine using taguchi method. The authors have purchased polnag based biodiesel from the local vendor of Rajasthan. The authors have considered fuel blending ratio (0%, 10%, 20%, 30%, 40%) , Injection Pressure in bars (160, 180, 200, 220 and 240 bar, Injection timing (15,19,23,27,31) before TDC with five levels and considered L_{25} orthogonal array for conducting the experiments . The experimental values of Brake Thermal Efficiency, Unburnt Hydrocarbon, NOx, and Smoke have been tabulated for further analysis. The authors have analyzed the effect of individual factors over the output responses and the calculation of Multi Signal to Noise Ratio (MSNR) has been calculated. The parameter Injection pressure has more influence over the output parameters than the other parameters. The authors have conducted ANOVA analysis, and they have found that both injection timing and injection pressure has significant impact on the multiple quality characteristics.Injection timing has substantial percentage contribution .

Sangjun Park et.al [10] has conducted numerical study on the performance and NOx emission of a diesel-methanol dual-fuel engine using multi-objective Pareto optimization. The authors have considered the methanol blend percentage, injection timing and exhaust gas recirculation rate as input parameters to understand their effect over the performance and emission levels. The authors has conducted Numerical analysis using a one-dimensional (1D) cycle simulation (GT-Power, Gamma Technologies), to predict engine performance quantities such as torque, BMEP, BSFC, and emissions. The methanol fuel has been injected in to the intake manifold as fraction values with respect to the diesel fuel (0,5,10 and 15) . The authors have considered the engine to run at 2500 RPM during the experimental trials. The authors have generated plots for different cases and the results are further considered for optimization through multi objective pareto optimization technique.

Suresh Vellaiyan and Amithagadeswaran [11] has investigated the effect of water in diesel emulsion fuel by varying the input parameters such as load in Kg , Compression ratio and water content in diesel to evaluate their effect over the output parameters such as Brake thermal efficiency and engine emission such as HC, CO,NOx and CO_2. The authors have used Taguchi based Grey Relational anlaysis to optimize the input parameter setting which maximizes the brake thermal efficiency and reduces the emissions. The input parameter setting is varied in to different levels and Taguchi's L_{16} orthogonal array is considered for experimentation. The experimental values are tabulated for identifying the optimized parameter setting and the authors have identified that based upon the parameters considered, it can be predicted that the engine load has the maximum contribution (62.5%) on

engine performance and emission levels. The CR of the engine contributes 28.2% on engine performance and emission levels, whereas, WC con-tributes 9.3%. The optimized parameter setting that enhances the brake thermal efficiency and reducing the emissions have been identified and validated through confirmation experiments by the authors.

M.Shailaja and A V Sitarama Raju [12] has utilized taguchi and grey relational analysis for optimizing the engine design and operating variables such as injection timing (IJT), injection pressure (IP), compression ratio (CR) and load by varying three levels on each to optimize brake specific fuel consumption (BSFC), exhaust gas temperature (EGT), ignition delay (ID), emissions (CO, NOx, HC) and to increase peak pressure (PP), brake thermal efficiency (BTHE), heat release (HR) simultaneously with least number of experimental runs. The authors have identified the individual parameter setting for all the output parameters and found them as different Through Grey Relational Analysis the optimized parameter setting was identified as injection timing 28^0 bTDC, injection pressure 180 bar, compression ratio 19 and load 80% full load and load was observed to be most influential factor among the four with a contribution of 70.37%. The model developed was validated through confirmation test by the authors and found good agreement between predicted and experimental values of responses.

Y. Datta Bharadwaz et.al [13] has conducted experiments through RSM technique to improve the performance and to reduce emissions from a variable compression engine which uses biodiesel methanol blends as fuel. The authors have considered compression ratio, fuel blend, and load as the input parameters and for the purpose of optimizing thee authors have considered the performance parameters such as BTE , BSFC and emission parameters such as carbon monoxide (CO), unburnt hydrocarbons (HC), Nitric oxides (NOx) and smoke are taken as output responses . The multi response optimization is further conducted through derringer's desirability analysis and the optimized parameter combinations are obtained. The authors have concluded that the used of methanol blends increases the formation of CO and HC emissions and reduces the formation of NOx and smoke. The increase in methanol content increases brake thermal efficiency and brake specific fuel consumption.

Vincent H. Wilson and Udayakumar [14] have investigated the effect of diesel engine design and control parameters over the No_x emissions and brake specific fuel consumption from a direct injection single cylinder diesel engine. The authors have considered the design variables piston to clearance volume, nozzle spray hole area and the operating variables such as Nozzle Valve Opening Pressure, Static Injection Timing, load torque for understanding their effect over the Nox emissions and BSFC. The selected variables are considered to vary by four levels and the experimental design matrix is prepared by using Taguchi's L16 Orthogonal array. The experimental values are further analyzed by signal to ratio values and the significant parameter affecting the output parameters considered for study are identified through ANOVA. The authors have stated that the parameter valve opening pressure has greater influence over the No_x emissions and BSFC, next to that the second greater effect goes to piston to head clearance volume and nozzle valve opening pressure ranks as the third influencing parameter. The parameters such as nozzle spray hole area and load torque has shown very minor effects over the outputs concerned. The authors have reported about the optimum setting for the lowest values of No_x emissions and BSFC.

M.K Paridha et.al [15] has conducted multiresponse optimization study to optimize the factors influencing the parameters affecting the various characteristics of a VCR Engine which uses Argemone Mexicana Biodiesel-Diesel Blends as fuel for its operation. The authors have considered load on engine , CR and blending using biodiesel as the input parameters and the experimental design matrix is prepared by using full factorial response surface methodology technique using Minitab software. The multi response optimization is done by using desirability function analysis methodology. The authors have considered output parameters such as BTE, BSFC for improving the performance of the diesel blended engine and in case of reducing the harmful emissions from exhaust gas. The experimental values obtained for the performance and emission characteristics are tabulated and the values are analyzed through regression analysis .The authors have concluded that the improved performance of the engine can be obtained from CR18, with blending of 20% and 9.8 kg load, A composite desirability of 0.97009is obtained using D-optimal test for maximum performance and minimum emission. The Output responses from the mathematical modeling is found to have good level of accuracy and the model developed for all the output responses are found to be quadratic.

Conclusion

1. The authors have stated that the application of DOE methods such as Taguchi's OA and RSM for reducing the experimental time and cost to a considerable amount.
2. The authors have experimentally tested with pure diesel and with diesel blends to identify the significant effect over the performance and emission characteristics with and without blend addition.
3. Most of the authors have used a single stroke direct injection diesel engine with data acquisition setup.
4. Most of the authors have used MINITAB software for creating the experimental design and for the generation of plots.
5. The authors have considered both design and operating variables to prepare the experimental design layout.
6. The authors have used four stroke single cylinder direction injection diesel engine for conducting experiments.
7. The authors who have considered the blending fuel for diesel have also considered pure diesel without blending with other fuel as one of the experimental trial with other variables to evaluate the emission , combustion and performance characteristics of the engine.
8. In case of Taguchi's Orthogonal Array L_{16}, L_{25}, L_{27} have been considered for creating the experimental design layout.
9. Modern machine learning and deep learning Algorithms may be adopted along with the experimental data set to analyze and predict the appropriate combination of process parameters which can enhance the performance of diesel engine and thereby reduces the emission.

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THEORITICAL STUDY OF METAL JOINING PROCESSES FOR UNDERWATER MARINE ENVIORNMENT WITH IT's RISK AND CHALLENGES

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ABSTRACT

Developments in welding technology are playing a major role in the joining of metals at any environmental condition. Welding processes have been used extensively as joining similar and dissimilar metals. In this review paper, the basic aim is to highlight the importance of welding processes in the underwater wet environment e.g. Marine applications. This review represents an underwater welding (UWW) process that has found a most important role in welding. And also taking a review of the classification, importance of the UWW process. This review elaborate the, applications as well as the characteristics and the risk involved in underwater welding (UWW) techniques, also discussed the major problems in underwater welding in context to the existing welding techniques. A detailed description of a few advanced welding techniques has also been discussed. Underwater welds can be difficult but it is possible with using various non-destructive testing, especially for wet underwater welds, because defects are difficult to detect if the defects are beneath the surface of the weld. Welding in offshore applications is an area of research where many problems are still unsolved. This review paper described a classification of underwater welding and also discussed their advantages and disadvantages of the various types of underwater welding.

***Keywords**: Underwater welding, Marine applications, SMAW, FCAW, FSW, LBW.*

The recent developments in welding technology are playing a major role in the joining of metals in any environmental condition. Welding technique have been used very extensively as joining similar or dissimilar type of metals, and also used in the design and fabrication of structures like naval ships, airplanes, automobiles, bridges etc. Underwater welding has an emerging trend in compare to other metal joining techniques in terms of joint efficiency, mechanical properties. In critical environments, the Robotic welding processes have been used with the replacement of manual operating welding techniques. The automation of the welding process for pipe structures has gained significant changes to improve productivity and accuracy in the areas involving offshore applications. The underwater welding was the first carried out by the British admiralty dockyard for sealing leaking ship rivets below the waterline. It is an important process for underwater structure fabrication and repair works. In 1946 in Holland by 'Van der Willingen' special waterproof electrodes were developed. The underwater hyperbaric welding Process was invented by the Russian metallurgist Konstantin Khrenov in 1932. Underwater welding like hyperbaric welding is one of the technique of welding which carried out at elevated pressures, normally at deep water. Hyperbaric welding can either take place wet in the water itself or dry inside a specially constructed positive pressure enclosure in a dry environment. It is known as "hyperbaric welding" when used in a dry environment, and "underwater welding" when in a wet environment. Dry welding is used in preference to wet underwater welding when high-quality welds are required because of the increased control over conditions that can be exerted, through the application of prior and post-weld heat treatments. When a very high welding strength is required, dry hyperbaric welding techniques is used. The researchers are working on dry hyperbaric welding at depths of up to 1,000 meters (3,300 ft). Underwater Welding (UW) plays very important role for marine application welding techniques. The underwater welding process came into existence with the development of water-proof electrodes in the 1940s. It may be carried out in the water itself

or dry inside a specially constructed positive pressure envelope under a wet environment.

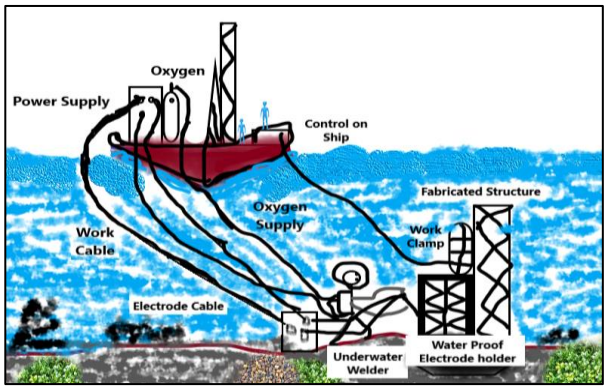


Fig: 1. Schematic setup of underwater welding.

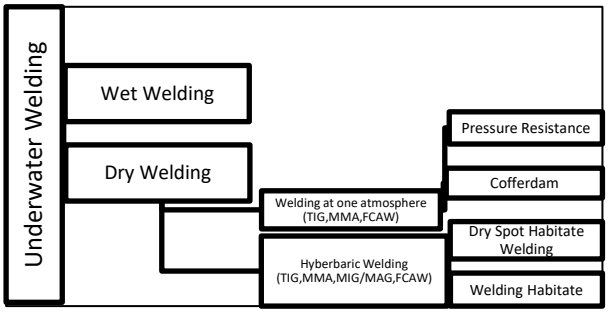
There are many application areas of UWW e.g. fabricated structures, repairing of ships, offshore oil platforms, and Oil and Gas pipelines repairing.

Under Water Welding (UWW)

In the underwater welding technique, the main challenge is to visibility and to create an environment for welding. The main difficulties in underwater welding environment is the presence of a higher pressure due to the water head under which welding takes place and sudden cooling action of the water on the weld metal which changes the metallurgical structures and properties of joint, the possibility of producing the arc mixtures of hydrogen and oxygen in pockets, which set up an explosion and the common danger sustained by divers, of having nitrogen diffused in the blood in dangerous proportions. The complete insulation of the welding circuit is the most important requirement of underwater welding.

Fig: 2. Actual underwater welding technique.

Welding process is important process and there are various types of welding techniques are available but many of these techniques cannot be applied in offshore and marine applications because of the water environment. Underwater welding is to carry out for offshore repairing and surfacing work at a relatively shallow depth, in the region intermittently covered by the water known as the splash zone. The ship repairs is carried out at an underwater deep sea, the most challenging task is a repair at depths. The advantages of underwater welding are large of an economic nature because underwater welding for marine maintenance and repair jobs passes the need to pull the structure out of the sea and saves valuable time and dry docking costs. In recent years the number of offshore structures including oil drilling rigs, pipelines, and platforms is being installed significantly. Some of these structures will experience failures of their elements during normal usage and unpredicted occurrences like storms, collisions. And these type of repairs, the method will required the use of underwater welding. The application of underwater wet welding for offshore repairs has been limited mainly because of porosity and low toughness in the resulting weld. Using an appropriate design, it is possible to reduce porosity and to enhance weld mental toughness through microstructure refinement.



Classification of underwater welding.

Fig.3. Classification of Underwater Welding

Wet welding

In wet welding, the welding is performed underwater, directly exposed to the wet

environment. A special waterproof electrode is used and welding is carried out manually just as one does in open air welding. The increased freedom of movement makes wet welding the most effective, efficient, and economical method. The power supply used DC and Polarity -VE Polarity used. The welding power supply is located on the surface with a connection to the diver/welder via cables and hoses.

Principle of Operation of Wet Welding

The work to be welded is connected to one side of an electric circuit, and a metal electrode to the other side. These two parts of the circuit are brought together and then separated slightly. The electric current jumps the gap and creates an arc, which melts the bare metal, forming a weld pool. At the same time, the tip of the electrode melts and metal droplets are projected into the weld pool. During this operation, the flux covering the electrode melts to provide a shielding gas, which is used to stabilize the arc column and shield the transfer metal. The wet type of welding process is carried out at ambient water pressure in which there exists a relationship between the welder and the diver in the water. This is carried out utilizing a water-proof stick electrode, with no physical barrier between water and welding arc. Using the wet welding technique the many complex structures may also be welded underwater environment. One of the most commonly used wet welding techniques is the Shielded Metal Arc Welding (SMAW) process and the Flux Cored Arc Welding (FCAW) process. The cooling rate in wet welds is much higher than in those obtained in dry welding. In the temperature range from 800 °C to 500 °C, it can change from 415 to 56 °C/s. underwater wet welds are also known to contain high amounts of porosity. Porosity may be formed by molecular hydrogen, carbon monoxide, or water vapours. The pores are present to some extent in all types of wet welding joints. The main factors affecting this phenomenon are water depth, electrode covering, and arc stability. Wet welding does not need any complicated experiment setup, it's economical and can be immediately applied in case of emergency and accident as it does not need water to be evacuated. The major difficulties in welding operation due to lack of visibility in the water, presence of sea current, ground swells in shallow water and inferior weld qualities. The main disadvantages of wet welding techniques are increased porosities, reduced ductility, greater hardness in the heat-affected zone, hydrogen pick up from the environment. Wet underwater welding directly exposes the diver and electrode to the water and surrounding elements. Divers usually use around 300–400 amps of direct current to power their electrode. This is most commonly uses a variation of shielded metal arc welding with a waterproof electrode. The two other techniques used include the flux-cored arc welding and friction welding. The welding power supply is connected to the welding equipment through cables and hoses. The process is generally limited to low carbon equivalent steels, especially at greater depths, because of hydrogen-caused cracking. Wet welding with a stick electrode is done with similar equipment to that used for dry welding, but the electrode holders are designed for water cooling with proper insulated. A constant current welding machine is used for manual metal arc welding. Direct current is used and a heavy-duty insulation switch is installed in the welding cable at the surface control position so that the welding current can be disconnected when not in use. The welder instructs the surface operator to make and break the contact as required during the operation. The contacts should only be closed during actual welding, and opened at other times particularly when changing electrodes. The electric arc heats the workpiece and the welding rod and the molten metal is transferred through the gas bubble around the arc. The gas bubble is partly formed from the

decomposition of the flux coating on the electrode but it is usually contaminated to some extent by steam. Current flow induces the transfer of metal droplets from the electrode to the workpiece and enables positional welding by a skilled operator. Slag deposition on the weld surface helps to slow the rate of cooling, but rapid cooling is one of the biggest problems in producing a quality weld.

Dry Habitat Welding

Welding at ambient water pressure in a large chamber from which water has been displaced, in an atmosphere such that the welder does not work in diving gear. This technique known as dry habitat welding. Dry hyperbaric welding involves the weld being performed at raised pressure in a chamber filled with a gas mixture sealed around the structure being welded. Arc welding processes such as Shielded Metal Arc Welding (SMAW), Flux-cored arc welding (FCAW), Gas tungsten arc welding (GTAW), Gas metal arc welding (GMAW), Plasma Arc Welding (PAW) could be operated at hyperbaric pressures. Gas tungsten arc welding (GTAW) is most commonly used. The degradation is associated with physical changes of the arc behaviour as the gas flow regime around the arc changes and the arc roots contract and become more mobile. It is a dramatic increase in arc voltage which is associated with the increase in pressure. Overall degradation in capability and efficiency results as the pressure increases. Special control techniques have been applied which have allowed welding down to 2,500 m (8,200 ft) simulated water depth in the laboratory but dry hyperbaric welding has limited operationally to less than 400 m (1,300 ft) water depth by the physiological capability of divers to operate the welding equipment at high pressures and practical considerations concerning the construction of an automated pressure/welding chamber at depth.

Dry Chamber Welding

Welding at ambient water pressure in a simple open-bottom dry chamber that accommodates the head and shoulders of the welder/diver in full diving gear.

Dry spot welding.

Welding at ambient water pressure in a small transparent, gas-filled enclosure with the welder/diver in the water and no more than the welder/diver's arm in the enclosure.

Dry welding at one atmosphere.

Welding at pressure vessel in which the pressure is maintained at approximately one atmosphere regardless of outside ambient water pressure.

Hyperbaric Welding

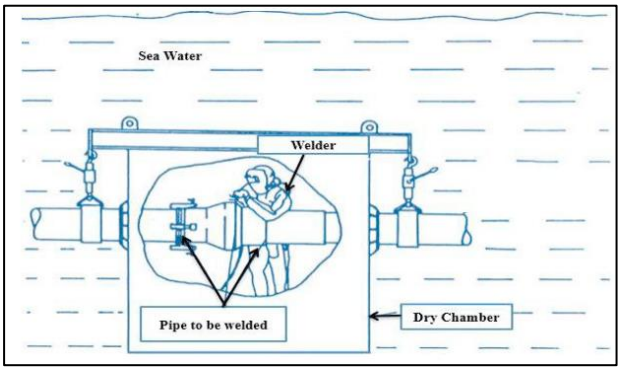


Fig: 4. Dry hyperbaric welding

Hyperbaric welding is carried out in a chamber sealed around the structure to be welded. The chamber is filled with a gas (commonly helium containing 0.5 bar of oxygen) at the prevailing pressure. The habitat is sealed onto the pipeline and filled with a breathable mixture of helium and oxygen, at or slightly above the ambient pressure at which the welding is to take place. This method produces high-quality weld joints that meet X-ray and code requirements. The gas tungsten arc welding process is employed for this process. The area under the floor of the Habitat is open to the water. Thus the welding is done in the dry but at the hydrostatic pressure of the seawater surrounding the habitat.

Principle of Dry Welding

Underwater welding in a dry environment is made possible by encompassing the area to be welded with a physical barrier (weld chamber) that excludes water. The weld chamber is designed and custom-built to accommodate braces and other structural members whose centrelines may intersect at or near the area that is to be welded. The chamber is usually built of steel, but plywood, rubberized canvas. The size and configuration of the chamber are determined by the dimensions and geometry of the area that must be encompassed and the number of welders that will be working in the chamber at a time. Water is placed from within the chamber by air or a suitable gas mixture depending upon water depth and pressure at the worksite. The buoyancy of the chamber is offset by ballast, by mechanical connections and chamber to the structure, or by a combination of both.

Cofferdam Welding

Fig: 5. Cofferdam welding

Welding inside of a closed bottom, open-top enclosure at one atmosphere. Dry welding requires a pressurized enclosure having a controlled atmosphere. Weld metal is not in direct contact with water. Advantages of dry welding are improvement in the stability of welding operation, reduced hydrogen problem; lower quench rate of the weld and base metal, and restoration of weld strength and ductility. Dry welding may be carried out under high pressure, which consists of preparing an enclosure to be filled with gas (helium) under high pressure (hyperbaric) to push water back, and have the welder, fitted with a breathing mask and other protective equipment (Oates, 1996). Limitations of hyperbaric welding are the practical difficulties in sealing the chamber and the increase in pressure as weld depth increases leading to a problem that affects both the weld chemistry and microstructures.

Conventional Underwater Welding Techniques

The fusion welding processes of greatest practical significance in underwater welding are manual shielded metal arc welding (SMAW), Tungsten inert gas (TIG), Metal inert gas (MIG) welding.

1. Shielded Metal Arc Welding (SMAW)

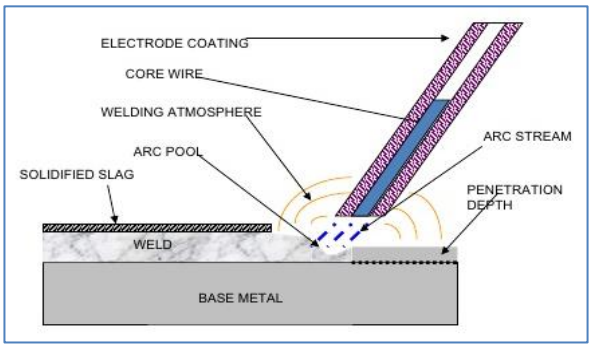


Fig: 6. Shielded Metal Arc Welding (SMAW)

In Shielded Metal Arc Welding (SMAW) the flux covering the electrode melts during welding. This forms the gas and slag to shield the arc and molten weld pool. The slag must be chipped off the weld bead after welding. The flux also provides a method of adding scavengers, deoxidizers, and alloying elements to the weld metal. For underwater wet welding, direct current is used and usually, polarity is straight. Waterproof Electrodes are normally used. It is flux coated which causes the generation of the bubble during welding and displaces water from the welding arc and weld pool area. Hence, the flux composition and depth of flux coating should be optimized to ensure adequate protection. Electrodes for

shielded metal arc welding are classified by AWS as E6013 and E7014. There are some advantages of this technique i.e Versatility, simplicity in construction, and economy in operation, and finished product quality. During welding, all electrical leads, lighting gear, electrode holder, gloves, etc., must be fully insulated and in good condition. Ferrite electrodes with a coating based on iron oxide should be used as they resist hydrogen cracking.

1. Flux Cored Arc Welding (FCAW)

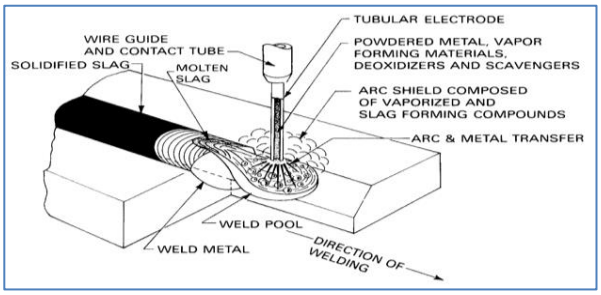


Fig: 7. Flux Cored Arc Welding (FCAW)

Flux Cored Arc Welding (FCAW) is a commonly used high deposition rate welding process that adds the benefits of flux to the welding simplicity of MIG welding. As in MIG welding wire is continuously fed from a spool. Flux-cored welding is a semiautomatic welding process. Self-shielding flux-cored arc welding wires are available or gas shielded welding wires are used. The condition of the base metal can affect weld quality. Excessive contamination must be eliminated. Flux-cored welding produces a flux that must be removed. Flux-cored welding has a good weld appearance (smooth, uniform welds having good contour). Advantages of flux-cored arc welding. Flexibility in operation, higher deposition rate, low operator skill, and good quality of the weld deposits. And the presence of porosities and burn back are the major problems that occurred during the process. The recent development of nickel-based flux cored filler materials have provided improved wet weldability and halogen-free flux formulation specifically designed for wet welding application. To improved, underwater wet welding capabilities and halogen-free flux formulations have been developed with stainless steel flux cored wires. Flux Cored Arc Welding (FCAW) is a commonly used high deposition rate welding process that adds the benefits of flux to the welding simplicity of MIG welding [Khanna, 2004]. As in MIG welding wire is continuously fed from a spool. Flux-cored welding is therefore referred to as a semiautomatic welding process. Self-shielding flux-cored arc welding wires are available or gas shielded welding wires may be used. Less pre-cleaning may be necessary than MIG welding. However, the condition of the base metal can affect weld quality. Excessive contamination must be eliminated. Flux-cored welding produces a flux that must be removed. Flux-cored welding has a good weld appearance (smooth, uniform welds having good contour). Flexibility in operation, higher deposition rate, low operator skill, and good quality of the weld deposits are the notable advantages of flux-cored arc welding. However, the presence of porosities and burn back are the problems associated with the process. The recent development of nickel-based flux cored filler materials have provided improved wet weldability and halogen-free flux formulation specifically designed for wet welding application [Oates, 1996]. Similarly, improved underwater wet welding.

2. Tungsten Inert Gas Welding

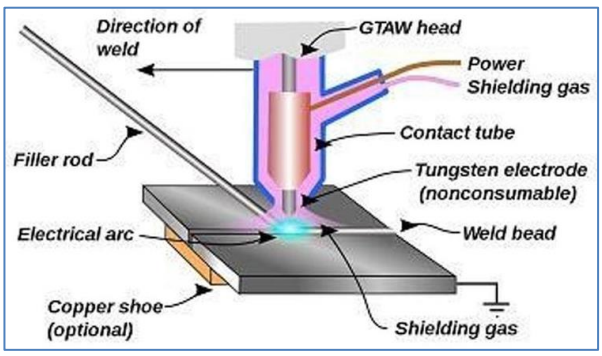


Fig: 8. TIG Welding

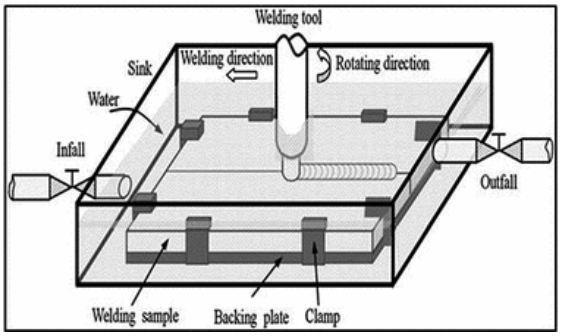
TIG-welding or GTAW welding (Gas Tungsten Arc Welding) uses a permanent non-melting electrode made of tungsten. Filler metal is added separately, which makes the process very flexible. It is also possible to weld without filler material. TIG welding has got the advantage that it gives a stable arc and less porous weld. The most used power source for TIG welding generates Alternating Current (AC). Direct current can be used. AC TIG-welding usually uses argon as a shielding gas. By changing the diameter of the tungsten electrode, welding may be performed with a wide range of heat input at different thicknesses. Alternating Current TIG-welding is possible with thicknesses down to about 0.5 mm. For larger thicknesses, > 5 mm, AC TIG-welding is less economical compared to MIG-welding due to lower welding speed. DC TIG-welding with electrode negative is used for welding thicknesses above 4 mm. The negative electrode gives a poor oxide cleaning compared to AC-TIG and MIG, and special cleaning of joint surfaces is necessary. The process usually uses helium shielding gas. This gives a better penetration in thicker sections. In deep-sea structures welding, a free burning arc is used for fusion welding. The arc is then operated in a localized dry region created around the weld at elevated pressures. Similar ambient conditions can be found in high-pressure discharge lamps and some plasma heaters and torches.

Recent Underwater Welding Techniques

a. **Friction Stir Welding**
b. **Laser Beam Welding**

Friction Stir Welding (FSW)

Friction welding is a solid-state welding process that produces coalescence of materials by the heat obtained from mechanically induced sliding motion between rubbing surfaces. The work parts are held together under pressure. This process usually involves rotating one part against another to generate frictional heat at the junction. When a suitable high temperature has been reached, the rotational motion ceases and additional pressure is applied and coalescence occurs. Friction welding is also used for underwater repair of cracks to marine structures and pipelines. There are two variations of the friction welding process. In the first process, one part is held stationary and the other part is rotated by a motor that maintains an essentially constant rotational speed. The two parts are brought in contact under pressure for a specified



period with a specific pressure.

Fig: 9. Underwater Friction Stir Welding.

Rotating power is disengaged from the rotating workpiece and the pressure is increased. When the rotating workpiece stops the weld joint occurs. This process can be accurately controlled when speed, pressure, and time are closely regulated. There are three major important parameters involved in making a friction weld i.e first one, the rotational speed which is related to the material to be welded, and the diameter of the weld at the interface. The second one, the pressure between the two parts to be welded. Pressure changes during the weld sequence. At the start, it is very low, but it is increased to create frictional heat. When the rotation is stopped pressure is rapidly increased so that forging takes place immediately before or after rotation is stopped. And the third one is welding time. Time is related to the shape and the type of metal and the surface area. It is normally a matter of a few seconds. The actual operation of the machine is automatic and is controlled by a sequence controller which can

be set according to the weld schedule established for the parts to be joined.

Laser Beam Welding

A laser as a source of coherent and monochromatic radiation has a wide scope of application in materials processing. Laser-assisted welding, because of the sheer volume/proportion of work. The focused laser beam is made to irradiate the workpiece or joint at the given level and speed. A shroud gas protects the weld pool from undue oxidation and provides the required oxygen flow. Laser heating fuses the workpiece or plate edges and joins once the beam is withdrawn. In the case of welding with filler, melting is primarily confined to the feeding wire tip while a part of the substrate being irradiated melts to insure a smooth joint.

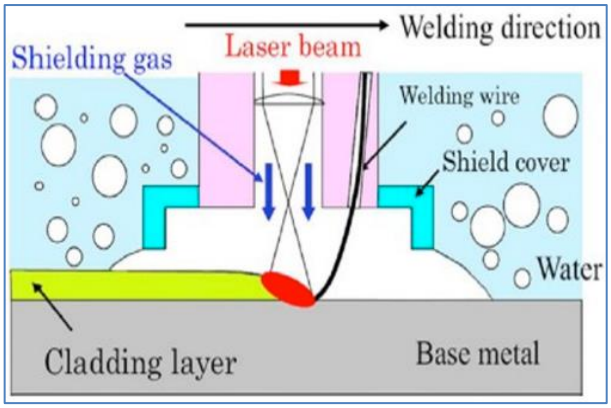


Fig: 10. Underwater Laser Beam Welding.

The workpiece rather than the beam travels at a rate conducive for welding and maintaining a minimum Heat Affected Zone (HAZ). There are two fundamental modes of laser welding depending on the beam power: (a) Conduction welding and (b) Penetration welding. Conduction-limited welding occurs when the beam is out of focus and power density is insufficient to cause boiling at the given welding speed. In deep penetration Keyhole welding, there is sufficient energy/unit length to cause evaporation, and hence, a hole forms in the melt pool. The 'keyhole' behaves like an optical black body in that the radiation enters the hole, the advantages of low heat input, easy to transfer energy, and control adaptability. The low heat input is of significance for reducing the sensitivity of stainless steels to Stress Corrosion Cracking. The plasma-induced by the interaction of the laser beam and the metal vapor or the shielding gas in CO2 laser-assisted welding has a shielding effect on the laser beam, but the plume induced in Nd: YAG laser-assisted welding has not such shielding effect on laser energy transferring. No matter CO2 or Nd: YAG laser-assisted welding; the optical emissions induced in the welding process indicate the basic characteristics of the keyhole and the variation of welding parameters. The filler metal used for Underwater Laser Beam Welding (ULBW) is the same as that for Gas Tungsten Arc Welding (GTAW), It is introduced into the pool created by the laser beam in a manner very similar to that seen during welding with a gas metal arc welding machine. ULBW is a completely automatic welding process. It differs from GTAW performed with a machine, where the operator makes adjustments during welding. The laser beam's precise heat input and dilution controls result in consistent weld quality. Weld chemistry testing shows high deposit purity as a result of the low heat input.

Challenges and Risks Involved

Underwater welding is a very tedious job and there is a risk to the welder of electric shock. The welding equipment is to be properly electrical insulated. The electrical supply immediately shutting off when the arc is extinguished. During wet welding process the hydrogen and oxygen gases are produced by the arc. So, precautions must be taken to avoid the build-up of pockets of gas, which are potentially explosive. The other main area of risk is the health of the welder from nitrogen introduced into the bloodstream during exposure to air at increased pressure. Precautions must be include the provision of an emergency air or gas supply, stand-by of welding divers, and decompression

chambers to avoid nitrogen narcosis following rapid surfacing after saturation diving. During the structures being welded by wet underwater welding techniques, inspection following welding may be more difficult than for welds deposited in the air. Assuring the integrity of such underwater welds may be more difficult, and there is a risk that defects may remain undetected. To prevent this, the welding equipment must be adaptable to a marine environment, properly insulated and the welding current must be controlled. Commercial divers must also consider the occupational safety issues that divers face; the risk of decompression sickness due to the increased pressure of breathing gases. Many divers have reported a metallic taste that is related to the galvanic breakdown of dental amalgam. There may also be long-term cognitive and possibly musculoskeletal effects associated with underwater welding.

Underwater Welding Characteristics Requirements

- The welding equipment should be inexpensive and easy to operate with the flexibility of operation in all positions. And underwater welding setup should be easily automated.
- Minimum electrical hazards for humans, a minimum of welding speed at least 20 cm/min.
- The requirement of good visibility and produce good quality as well as reliable welds.
- The welding operator should be trained and he should be in supporting himself.

Applications of Underwater Welding

- Development and construction of large ships beyond the capacity of the existing dockyard.
- Offshore construction for tapping sea resources, repairing and maintenance of ships.
- Salvaging vessels sunk in the sea. Repairing and Maintenance of underwater structures at the hydropower station, Bridges, Oil, and refinery pipelines repairs.

Future Scope

The major efforts on research and development should be focused on process performance and control strategies and automation of the underwater joining and inspection of the welded structures. Mechanized underwater welding for actual usage of very large floating structures. Investigation of the potential of using a robot manipulator for underwater ultrasonic testing of welds in joints of complex geometry. Application of advanced welding techniques, like friction, laser welding, and understand the behaviour of materials after the welding and process optimization. The invention of new welding techniques and explore the possibility of its application in underwater welding. Generation of research data book on weldability of materials during underwater welding. Investigation of the potential of using a robot manipulator for underwater ultrasonic testing of welds in joints of complex geometry. Application of advanced welding technique can be developed e.g. friction welding, laser welding, and study of material behaviour after the welding and process optimization.

Conclusion

In this review, we have been discussed the various classification of underwater welding processes and the importance of underwater welding. We have been summarized the risk and challenges of underwater welding processes. Also discussed conventional methods of underwater welding with their characteristics and applications of offshore work and described the upcoming research-oriented future scope.

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A STUDY ON WOMEN PERCEPTION TOWARDS BRANDED JEWELRY IN CHENNAI

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ABSTRACT

Each event of family celebration can't be celebrated without gold Jewelry. In India, gold demand raised every year. Gold price also increase in unpredictable manner. An impulse cause shaped by means of well-informed entrepreneurs allows customers to quickly discuss with their memory and make the purchase decision. It is the second biggest unfamiliar trade work in the country. Each Indian family thinks about gold as an image of abundance, status and flourishing. The shopper scene in India is changing past creative mind. Current purchasers are having an intriguing blast of decisions – new classes, new brands, new shopping alternatives – and have expanding discretionary cash flow to satisfy their desires. Customer perception is an important factor to help sustain competitive advantages. Most of the people like it and they buying branded jewels only. Therefore, the cause of this studies is to go looking and examine the factors, which have an effect on patron notion toward branded jewels a number of the clients. This paper is descriptive in nature, and the primary and secondary date were collected by researcher for the study. After collected the data, researcher used chi-square test and Garret ranking technique for analyse the data. The major of the study is that majority of the customers are satisfied.

***Keywords**: Aspirational, Handmade, Jewellery, Designs, Business.*

Introduction

India is having a fairly dynamic purchaser marketplace for Jewellery, which has grown hastily during the last a long time. This is fuelled via a variety of of factors like the quick increasing financial system, a widening client base and a tradition where valuable jewelry plays an intrinsic position in social events and circle of relatives traditions. Jewellery buying in India are normally consultative techniques, in which girls are the main choice makers, taking the opinion of own family and buddies. Retailers additionally play an important role in supplying reassurance and recommendation. Jewellery is an 'aspirational' product in India and is greater desired than another luxury merchandise. Jewellery is the maximum favored present given by using the dear ones to express their love, affection and gratitude. Jewellery has no longer handiest been taken into consideration for the motive of decoration, but it also acts as a safety in instances of contingency. Gold is likewise valued as an vital savings vehicle in India, and is the second preferred funding in the back of bank deposits.Indian jewellery is unique in its design and workmanship. India and jewellery, jewellery and Indian women - the terms are linked inherently.

Statement of Problem

`Jewellery has been an essential part of the Indian lifestyle and civilization because ancient records. They were in demand and style when you consider that ancient civilization of Harappa and Mohanjadora. It has always performed a pivotal role within the Indian social material. Even today, Jeweler remains the Indian brides' streedhan, the only wealth women take with them when they go to their new home. In India, jewellery is not just a means of adding glitter and attraction to the personality. It is worn to strengthen various religious beliefs and for social security. Earlier both men and women used to wear ample of them but with the passage of time, men didn't really seem keen on wearing them. However, they still use simple jewellery like chains, rings and bracelets. Even men wear simple gold ornaments like rings, bracelets and chains. The average customer now wants designs that are unique and contemporary. A woman buys jewellery today not just for investment and as a status symbol but also to express her individuality. India has well established

capabilities in making handmade and machine made jewellery in traditional as well as modern designs. The Indian jewellery retail sector continues to be dominated by the unorganized jewellers. People in Tamil Nadu have a culture of buying gold from their savings and the yellow metal is seen as an investment here because of its liquidity. Indian jewellery industry plays an important role in Indian economy. But the industry faces certain problems that act as bottlenecks for the industry to compete globally. Being largely unorganized, the jewellery sector mainly uses labour-intensive and indigenous technology that affects their growth prospects. This sector is mainly constituted by small and medium jewellers who face stiff competition from large and organized retailers. Further, banks and financial institutions hesitate to provide financial assistance to these retailers who mainly carry on jewellery retailing as family-owned business. It provides the ability to buy the branded products. However, the future for jewelers market looks bright and promising. This is especially true in the context of customer in women Therefore, this study aims to examine the women perception towards branded jewelry in chennai

Review of Literature

Dr. V. Selvarani and Ms. T. Chitradevi (2020), "A Study on Women Perception Towards Branded Jewelry in Tiruchirappalli District" they concluded that the gold jewellery in India varies from region to region and within regions. The Sector is hugely dominated by fragmented unorganized players. The growth of branded jewellery segment is fuelled by the 'retail revolution'. The Indian jewellery consumer is getting more & more trend conscious. The branded gold jewellery segment occupies a small share of the total jewellery market because of the mindset of the average Indian buyer still considers jewellery as an investment. Women today have realized that they do not have to wait for long periods of time to buy the piece of jewellery which they wanted. It would take long time to choose the design and make an order and wait till the jewellery was ready. Today they can buy the trendy and contemporary designs they want in less time in any outlets. This study aimed at analyzing various perceptional aspects of women which influence in purchasing the branded gold jewellery and thereby help to design market strategies to promote the sale of branded gold jewellery.

Dr. B. Revathy, (2018)), "A Study on Customer Satisfaction towards Jewellery in Marthandam Town", This examination started by investigating basic strategies for show used to introduce contemporary adornments in the exhibition space delineated the viable and hypothetical endeavours that were embraced in an offered to address the connection amongst protest and watcher. This examination coordinated my enquiry towards methods of show that impart the part of the body in contemporary gems and are intended to draw in a group of people. The techniques utilized amid this examination empowered me to draw without anyone else hone as a method for setting up methods for speaking to the individual and social body that are perfect with the display condition. The underlying viable examination, as itemized in concentrated my enquiry on crowd cooperation and real procedures. As a reaction to my logical discoveries, a blend of computerized media and customary specialty strategies were utilized to record and speak to the missing body in the exhibition space. This brought about two useful results that were planned to give a perpetual show of the transient connection between the body and adornments. Perceptions were made of adornments while on the body, utilizing advanced media to catch and present the point by point developments and conduct of the wearer. This approach was created to consolidate sound and visual strategies; these were proposed to speak to the suggestions for the specialty question of group of onlooker's cooperation. Advanced strategies for introduction were utilized as an elective method of association to contact and enabled watchers to encounter the materiality of a question through a mix of tactile techniques. The two results were intended to present or incite an emotive response from the watcher in light of adornments in plain view.

Objectives

- To know socio economic background of sample respondents

- To measure the frequency of buying gold jewellery
- To find out the compare between socio economic factors and perception level of the respondents.

Research Design

The present study is Descriptive in nature. Sample size selected for the study was 90 respondents in Chennai city of Tamil Nadu State. For analyzing the data, percentages, Chi square test and Garrett ranking techniques were applied.

Limitations of the Study

- The present study considers only the selected respondents in Chennai city.
- The research work is based on the primary data which are collected from the selected respondents. Therefore, the findings are not to be generalised.

Results And Discussions

Table 1: Demographic Variables

VARIABLES		No of Respondents	Percentage
Age	Upto 25	12	13
	25 to 35	28	31
	35 to 45	23	26
	45 to 55	20	22
	Above 55 years	7	8
	Total	**90**	**100**
Marital status	Married	**58**	64
	Unmarried	**32**	36
	Total	**90**	100
Educational Qualification	Upto SSLC	26	29
	HSC	25	28
	Graduation	27	30
	Post-Graduation	12	13
	Total	**90**	100
Occupation	Homemakers	14	16
	Business	19	21
	Private Employees	20	22
	Government employees	21	23
	Professionals	16	18
	Total	**90**	100
Income Per Month	Less than Rs.10,000	12	13
	10000-20000	22	24
	20001-30000	23	26
	30001-40000	19	21
	Above 40000	14	16
	Total	**90**	100

Sources: Primary Data

Table No.1 shows demographics wise distribution of the respondents. It reveals that. Majority of respondents' age group of 26-30 and Graduates were high as compared to other Educational groups. Majority of the respondents were Government employees and 20001-30000respondents were high as compared to other Income per Month.

Table 2: Frequency Of Buying

Frequency of purchase	No of Respondents	Percentage
Monthly	4	4
Once in 3 months	13	14

Once in 6 months	18	20
Once in a year	36	40
Very rarely	19	21
Total	**90**	**100**

Primary Data

The above table shows that consumers buying gold jewellery in which most of the respondents said that they buying Once in a year.

Table-3: Occasions Of Buying

S.No	Factors	No of Respondents	Percentage
1	Marriage / other ceremonies	14	16
2	Diwali	7	8
3	Christmas	8	9
4	Ramzan	5	6
5	New Year	9	10
6	Aadiperuku	6	7
7	Akshaya Tritiya	13	14
8	After harvest	4	4
9	On receiving bonus	10	11
10	Price decrease	11	12
11	No such occasion	1	1
12	Maturity of savings	2	2
Total		**90**	**100**

Primary Data

The above table reveals that occasions of buying gold jewellery these consumers buy gold jewellery on occasions like marriage and other ceremonies for the purpose of giving it as a gift.

Table-4: Jewel Collections Of Women

S.No	Statement	No of Respondents	Percentage
1	Necklace	9	10
2	Earrings	18	20
3	Bangles	14	16
4	Chains	11	12
5	Maalai	7	8
6	Rings	15	17
7	Bracelets	10	11
8	Nose pins	6	7
	Total	**90**	**100**

Sources: Primary Data

The above table mentioned that most of the respondents prefer earrings.

Table 6: Perception Level Of Jewellery

Variables	No of Respondents	Percentage
Very Frequently	13	14
Frequently	32	36
Sometimes	26	29
Never	19	21
Total	**90**	**100**

Sources: Computed Data

The above table reveals that perception level of consumer. In which, 32 percent of the respondents were frequently, it is a highest level out of others.

Association Between Socio-Economic Characteristics And Perception Level **Of The Respondents**

The non-parametric chi-square test is applied to find the association between perception level of the Respondents and Socio-Economic factors such as sex, education, and Experience.

Table - 7: Age and Opinion of the Perception Level of the Respondents

Age	Very Good	Good	Poor	Very Poor	Total
Upto 25	2	1	5	4	12
25 to 35	5	8	10	5	28
35 to 45	2	11	5	5	23
45 to 55	2	10	4	4	20
Above 55 years	2	2	2	1	7
Total	**13**	**32**	**26**	**19**	**90**

Sources: Computed data

Results of chi-square test are as follows

	Calculated value	Df	Table Value	Result
Chi-Square test	15.58	12	21.03	**Accepted**

Above table indicate that the Table Value is less than calculated value. Therefore, test is accepted.

Table - 8: Marital Status and Perception Level of the Respondents

Sex	Very Good	Good	Poor	Very Poor	Total
Married	8	19	17	14	58
Unmarried	5	13	9	5	32
Total	**13**	**32**	**26**	**19**	**90**

Sources: Computed data

Results of chi-square test are as follows

	Calculated value	Df	Table Value	Result
Chi-Square test	1.12	3	7.81	**Accepted**

Above table indicate that the Table Value is less than calculated value. Therefore, test is accepted.

Table - 9: Education and Perception Level of the Respondents

Age	Very Good	Good	Poor	Very Poor	Total
SSLC	4	8	9	5	26
HSC	4	11	7	3	25
Graduation	3	12	6	6	27
Post-Graduation	2	1	4	5	12
Total	**13**	**32**	**26**	**19**	**90**

Sources: Computed data

Results of chi-square test are as follows

	Calculated value	Df	Table Value	Result
Chi-Square test	19.55	9	16.92	**Rejected**

Above table indicate that the calculated value Table Value is less than table value. Therefore, test is rejected.

Table - 10: Occupation and Perception Level of the Respondents

Occupation	Very Good	Good	Poor	Very Poor	Total
Homemakers	2	3	5	4	14

Business	6	4	5	4	19
Private Employees	2	10	5	3	20
Government employees	2	6	9	4	21
Professionals	1	9	2	4	16
Total	**13**	**32**	**26**	**19**	**90**

Sources: Computed data

Results of chi-square test are as follows

	Calculated value	**Df**	**Table Value**	**Result**
Chi-Square test	19.38	12	21.03	**Accepted**

Above table indicate that the Table Value is less than calculated value. Therefore, test is accepted.

Table - 11: Income and Perception Level of the Respondents

Occupation	**Very Good**	**Good**	**Poor**	**Very Poor**	**Total**
Less than Rs.10,000	2	3	3	4	12
10000-20000	6	4	7	5	22
20001-30000	2	10	5	6	23
30001-40000	2	6	9	2	19
Above 40000	1	9	2	2	14
Total	**13**	**32**	**26**	**19**	**90**

Sources: Computed data

Results of chi-square test are as follows

	Calculated value	**Df**	**Table Value**	**Result**
Chi-Square test	21.75	12	21.03	**Rejected**

Above table indicate that the calculated value Table Value is less than table value. Therefore, test is rejected.

Table 12: Reasons For Preferring Modern Designer Jewellery

Variables	**Garrett's Mean Score**	**Rank**
Innovative designs	67.31	**I**
Suitable for all occasions	66.19	**II**
Light weight	63.78	**III**
Graceful to wear	61.25	**IV**
Suits all attires	60.52	**V**
Affordable price	58.82	**VI**
Stylish and sleek	55.35	**VII**

Sources: Computed Data

The above table reveals that reasons for preferring Innovative designs jewellery with mean score of 67.31 points is the prime reason for consumers preferring designer jewellery.

Findings

- Majority of respondents' age group of 26-30.
- Graduates were high as compared to other Educational groups.
- Majority of the respondents were Government employees.
- 20001-30000, respondents were high as compared to other Income Per Month.
- Majority of the consumers buying gold jewellery once in a year account for 40 per cent.

Suggestions

- Jewellers should try to provide better quality of jewellery to customers at reasonable price.
- Jewellers should concentrate to provide better services to each valued customers.

Conclusion

Nowadays branding is an important tool for every business. Especially, Branded jewellery confirms the quality, purity, durability and several social, environmental standard of the jewellery. From the study undertaken, it is found that, maximum number of consumers, they were frequently buying the branded jewellery and they have a very good opinion about branded jewellery. Branded jewellery is always priced high as most of the consumers hesitate to purchase branded jewellery. When researcher compare with socio economic factors and perception level of the consumer. There some factors like age, marital status and occupation were accepted. But some other factors like education and income level were accepted. By these, researcher understood their perception level of branded jewels.

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AN INVENTORY MODEL FOR DETERIORATING ITEMS WHEN DEMAND DEPENDS ON ADVERTISEMENT AND STOCK WITH INFLATION

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ABSTRACT

This study incorporating with the production of the inventory model depends upon the goodwill of the product to the customers, the present paper investigates the procurement reliability of the product in which demand depends upon the `factors of advertisement of time and stock dependent. Whereas introducing the time dependent deterioration factors makes the paper more realistic in the inventory model. Inflation has been considered for exploring the research. An optimal order quantity has been finding out by using the different parameter rate.

Keywords: *Inventory, Deterioration, Demand Depends on Advertisement and Stock*

1. Introduction

The demand might not be unchanged because of big changes in interest and upcoming latest features of the new launched product and production rate as well. The classic EOQ modelling was rituals where ordering rate remain unchanged but realistic part hard to be considered. In the modern inventory model, the ordering rate depends upon on the order level in which organized, and electronic arrangements of the product in the large number of quantities tempt the more customers to purchase the product on the contrary, the shortages of items and backlogged items always bring the bad impression to grasp the product. The effect of inventory level on good will is extremely the part of highly competitive market. A company facing with the high competition in market may go for the advertisement factors would be boosted up the goodwill of product and naturally demand of the product would be increasing. In the supermarket, the abundant supply of the product is strictly increasing the procurement of the product in the inventory which can be reduced in the holding cost. This behavior may be called advertisement and stock dependent demand pattern. As the previous researches considered EOQ models for non-perishables items and have indefinite life value. But in the real phenomenon of inventory models is different, some items are subject to risks of wastage with time which is major part of concern in study of inventory model that cannot be neglected. As we have seen many items in market due to the different types of factors such as evaporation, decaying, spoilages, pilferages are the constraints that would be naturally sustained some cost of deterioration in inventory models. So, these products cannot retain in the nature if their original properties they loss their original senses of serves such types of products results the loss. As the matter of the fact,the past researcher has been considered the deterioration in the planning of inventory models and supposed an exponential decay and explored the result to minimize the total coast. Schrader and Ghare[1967] supposed exponential deterioration presented the result to minimize the total coast. Many diligent Kamalabadi and Maihami [2012], S. Panda, S. Saha et al [2013], Many diligent Jaggi et al. [2016], Bhunia [1998] and Mishra [2018] have been taken the subject of the interest. Later, S. Jindal and S.R Singh [2016] proposed an Integrated quality and maintenance decision in a production inventory model with multiple market demand. Then this idea has been cultured by many researchers, after then many devotes worked hard for organized the deteriorating models over the past decades by

Raafat [1991] and Goyal and Giri [2001]. Reviewer suggested that many items' losses their senses after a short period of time in meanwhile some reviewer discussed as the items reaches in inventory, they become start deteriorates. Wu et al. [2018] leading the natural state of products as "non-instantaneous deterioration (NID)" that no time is fixed for deterioration. In realistic, this type of phenomenon concludes that such as vegetables, and fruits remain fresh for a while. Further these researches were continued by many practitioner Hsu et al [2007], Jaggi et al [2015], [2017], at such products where the deterioration occurs up to 100% of the product's original nature. First allowed that demand and stock level are inversely proportional to each other in super market. Accumulating the products in systematic ways and gearing up in the market impact to raise the product's goodwill and decision-making for procured the inventory cause huge loses of economy. Further onwards, practitioners highlighted the market demand reveals upward inclination has been introduced by the first Levlin et al. [1972], They observed the market demand depends on how they organized the huge amount of stock and advertisement factors as well. It is known as stock-dependent demand. Vrat and Gupta [1986] they derived an expression where stock and variable demand rate and proposed a significant model After then, Urban, Baker [2005] established that effects a declination in case stock is less in amount they discussed the impact of inventory on the demand influenced by practitioner, such as Khana et al [2020] and Khare et al. [2020]. Vipin Kumar et al. [2020] assumed the multivariate demand with trade credit. Urban [2005] given two models of different type, the demand rate depends upon the initial stock, and the demand does not depend on time. Advertisement factors not effects the current demand of the firm it is a dynamic process and committed subject for future gain of any reputed firm, excessive goods level revert to maximum reputation in market as well. On the other hand, when the inventory level is stock out, that is a fact is most pursuit in the past research by backorder, where the backlog cost is leads loss of mouth words of a firm.

2 Assumption and Notations

Following are the assumptions for this study

1. The replenishment rate is infinite and the lead time is zero
2. Demand rate is a function of the frequency of advertisement A and the displayed inventory level defined as $D(t) = \begin{cases} A^{\mu}\left(a + bI(t)\right), & 0 \le t \le \nu \\ aA^{\mu}, & \nu \le t \le T \end{cases}$
3. A single instantaneous deteriorating item is Assumed
4. Shortages are allowed and partial backlogged with the rate dependent on the length of the waiting time for the next replenishment and defined as $\frac{1}{1+\delta(T-t)}$, where $\delta \ge 0$ and $\nu \le t \le T$

Following are the notations for this study

W: The maximum amount of positive inventory levels per cycle.

S : The maximum amount of shortages per cycle.

Q : The total order quantity per cycle.

C_0 : Ordering cost of inventory, \$/per order.

C_1: Holding cost, \$/per unit/per unit time.

C_2: Deterioration cost \$/per unit.

C_3: shortage cost, \$/per unit/per unit time.

C_4 : opportunity cost due to lost sales, \$/per unit.

r : representing the net constant discount rate of inflation

$I(t)$: Inventory level at any time t.

$\theta(t)$: The parameter of deterioration rate of the stock.

ν : the time from which the shortage of goods begins (Decision variable).

T: Length of each ordering cycle (Decision variable).

3 Mathematical Formulation

The model starts at $t = 0$ with maximum inventory level W . The inventory level depleted due to both demand and deterioration that reaches to zero level at time $t = \nu$. After that the shortage of goods begins up to cycle length $t = T$.

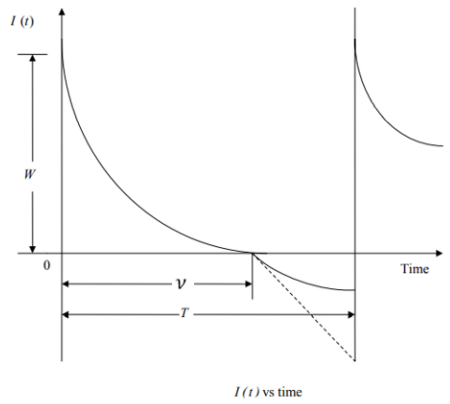

Figure 1: Inventory level $I(t)$ vs. time

Therefore, the positive inventory system in $[0, \nu]$ representing by the differential equations (3.1) as

$$\frac{dI(t)}{dt} + \theta I(t) = -A^{\mu}\left(a + bI(t)\right), \quad 0 \le t \le \nu, \quad (3.1)$$

With I $(\nu) = 0$.

The solution of the differential equation (3.1) is

$$I(t) = \frac{a}{b+\theta A^{-\mu}}\left(e^{(A^{\mu}b+\theta)(\nu-t)} - 1\right) \quad (3.2)$$

The maximum inventory level W is obtained by putting $t = 0$ in (3.2), we get

$$W = I(0) = \frac{a}{b+\theta A^{-\mu}}\left(1 - e^{(A^{\mu}b+\theta)\nu}\right) \quad (3.3)$$

The shortages inventory system in $[t_1, T]$ representing by the differential equation

$$\frac{dI(t)}{dt} = -\frac{aA^{\mu}}{1+\delta(T-t)}, \qquad \nu \le t \le T \quad (3.4)$$

With I$(\nu) = 0$.

The solution of the differential equation (3.4) is

$$I(t) = \frac{aA^{\mu}}{\delta}\ln\left(\frac{1+(T-t)\delta}{1+(T-\nu)\delta}\right) \quad (3.5)$$

Therefore, the total average cost

$$TAC = TAC(\nu, T)$$

$$= \frac{1}{T}\{OC + HC + DC + SC + BC\}$$

$$\frac{1}{T}\Bigg\{C_0 - \frac{aA^{\mu}e^{-r\nu}(A^{\mu}b(-1+e^{r\nu}) - e^{(A^{\mu}b+r+\theta)\nu}r - \theta + e^{r\nu}(r+\theta))C_1}{r(A^{\mu}b+\theta)(A^{\mu}b+r+\theta)} +$$

The maximum negative inventory level S is obtained by putting $t = T$ in (3.5), we get

$$S = -I(T) = -\frac{aA^{\mu}}{\delta}\ln[1 + \delta(T-\nu)] \quad (3.6)$$

Hence, the total ordering quantity

$$Q = W + S = \frac{a}{b+\theta A^{-\mu}}\left(1 - e^{(A^{\mu}b+\theta)\nu}\right) - \frac{a}{\delta A^{-\mu}}\ln[1 + \delta(T-\nu)] \quad (3.7)$$

4 **COST ANALYSIS:** The different inventory cost associated with the model per cycle are calculated as

(i) Setup Cost

$$OC = C_0 \quad (3.8)$$

(ii) Holding Cost

$$HC = \int_0^{\nu} c_1\ I(t)e^{-rt}dt$$

$$HT = \frac{aC_1}{r(b+\theta A^{-\mu})(A^{\mu}b+r+\theta)}\left((e^{(A^{\mu}b+\theta)\nu} - 1)r - A^{\mu}b(1 - e^{-r\nu})\right) \quad (3.9)$$

(iii) Deterioration Cost

$$DC = C_2\left(W - \int_0^{\nu} D(t)\, e^{-rt}dt\right)$$

$$DC = C_2\frac{a}{b+\theta A^{-\mu}}\left(e^{(A^{\mu}b+\theta)\nu} - 1 - \frac{b\left(e^{(A^{\mu}b+\theta)\nu} - e^{-r\nu}\right)}{A^{\mu}b+r+\theta} - \frac{(1-e^{-r\nu})\theta A^{-\mu}}{r}\right) \quad (3.10)$$

(iv) Shortage Cost

$$SC = C_3\left(-\int_{\nu}^{T} I(t)e^{-rt}dt\right)$$

$$SC = \frac{aA^{\mu}e^{-r(T+\nu)}\left(-e^{rT} + e^{r\nu}(1+r(T-\nu))\right)C_3}{r^2} \quad (3.11)$$

(v) Opportunity Cost Due to Lost Sales

$$BC = C_4\left(\int_{\nu}^{T}\left(1 - \beta(T-t)\right)\right)D(t)e^{-rt}dt$$

$$BC = \frac{aA^{\mu}C_4}{2\delta^2}\left(\delta(T-\nu)\left(2(\delta+r) - \delta r(T+\nu)\right) - 2(r+\delta-rT\delta)\ln[1-(T+\nu)\delta]\right) \quad (3.12)$$

$$\left(-\frac{aA^{\mu}(1-e^{(A^{\mu}b+\theta)\nu})}{A^{\mu}b+\theta} - \frac{a\left(\frac{A^{\mu}be^{-r\nu}(-1+e^{(A^{\mu}b+r+\theta)\nu})}{A^{\mu}b+r+\theta} + \frac{\theta - e^{-r\nu}\theta}{r}\right)}{A^{\mu}b+\theta}\right)C_2 - \frac{aA^{\mu}e^{-r(T+\nu)}(-e^{rT}+e^{r\nu}(1+r(T-\nu)))C_3}{r^2} + \frac{aA^{\mu}(\delta(T-\nu)+\mathrm{Log}[1-T\delta+\delta\nu])C_4}{\delta}\Bigg\}$$

5. Solution Procedure

The objective of this paper is to reduce the total average cost to the optimum value of ν and T which must satisfy the following equations.

$$\frac{\partial TAC(\nu,T)}{\partial \nu}=0,\frac{\partial TAC(\nu,T)}{\partial T}=0$$

$$\frac{\partial TAC(\nu,T)}{\partial \nu}=\frac{1}{T}\left(\frac{aA^{\mu}e^{-r\nu}\left(A^{\mu}b(-1+e^{r\nu})-e^{(A^{\mu}b+r+\theta)\nu}r-\theta+e^{r\nu}(r+\theta)\right)C_1}{(A^{\mu}b+\theta)(A^{\mu}b+r+\theta)}-\frac{aA^{\mu}e^{-r\nu}\left(A^{\mu}be^{r\nu}r+e^{r\nu}r(r+\theta)-e^{(A^{\mu}b+r+\theta)\nu}r(A^{\mu}b+r+\theta)\right)C_1}{r(A^{\mu}b+\theta)(A^{\mu}b+r+\theta)}+\left(aA^{\mu}e^{(A^{\mu}b+\theta)\nu}-\frac{a\left(A^{\mu}be^{-r\nu+(A^{\mu}b+r+\theta)\nu}+e^{-r\nu}\theta-\frac{A^{\mu}be^{-r\nu}\left(-1+e^{(A^{\mu}b+r+\theta)\nu}\right)r}{A^{\mu}b+r+\theta}\right)}{A^{\mu}b+\theta}\right)C_2+\frac{aA^{\mu}e^{-r(T+\nu)}\left(-e^{rT}+e^{r\nu}\left(1+r(T-\nu)\right)\right)C_3}{r}-\frac{aA^{\mu}e^{-r(T+\nu)}\left(-e^{r\nu}r+e^{r\nu}r\left(1+r(T-\nu)\right)\right)C_3}{r^2}+\frac{aA^{\mu}\left(-\delta+\frac{\delta}{1-T\delta+\delta\nu}\right)C_4}{\delta}\right)$$

$$\frac{\partial TAC(\nu,T)}{\partial T}=\frac{1}{T}\left\{-\frac{aA^{\mu}e^{-r(T+\nu)}\left(-e^{rT}r+e^{r\nu}r\right)C_3}{r^2}+\frac{aA^{\mu}e^{-r(T+\nu)}\left(-e^{rT}+e^{r\nu}\left(1+r(T-\nu)\right)\right)C_3}{r}+\frac{aA^{\mu}\left(\delta-\frac{\delta}{1-T\delta+\delta\nu}\right)C_4}{\delta}\right\}-\frac{1}{T^2}\left\{C_0-\frac{aA^{\mu}e^{-r\nu}\left(A^{\mu}b(-1+e^{r\nu})-e^{(A^{\mu}b+r+\theta)\nu}r-\theta+e^{r\nu}(r+\theta)\right)C_1}{r(A^{\mu}b+\theta)(A^{\mu}b+r+\theta)}+\left(-\frac{aA^{\mu}\left(1-e^{(A^{\mu}b+\theta)\nu}\right)}{A^{\mu}b+\theta}-\frac{a\left(\frac{A^{\mu}be^{-r\nu}\left(-1+e^{(A^{\mu}b+r+\theta)\nu}\right)}{A^{\mu}b+r+\theta}+\frac{\theta-e^{-r\nu}\theta}{r}\right)}{A^{\mu}b+\theta}\right)C_2-\frac{aA^{\mu}e^{-r(T+\nu)}\left(-e^{rT}+e^{r\nu}\left(1+r(T-\nu)\right)\right)C_3}{r^2}+\frac{aA^{\mu}(\delta(T-\nu)+\mathrm{Log}[1-T\delta+\delta\nu])C_4}{\delta}\right\}$$

Provided it satisfied the condition

$$\begin{vmatrix}\frac{\partial^2 TAC(\nu,T)}{\partial \nu^2} & \frac{\partial TAC(\nu,T)}{\partial \nu \partial T}\\ \frac{\partial TAC(\nu,T)}{\partial T\partial \nu} & \frac{\partial TAC(\nu,T)}{\partial T^2}\end{vmatrix}>0$$

5 Numerical Example

To check the above study, here an example is presented whose theoretical results have been solved with the help of Mathematica software. The various parameters used in this study and their mathematical values have been taken as follow

$C_0 \to 500, C_1 \to 15, C_2 \to 20, C_3 \to 10, C_4 \to 20, A \to 15, \mu \to .04, a \to 500, b \to 1, \theta \to 0.02, \delta \to 2.4, i = 0.3$

After solution, we obtain the optimal value are as follows

$\nu^* = 0.6567, T^* = 0.82241, TAC^* = 130.21210$

6 Conclusion

This paper studied about a model for inventory for stock and advertisement dependent demand. Here we considered deterioration factors on product, where Shortages are not allowed. The whole study is based on the market depends on advertisement of the product to stimulate the future demand and would be helpful to maintain the future demand. Stock dependent demand is also coming into existence for the researchers to ease the maximizing the profit and minimize the cost which is profitable for any company. we have taken the demand dependent on both factors. The findings are given to validate numerical examples and graphical representation concludes the significant of the result as well. To validate the above model used a various technique along with the mathematical

proofs and numerical examples. Presented inventory model can be further extended by choosing the different demand rates and variable holding cost for future scope.

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PRACTICES OF BUSINESS TRANSFORMATION FOR THE SURVIVAL OF SMALL & MEDIUM SIZED COMPANIES (SMEs) IN COVID-19: THE IMPORTANCE OF ENCOURAGEMENT

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ABSTRACT

Global pandemic crises, such as the coronavirus (COVID-19), often expose small and medium-sized companies (SMEs) to a variety of problems and may endanger their lives. The purpose of this research is to create a theoretical model that will give insights into the link between innovative management practises and the performance and survival of SMEs, while emphasising the auxiliary role of external assistance in such a relationship. An online questionnaire was utilised to gather data from 209 randomly assigned SME managers in the state of Maharashtra, and the analysis was performed using the SmartPLS3 software. The findings of the principal component analysis revealed that SMEs' inventive development and implementation of new to deal with the consequences of COVID-19 had a positive impact on performance and business survival. According to the PLS-SEM bootstrap results, external assistance significantly enhances the beneficial impact of SMEs' innovative practises on firm survival rather than performance. As previously stated, the study has numerous major practical implications for entrepreneurs, governments, and policymakers.

***Keywords**: performance, SME survival, pandemic, crisis, Innovative practices, encouragement.*

Introduction

The COVID-19 infection has impacted all economic sectors and organisations, including small and medium-sized enterprises (SMEs). The government's attempts to prevent the virus's spread have caused distortions in the system of supply and demand for products, slowing the economy of several countries. Because of distribution network imbalances, SMEs have faced a scarcity of employees and manufacturing materials. SMEs have also developed a range of strategies and techniques to deal with the consequences of the crisis (Thorgren & Wil-liams, 2020; Ahmad et al., 2020). However, just a few studies have focused on SMEs' post-emergency survival methods.

The web gives us a vast vary of opportunities, such as; having a connection with humans all around the world; creating, sharing, and disseminating content; gaining and searching for statistics on an limitless wide variety of subjects; and staying up to date. More or less, there are some indisputable consequences and changes due to the emergence of the internet, however particularly the full-size use of social media. One of these essential modifications takes place in commercial enterprise models, as well. By the commencing of the 21st century, the use of the internet and social media had come to be a phase of commercial enterprise strategies. In addition to this, groups have began using the special qualities of the net and have shifted their market method to e-commerce. The Web has come to be one of the most worthwhile equipment for promoting merchandise and offerings to appeal to the goal audience. Some of them bought into the market as e-retailers, while others grew to be content providers, transaction brokers, market creators, or service providers. However, one of the most essential motives that made them penetrate into the market was once low barriers to entry. That's why many small and medium sized enterprises (SMEs) put their products on the net or use multiple business models which includes the internet.

Henceforth, the firms started out adding online infrastructure to their enterprise model as well. In addition to this, they modified the income models because of the top notch return on the web and modified and renewed the key factors of traditional marketing. Since the time of these ground-breaking developments, social media has additionally grow to be a turning factor due to its realistic opportunities from the standpoint of business, such as value effectiveness, time-

saving, and engagement with customers. The more businesses, particularly SMEs, started to use social media, the greater it grew to become a famous advertising device regarded as Social Network Marketing (SNM).However, there are some imperative and controversial factors concerning the effectiveness of SNM. Particularly, debates take place over the size of success in phrases of great and quantity.

The existing lookup targeted the impact of SMEs' innovation practises on enterprise performance and survival. The cutting-edge lookup additionally examined the moderating impact of exterior help in the relationship between SMEs' innovation practises and commercial enterprise performance and survival. Focusing on the advertising and organisational innovation practises adopted by means of SMEs in maharashtra state to face the threats created by using the COVID-19 pandemic, the existing find out about is based basically on the speculation that SMEs' innovation practises in times of crisis, such as the COVID-19 pandemic, may additionally help increase the organization's overall performance and, subsequently, make sure its survival.

Research Methodology

This study contributes to the developing literature on SMEs' practises and external support in times of disaster and provides additional insights for SME managers and policy-makers about the significance of external help in strengthening the fine have an effect on commercial enterprise survival. After reviewing the literature on SMEs' innovation practices, performance, survival, and exterior support, we will introduce our theoretical framework and analysis of the five hypotheses being tested. We then present and discuss the consequences of our record analysis to spotlight our most important conclusions. It is a paper based on secondary data regarding challenges and opportunities of use of business tool in SMSs sector, this is conceptual paper written for the understanding of available literature on the topic of business analytics, in this paper, researcher is going to use secondary data from the previous literature review of the Business tools and its application in SMSs retails,

Review of Literature

Even though a long time has passed since social media has started to be used to maintain interaction with customers, it has turned out to be a necessary position in business life. In this regard, some important seminal articles in the literature have been studied about using social media as a strategic device, in particular for SMEs in this brief time period. In the literature evaluation section, we would like to define which factors the SMEs' advertising activities through social media are affecting their performance. Firstly, social media user purchaser types are categorised based on the literature definitions, and then how social media customers affect SME advertising efforts on social media is specified. The specified overall performance requirements in the existing research for assessing the efficacy of social networking sites through branding operations for SMEs are recognised in the second step.

2.1. Importance of the usage of social media as a marketing strategy.

Web 2.0 social media is a doubtlessly effective medium for discovering key consumer influencers, engaging them, and producing company advocates. However, in order to build viral campaigns and foster online word of mouth advertising (WOM), confidence needs to be mounted and, due to this fact, strengthened in order to overcome any reluctance on the part of the would-be purchaser (Miller and Lammas, 2010:7). Since the emergence of new technologies, clients have been searching on social media rather than Google or other search engines in order to get data about corporations (Newman, 2013). Social media is beneficial for building trust between customers and businesses in a way that the traditional media has not seen (Deelmann and Loos, 2002).

Innovation practises and the performance of SMEs

Innovation has come to be a necessity for all current corporations that choose to survive in a world characterised by competition, technological change, and recurring crises. Tornatzky et al. (1990) define innovation as the

use of new technological know-how or new administrative practises in a company to achieve a focused improvement in its operations. From an SME perspective, innovation regularly indicates new merchandise or processes that ad-dress client needs more competitively and profitably than existing ones (O'Regan & Gho-badian, 2006; Zahra et al., 1999). We use the time period "innovative practices" in this learn about to refer to the fantastic implementation of new solutions to challenges faced by using SMEs, which encompass fine implementation of new thoughts in relation to the organization's product, services, or processes; new advertising mechanisms; or new administrative practises for work amelioration and upgraded performance (Damanpour, 1992; Johannessen et al., 2001; Eurostat, 2005).

The key driver of innovation practises in organisations is the ambition to get reimbursement in the form of higher performance. Therefore, innovation is described as the creation of some adjustments in the enterprise's practises that are supposed to gain an enchancment in performance (Curristine, 2006). Based on the literature, overall performance in this study is described as achieving the institution's goals associated with sales, profit-ability, competition, market share, and any other strategic dream (Hult et al., 2004). Re-searchers also described overall performance as reaching a set of preferred effects ensuing.

There is a lot of writing supporting the huge positive connection among development and SME execution (Qian and Li, 2003; Rosenbusch et al., 2011; Verhees and Meulenberg, 2004; Yıldız et al., 2014). The distributed examination likewise showed the positive effect of development abilities on SME execution (O'Cass and Sok, 2014; Oura et al., 2016; Zhang, et al., 2018). noticed that the endeavours applied to foster various developments are the essential justification for the improvement in SMEs' monetary pointers. Past investigations likewise showed a positive relationship between's advancement abilities and SME execution (O'Cass and Sok, 2014; Oura et al., 2016; Zhang et al., 2018). Freeman (2004) added that unmistakable SMEs' per-formance is a result of the viable execution of developments. Nonetheless, Lin and Chen (2007) contended that the effect of supervisors' development rehearses on SME in-come offsets that of mechanical advancement. Along these lines, we contend that the development practises of SMEs in all natural circumstances—for example, the COVID-19 pandemic—can contribute emphatically to successful business execution. In this manner, we speculate the accompanying:

SME's development rehearsals emphatically affect its exhibition.

Advancement practises and SME endurance.

In the current review, undertaking endurance was used to show the amount of time it takes the endeavour to complete its exercises from start to finish (Bercovitz and Mitchell, 2007).There are many gatherings locally that benefit from the endeavor's endurance, besides its chiefs. They incorporate laborers, buyers, and sup-pinocers (Bercovitz and Mitchell, 2007). Scientists affirm that undertaking endurance is one component of its presentation (Danes et al., 2008; Kalleberg and Leicht, 1986). An undertaking can endure on the off chance that it can adjust to the conditions and its general climate (Child, 1972; Pfeffer and Salancik, 1978). In comparison to large enterprises, SMEs have shorter life expectancies, are more productive, and are heavily influenced by external environmental variables (Carroll and Huo, 1986).A few specialists believe endurance to be a target proportion of business achievement (Miner, 1997).

In the midst of an emergency, the presence of SMEs is at serious risk (O'Reilly III and Tushman, 2011). Emergencies debilitate SMEs' development and undermine their undertakings on the grounds that their adverse consequence stretches out to all components of the outside big business climate (Dhochak and Sharma, 2015). For example, in the midst of an emergency, SMEs have restricted financing openings because of frail capital market execution, absence of adequate data, and part absconds all over the economy (Bester and Hellwig, 1989; Binks et al., 1992; Cowling et al., 2012; Hillier and Ibrahimo, 1993; Mason and Harrison, 2015).

The business development endurance relationship has been represented in various investigations. Development is essential to the success of any project (Ortiz-Villajos, 2014).As indicated by Gaynor (2002), advancement is the centre factor behind the endurance and continuity of endeavors; it upholds the organization's extension and development and improves the undertaking's future achievement. Past examinations proposed utilising advancements to defeat the hindrances and difficulties of mechanical SMEs' prosperity and endurance (Bruns and Stalker, 1961; Hurley and Hult, 1998; Porter, 1990; Schumpeter and Redvers, 1934). Schumpeter (1942) proclaimed that an undertaking's endurance is firmly connected to its development rehearsals. A few examinations have endeavoured to clarify this connection by highlighting a few ideas applicable to both development and endurance. For example, an advantage is both the result of extensive business development rehearsals and a critical component of its long-term viability (Brüderl et al., 1992; Cefis and Marsili, 2003; Helmers and Rogers, 2010).Schumpeter (1942) contended that undertakings couldn't endure and proceed with their exercises without being creative. Notwithstanding, endurance likewise comes about because of achieving triumph despite emergencies forced by the outer climate (Aldrich, 1979; Han-nan and Freeman, 1977; Kanter and Brinkerhoff, 1981). Subsequently, this review contends that the different advancement endeavours applied by SMEs to alleviate the adverse consequences of the COVID-19 pandemic can bring positive outcomes for these ventures. Along these lines, the second theory of this examination is expressed accordingly:

SME's advancement emphatically affects its exhibition.

SMEs and outside help

Outer help alludes to the help given to the venture by outside parties (Global, I, 2018). SME's are progressively utilising outer help (Bennett et al., 2003) on the grounds that it furnishes them with the fundamental information and data important to reinforce their serious position and increment their opportunities for future thriving (Bennett and Robson, 1999; Penrose, 1959a, 1959b; Teece, 2002; Teece et al., 1997). Governments, advocates, and various offices and foundations provide outside assistance to SMEs in order to save their lives, support their development, animate their advancement, and upgrade their capacities by expanding administrative abilities and further developing advertising abilities, ensuring they make a more significant business contribution to the public economy (Christian and McMullan, 2004; M).Governments, on the other hand, urge SMEs to take outright help to be better prepared to take advantage of their business limits, work on their presentation, increase their intensity, and aid business development and development (Cliff, 1998; Gimeno et al., 1997; Story et al., 2010).

SMEs' outside help can be either immediate or backhanded. Direct outside help typically appears as monetary guide that will be utilised in the obtaining of resources, the acquisition of innovation, or the execution of improvement plans determined to tackle financing insufficiency issues. It is typically given by explicit government strategies or monetary go-between conditions (Freitas and Von Tunzelmann, 2008; Nishimura and Okamuro, 2011). Aberrant outer help ordinarily appears as counsel, thoughts, and exhortation given by specialists, warning workplaces, and instructive establishments to assist with disposing of the absence of information and increasing the accessible sum of information (Freitas and Von Tunzelmann, 2008; Metcalfe and Ramlogan, 2005). Notwithstanding the variety and significance of outer help for SMEs, scientists have found that SMEs benefit little from this help because of the absence of data and mindfulness about this type of help and the endeavour board's failure to pick the right sort of help (Story, 1994).

The majority of responders (75%) were married, while the remainder (25%) were single. In terms of age distribution, the majority (45%) were between the ages of 20 and 35, followed by 36-50 (35%), and the remainder (20%) were over the age of 50.

TOOL USED: A structured interview was used to collect data.

STATISTICAL DEVICES: The availability of data in the form of numbers and percentages has been exploited for data analysis.

Analysis And Processing of Data:

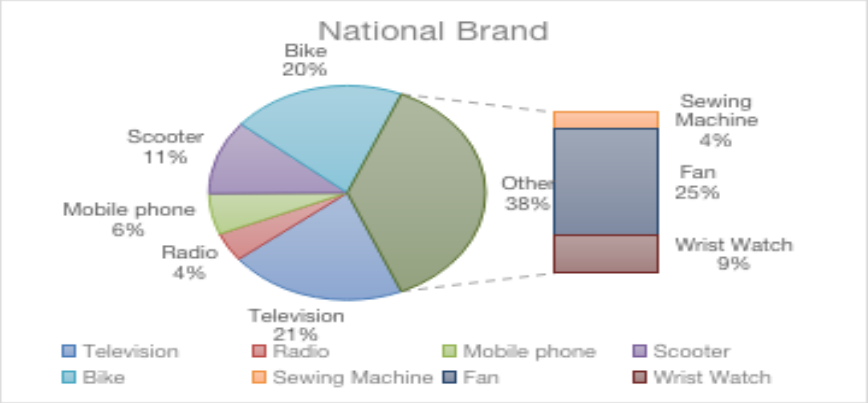

Fig. 1: Pattern of Consumption of Long-Lasting Products in Covid-19 situation;

It is clear from Fig. 1 that rural consumers favoured branded items when they perceived higher technology and quality. People have demonstrated an interest in local brands for items such as radios, sewing machines, and fans. Contributing scenarios include inexpensive cost, simple accessibility, a well-known supplier, ease of complaint, & minimal danger.

A nigher gander at the breakdown of the MSME area clarifies why MSMEs are so helpless against cash turning pressure. How are MSMEs characterized? Officially, MSMEs are classified according to their interest in shops and means (Map 1).Be that as it may, this basis for the likeness was for some time reprimanded on the grounds that conceivable and exact subtleties of ventures weren't uninhibitedly accessible by specialists. That is the reason, in February 2018, the Union Cabinet chose to change the basis to "successful train", which was more in accordance with the impost of GST. As per the proposed likeness, which is yet to be officially acknowledged, a miniature venture will be unified with an incessant train not as much as Rs 5 crore; a small endeavour with a train between Rs 5 crore and Rs 75 crore; and a medium undertaking with a train not as much as Rs 250 crore.

WHAT IT MEANS, HOW MANY, AND WHERE THEY STAND

CHART 1: DEFINITION OF MSME

Classification	Manufacturing Enterprise*	Service Enterprise*
Micro	Up to Rs 25 lakh	Up to Rs 10 lakh
Small	Above Rs 25 lakh to Rs 5 cr	Above Rs 10 lakh to Rs 2 crore
Medium	Above Rs 5 cr to Rs 10 cr	Above Rs 2 cr to Rs 5 cr

*Manufacturing Enterprise: investment in plant & machinery;
Service Enterprise: investment in equipment

CHART 2: ESTIMATED NUMBER OF MSMEs (IN LAKH)

Activity category	Rural	Urban	Total	Share
Manufacturing	114.14	82.50	196.65	31%
Trade	108.71	121.64	230.35	36%
Other services	102.00	104.85	206.85	33%
Electricity*	0.03	0.01	0.03	–
All	324.88	309.00	633.88	100%

*Non-captive electricity generation and transmission

CHART 3: ESTIMATED EMPLOYMENT IN MSME SECTOR (IN LAKH)

Broad activity category	Rural	Urban	Total	Share
Manufacturing	186.56	173.86	360.41	32%
Trade	160.64	226.54	387.18	35%
Other services	150.53	211.69	362.22	33%
Electricity*	0.06	0.02	0.07	—
All	497.78	612.10	1109.89	100%

*Non-captive electricity generation and transmission

CHART 4: DISTRIBUTION OF ENTERPRISES CATEGORY-WISE (IN LAKH)

Sector	Micro	Small	Medium	Total	Share
Rural	324.09	0.78	0.01	324.88	51%
Urban	396.43	2.53	0.04	309.00	49%
All	630.52	3.31	0.05	633.88	100%

CHART 5: POTENTIALLY ADDRESSABLE CREDIT GAP IN THE MSME SECTOR (IN RUPEES TRILLION)

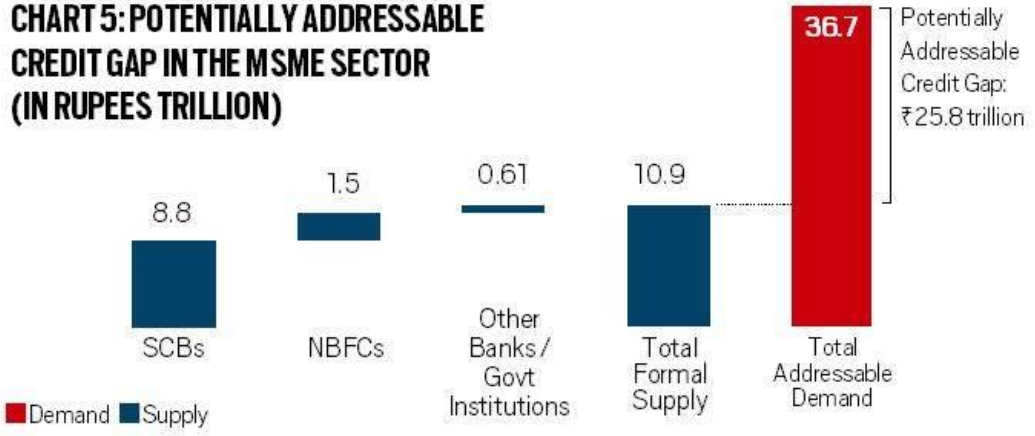

CHART 6: SEGMENT-WISE NPA

How many various MSMEs does India have? Who possesses them, and where are they put? As indicated by the last accessible (2018-19) Annual Report of the Department of MSMEs, there are 6.34 crore MSMEs in the nation (Map 2). Approximately 51% of these are placed in peaceful India.They employ slightly more than 11 crore people (Map 3), but administrative MSMEs account for 55 percent of all business.Overall, fewer than two individuals are utilised per MSME. At one arrive, that gives an image of how small these truly are. In any case, a fractionation of all MSMEs into miniature, little and medium sorts is yea more pregnant. As shown in Chart 4, 99.5 percent of all MSMEs are of the miniature variety.While miniature ventures are similar to conveyed over peaceful and administrative India, little and medium bones are by and large in legislative India. All in all, miniature endeavours naturally bear witness to a solitary man or a lady chipping away at their own work from the comfort of their home. The medium and small undertakings—that is, the remaining 0.5 of all MSMEs—utilise the excess 5 crore-odd specialists. The circulation of big business by layer further finishes the image. Around 66% of all MSMEs are held by individuals having a place in the Slated Strata (12.5), the Slated Races (4.1) and other backward classes (49.7). Regardless of how you look at it, the sex rate among labourers is largely nonconflicting, with around 80 men and 20 women.As far as topographical conveyance is concerned, seven Indian sways alone account for 50% of all MSMEs. These are Uttar Pradesh (14), West Bengal (14), Tamil Nadu (8), Maharashtra (8), Karnataka (6), Bihar (5) and Andhra Pradesh (5). What sort of issues do MSMEs in India face? Given the shape and type of MSMEs, it isn't difficult to see the sort of issues they would confront. Regardless, most of them aren't enlisted anywhere. An integral justification behind this is that they're simply excessively little. Yea, GST has its limit and top miniature endeavours don't qualify. This clear intangibility will, in general, work for ventures just as well as against them. Being outside of the conventional organization, they don't need to keep up with accounts, pay imposts, or cut to dictator standards, and so on. This cuts down their expenses. However, as it's unmistakable in a period of limit, it likewise compels an administration's capability to help them. For example, in some nations, the public authorities have attempted to straightforwardly hand down instalment qualification and pointless credit to bring down houses, but that could go down since yea lower houses were being schemed. Identifying this is maybe the single-greatest bar confronting MSMEs – the absence of bankrolling. According to a 2018 report by the International Finance Corporation (region of the World Bank), the traditional financial framework provides less than 33% (or approximately Rs 11 lakh crore) of the credit MSME credit needs that it may subsidise (Chart 5).As such, the consummate of the MSME bankrolling comes from casual sources, and this reality is key since it clarifies why the Reserve Bank of India's efforts to push liquidity towards the MSMEs have had a limited effect. A significant justification for why banks qualm about stretching out advances to MSMEs is the high extent of terrible advances (Chart 6); this information shows forward slippage for like-greater endeavors. The other major issue impeding the area is the detention of MSMEs in instalments — whether from their purchasers (which includes the government as well) or from effects such as GST discounts and so on.

Five Challenges

The world is presently confronting an exceptional emergency from COVID-19. What at first began as a wellbeing emergency has quickly developed into one of the most noticeably terrible financial emergencies ever. For some SMEs, the test is to leap from one emergency to another, but a progression of emergencies—wellbeing, financial matters, and business—with stages that generally rely upon the speed at which the public authorities can contain the spread of the infection and kick off the economy.

Figure 1: Key Challenges for Micro, Small, and

Mid-Sized Enterprises

MSMEs are short for "miniature, small, and medium-sized undertakings."

Source: Survey on the effect of COVID-19 by the Asia-Pacific MSME Trade Coalition (link is outer), 31 March to 6 April 2020. the pandemic's effect on private companies has been quick. As indicated by the study, these are the five significant difficulties that face SMEs:

Absence of functional income: Almost half of the SMEs reviewed have not exactly a month or simply a month of money held in reserve.

Low client interest Business conclusion because of a state lockdown approaches

Diminished freedom to meet new customers.

Issues that involve changing plans of action and procedures and giving new items or administrations

Except if these issues are tended to through government strategy intercessions and different drives, numerous SMEs are at risk for conclusion. Overall, according to the Asia–Pacific MSME Trade Coalition, nearly 33% of SMEs expect to lay off half or more of their workforce in order to survive.

Relief and Recovery Measures

Governments have begun to set up a wide exhibit of measures to moderate the monetary effect of the Covid flare-up on organizations. Some have zeroed in on more broad arrangements that are expected to cushion the blow for the economy and for all organizations.

Many countries are also delivering a wide range of strategy instruments to assist SMEs and particularly the self-employed during this extremely difficult time.The prompt centre is tending to momentary liquidity. Such approaches take different shapes, here they are generally normal: Assessment Deferment. Annual assessments, local charges, extract obligations, & different instalments transmitted by organisations to the public authority are conceded to ease liquidity imperatives that SMEs face.

Conclusions

The state-of-the-art query proposes a hypothetical model for concentrating on the directing impact of outside help, outfitted throughout the COVID-19 scourge emergency, in fortifying the hyperlink between advancement rehearses and the general presentation and endurance of SMEs the use of the PLS-SEM calculation. The look into principally dependent on 4 basic theories corresponding to the association between these factors. The central discoveries of the look into suggest that the advancement practices of SMEs have a critical effect on the exhibition and endurance of SMEs. Moreover, the review results approved the enormous and directing situation of outer guide provided to SMEs all

through the COVID-19 pestilence emergency and the endurance of the business. Consequences of the review showed that the protection approaches embraced with the guide of maharashtra specialists to restrict the repercussions of the COVID-19 pestilence emergency on SMEs, which addressed severa monetary aide programs and empowered the assistance of nongovernmental associations, was relied upon to add to the flexibility of these organizations in managing such an emergency.

Albeit the current day look into has executed discoveries that have huge ramifications for SME directors and strategy creators, it has a few restrictions. Due to the tremendous scope of development rehearses, the review zeroed in just on authoritative advancement rehearses and rejected different fields, like mechanical developments. Another limita-tion of this find out about is the estimation of the presentation of SMEs utilizing money related and promoting cautioning signs and overlooking different pointers, like regulatory, social, and mental elements.

The current query proposes a hypothetical life sized model for examining the directing impact of outer help, provided at some stage in the COVID-19 plague emergency, in reinforcing the connection between advancement rehearses and the general presentation and endurance of SMEs the use of the PLS-SEM calculation. The find out with regards to dependent on four straightforward speculations comparable to the association between these factors. The significant discoveries of the review advocate that the advancement practices of SMEs have an incredible affect on the exhibition and endurance of SMEs. Furthermore, the look into outcomes affirmed the huge and directing job of outside help provided to SMEs during the COVID-19 pandemic emergency and the endurance of the business. Aftereffects of the look into showed that the arrangements embraced via Maharashtra administration to limit the repercussions of the COVID-19 pandemic catastrophe on SMEs, which addressed various money related help applications and persuaded the help of nongovernmental associations, used to be expected to add to the flexibility of these organizations in confronting such an emergency.

Albeit the current day look into has completed discoveries that have large ramifications for SME supervisors and strategy creators, it has a few restrictions. In light of the wide change of advancement rehearses, the review zeroed in exclusively on managerial development rehearses and rejected different fields, like mechanical advancements. Another limitation of this look into is the element of the general presentation of SMEs the utilization of money related and promoting markers and disregarding various pointers, like managerial, social, and mental components.

Future examination should increment upon these ends by tending to the shortcomings of the cutting edge study. In view of the scope of the areas to which little enter-prises have a place, it would be prescribed to propensities an area based assessment of their practices. Moreover, to achieve complete and top to bottom understanding into the idea of the connection between SMEs' advancement rehearses, outer help, and business execution and endurance, all pointers for estimating association execution ought to be thought of, and the sorts of development ought to be tended to.

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IMPACT OF FRINGE BENEFITS ON EMPLOYEE MOTIVATION IN INDIAN PRIVATE COMMERCIAL BANKS

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ABSTRACT

Employers are always making money to retain their employees and improve their performance in a consistent and equitable manner; employers can make sure that their investment yields outcomes. Employees too get advantage from performance dimension and escalate accurate product testing. This can only occur when performance is measured constantly in the organization. Managers and administrative investigators have long believed that the organization's goals are not achievable without the enduring commitment of the members of the organizations. This study will examine the impact of the benefits below on the performance and development of staff and self-promotion in the HDFC Bank Pune region. Performance and development is a way of judging the past and present productivity of an employee in an organization. The fringe benefits are the non-financial compensation that organizations use as a source of motivation to improve the performance of employees working in the organization. The study will look at the relationship between benefits in terms of end-to-end benefits and staff performance and development. This will reduce annual leave, free health scheme, pensions, maternity leave, employee loans and development. For the study 100 employees were taken as sample size for the study from HDFC Bank Pune region. On the basis of the research the researcher endeavored to make recommendations and recommendations that will always focus on promoting the management of all banks to calculate the benefits offered to their employees nationwide by the Banks' Employers Association and align their appropriate benefit policies accordingly.

***Keywords**: Fringe Benefits, Motivation, Employee Performance, HDFC Bank, Employees Development.*

Introduction

Fringe benefits are aids offered by the employer to the member of staff in addition to the normal pay and salary, which may be in the type of financial aid or assistance for everyday living requirements or financial aid for retirement age or other type of retention. Everyone on this planet loves it when they get something more and more than what is requested. Like chili flakes oregano in Domino's Pizza. That “extra” rule is most applicable in the employment sector. The benefits of Fringe are "an additional component". You get paid for the service given in the organization, no doubt. But then wouldn’t you like to be informed about your performance? Don't you like to be pampering during needs? Some of the things of value are more than salary.

Examples, types, benefits, relevance, and all sorts of things will be shadowed in the next section of the article. But most importantly understand that these benefits can be permanent or temporary. You can get assistances under your present job but then you may not get the job alteration. Receiving more out from institutions is very important.

In the early days of business, the only method to retain employees was to increase existing wages. Days went by and only those employees who were faithful to their job outlines were retained. In the current world today, retaining employees is provided by providing them additional aids for their extended service with the organization.

As numerous companies offer lower profits, it is also a type of compulsion for the outstanding companies if they want to be competitive with the environment. In order to attract brilliant employees, institutions offer a fair amount of pay together for various aids because if they do not donate, others will catch them off guard. It’s been noted earlier those numerous talented employees leave the institute if they do not receive adequate long-term benefits. Background benefits vary from owner to owner. Employees have the right to select the ultimate welfares. Employees prefer those

options where they benefit the most. Employees with trade businesses (such as electronics retailers) are offered discounted profits, cost-effective sales, increased customer rewards, etc.

The advantages of the edges are two-edged swords. On the other hand, it gives employees pleasure and a sense of satisfaction; on the other side it provides the final assurance to the owner at a lower charge. The nature is always respected. The similar is true of aids. Employees like to remain longer with those bosses who offer different welfare aids.

HDFC Bank assists trusts and non-profit organizations with a variety of savings resources to make it more efficient and efficient. These include maintaining security, participating in RBI (Reserve Bank of India) auctions and maintaining SGL (Subsidiary General Ledger) accounts. Our services help trustees to increase returns on their wallets, reduce the cost of revenue and expenditure and enjoy seamless reporting on their accounts and transactions.

HDFC Bank: HDFC Bank is listed as the No.1 Bank India ahead in the world. It has around 90,000 full-time employees and is based in Dubai, Hong-kong and Bahrain. HDFC Bank is the biggest lender of private companies in India with properties. It is India's biggest bank in terms of market capitalization since 2020 March. Revenue is approx. 2 lakh cr and total assets were around 12 lakh crore.

HDFC Bank has a network of around 5500 branches and 15000 ATMs across major capitals and cities. Euro money Private Banking and Capital Administration Survey 2021. HDFC Bank positions No. 1 in the prosperous category.

The benefits of the edges, however, can give employees a solid satisfaction that stands as a result of your staff performance and motivation in making the product. They may have a strong passion and love for a particular holiday cottage. The provision of free childcare can address the problems of a home-based trade union. The fact is that the defined benefits are chosen from the basic salary, so the employee evaluation is influenced by the cost and construction results.

There are many reasons why corporate benefit policies have greater market forces than smaller firms especially in the banking sector. The corporate sector is likely to produce items for assets that can be considered as back profits for HDFC Bank employees. Institutions such as HDFC Bank should be more concerned with recruitment strategies and how to retain and motivate staff. In addition to basic wages, a large portion of the labour costs of most companies today are used for lower profits.

Review Of Literature

Dr. Singh Preeti Rajpal 2021 is trying to study Monetary Incentives or Fringe Benefits - What Do Corporate Employees Prioritize. Abhay Kumar Patil 2021 looks at community dependence on forest edges from already endangered and endangered Medicines (TNMTs) resources in state forests for their health and livelihood needs, and research was conducted in all six eco regions. state after selecting the most forested sections and the deliberately selected infrastructure and socio-economic surveys were conducted in the valleys adjacent to these parts of the forest. Dr. J. Mohamed Ali 2021 Examine the Effect of Integration and Acquisition on Organizational Behavior of Manufacturing Companies. The survey was conducted on 5 selected companies that received mergers in the recent past.

Amal Jishnu 2021 reiterated the impact of external and internal rewards employee commitment and the importance of internal remuneration rather than external remuneration. Findings useful for file to enable managers to create standard remuneration packages based on employee preferences with external combinations as well internal rewards in varying degrees. Zala 2021 conducted research

into achieving key objectives such as finding strategies to retain staff from other private and public banks in Saurashtra, to look at flexible banks and efforts to promote personal employment, to look at earnings and benefits structure that greatly affects the level of attractiveness.

Dr. V. Pasupathi 2020 looks at the link between human resource development processes and the HRD climate variables from which. The results are mainly based on the second data base in a few pharmaceutical industries and discussions with corporate executives have been put in place. Nirmal Chandra 2020 concludes that labor, i.e. labor, is not well managed in the tea plantation industry in North Bengal. As a result, workers involved in the tea industry to support themselves and their families are adversely affected. As a result, union-backed workers called a strike, creating pressure on management to meet their demands. Therefore, labor disputes have become quite common in this area. Eventually, all of these problems lead to workers 'frustrations with strikes, gheraos, etc. So the industry is in jeopardy.

Need And Significance Of The Study

This research project will highlight the importance / impact of benefits on the performance of employees in the banking sector, especially HDFC Bank which is the second largest bank in India. Emphasis will also be placed on the impact of mutual benefits on employee behavior to increase organizational productivity. This study is very important as it aims to provide a variety of end-to-end benefits and guidelines or processes that will ensure its successful implementation in improving the performance of employees. It can also give a high school student the opportunity to fully understand and comprehend what the background benefits are talking about; types, implementation guide and impact on staff performance. Ultimately, this study will serve as a source of information on business start-ups, government and the general public on what perceptions they should have about employees in terms of back benefits. This study only examined the impact of mutual benefits on the performance of employees in the banking sector. Therefore; the significance of this was explored through this research project and the use of HDFC Bank as a study and limitations in research. A lesson again looks at determining the compliance of benefits to the bank's performance limits and identifying critical issues affecting the profitability behind the organization.

Objectives Of The Study

- To study various fringe benefits provided by HDFC Bank.
- To examine the impact of fringe benefits in motivating employees to perform their best in the organization.
- To investigate the impact of these fringe aids on the overall development of the employees and provide some suggestions on the basis of the study.

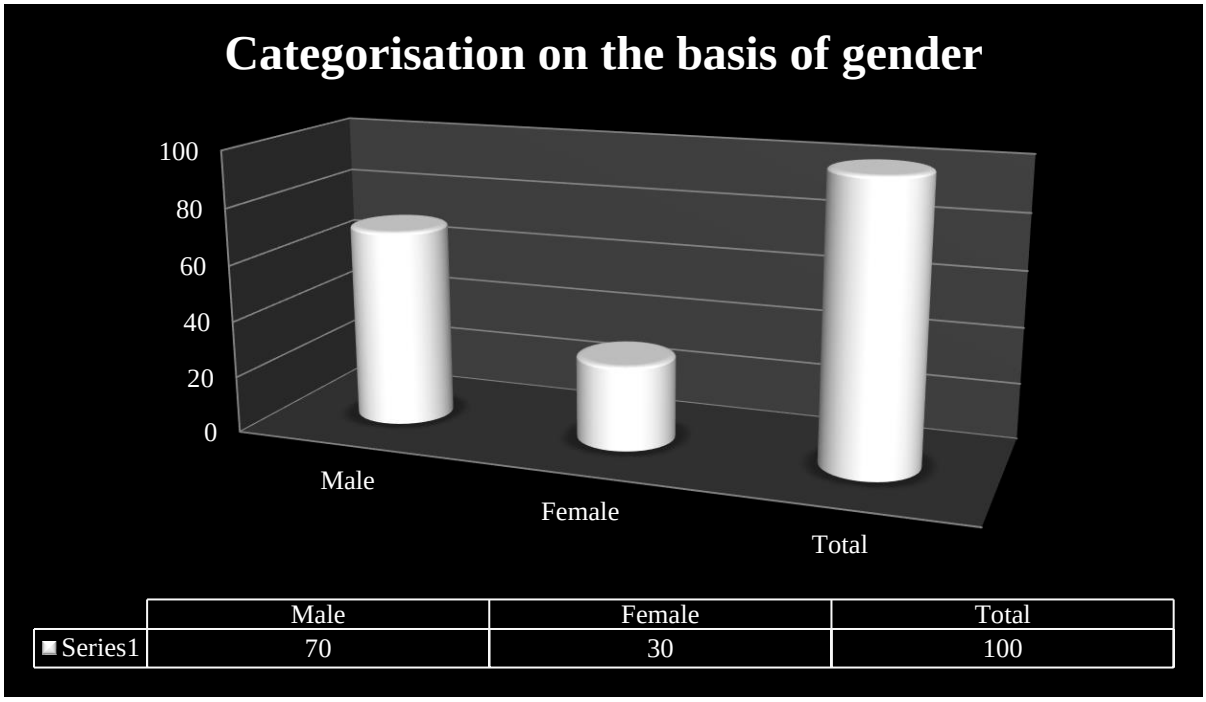
Research Methodology

For successful completion of the study both the data primary and secondary taken into consideration. Primary data has been collected with the help of questionnaire which was distributed among the randomly selected 100 employees of HDFC Bank Pune region and side by side detailed discussion was also done with the employees selected randomly for the study. Different charts, bar graphs and weighted average chart were prepared for analyzing the collected data and for secondary data various research publications, books, magazines survey and literature was taken into consideration.

Findings And Discussion

- Categorization on the basis of gender of the employees

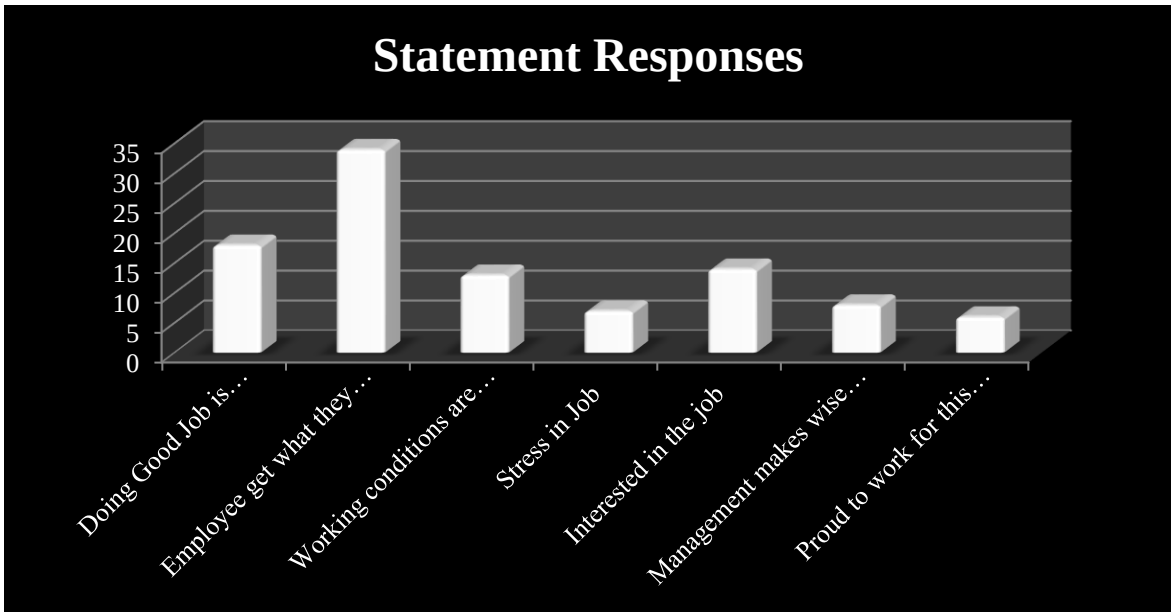
Male	**Female**	**Total**
70	30	100



- Employees asked to agree on various statements.

Statements	**Respondents**
Doing Good Job is rewarded	18
Employee acquire what they want to do job well	34
Working circumstances are good	13
Stress in Job	7
Interested in the occupation	14
Organization makes intelligent decisions	8
Pleased to work for the Institution	6

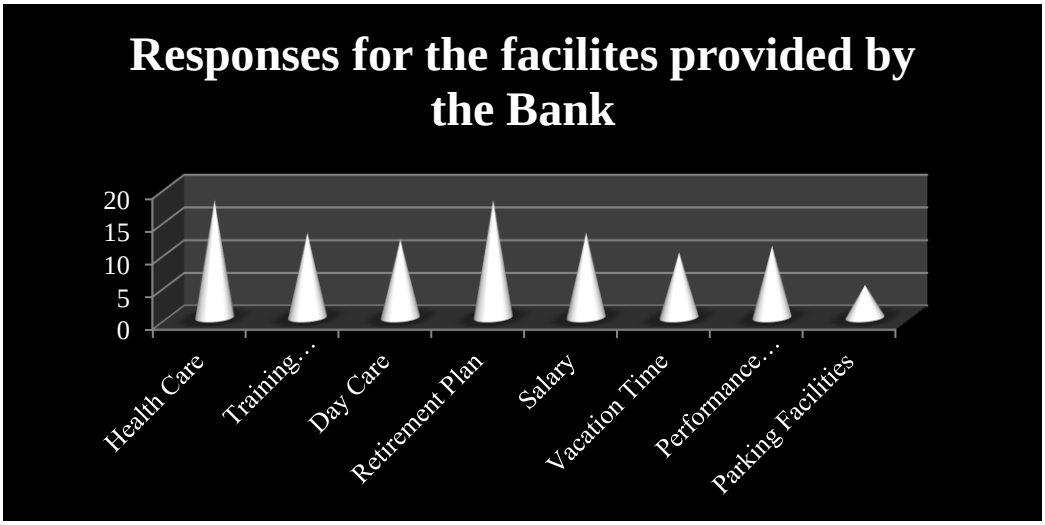
For conducting the study 100 employees from HDFC Bank Pune Region were taken as sample size and when the employees were asked about different statement than 34% believes that they get the facilities in the institution what they want for working well and 18% believes that if they work hard and well in the Institution they were rewarded with various benefits.14% of the employees believe that they took interest in their jobs and don't feel the job as burden, whereas 13% believes that the working conditions in which they are working are up to the point. Whereas 7% of the employees believe that they feel stressed in their job and only 6% believes that they are proud to be the part of the bank.



- **Employees ask to tick the facilities provided by the bank to them**

Facilities	Respondents
Health Care	18
Training Availability	13
Day Care	12
Retirement Plan	18
Salary	13
Vacation Time	10
Performance Reviews	11
Parking Facilities	5

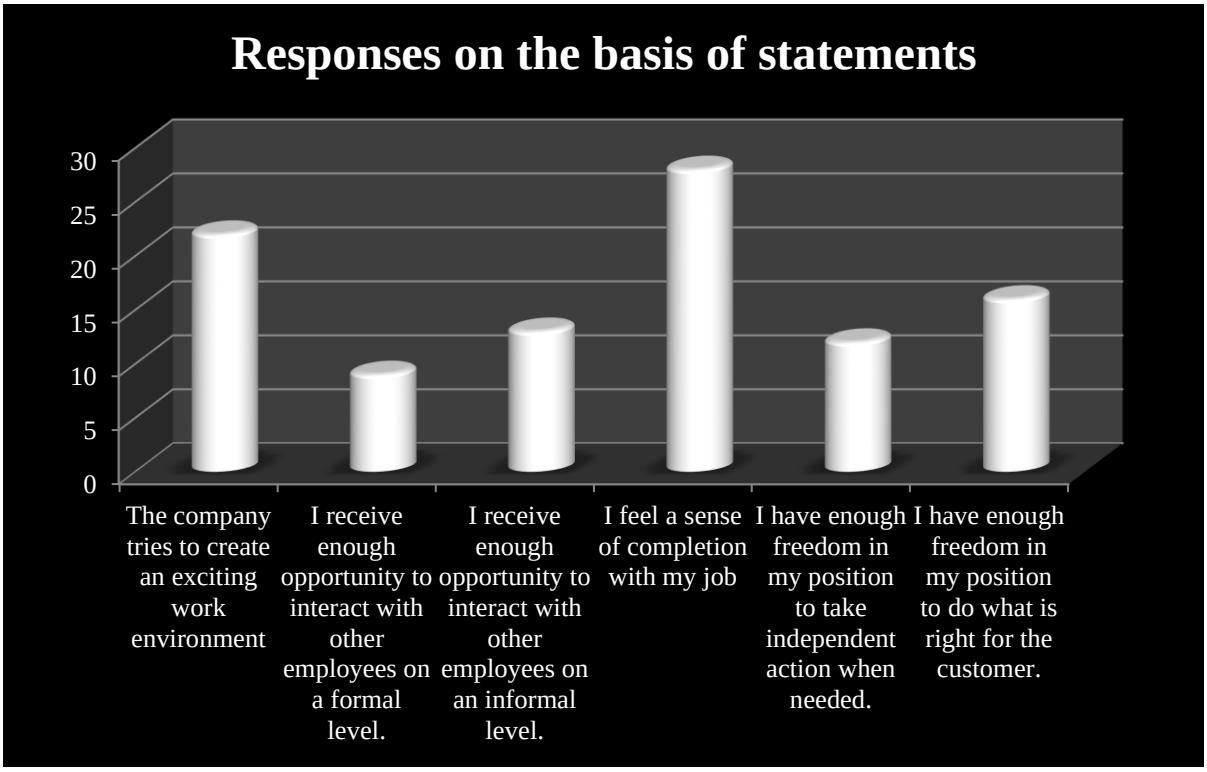
When employees were asked about the facilities they got from the bank then 36% believes that that are getting a good health care facility and retirement benefits by the bank and 12% believes that they get a good day care facilities for their kids in the institution. 13% believes that they got good salaries and 10% believe that they got a good vacation time by the bank and 5% believe that parking facilities of the bank are good.



- Employees ask to tick the statement

Statements	Respondents
The company attempts to generate an exciting working environment	22
I get enough chance to interact with other staffs on a formal level.	9
I get enough chance to cooperate with other employees on an informal level.	13
I feel a intellect of accomplishment with the job	28
I have sufficient freedom in my situation to take self-regulating action when desired.	12
I have sufficient liberty in my place to do what is correct for the client.	16

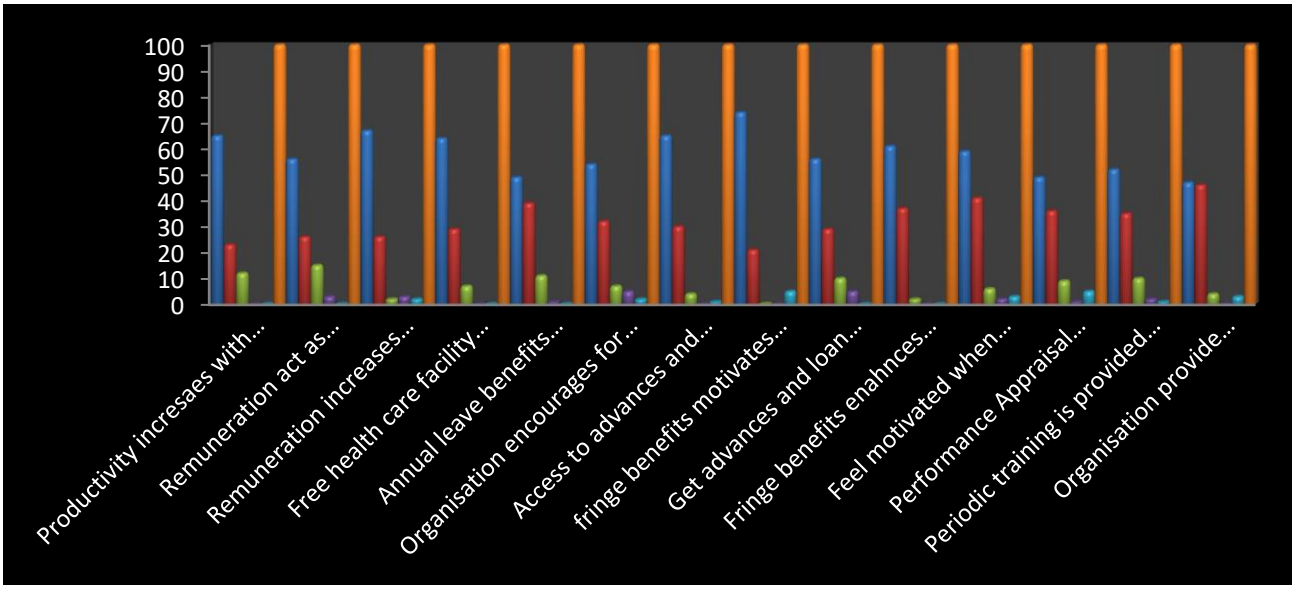
When the employees were asked to choose one statement for the bank then 28% employee were feel that they feel themselves complete with their job. 22% believes that the company always try to create an exciting working environment for them and 13% feel that they got sufficient chance to cooperate with the employees at casual level and 28% feel that they got freedom at their job place to deal with the customers and only 9% feel that they got various chance to cooperate with other staffs at an casual level.



There is a positive relationship between the benefits of the benefits and the work performance of employees who feel encouraged by the lower benefits they have received from the bank and helps to improve their morale and loyalty to the company. A good salary has been achieved over the years to become one of the policies an organization can use to increase the performance of its employees and thus increase the productivity of organizations.

- When employees were asked to rate the statement s on the agreement and disagreement level

Statements	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree	Total
Productivity increases with salary	65	23	12	0	0	100
Remuneration act as motivating factor	56	26	15	3	0	100
Remuneration increases efficiency and effectiveness	67	26	2	3	2	100
Free health care facility improves efficiency	64	29	7	0	0	100
Annual leave benefits motivates for better performance	49	39	11	1	0	100
Organization encourages for Examination preparation leave	54	32	7	5	2	100
Access to advances and loand enhance commitment level	65	30	4	0	1	100
Fringe benefits motivates and enhance performance level	74	21	0	0	5	100
Get advances and loan whenever needed	56	29	10	5	0	100
Fringe benefits enahnces commitment level	61	37	2	0	0	100
Feel motivated when appreciated for performance in the job	59	41	6	2	3	100
Performance Appraisal creates positive working environment	49	36	9	1	5	100
Periodic training is provided by the Institution for employees betterment	52	35	10	2	1	100
Organisation provide housing loan schemes which helps in generating sense of belonging	47	46	4	0	3	100



- When employees were asked that their productivity increases with the salary then around 80% of the employee were agree with the statement and no employee was disagree with this point
- When employees were asked that remuneration works as a motivating factor for them then around 82% of the employees were agree with the statement and they feel that remuneration act as a motivation for them
- When employees were asked that remuneration increases their efficiency than around 90% of the employee were agree on this statement
- Employees were asked that free health care facility improves their efficiency then 64% were strongly agreed and 29% were agreeing with the statement.
- Employee asked that they are encouraged by the organization for taking preparation leave for the exam than, 88% were agree with the statement and 7% don't believe that they are encouraged for the preparation leave by the organization.
- When employees asked that fringe benefits motivate them then around 95% of the respondents believe that yes fringe benefits motivates them a lot for better performance.
- When respondents were asked that fringe benefits enhances their commitment level then, around 98% of the respondents believe that yes the benefits helps in increasing their commitment level for the organization.
- When employees asked that periodic training is given to them for their betterment then around 87% of the respondents were agree on the statement.
- When employees asked that the organization provides loan scheme to them and it helps in generating sense of belonging then at this point around 90% employees were agree.
- Employees were asked that annual leave benefits motivate them for better performance then, 88% respondents were agreeing with the statement.
- When employees were asked that they get loan from the institution when they needed it then, around 80% were agree on this point and only 5% were disagree.
- Access to advance and loan enhances their commitment level then at this point around 95% of agree.
- 99% of the employees feel that and agreeing with the point that they feel motivated when they were appreciated by the institution for their performance in the job.

- Around 90% of the employee believes that performance appraisal in the organization creates a positive working environment in the organization.

The profits of the fringes of HDFC Bank are determined by a number of critical factors including income, level of employee contribution, economic status, industrial standard, types of competitor benefits and government regulations. It is easy to see that employee benefits represent significant costs in any organization. However, they are the most important and motivating factor in the entire compensation package.

However, they are referred to as lower profits which are considered to be an important part of the earning staff. Therefore, it requires better management in the organization. This is because they are expensive and once they are given to workers, they cannot be withdrawn without resorting to violence and very dangerous consequences. ” Pay is the main reason why people change their jobs and because of this, organizations need to encourage their employees to make a product.

Heavy payroll programs create a healthy environment for employers and employees to reduce excessive profits and to feel individual safety from the risks and problems of life with the aim of strengthening employee loyalty in the company and improving productivity. employee benefits provided to employers by law or by voluntary employment. Social services under the Act are operational, organized in 1948, in the banking sector including bars, accommodation, kindergarten, or locks, rest area, bathing and cleaning facilities and the appointment of officers, etc. participation, arrival and performance bonuses, security, free delivery of service permit fees.

The social security scheme offers aids such as a provident fund, state-run employment insurance (ESI) system, economizing compensation and occupational health, maternity, grant, retirement income, dependency grant and pension and thank you benefits. In accumulation, other things that employees enjoy include health and wellness, restaurants, cooperative communities and consumer markets, corporate housing, housing allowance. Recreation and culture, clubs, financial benefits some employers also offer paid study, transportation and transportation equipment.

• The management of HDFC Bank should strive to co-operate with the management of other competing firms through trade unions or employers' organizations to align the various benefits policies available to their organizations such as having the same employees moving to another country in the same sector.

• The management of HDFC Bank should adopt a separate interest-based approach based on current economic conditions. This will ensure that workers' interests are well protected and will discourage workers from engaging in any form of industrial dispute by using the union as a result of the improper implementation of management benefits.

• The Bank must adopt a new approach to the provision of benefits to the best employees. This new approach could be the provision of benefits derived from the type of personnel training and development abroad. This will not only improve the productivity of the job, but it will also ensure the long-term sustainability of the job that will be officially registered and signed before the new profit is implemented.

• The bank may reduce the amount of operating costs associated with the provision of benefits to its employees over a period of time by providing financial benefits in the form of stock options. This will ensure that less liquid money is spent and open up a sense of ownership to employees that will increase their overall performance.

Conclusion

The study attempted to investigate the effects of certain benefits on employee performance in

the banking sector with a particular focus on HDFC Bank. The findings summarized here are the results of field management research a list of questions for employees of HDFC Bank. The study revealed that there are two types of benefits used in the Bank. Non-financial and financial benefits. Both of these types of benefits are set out in the employees' employment agreement.

Types of financial benefits available include; medical insurance, salaries, car maintenance and bonuses. Non-financial benefits include medical leaves, sympathetic leave, probation leave, monthly soap sharing and annual rice distribution. Factors that determine the benefits of fringes include; corporate income, labor performance, current economic conditions, and minimum wage regulations, applicable standards in a particular industry and the type of revenues obtained by other competing firms.

In this regard, the Human Resources Manager of HDFC Bank in the event of a positive economic transformation is empowered to recommend a comprehensive review of employee benefits. It was also found that the role of Government affects the level of profits by providing compulsory benefits by enforcing policies and regulations, which they do to prevent conflicts in the industry. In addition, the findings have shown that the provision of certain benefits enhances employee morale, encourages employees to improve their productivity in the organization and creates a deeper sense of commitment or closeness of employees that prevents them from leaving the organization to other competitors.

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CRITICAL ANALYSIS OF ARTIFICIAL INTELLIGENCE IN SHAPING SUSTAINABLE STRATEGIES FOR AUTO INDUSTRY IN INDIA

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ABSTRACT

India has become the largest automobile manufacturer over the last few decades. Therefore, the impact of artificial intelligence (AI) on India's automotive industry is critical. This study will seek to address how AI-based technologies are shaping sustainable strategies for auto industry in India. It will also review how these trends are expected to impact current market dynamics and how this technological innovation might be propelling future growth opportunities. The study concluded that information technology (IT)-enabled tools are best suited to assist decision making. Technology has a potential to be a transformative force for the Indian automotive industry.

Keywords*: Artificial Intelligence, Auto Industry, Technology, Sustainable strategies, Internet of Things (IoT).*

Introduction

The accelerated penetration of Artificial Intelligence in everyday life has made a profound impact on the Indian auto industry. It has been identified as a key driver in the transformation of the auto industry from being a traditional business run by car dealers and mechanical engineers to an innovation-driven one which is led by Artificial Intelligence and Machine Learning. The current research endeavors to provide an insight into how organizations can benefit from Artificial intelligence in order to strategically respond to challenges arising from incessant disruptive change.

The automotive industry is at the crossroads of disruptive technologies like autonomous cars, ride sharing, block-chain technology and internet of things. It has to adapt to rapid technological advances, but it also faces serious challenges posed by the government policies like the banning of diesel vehicles and increasing pollution. On the one hand, organizations face an unprecedented level of disruption; on the other hand they cannot afford to miss out on opportunities arising from disruptive technologies.

The evolving trends in technology are highly conducive for Artificial Intelligence (AI), which is enabling automated processes in multi-sensory environments. Block-chain is another emerging technology which has become extremely relevant for organizations today as it facilitates secure transaction processes without any human intervention or intermediaries. These new technologies have already started transforming the automotive industry and it is a matter of time before they completely reshape the market.

The traditional markets of the auto industry are highly consolidated with a very few players which controls over 80% share of sales. In 2016, the Indian auto sector was valued at $130 billion and has been estimated to grow to $150 billion by 2020. This is indicative of how critical the Indian automobile market is as it accounts for nearly 25% of domestic consumption. In contrast, China, despite being a significantly larger market is only 2% domestic consumption. Moreover, this market has been estimated to be worth $120 billion by 2020. The automobile industry of the India is also home to a number of startups disrupting the existing market structure and they are poised to gain significantly from Artificial Intelligence and Block chain.

Until recently, the automobile sector was relatively untouched by Artificial Intelligence and this is likely to change in the near future as organizations across the world are starting to embrace it. Technology has been disrupting business for quite some time now and it has

begun disrupting India's auto industry as well. The question is: Has India's auto industry been able to leverage disruptive technology such as Artificial intelligence?

Almost every part of the Indian auto sector has been impacted by disruptive technologies. As low-end manufacturers are facing the threat of robotization, conventional large automobile manufacturers are experimenting with self driving cars . This hits at the heart of Indian automobile industry as most of its sales are driven by people buying cars for self use purposes.

Fully automated driving, Autonomous driving or automated driving is a type of autonomous robotic control computing system that can perform any or all functions of a car, including automatic braking, steering and acceleration.

India has a vast automotive industry with a strong base of established players and a large number of startups. The growth of auto industry in India was primarily driven by factors such as economic development, urbanization, and rising disposable income. Furthermore, the number of two-wheelers has been growing to make up for 70% of total vehicle production in India. In terms of vehicle sales, however, it is the four-wheeler segment that leads with 50% share in sales volume. With growing sales, concerns have been raised about environmental issues due to pollution from the automotive industry as well as traffic congestion and accidents. Both of these issues will become even more critical in the coming years with the implementation of new technology.

Objectives Of The Study

The article will analyze the magnitude of influence that automation has on the automobile industry in India. The main focus of the article is to analyze the implications of Artificial Intelligence in shaping sustainable strategies for auto industry in India.

Research Methodology

The research tool used is a desk study that includes secondary sources of information. Structure of this article contains two separate parts; the first part talks about the process of carrying out a study and achieving the objective while the second part highlights some key elements and details for understanding AI and new trends in the auto industry.

Literature Review

When it comes to artificial intelligence technologies, it has been experiencing massive developments over the past few years. However, this is not the only case when the progress faced some challenges too. The existence of the digital media has added many voices to the debate about AI, which are both positive and negative. While some people claim that artificial intelligence will replace all jobs, some others say that it will be integrated into businesses and help them to succeed (Priya et al., 2021).

Artificial intelligence (AI) is the idea of AI systems thinking like humans does, and it is considered to be one of the most powerful technologies today. This technology has had more impact on every team, business, corporation, and government across the globe (Rizvi et al., 2021).

Artificial intelligence is the technique of creating intelligent machines that are capable of thinking like humans, and executing complex tasks that are commonly carried out by human beings. This technology also known as machine learning provides systems the ability to learn without being explicitly programmed. This technology can improve many industries in significant ways, especially the auto industry. Auto manufacturers are aiming to make self-driving cars more prevalent on roads throughout the world. However, this technology will affect jobs in manufacturing, supply chain management, and even car sales. Therefore, it will be important for manufacturers to embed artificial intelligence into their businesses before it becomes too late (Raza & Khosravi, 2015).

"AI is one of the most powerful technologies of our generation that enables systems to better sense and understands their environments. It is the culmination of decades of research and billions of dollars in investment by the most talented engineers and scientists across the world" (Unhelkar & Gonsalves, 2021).

AI can be used to enhance many aspects of an automobile's life. For instance, the main purpose of AI is to "help machines behave like human beings". The technology can be used to

assist drivers in various ways, such as assist parking or avoiding collisions. AI technology could also be used to make improvements in navigation systems. Some examples include; generating directions if there are traffic jams on the road or finding best routes for getting from point A to point B (Lu, 2019)

Automobile manufacturers also use AI to make autonomous vehicles. The technology can be used to make self-driving cars safer on the roads. However, this technology will eventually eliminate jobs in auto manufacturing; therefore; it will be crucial for businesses to implement this technology before it is too late (Krishnamoorthy & Rajeev, 2018) .

"By 2030, AI could contribute up to $15.7 trillion dollars to the global economy", (Bell et al., 2017). There are many benefits that come with AI; however; there are some drawbacks as well. The technology remains interdisciplinary since it "extends well beyond the traditional boundaries of computer science, mathematics, engineering, and science" (Dhamija & Bag, 2020).

As the technology develops, the business world will have to develop strategies for using this technology appropriately. This is especially true in industries that are heavily regulated. AI can influence just about everyone in automobile manufacturing. From designers to engineers to salesmen; every business player will be impacted by this technology. AI will eliminate jobs that are currently held by humans who work for car manufacturers; however; employers must create new positions for these individuals if they want them to remain employed (Singha, n.d.).

There are many other industries that are currently working on this kind of technology, including financial services, energy, healthcare, and retail. Some other companies that are already implementing AI into their systems include Microsoft, Uber, Google, and Tesla. It is important for these companies to integrate the technology into their systems before it becomes too late. By using artificial intelligence in vehicles; consumers will have a better experience while driving. Businesses will realize the potential of this technology and its benefits; therefore; they will invest more in research and development (Rizvi et al., 2021) .

Businesses must also keep track of the potential risks associated with such a powerful technology such as AI. The technology could be used to target individuals who are not aware of its capabilities. AI can manipulate situations and data that is fed into it; therefore; it can be used for criminal purposes. For example, terrorists could use AI to design an attack on certain individuals or groups. The technology will continue to pose challenges to people who want to regulate the industry. Many countries are working together to address the challenges that come with artificial intelligence (Manimuthu et al., 2021).

There are also many legal issues associated with this kind of technology. For instance, "personal privacy remains the main issue in the development of artificial intelligence". The technology will allow people to track people on the internet. There are also privacy concerns about how AI affects privacy in schools, hospitals, and businesses (Horowitz et al., 2018).

Lastly; the implications of artificial intelligence on the economy might be too much for some countries to handle. Some scholars believe that AI will cause unemployment; however; others disagree. Employment is important to many countries around the world; therefore; this will be an issue that the community may need to address. Although these issues are very significant; AI is still considered one of the most influential technologies of modern time.

Artificial Intelligence And Resent Trends In Auto Industry In India

AI (artificial intelligence) is an area that will influence most industry sectors both positively and negatively. It is used in many areas across industries including by banks to help identify fraudsters; in healthcare to make diagnosis of diseases based on various acoustic signals; and it has been used in agriculture. For automobiles, AI is expected to change the way vehicles are driven, how they are engineered, and also how they are designed. It will also have an impact on the vehicle design, seats, the tires, fuel efficiency, and other features.

Sensor Technology

From a market perspective, sensors are expected to be an important feature in automobiles in the future. Sensors are used in applications in many industries to monitor environmental conditions. For example, there is a wide range of sensors that are used for weather monitoring or detecting materials. The automotive industry has started to use sensors for navigation systems and for health monitoring purposes. Automakers are starting to work together to integrate these technologies without compromising safety since this technology will help improve driving behavior at the same time as reducing vehicle maintenance costs.

Internet Of Things (Iot)

IoT (internet of things) is an emerging technology that is enabling connection of devices to the internet. This allows for devices that are enabled to communicate with each other via the internet. Recent years have seen many new applications being developed in IoT, including smart cities, social media, and health monitoring. The automotive industry has started to use IoT because it offers a good opportunity for making up for traffic congestion. For example, sensors are being used to create digital maps to improve traffic flow/flow efficiency, as well as using data analytics to increase efficiency in traffic management.

Self-Driving Cars

Self-driving cars are artificial intelligence systems that can guide a vehicle on an open road on their own. The first commercially available self-driving car was produced by Google in 2009. It is known as Google Chauffeur. This car operates on its own, without an actual driver. It follows the road on its own and automatically avoids obstacles by interpreting images it sees with its sensors. Google Chauffeur has driven more than 2 million kilometers without human intervention. It has driven all kinds of roads ranging from highways to dirt roads.

Google's self-driving cars use many technologies. One important technology is Laser detection, which senses objects through laser beams mounted on top of the vehicle. The lasers simulate human eyes, providing 360 degree vision around the car at high speed to detect any obstacles in the way.

Connected Cars

Vehicle connectivity is another emerging technology that will impact the auto industry in India. Although connectivity has existed for quite some time, what has changed recently is that infotainment systems are beginning to be provided as standard features rather than options. This trend is expected to accelerate, especially considering the large number of apps available for smart phones.

Autonomous Vehicles (AV)

AV (autonomous vehicles) is an AI technology that enables vehicles to drive on their own without drivers behind the wheel. This eliminates the need for drivers to monitor the driving process, but does not eliminate the need for drivers. Some believe that AV's will lead to fewer traffic accidents due to better driving behavior.

However, there are also some concerns about usage of AVs. For example, how will drivers be compensated for the loss of income if they are not allowed to drive anymore? Furthermore, some people may feel alienated by having less contact with others while driving.

Robotics

Robotic technology is another emerging technology that will have an impact on India's auto industry in terms of production and also in terms of car design. For example, automated production lines will enable automaker to produce greater numbers of vehicles. At the same time, robotic technology is also expected to be used in the design stage of automobiles specifically for new types of vehicles such as trucks and SUVs.

Artificial Intelligence and its Impact on the Auto Industry in India

India's auto industry is expected to see a rise in AI use, especially following the government's vision to change from a manufacturing economy to an innovation economy. By 2022, it is estimated that there will be 100 million cars in India. This will create a large market for

many different kinds of automotive companies in India, including established players and startups alike. The Indian government is also taking steps towards supporting these startups through various forums such as the "Startup India Action Plan". the Automotive India Initiative (AI India). AI will be a large feature of the industry and could provide a major boost to growth.

The Impact Of AI On The Auto Industry In India

There are several ways in which AI will change the market dynamics within India's automotive industry:

- It will define the product cars and its features.
- It will be used to improve driving behavior.
- It will enable better driving experience, such as driving safely and at higher speeds or driving more efficiently.
- It also has an impact on vehicle design, including defining new types of vehicles like trucks and SUVs (small SUV).
- It will support the growth of robotics in the automotive sector.

Conclusion

Artificial Intelligence (AI) in India has been in the limelight for quite a few years now. It is among the most sought-after and expensive technological tools and with good reason: AI is accelerating innovation in automobiles. The automotive industry in India has always been one of the leading industrial sectors, accounting for over 6 percent of Indian GDP, more than 1 million jobs, and about 20 percent of global investment. However, there have been many challenges that have prevented the Indian automotive industry from growing at this pace or sustaining its competitiveness internationally. One of these challenges has been to get new technologies on par with global standards due to high dependency on imports thus increasing its vulnerability to fluctuating international prices. The emergence of AI as a technology that promises to create a paradigm shift in manufacturing has been followed by a lot of interest from business analysts and decision makers. The Indian automotive industry has been laying the foundation to develop India as an established global player, and is keen to capitalize on AI. India's automobile sector's ability to adapt to new technologies has long been its forte. Current investments in innovations are aimed at creating opportunities for Indian companies in overseas markets. Companies have also started using AI in the virtual world, wherein it can be used for development of products with better quality control by minimizing need for physical checking of product features.

AI-enabled technologies are being used in various applications in the automobile industry including enhanced automation of manufacturing, IT integration across the production chain, advanced design and engineering capabilities for specialized car models, advanced analytics in simulation for predicting lifecycle performance of cars with the aim to improve the quality of products, digitalization of marketing communications aimed at getting visibility in high-value markets.AI has a wide range of benefits that create a win-win scenario but these benefits have been restricted to a small set of industries that were willing to invest significant amounts. As a result, India is unlikely to produce major innovations other than those that have already been developed by many countries around the world.

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ALLIANCE FOR HOLISTIC EDUCATION THE GRADUATION EFFECT OF COLLEGE STUDENTS FOR COMMUNITY DEVELOPMENT

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ABSTRACT

The Alliance for Holistic Education is the need of the hour for nurturing, learning and communication. This aims is to support colleges and teachers those are re-molding their system's to develop people who cope better with mental health issues after leaving college. This also provides resources and information about holistic education within the academic community as well as the community at large. The study aims to explore the role of holistic education system on graduation students for community development. The current study is based on secondary source of information, the study want to showcase a clear view on impact of holistic education of graduation students on community development. The study concludes that the successful college graduates are more likely to contribute to their community in a positive way. Most successful college graduates were more likely to contribute something positive in their communities following graduation.

***Keywords**: Holistic Education, College Graduates, Community Development, Community Contribution, Community Involvement.*

Introduction

The Alliance for Holistic Education is the need of the hour for nurturing, learning and communication. This aim is to support colleges and teachers those are re-molding their systems to develop people who cope better with mental health issues after leaving college. This also provides resources and information about holistic education within the academic community as well as the community at large.

The Alliance for Holistic Education strives to improve the mental health by providing better education to students who will commonly experience difficulties upon entering society due to challenges they have learned to cope with while in school.

The Alliance for Holistic Education also aims to bridge the gap between research and application. This is an important role filled by this organization because it helps identify the gaps in academic knowledge and make recommendations for progress in training, research, and application of findings related to holistic education.

This is also involved with building a community that can share best practices, knowledge and information related to holistic education within the academic community as well as the community at large.

In addition, The Alliance for Holistic Education strives to improve society through evidence-based research on holistic education concepts. This will be done by focusing on how schools can better train teachers who will subsequently be able to train students in a way which fosters a deeper sense of belonging.

This also focuses on providing information about holistic education concepts, best practices, and knowledge sharing and curriculum implementation within the academic community as well as the community at large. This aims to provide more comprehensive and intensive services to those individuals who are struggling with mental health issues such as depression and general anxiety after leaving college. This will be done by focusing on how schools can better train teachers who will subsequently be able to train students in a way which fosters a deeper sense of belonging.

Objectives Of The Study

The study aims to explore the role of holistic education system on graduation students for community development. It also explains the importance of holistic education for graduation students.

Research Methodology

The current study is based on secondary source of information, the study wants to showcase a clear view on impact of holistic education of

graduation students on community development. Different existing literature was reviewed for the same to explore different aspect graduation effect of students on community development. The information was collected from different reports, research articles and published data from different reputed database.

Literature Review

In a study it is found that 86% of American adults want to learn about the "real" world. Many schools are now focusing on making education more meaningful, relevant, and practical for students' future livelihoods (Bridgstock, 2009).

The Alliance for Holistic Education has identified many groups working towards decreasing the "graduation effect" of college students by helping them develop skills in their community in areas such as literacy, money management, art, and land stewardship(Howard-Hamilton et al., 1998).

It is imperative to help these students re-mold their lives so that they can maximize societal benefits while minimizing risks when completing degrees in college. It was found that students who graduate with degrees in business or engineering are most likely to not only experience the graduation effect but also suffer from depression after graduating (Baxter Magolda, 2003)

Students graduating with business degrees were found to have the highest likelihood of committing suicide compared to other students. These findings support the idea that many students are unaware of how they will use their degree in the future(Howard-Hamilton et al., 1998).

The study also emphasizes how much levelheadedness, wisdom, and overall education is lacking among College Students. Poorer financial abilities were seen among students who had taken out student loans, which indirectly indicates that these individuals lack sound decision-making skills when it comes to managing their finances and resources. -making skills (Bridgstock, 2009).

Further studies by U.S.-based researchers have shown that those who graduate with degrees in science, technology, engineering and math (STEM), such as those in the fields of computer science and research and development, are less likely to commit suicide than those who don't (4 percent compared to 7 percent). When compared to other college PsycD programs' graduates, PsyD graduates were also found to be at a lower risk of anxiety, depression and substance abuse than their peers (Stebleton et al., 2013).

The Alliance for Holistic Education is suggesting that students gain real job-related skills and practical experiences which will help them be more employable upon graduating from college.

A study by Harvard researchers shows that participation in community service is directly associated with an increased likelihood of college-wide engagement (Gardner & Barnes, 2007).

To avoid the graduation effect, colleges are now starting to improve their services by offering students more relevant courses and opportunities to gain real-world experiences. These services are also better integrating students into their communities. For example, programs throughout the United States are helping older adults maintain independence through physical activites, social gatherings and mentoring programs. Educational institutes are also attempting to combine real-world learning with the classroom. This is done through providing students with opportunities to volunteer at local shelters or help clean public parks, for instance(Smith & Bath, 2006).

Effects Of Holistic Education on Educational Success for College Students

Since it is now common knowledge that education has a profound impact on one’s career prospects, it is not surprising that so many studies have been devoted to evaluating the relation between an individual’s graduation rate and degrees obtained with his or her future earnings (Rae, 2007). From various literatures it has found there is a strong correlation between higher graduation rates and communities with higher incomes, higher levels of education (e.g. undergraduate and postgraduate degrees), and higher levels of civic engagement. This suggests that holistic education has a positive, long-term impact on student success, which is an important issue in the context of postsecondary attainment rates

for minority students, who are disproportionately represented in community colleges, community service-learning programs, associate degree programs, the workforce transition programs aimed at professionalizing new immigrants and people with disabilities.

What Is Holistic Education?

Holistic education is a philosophy towards school, college, and workforce programming that emphasizes holistic development of the whole person (e.g., the mind, body, and spirit) through experiences in integrated learning environments that include academics and extracurricular activities that utilize community resources. Holistic education also emphasizes reflective practice whereby students use an experiential approach to teaching and learning by applying what they learn in their academic and extracurricular activities to develop their character traits (Berge & Huang, 2004).

How Do Holistic Educators Promote Holistic Development?

Holistic educators promote holistic development in the following ways: through experiential education, community volunteer's service, educating youth about culture, history, and the role of arts in life. Holistic educators also encourage students to develop their inner voice that leads them to an awareness of their own culture, which provides them with the capacity to understand people of other cultures on a deeper level(Sampson et al., 2011).

How Is Holistic Education Changing the Higher Education Landscape?

Holistic educators believe that higher education can be radically improved by adopting holistically based approaches or strategies. Some strategies are fairly simple, such as creating a new kind of living/learning or community-based dormitory on campus. Other holistic education strategies are more complex, including creating new types of credit recovery programs, revising cadres of college faculty to include new types of faculty with different kinds of professional training that is suited for holistic education methods, providing special credit recovery programs for students at risk for dropping out (Barbatis, 2010).

How Do the Effects of Holistic Education Affect College Graduation Rates?

The impact that communities have a positive impact on graduation rates. They reasoned that community resources have an important impact on student success, especially resources that address the holistic development of students. Thus, they sought to establish which communities have higher graduation rates for college students that are associated with honors, bachelors, masters and PhD degrees(Paulsen & Perna, 2016).

What Did the Research Find?

The research found a strong correlation between higher graduation rates and communities with higher incomes (most notably non-Hispanic White), higher levels of education (e.g. undergraduate and postgraduate degrees), and higher levels of civic engagement. The data also showed that graduation rates for other ethnic groups were higher in communities characterized by higher income, greater levels of education and civic engagement.

How Do We Know That Holistic Education Works?

Holistic educators want their programs to improve student success through holistic development. Holistic educators believe that higher education can be radically improved by adopting holistically based approaches or strategies.

How Might the Effects Of Holistic Education Vary According To Race?

A community can have many influences on students, including the economy, economy, culture, social climate, political climate and opportunities for service and civic engagement. These factors may influence changes in higher education graduation rates for various ethnic groups (Bridgstock, 2009).

How Do Other Factors Influence Graduation Rates?

Some other factors create differences in higher education graduation rates. Research indicates that technical schools have higher graduation rates than other types of schools, which has been attributed to community ties that are

strong among technical school alumni who tend to help their classmates succeed in their careers. Another factor that influences higher education graduation rates is the number of near-field and far-field schools in a community.

Conclusion

Successful college graduates are more likely to contribute to their community in a positive way. Most successful college graduates were more likely to contribute something positive in their community's following graduation. Additionally, they are more likely to contribute these resources for the benefit of their community.

Graduates who had gone to college were also less likely to be involved in criminal activity. Furthermore, the results suggest that community-based activities are effective ways of assisting students after they have graduated from different institute. These activities may be beneficial for students because they enable them to reach out and interact with others, which can improve their social skills. They are also beneficial because they provide an opportunity to practice leadership abilities. College graduates are more likely to have a positive outlook on life. This reflects what other studies have revealed the generations before us who have continued this trend of being more positive about life by expecting better things for themselves and society as a whole. Increasingly, people are recognizing the importance of the education not just in terms of their own lives, but also for future generations to have a better quality of life. This is because education teaches students skills that are necessary to succeed in society.

The study found that students who had gone to college were less likely to be involved in criminal activity. Although this was not a significant finding, it does suggest that college graduates are less likely to engage in criminal behavior. This knowledge can also help educators identify ways they can help their students become more positive and hopeful about life after graduation which may produce results similar to those found in this study.

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ANALYTICAL STUDY OF LIQUIDITY MANAGEMENT AND FINANCIAL PERFORMANCE OF PUBLIC SECTOR INSURANCE COMPANIES IN INDIA

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ABSTRACT

In any business organization for the smooth flow of operations, it is vital to uphold the appropriate liquidity. One of the important factors contributing the progress of any organization is to retain the proper liquidity position which has direct control over the financial performance. Liquidity position is achieved through maintaining proper working capital. . It can be termed as life blood of an organization. If there is any disorder in the smooth flow of working capital, it may create disaster in the functioning as well as survival of the organization. Moreover, organization can't keep excess working capital. The organization is not utilizing the funds properly. Hence the organization should maintain the optimum working capital. This paper focuses on the liquidity and financial performance of the organization. The relationship between the liquidity and profitability of the public sector insurance companies is studied using statistical tools.

***Keywords**: Liquidity ratios, Profitability, Working Capital Management, Public Sector undertakings, Insurance companies in India.*

Introduction

Any organization profits are purely based on the successful sales program. There is time lag between the conversions of credit sales to cash. If the credit sales are not converted to cash, then the organization routine operations will be affected. Hence there is need of meticulous system for working capital is very important for any business entity. Hence the business entity is interested to the conversion of current assets to meet the current liability of the organization. To cater the need of the organization and sustain sales activity, sufficient working capital is required.

For carrying our day to day operations smoothly in any business organization, working capital management plays too important role. It implies that for funding resource of day to day activities of any business entity is nothing but working capital. Hence proper management of working capital is most requisite function of any business entity. If working capital is not managed properly, then the business entity will not for existence by also for solvency. Depending upon the scale of the organization, many entities generate working capital for arranging for short term funding resources through short term credits from relatives and friends as well as from short term loans from the financial institutions.

Let us ponder over the chief common sources of working capital of any enterprise. Supplier render trade credits, Customers also pay money in advance, Discounting of Bills of Exchange and Promissory Note, overdraft and cash credit furnished by the bankers and subsidy granted by the Government Agencies etc. can be considered as the mostly used sources for raising working capital. If capital is blocked in working capital such as inventory etc. it affects the profitability of the organization. Hence deciding the optimum working capital is very essential for business entity.

For any human being to survive, smooth circulation of blood is essential. Similarly, working capital acts as life blood and nervous system of any business enterprise. It implies that working capital is key important for smooth running of business entity. Moreover it should be noted that business entities cannot hold either excess working capital, since it impacts the profitability of the business entity. Hence the business organization are requested to maintain optimum and adequate working capital.

Theoretical Background

To measure the financial performance and judge the financial condition commonly used tool is Ratio Analysis. As per the oxford Dictionary, the term Ratio is explained as "the relationship between two groups of people or things that is represented by two numbers showing how much larger one group is than the other"i. It implies that one number is denoted in terms of other. From that the relationship between the two numbers can be estimated.

Khan and Jain quote that the term ratio analysis refers to "the systematic use of ratio to interpret the financial statements so that the strengths and weaknesses of a firm as well as its historical performance and current financial conditions can be determined (Khan, 2011)". Stakeholders of any organization are interested to know the strength as well as weakness. Ratio analysis is best tool for gaining insights about the operation efficiency, profitability and liquidity position of the organization.

Types of Financial Ratio Analysis

Ratio Analysis can be classified into four major types which is depicted in the following figure.

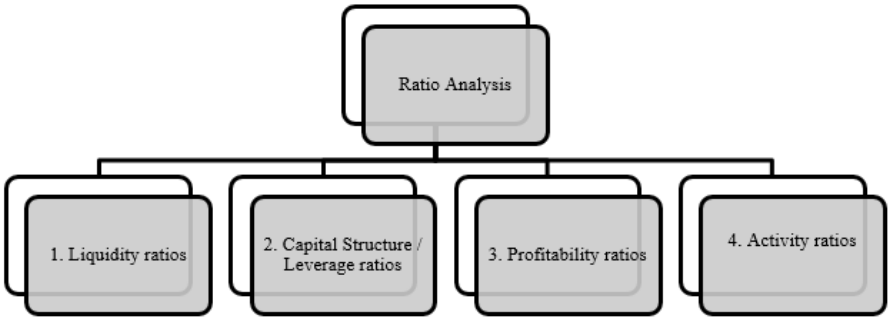
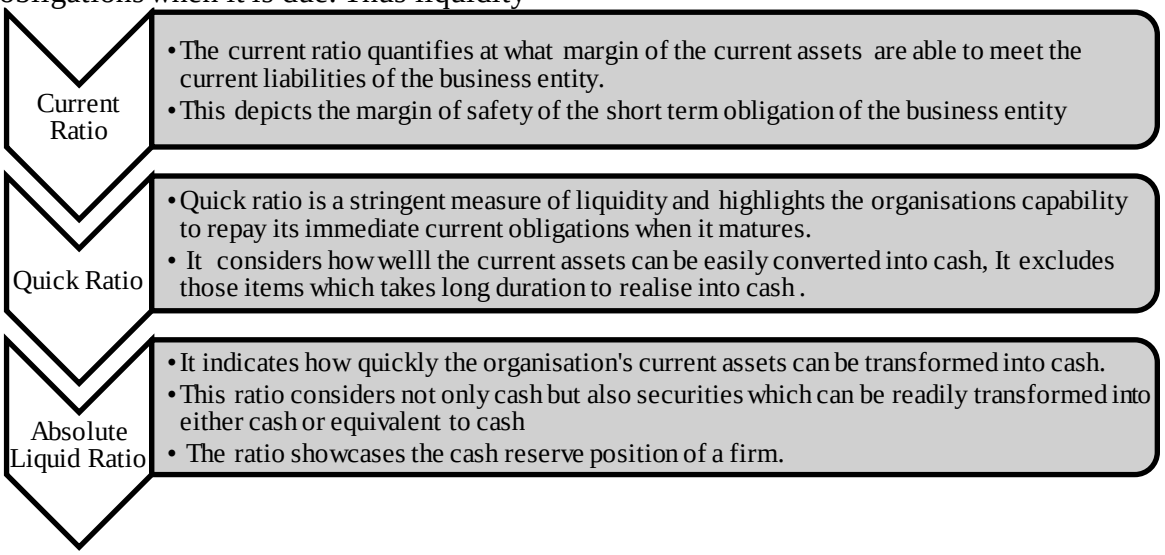


Fig 1. Types of Financial Ratio Analysis

Liquidity Ratios

Any organization liquidity position highlights how well the organization meets their current liability which is also coined as short-term financial obligations when it is due. Thus liquidity ratios are computed by instituting the association of current assets with current liabilities of the business entity. Widely used liquidity ratios are specified in the following figure.



Profitability Ratios

Business entity is established for getting returns from the capital invested. To measure the efficiency the profitability ratios are used. Usually Profitability ratios can be computed by comparing Business entity sales, operating profit, gross profit,

net profit, and dividend paid to shareholders etc.

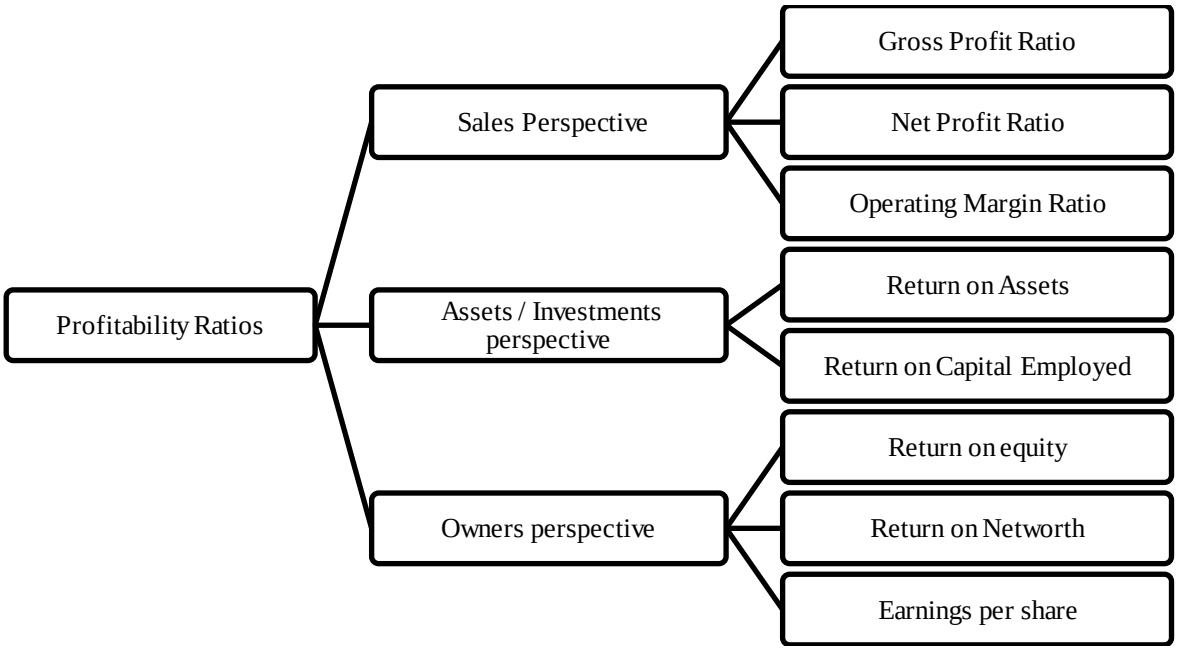


Fig 2. Types of Profitability Ratios

Literature Review

Pardeshi et al (Pardeshi B. D., 2012) in their paper studied the financial performance of selected Indian Airline Companies. They have chosen three companies from the listed companies at BSE namely Kingfisher Airlines
Ltd., Jet Airways Ltd. and Spicejet Ltd. The researchers have not only studies the financial Performance of the leading giants in the airline sector were studied but also checked the financial soundness. The researchers have used the renowned Altman Z-Score model in the study. They concluded that Spice Jet position was healthy during the period of study. But the position of Kingfisher Airline was in distress zone.

Sur, D. and et.al (Sur, 2013) have examined the impact of Liquidity on profitability of Bharat Heavy
Electrical Ltd. (BHEL) during the period commencing from 2000 till 2012.The researchers have found that the short term repaying capacity is significantly declining. The major reasons were poor inventory management, cash management and debtor's management. This has adversely affected the liquidity position of the organization

Objectives Of The Study

1. To Compute the liquidity and profitability position of public sector insurance companies under the study
2. To study the relationship between profitability position and public sector companies under the study.
3. To demonstrate the functional relationship between the liquidity and profitability.

Scope Of The Study

Subject Scope: It pertains to the ratios pertaining to the Liquidity position and Profitability Position

Time Scope: It permits to the period from 01-04-2017 to 31-03-2021

Geographical scope: It pertains to the New India Assurance and General India Insurance

Research Methodology

The study is based on the data collected from the secondary sources. The universe is Insurance companies which are public sector. The sample frame of the public sector insurance companies are

1. Life Insurance Corporation of India – (LIC)
2. General Insurance Corporation of India-(GIC)
3. United India Insurance
4. The New India Assurance Company Limited
5. National Insurance Company Limited
6. Agriculture Insurance Company of India Limited and
7. The Oriental Insurance Company Limited

Out of these seven leading public sector Insurance companies General India Insurance and New India Assurance were chosen for the study based through convenience sampling.

Profile Of The Organizations

General India Assurance

General Insurance Corporation of India famously known as (GIC) is a private Company governed under the umbrella of Companies Act 1956. It was established on 22nd November 1972. GIC was established for the main purpose is for superintending, controlling and running general insurance. After the merger of Insurance companies, GIC was supervising the leading four Insurance Companies in the India. GIC got relived from the monitoring the subsidiary companies since November 2020. Moreover, GIC Re South Africa Ltd is a 100% owned subsidiary of GIC.

New India Assurance

New India Assurance (NIA) was instituted by Sir Dorab Tata and incorporated on 23rd July 1919. They are pioneers in the Insurance Industry.

Data Analysis And Findings

Profitability Ratios

Table 1- Profitability Ratios of General Insurance Corporation of India

	General Insurance Corporation of India					
	Mar '21	**Mar '20**	**Mar '19**	**Mar '18**	**Mar '17**	**Change**
Operating Profit Margin(%) -(OP)	94.92	-74.83	79.77	93.9	91.1	4.19
Profit Before Interest And Tax Margin(%) PBIT	94.92	-64.49	78.06	93.64	90.24	5.19

Gross Profit Margin(%) GP	94.92	-74.83	79.77	93.9	90.63	4.73
Adjusted Net Profit Margin(%) NP	57.62	-40.81	51.95	82.79	78.26	-26.37
Return On Capital Employed(%) ROCE	13.15	-1.76	10.8	11.79	12.72	3.38
Return on Long Term Funds(%) ROLTF	13.15	-1.76	10.8	11.79	12.72	3.38

Source : Dion Global Solutions Limited

GIC has recovered from the impact of pandemic considering OP, PBIT,GP, ROCE and ROLTF. But it has to improve ANP.

Table 2- Profitability Ratios of New India Assurance

	New India Assurance					
	Mar '21	**Mar '20**	**Mar '19**	**Mar '18**	**Mar '17**	**Change**
Operating Profit Margin(%) -(OP)	75.06	57.66	87.28	99.27	97.97	-23.38
Profit Before Interest And Tax Margin(%) PBIT	74.21	56.41	82.18	95.52	79.87	-7.09
Gross Profit Margin(%) GP	75.06	57.66	87.28	99.27	97.97	-23.38
Adjusted Net Profit Margin(%) NP	59.36	50.68	79.14	80.2	85.17	-30.30
Return On Capital Employed(%) ROCE	5.4	7.86	2.74	11.28	5.77	-6.41
Return on Long Term Funds(%) ROLTF	10.71	7.86	2.74	11.28	5.77	85.62

Source : Dion Global Solutions Limited

NIA has to recover from the impact of pandemic considering OP, PBIT,GP, ANP and ROCE . But ROLTF got doubled indicates the Return from the Long term got 85% with respect to base year.

Descriptive Statistics of Profitability Ratios of General Insurance Corporation of India

Table 3- Descriptive Statistics of Profitability Ratios of General Insurance Corporation of India

	Op	*Op*	*PBIT*	*PBIT*	*ANP*	*ROCE*	*ROLTF*
Mean	56.972	58.474	56.878	45.962	9.34	9.34
Standard Error	33.0605 2	30.8851	33.0363 9	22.4728 8	2.80432 3	2.80432 3
Median	91.1	90.24	90.63	57.62	11.79	11.79
Standard Deviation	73.9255 8	69.0611 9	73.8716 1	50.2508 9	6.27065 8	6.27065 8
Sample Variance	5464.99 1	4769.44 8	5457.01 5	2525.15 2	39.3211 5	39.3211 5
Kurtosis	4.86316 6	4.80780 7	4.86408	3.69138	4.58164 1	4.58164 1
Skewness	-2.1989	-2.1856	-2.2003	-1.8478	-2.12228	-2.12228
Range	169.75	159.41	169.75	123.6	14.91	14.91
Minimum	-74.83	-64.49	-74.83	-40.81	-1.76	-1.76
Maximum	94.92	94.92	94.92	82.79	13.15	13.15
Sum	284.86	292.37	284.39	229.81	46.7	46.7
Count	5	5	5	5	5	5

In the case of GIC, Standard deviation is high for profits due to the impact of Pandemic. The distribution is Lepto-Kurtic distribution. It is negatively skewed distribution

Descriptive Statistics of Profitability Ratios of New India Assurance

Table 4- Descriptive Statistics of Profitability Ratios of New India Assurance

Op	*Op*	*PBIT*	*GP*	*ANP*	*ROCE*	*ROLTF*
Mean	83.448	77.6238	83.448	70.91	6.61	7.672
Standard Error	7.7782313	6.3551452	7.7782313	6.7008353	1.4233341	1.5846887
Median	87.28	79.87	87.28	79.14	5.77	7.86
Standard Deviation	17.4017 8	14.2105 3	17.4017 8	15.0003 3	3.18268 8	3.54346 9
Sample Variance	302.822	201.9392	302.822	225.01	10.1295	12.5561 7
Kurtosis	-0.44065	1.37679 7	-0.44065	-2.10742	0.58884	-1.18603
Skewness	-0.84289	-0.54933	-0.84289	-0.6865	0.561894	-0.48544
Range	41.61	39.11	41.61	34.49	8.54	8.54
Minimum	57.66	56.41	57.66	50.68	2.74	2.74
Maximum	99.27	95.52	99.27	85.17	11.28	11.28
Sum	417.24	388.19	417.24	354.55	33.05	38.36
Count	5	5	5	5	5	5

Standard deviation is high because of the impact of Pandemic on the business of New India Insurance. The values of Skewness of the given data were ranging from -1 to 1. Moreover the values of the Kurtosis of were ranging between-3 to 3 for all the variables. Hence the data is tending to follow normal distribution. Hence parametric tests can be applied

Liquidity Ratios

Table 5- Liquidity Ratios of General Insurance Corporation of India

	General Insurance Corporation of India					
	Mar '21	**Mar '20**	**Mar '19**	**Mar '18**	**Mar '17**	**Change**
Current Ratio- CR	0.3	0.5	0.	0.	0.	-

	9	2	45	48	45	13.33
Quick Ratio- QR	0.39	0.52	0.45	0.48	0.45	-13.33
Number of Days In Working Capital- NDWC	-7,364.20	-20,951.95	-4,185.24	-3,841.99	-3,342.60	120.31

Source: Dion Global Solutions Limited

GIC Current and Quick ratio position was improving in year 2018 and slightly declining in March 10 and repositioned during march 2019 and increased during 2020, but declined drastically during 2021 because of the pandemic.

Table 6- Liquidity Ratios of New India Insurance

	New India Assurance					
	Mar '21	**Mar '20**	**Mar '19**	**Mar '18**	**Mar '17**	**Change**
Current Ratio- CR	0.35	0.44	0.35	0.37	0.36	-2.78
Quick Ratio- QR	0.55	0.44	0.35	0.36	0.35	57.14
Number of Days In Working Capital- NDWC	-5,689.33	-4,401.28	-19,293.75	-4,439.20	-12,138.95	-53.13

Source: Dion Global Solutions Limited

NIA Current and Quick ratio position was stable during 2017 to 2019. It liquidity position was slightly improved in year 2020 and started slightly declining during March 2021 because of pandemic.

Descriptive Statistics of Liquidity Position of General Insurance Corporation of India

Table 7- Descriptive Statistics of Liquidity Position of General Insurance Corporation of India

General Insurance Corporation of India

Current Ratio	*CR*	*QR*	*NWC*
Mean	0.458	0.458	-7937.2
Standard Error	0.0213073	0.021307	3329.192
Median	0.45	0.45	-4185.24
Mode	0.45	0.45	#N/A
Standard Deviation	0.0476445	0.047645	7444.299
Sample Variance	0.00227	0.00227	55417586
Kurtosis	0.830018	0.830018	4.054301
Skewness	-0.2561185	-0.25612	-2.00565
Range	0.13	0.13	17609.35
Minimum	0.39	0.39	-20952
Maximum	0.52	0.52	-3342.6
Sum	2.29	2.29	-39686
Count	5	5	5

Standard deviation depicts that data is little bit consistent. The values of Skewness were ranging between -1 to 1. Moreover the values of the Kurtosis were also ranging between -3 to 3 for all the variables. Hence the data is tending to follow normal distribution. Hence parametric tests can be applied.

Table 8- Descriptive Statistics of Liquidity Position of New India Assurance

New India Assurance			
	CR	*QR*	*NWC*
Mean	0.374	0.41	-9192.5
Standard Error	0.016912	0.038859	2902.918
Median	0.36	0.36	-5689.33
Mode	0.35	0.35	#N/A
Standard Deviation	0.037815	0.086891	6491.122
Sample Variance	0.00143	0.00755	42134667
Kurtosis	4.02807	1.147406	0.22003
Skewness	1.980548	1.406196	-1.2125
Range	0.09	0.2	14892.47
Minimum	0.35	0.35	-19293.8
Maximum	0.44	0.55	-4401.28
Sum	1.87	2.05	-45962.5
Count	5	5	5

Standard deviation depicts that data is little bit consistent. The values of the Skewness of all the variables were ranging between -1 to 1. Moreover the values of the Kurtosis were also ranging between -4 to 4 for all the variables. Hence the data is tending to follow normal distribution. Hence parametric tests can be applied.

Analysis of Correlation

Correlation helps to identify whether relationship exists or not, direction of the relationship and the strength of the relationship.

Table 10-Correlation Analysis of General Insurance Corporation of India

	CR	*QR*	*Op*	*PBIT*	*GP*	*NP*	*ROCE*	*ROLTF*

CR	1							
QR	1	1						
Op	-0.737 84	-0.737 84	1					
PBIT	-0.739 98	-0.739 98	0.99984	1				
GP	-0.738 12	-0.738 12	0.99996	0.99883	1			
ANP	-0.591 92	-0.591 92	0.9743 31	0.9748 97	0.9740 21	1		
ROCE	-0.779 97	-0.779 97	0.95927	0.96331	0.95797	0.96436	1	
ROLTF	-0.779 97	-0.779 97	0.95927	0.96331	0.95797	0.96436	1	1

In the case of GIC, there is negative strong correlation between current ratio as well as quick ratio with operating profit, Profit before interest, gross profit, return on capital employed, return and long term fund, the relationship is negative and the magnitude is strong. It implies that if currents are hold more, it affects the profit to high magnitude. In the case of current ratio and quick ratio with adjusted net profit, the relationship is negative but the magnitude is moderate. It implies that if currents are hold more, it affects the profit to moderate magnitude.

Table 11-Correlation Analysis of New India Assurance

	CR	*QR*	*Op*	*PBIT*	*GP*	*ANP*	*ROCE*	*ROLTF*
CR	1							
QR	0.0836 93	1						
Op	-0.70	-0.63	1					

	63 5	49 5						
P B I T	- 0. 71 20 5	- 0. 48 94 3	0. 91 88 95	1				
G P	- 0. 70 63 5	- 0. 63 49 5	1	0. 91 88 95	1			
A N P	- 0. 65 77	- 0. 77 44 8	0. 96 17 39	0. 82 60 93	0. 96 17 39	1		
R O C E	0. 41 02 47	- 0. 07 48 5	0. 11 18 32	0. 23 03 31	0. 11 18 32	- 0. 0 6 1 5 6	1	
R O L T F	0. 13 07 11	0. 53 63 85	- 0. 08 01 4	0. 11 65 07	- 0. 08 01 4	- 0. 3 4 3 7 5	0. 75 57 56	1

In the case of NIA, there is negative strong correlation between liquidity position and profitability position with respect to operating profit, profit before interest & tax, Gross profit and Average net profit. But in the case of relationship between current ratio and return on capital employed, it is positive correlation with moderate magnitude. It implied that liquidity position has impact in the profitability of the New India Insurance. Let us ponder over the relationship between current ratio with the Long term fund; it is depicting positive relationship, with very weak magnitude. It implies the Quick ratio and Return on Long term fund has meager relationship between them.

Similarly in the case of quick ratio with operating, gross profit and adjusted net profit, they were showing negative strong relationship. It depicts that if more current assets are hold by NIA, it affects the profitability position of NIA. In the case of quick ratio with PBIT, it depict that there is negative relationship with moderate magnitude. It depicts if current assets are more, the profit before interest and tax is affected to moderate level. Let us ponder over the relationship between quick ratio and return on capital employed; it depicts negative relationship with very weak magnitude. In the case of the relationship between quick ratio with return on long term fund; it depicts positive relationship with moderate magnitude.

Conclusion

Each and every organization has to maintain sound liquidity position. In the case of GIC as well as NIA the company liquidity position is not up to the Industry Standard in the case of

service industry 1:1. It is below the benchmark. Both the companies have to improve their liquidity position and maintain adequate current ratio and quick ratio. The investment in current assets has negative correlation towards profitability position of the GIC as well as NIA. This study is mainly related to the relationship between profitability and liquidity as well as their trade off.

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IMPLICATIONS OF BASEL ACCORD III FOR CAPITAL, LIQUIDITY AND PROFITABILITY OF SCHEDULED COMMERCIAL BANKS IN INDIA

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ABSTRACT

Purpose of this article is to analyze the effect of Basel Accord III on capital, liquidity and profitability of scheduled commercial banks in India. The Liberalization of the Economy Policy initiated by the Government of India in 1991 had a profound impact on Indian banking. The centuries old State dominated banking system was gradually replaced by private sector banks. This change in trend has boosted banking competition which had cascading effect for all stakeholders (including customers). Scheduled Commercial Banks (SCBs) are now reeling under increasing pressure to measure up with increasing competition and new regulatory norms (Basle III), which were largely responsible for their shrinking profitability.

***Keywords**: Basel Accord III, Capital, Liquidity, Profitability, Scheduled Commercial Banks.*

Introduction

The primary aim of the present article is to analyze the effect of Basel Accords on capital, liquidity and profitability of SCBs in India. The other important objective is to highlight the capital adequacy position at a time when SCBs are witnessing a decline in their return on assets. The Bank for International Settlements (BIS) has continued its role as a central bank of Central Banks by monitoring global financial stability through various industry forums such as the Committee on Payment and Settlement Systems, Chaired by YV Reddy, Deputy Governor of RBI. In this committee, RBI has been actively participating from Indian perspective and has been part of a number of technical groups who formulate new Guidelines/Directives for all stakeholders.

BIS has stated that with the changing global financial scenario, it is necessary to review capital adequacy norms with the objective of ensuring safe and sound banking environment. The new Basel Accord has been widely accepted as a yardstick for its adoption by other countries. The International Convergence of Capital Measurement and Capital Standards: A Revised Framework (Basle Accord II) was introduced in 1998 followed by Basle Accord III in 2006. This revision of the Basle Accord was necessitated because of worldwide credit event witnessed during 2007-2008 financial crises, which shook the very foundation of global economy. Banks worldwide witnessed the collapse of number of major financial institutions, which had negative impact for all stakeholders including depositors. As a result, regulators across the globe started demanding higher capital adequacy ratios to ensure safety of deposits and smooth functioning of banking system. Since India had more than 70 percent of its total deposits held in banking system, RBI imposed new regulatory norms on SCBs to ensure that there was no systemic risk in the Indian Banking System.

Objectives Of The Study

- To analyze the effect of Basel Accord III on capital, liquidity and profitability of scheduled commercial banks in India.
- To explore different key aspect of Basel Accord III for scheduled commercial banks in India.

Research Methodology

This article examines the implications of Basel Accord III for Capital, Liquidity and Profitability of Scheduled Commercial Banks in India. The research tool used is a desk study that includes secondary sources of information. Structure of this article contains two separate parts; the first part talks about the process of carrying out a study and achieving the objective while the second part highlights Implications of Basel Accord III for Capital, Liquidity and Profitability of Scheduled Commercial Banks in India.

Review Of Literature

Scheduled commercial banks face several challenges, which need to be addressed so that they can maintain their profitability. This article will analyze the key implications of the Basel Accord III to clarify the potential areas where banks will be impacted. It also analyzes capital adequacy standards and liquidity standards under Basel Accord III that were announced by the central bank on January 16 (Singh et al., 2020).

Scheduled commercial banks are banks that are given three distinct categories under the Reserve Bank of India Act, 1934. The Indian banking system has over 3,000 such banks. Most of these are small banks which have less than Rs. 250 crore in assets under management, or under Rs. 100 crore in gross non-performing assets (NPA), so they are most vulnerable to failure (Prakash & Sathya, n.d.).

Basel III has not yet been implemented in India due to the problems arising out of the Basel Committee being unable to set up a technical unit that will ensure that international accounting standards are interpreted correctly by Indian companies and employees, thereby ensuring that the world's largest business houses comply with these standards for reporting purposes (Boora & Jangra, 2019).

Most of the scheduled commercial banks in India will not be impacted negatively by the Basel III measures as they do not have a large proportion of assets or liabilities exposed to international capital markets. In defense, the government may need to bail out banks exposed to international capital markets. After all, these banks are majority owned by Indian companies (Swamy, 2014).

In addition to that, many scheduled commercial banks may be able to restructure their balance sheets and improve their capital ratios under Basel III if they follow certain guidelines. They must set targets for reducing NPA ratio and lowering interest rate on deposits with the higher risk assets, which include shares of equity shares and bonds issued by non-regulated financial institutions that are trading in international markets (Hussain et al., 2019).

The impact of Basel III will be most keenly felt by banks with significant exposure to the capital markets, including foreign banks operating in India. The most important aspect of the Capital Adequacy Standards is that it is expected to have a positive impact on small and medium-sized businesses in India because there are very few large companies which are expected to find the new capital ratio ratios difficult to meet, especially if they have not been able to clean up their balance sheets. He also pointed out that "The key burden will be on private banks with high capital requirements. They are already taking actions." Ms. Rajan stated that smaller cooperative banks are more resilient than commercial banks, as they have better access to deposits from retail customers (Singh, 2019).

Under Basel Accords II and III, 9 percent of the bank's capital must be "tier I" capital. This category consists of all paid-up equity and disclosed reserves. The minimum tier I capital is fixed at 8 percent for Indian banks, which is very low by world standards. India will be keeping this level for a longer period under the Basel III norms as banks need time to adjust their balance sheets to meet the new standards. Thus, Indian banks should look to raise more tier I capital from the market in the next couple of years (Ogboi & Unuafe, 2013).

The ratio of tier I to total risk-weighted assets (RWA) must be at least 6 percent by January 1, 2019. The minimum capital conservation buffer will be set at 2.5 percent of the bank's risk-weighted assets (RWA), but banks would need to maintain a higher ratio depending upon their economic capital requirements, which will reflect different risk weights for individual assets (SHUKLA, 2018). Banks are required to maintain a minimum leverage ratio of 3 percent under Basel III; this means that they must keep enough capital relative to assets that they could lose without having to tap into other sources, like government or institutional funding or government guarantees.

Implications of New Basel Accord III

The new Basel III was introduced in 2014 aimed at increasing the capital adequacy of banks to 12 percent with a prudential requirement of 9-10 percent. The new norms also included significant changes in the way banks will measure capital. The RBI had adopted the final guidelines for calculating capital adequacy ratio (CAR) on 26 February 2016. Banks with gross non-performing assets

(NPAs) above 8 percent are required to maintain minimum CAR of 9 percent, which includes provisions for bad loans, provisions for contingencies etc.

The new Basel norms has increased the minimum capital requirements for SCBs across all category of assets and liabilities. The new Basel norms also introduced two components i.e. amount and speed of provisioning of bad assets/deposits by banks to ensure safety of depositors and to maintain smooth functioning of banking system.

Earlier, banks were required to set aside capital for bad loans based on the provisions they made. Under the new framework, banks are required to raise additional capital if they are unable to meet their Capital Adequacy Ratio (CAR). If a bank is unable to meet its Basel III norms, it may approach the concerned regulators for permission to raise additional capital through issuance of equity shares. If permission is granted, then banks will have two options i.e. one option is Government Sponsored Schemes that are issued under private placement basis open only to Financial Institutions. The other option is open to all banks for sale of equity shares in the market. RBI has clarified that SCBs are not allowed to issue commercial papers (i.e. bonds) in the market.

Though neither banks nor regulators will allow SCBs to raise additional capital through issuance of commercial papers, they are allowed to sell their equity shares in the market. The maximum amount that can be raised will be consistent with the rate available on offer to other common shareholders of public sector banks (PSUs). If a bank is unable to raise the additional capital, then its FD level will be reduced by the amount of additional capital required. The objective of this step is to ensure that banks have adequate buffer as low as possible against its capital adequacy ratios.

In India, there are three types of SCBs with 100 percent foreign investment i.e. Foreign Bank branches operating in India, Foreign Venture Capital Investment Firm and Foreign Institutional Investors (FII). Since, they have been given the status of a bank, they are subject to maintaining minimum CAR as per Basel norms. However, since there is no requirement for them to maintain minimum Tier-I Capital ratio i.e. Common Equity Tier-I, they can raise additional capital and adopt any other prudent investment methods to maintain their capital adequacy ratio.

Now, let's examine the impact of Basel III on SCBs profitability since they are operating with higher capital requirement. To do that, I have used both gross NPA ratio and Net NPA ratio. For example, if a SCB has total gross NPAs of 6 percent, then it will get 6 percent net NPA after applying provisions for bad loans for 6 percent.

As per the new Basel norms, SCBs are required to maintain Tier-I Capital Ratio on the basis of 30 June 2016 level. Since, Tier-I Capital is on the basis of '25% Equity/85% FRAs' after adjustment for adjustments made to meet CAR requirements, it's easy to see that banks with negative NPA ratio cannot fully meet their Tier-I Capital requirement. This indicates that SCBs which have not been able to increase their NPA ratio will find it difficult in meeting its Basel III requirements during 2017-2018.

Besides, banks are required to brings down their Tier-I Capital ratio. So, the profitability of SCBs will be further hit due to its requirement of Tier-I Capital. The key question is whether SCBs can eliminate their Non-Performing Asset (NPA) ratios under the revised Basel norms.

The Basel Committee agreed on the third global framework for capital adequacy, liquidity and profitability of banks with effect from 1 January 2018. The Accord III, which is more stringent than the previous Basel II Framework, is expected to boost financial performance of banks in India. This article discusses the implications on capital adequacy, liquidity and profitability for Indian commercial banks on account of Basel III.

The objective of Basel III is to implement the international regulatory framework by which banks are expected to set capital adequacy ratios, liquidity requirements, and efficiency ratios. Banks are encouraged to adopt more stringent international risk-based capital requirements by increasing the minimum common equity tier 1 (CET1) ratio on the basis of risk weighted assets. Liabilities on the Basel III Adequacy Framework are classified as regulatory capital (RC), which consists of Tier 1 (Tier 1 capital), Tier 2 (discretionary profits

buffer) and Tier 3 (Segment Risks) elements. The minimum compulsory ratio for Tier 1 is based on the risk-weighted assets based on internal models.

The Basel III framework has greater emphasis on liquidity requirements than earlier versions. Minimum requirement for the liquidity tier is Rs. 50,000 crore that include 10 per cent of net worth in liquid assets, along with eligible government securities and investments of the bank. Basel III also provides for a corridor to meet the requirements of the liquidity tier. The minimum threshold for net worth in liquid assets under this framework is Rs. 50,00,000 crore.

The Basel III framework now requires banks to follow internal models that are more complex than earlier standards. However, there are differences in the methodologies adopted by individual jurisdictions.

According to this paper, it has been observed that Indian banks may fail to meet these new compliance standards on capital adequacy and liquidity within the prescribed timeline. The paper notes that Indian banks are already saddled with non-performing assets (NPAs) that have led to a deterioration of their financial positions.

As it turns out, the long-term implications of the Basel Accord III for capital, liquidity and profitability of scheduled commercial banks in India is not as positively rewarding as it would be for commercial banks in other developing countries. However, this does not constitute to a total denial of any potential benefits that can arise from it. The benefits to be derived depend on the level and type of risk that are inherent or incidental to banking operations.

The previous two Basel Accords have reduced the cost of credit through increasing amounts of capital that are now required with lesser reliance on equity financing. More capital is required to cover potential losses through higher risks.

Basel III will increase capital requirements, which means that banks will need to raise additional capital above the levels required under Basel II regulations. According to India's Financial Policy Committee (FPC), total Indian banking system assets are estimated to be $1.6 trillion at the end of FY 2011-12 (April 1, 2012). Of this, assets held by scheduled commercial banks are estimated at around $600 billion, credit card transactions at around $130 billion and NBFCs at around $65 billion. The Basel Accord III is expected to result in an overall increase in the regulatory capital requirement by 10%, totalling INR 1. 8 lakh crores (USD 30 billion) based on the latest estimates. The impact will range from 0.25 percentage points for banks with Tier 1 capital ratios exceeding 12% to 1 percentage point for those with Tier 1 capital ratios below 8%. The impact on Indian banks' profitability is expected to be moderate, as the additional cost can be absorbed by pricing interest rates and other charges higher.

The implementation of Basel III will have a positive impact on the banking sector as a whole, bringing in much needed transparency and clarity in risk management practices. This can be attained through proper implementation of Basel III, the FPC and the RBI's guidelines for resolution of bad banks.

Conclusion

The paper's findings suggest that Indian banks need to meet the severity of risk exposures in order to maintain capital adequacy and liquidity. The focus on increasing capital and liquidity ratios is likely to adversely impact profitability of banks in India, the period during which the Basel III Adequacy Framework is expected to be implemented. This could affect the return on equity (ROE) and economic value added (EVA) of these banks in the short-term. This paper documents the new Basel III Adequacy Framework and its implications on capital adequacy, liquidity and profitability of Indian banks.

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LINEARITY BETWEEN DIGITALIZATION AND DIGITAL MARKETING IN AUGMENTING SALES REVENUE FOR AUTOMOBILE PRODUCTS IN INDIA

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ABSTRACT

The auto area has effectively accepted digital transformation in its plan, design, production, transportation, and lastly retail. Retailers have already started to move towards better digitalization and to implement a strong relationship with their customers. Digitalization has showed better responses in the automobile industry with with their customers and this progress helps to speed up sides as go from planning phase to creation in months instead of many years. The utilization of digitalization as innovation to improve online customer service is an incredible model like dealers are using e-Commerce as to straightforwardly sell their products. Digitalizing the industry has helped it in changing the clients behaviour towards the product and has helped the businesses to rethink about their selling and promotional activities which were done by traditional methods. Innovation, information and hierarchical change are the primary spaces for computerized change.

***Keywords**: Automobile, sales, online digitalization.*

Introduction

Nowadays, consumers are more active and connected with social networking as well as online platforms that contains the content about the automobiles. In general, they make regress search online to get to know about the most suitable vehicle for them. This is how, the journey of automobile consumers is one of the most complex of all industries. There are numerous online sites available to provide information about the vehicles. The informatic content about the vehicles on these platforms are in various forms like text, video, pictorial, etc. These platforms provide content in user-readable and understandable form. Despite the fact that clients actually buy their vehicles at dealerships, the major part of making the decision happens while searching online. When the consumers really come to purchase an automobile, they often create a mind-set about a vehicle prior to actual acquisition.

Concerning what content they devour, video research is seen as the most standard and convincing association for engaging individual in brand.

Viewpoints of test drived on YouTube, features, and choices, and stroll through have multiplied in the previous year. With seventy percent of people who used digital app such as YouTube as a part of their vehicle buying measure were influenced by what they watched. The primary concern to recollect for vehicle merchants is to reach and target customers at this questionable stage before they've made their decision or are affected by another competitor

As an integral part in ecosystem of automobile retail, dealers are able to produce extra revenue to push to increase their sales through online marketing platforms. Dealers prefer Original Equipment Manufacturers (OEMs), the original products, to promote and increase sale. Consumers approach to these OEMs parts through online platforms when they replace their damaged parts or components of their vehicles. These steps are used to yield extra revenue for dealers. The OEMs and dealer

The OEMs and dealers will continue to work together in finding new ways of engaging with the customers.

While researching, customers don't look for information on auto brand locales alone, they visit assessment stations to check expenses and customer reviews prior to strolling inside a business. Some 56% of new buyers most ordinarily start at an alien page and end up at a seller site. Year on year, traffic to vehicle research objections has extended by 12%, while merchants have seen a 2% lessening to their site. Locales, for instance, True Car and Edmunds outfit customers with significant and optimal information two or three essential snaps. This rising in pervasiveness of 'fair-

minded' information sources displays the gigantic necessity for merchants to give the crucial information to customers in a reliable and open way on the web, so they don't have to fish in another lake. Video is making the buyer's assessment and interaction much easier while making a encounter that is generously more significant and redone.

Automobile producers are attempting to use both expanded and virtual reality advancement to pass on the best experiences to clients. As shown by Digi-Capital, the extended/PC created experience assessed pay is to hit $120 billion by 2020.

Utilizing VR innovation and specific applications, pretty much every display area in any vendor can turn into a computer-generated simulation display area. Brands like Audi and BMW have effectively hopped on this marvel.

Literature Review

As per Jatinder singh 2014 auto mobile industry in India has gone through genuine rebuilding since changes started in 1991. The commitment of car industry came to about 8% of GDP of India. Due to increment of pay of the center level families in India. M. Krishnaveni, et.al (2015) clarified that creation and fares patterns of the auto in India has been rising step by step. The ascent popular and expansion in the inflows through 100% FDI has added to the ascent in the creation and exports of the autos in India. Dr. Mama Lokhande in 2013 clarified about the verifiable pattern of the auto business in India. The Indian auto industry has opened up after the progression (1990) and presently the auto market had become an exceptionally cutthroat one. To support in this aggressive, market the associations must be imaginative and bring developments. As per Maxwell and McCain Computerized innovation brings data and separates it into its littlest segments. By changing a simple signal into discrete pieces, digitalization makes it possible to control data, text, designs, programming code, sound, and video in never considered before manner. In the words of Hagberg Digitalization is quite possibly the most significant on-going change of contemporary society and incorporates numerous components of business and regular daily existence. Digitalization alludes both to a change from "analogue "to "digital"(e.g. a shift from cash to electronic payments) and to the help of new types of significant worth creation (for example Openness, accessibility, and straightforwardness).In the words of Eling and Lehman The incorporation of the simple and computerized universes with new advances that upgrade client communications, information accessibility and business procedure Gobble defined digitalization as the utilization of advanced innovation, and most likely digitized data, to make and gather values in innovative methods.

Research Gap

Digitalization is a coin with two sides, yet it has brought the automobile industry to the higher level but we should not forget that utilizing innovation makes us reliant upon it, hence it still lacks many things. A few of them are discussed below:

1. Social Disconnect: - Digitalization leads people to not connect physically to share and get information about the vehicles and related products/services.
2. Job Insecurity: - The major cause of unemployment is the digitalization process in the automobile industries.
3. Plagiarism and Copyright: - Generally the information shared on online platforms is more or less similar to one another. This increase the plagiarism and copyright issue.
4. Anonymity and Fake Products: - There are instances where products available on online platforms are different what the customers got. The pictures or videos of different products are uploaded after lots of quality-improved processes.
5. Overreliance on Gadgets: - Due to the increase of digitalization process in automobile industries, customers and potential customers are more addicted to the gadgets that supports digitalization.
6. Time Consuming: - Customers are spent more time on to search products that satisfies their needs and demands. This activity takes to provide relevant information about their search.
7. Security and Privacy Issues: - Generally most of the online platforms ask to sublit some kind of personal information like

Name, phone number, email, date of birth, current city, etc. This information can create a security and privacy issue.

Objectives Of the Study

- To study the linearity between digitalization and digital marketing on increasing sales for automobile products in India.
- To evaluate the digitalization of automobile industry
- To show the effect of computerization on the dealings of various auto parts

Research Methodology

Secondary data is altogether used as the main source in this study. The data available in Journals, published articles, and from other websites are collectively used to get this research work.

Need And Scope

As of now, like never before, companies should embrace an advanced outlook. To stay relevant organizations should stay aware of the changing client conduct, differentiate the retail design in to brand experience centers, use item digitization to make further continuous connections and put resources into a solid investigation spine,"

Computerization in automobile industry is flourishing speedly and is delivering quantifiable results for them. Below 3 steps are recommended and essential before implementing digital strategy:

- Comprehend your crowd: Be available with accommodating data all through buyers' buy ventures. Quit glancing at computerized as a lead-gen, last-click medium and begin looking at how advanced can have a full-channel sway for your business
- Adhere to the rudiments: To facilitate the progress from print to digital, plan for computerized like you'd plan some other mission. reach and recurrence should be the focus, learn to figure out how your crowd invests their energy in computerized stages.
- Test and measure: Measurability is perhaps the greatest benefit that advanced offers, so ensure you're continually trying, observing, and enhancing your missions. Seeing how to utilize advanced to develop will become one of the greatest serious differentiators for brands and advertisers in India pushing ahead.

Discussion & Conclusion

Computerized change is acquiring energy in the automobile business and will quickly change the worldwide scene of the area. In addition, it is causing a critical change in the manner vehicle producers and service providers are conveying services and products to the market. The outcomes shed light on the effect and variation procedures for computerized change in the automobile business.

the organizations that start to lead the pack in growing new administrations and items identified with the digitalization interaction will enjoy a critical benefit to contend in the automobile business. Hence, the outcomes recommend that it is important to put resources into sufficient measures for variation to computerized change, and makers will wind up having more prominent benefits, efficiency, and intensity

Lastly, the digitalization provides a system to address the patterns and difficulties of digital transformation changes in the automobile business that can be utilized during the decision-making process to generate better revenues and sales as output.

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SOCIAL MEDIA MARKETING STRATEGIES A HETEROGENEOUS MARKETING APPROACH WITH REGARD TO CUSTOMER VALUE ANALYSIS

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ABSTRACT

The scope of this study is to understand and analysis the Customer Value in the heterogeneous marketing on social media marketing (SMM) strategies. The researcher found that there is impact of SMM on Customer Value Analysis (CVA), it is inferred that the blend of content creation, content sharing and customer communication offer firms desired business openings and helps in satisfying clients. By using social media, the businesses can draw various individuals to the product and business in a heterogeneous market. Online media addresses establish and propagate interchanges between the businesses and customers. Social media gives proper, visible, and straightforward connections which motivate customers to join the brand and be loyal to it in a diverse market. Organizations connect with their clients via online media stages to draw in more purchasers and convey better worth to clients through viable and proficient correspondence in a heterogeneous market. It has been found that there is effect of appropriate marketing strategies in a heterogeneous market on clients if they are taken care of in other words if they are satisfied.

***Keywords**: Value analysis, social media, customer, heterogeneous.*

Introduction

People are opting social media in its various forms like for entertainment but from the past years of experience, it is far much more than that. Now, people on social media are expecting not only entertainment but lots more on social networking sites to utilize their power to communicate around the globe. These days online media turns out to be essential for an individual's life.

Social media like Facebook, Instagram, LinkedIn, or Twitter holds a large count of audience and continuously growing on daily basis. Social media not only helps in spreading information about an event but also able to spread information about different brands. Regardless of whether they are Fortune 500 organizations, non-benefits organizations, establishments of advanced education, or a neighbourhood organization not far off from where you reside. Social media permits every one of those substances to have a voice in the continuous discussion on it. At per the present condition, more than 500 million individuals are interacting with online media.The power of audience available on social media has drawn the attention of businesses. They have perceived social media advertising as a significant piece of their marketing communication strategies.

Online media can assist with setting another, maturing business on the guide, and it can permit steadfast clients to examine their inclinations in regards to an organization's product offering. It can help a decent standing spread, or a negative one flourish. The most amazing thing in it is a brand can be constructed or pulled down within few minutes.

Social Media Marketing (SMM) is the utilization of social media stages and sites to advance administration about the brands or products which are available to sell. Social media advertising is turning out to be more famous among professionals and analysts. A complete plan of business is the most fundamental step to reach to prospective consumers and convert them into customers general strategy to marketing. It contains the company's valuable offerings, products' branding, data of target audience, and other significant level components.

From the last few decades, people are more looking for products which are heterogeneous types. Products under heterogeneous in attributes or properties are significantly differ from other products and hard to substitute with other products. It simply means that consumers can't promptly substitute a competing product with another product due to its difference in

properties. This creates the concept of Heterogeneous Marketing and selling of such categories by the marketers on social media shows a high level of vision, management, and market strategies to sustain for long and build-up a strong relationship with their customers.

Heterogeneous marketing is a market segment that provides prospective customers of different needs, choices, demands, habits, etc. Nowadays, social media platforms show significant potential as a heterogeneous market where audience are available with variety of buying habits and products selection. As far as the current circumstances are concerned, social media platforms are one of the most common and famous platforms approached by the marketers to get a huge scope to direct connect to customers efficiently & effectively. Marketers show their products' variety in the form of social advertisements and campaigns as key brand messaging.

Social Media Marketing (SMM) requires a well-defined strategy as the key ingredient. SMM process should define goals & target audience, set metrics to measure success, create optimize assets, promote & syndicate content, and convert visitors to customers. Hence, these collective steps give profitability in return.

Businesses are putting significant focus on customer value as an essential component in competitive strategies. Now organizations are more interested in Customer Value Analysis (CVA) which includes perceived quality and perceived cost to survey their overall significance of their consumers. A statistical approach is required to formulate the utilization of a recursive model of CVA for performance to oblige buyer heterogeneity.

CVA refers to an research methodology that is utilized to recognize how an business is seen by customers of an association and their rivals. The CVA is critical on the grounds that it permits an association to measure how they are decided in contrast with their industry rivals.

The CVA analysis constructs a simple step of client's satisfaction. It leads to more significant and key measures that differentiates a firm from its competitors regarding the value offered by each. The CVA analysis addresses a basic inquiry of many firms that is "How fulfilled are our clients with our items and administrations in comparison to our rivals' items and administrations?"

LITERATURE REVIEW

According to Rockendorf 2011, social platform becomes the centre of market intelligence as businesses start to recognize client's purchasing habits and gets aware customers behaviour about product selection. This study examines role of online marketing strategies in a heterogeneous market with regards to customer value analysis. According to Forbes and Vespoli 2013, many a times various recommendations on social media effects the purchasing behaviour of the consumer.

As per (Gao et al 2018) organizations are enjoying benefits of social platforms to enlarge their access to consumers. Evaluating brands to build healthy relationship with the buyers. In 2016 Hamilton described that customers are being empowered by social network and are controlling the marketing transmission process and have become makers, associates, and reporters of the market. Lambert on in 2016 defined the role of social network which has slowly transformed from solitary marketing instrument to the main source of market knowledge through which a organization can notice, examine, and anticipate client practices, it has gotten progressively basic for advertisers to deliberately utilize and use web-based media to accomplish competitive advantage and prevalent execution.

In Choi and Theoni 2016 words despite of boundless comprehension among advertisers to connect with clients via web-based media stages, moderately couple of firms have appropriately planned their web-based media appearance and inclusion. On the topic of challenges with social media Schultz an Peltier 2013 explained that for most organizations, web-based media campaigns is not a big deal however they need to consolidate online media with their promoting methodology to draw in clients to build important and long term associations with them. While explaining about social media Spil in 2016 said that in spite of the boundless chances provided by the social network there is no reasonable definition or extensive system to direct the combination of online media with promoting procedures, to acquire a thorough comprehension of the nature and job of social media advertising

methodologies (SMMSs). Social media writing generally gets components from broadly divergent fields, like advertising, the executives, shopper brain research, and software engineering (Aral etal. 2013). The connection between web-based media and customer dynamic present that online media influences publicizing perspectives, brand mentalities, and buying aims of buyer. It won't really influence shopper's dynamic, yet may have an intervening impact (Training 2012)

Research Gap

From past few years social media is just not a medium for chit- chating with friends, following your favourite celebrity, giving thumps up to various videos and photos. Various businesses have started using them as a apparatus to advance their brands and create consciousness about them. This is termed as social media marketing. However, even after marketing the product on social media many business gets failed and falls in to the category of social business loop. Social business loop refers to those businesses which are inattentive and do not have much authority and primarily depends on social media to. encourage their sales but ends up in creating almost no leads by drawing in non designated audiences.

There are some drawbacks of SSM. A few of them are as follows:

- Not meant for every business concern
- Pessimistic response can spoil brand name
- Total dependency on ads
- Stubby return on investment
- Too much time taken
- Hard to measure
- Privacy policies
- Restricted to social network platform only

Not meant for every business concern: - Many businesses specially the one which have been newly set up, which are not alert enough about the working of the social network should not focus on social media marketing, one other reason for the same is web-based media like yet Facebook or Twitter are supporting various business promotions but they were not build for the same.

Pessimistic response can spoil brand name: - Being via online media implies presenting yourself openly to a wide range of individuals who could possibly have the aim of going over or seeing your image as there is consistently a clouded side to everything, and web-based media is no exemption. With the web being successfully accessible more than ever already, there are people who reliably plan to hurt one's standing. On the off chance that your business is dark or just starting to secure energy, the shots at getting an attack are more plausible. Since it's so regular to comment or interface with, anyone can without a doubt form cynical comments on your business, which could ruin your image's picture.

Total dependency on ads: - The new businesses total depend on these ads to introduce and promote their product social platform which can be harmful.

Stubby return on investment: Another fundamental negative effect of social media for business is to return for capital invested, social media advertising is likely the most nominal in social media promoting methodologies. Businesses need to give time, efforts and money to make things workable but the returns are not fixed and many a times does not comes as expected.

Too much time taken: - There are a few free or minimal expense online media apparatuses accessible, however one needs to spend a generous time to comprehend and gain proficiency with the utilization.

Hard to measure: - Estimating your promoting exertion via online media is simply quite troublesome and muddled This specific con of web-based media showcasing is the thing that numerous entrepreneurs should face. At one point, you have likes, remarks, re-tweets and supporters everywhere, at another point, you basically can't pinpoint precisely whether these perspectives truly matter for your effort. The commitment and connections are only everywhere and with this, you can't make certain about your image mindfulness procedures.

Privacy policies: - The best negative of online media advancing is the security and assurance related issues. At the point when you're using online media stages for publicizing, you basically need to surrender your information, both public and individual, to gain by your promoting effort.

Restricted to social network platform only: - At the point when you do web-based media showcasing, you're basically utilizing web-based media stages like Facebook, LinkedIn, Instagram or Twitter to market and construct brand awareness but this is simply restricted to online media. Dissimilar to other advertising channels like SEO or SEM, where you can extend your showcasing work to different spots, online media promoting just stays on friendly media. Another impediment here is that various stages require various procedures. This fundamentally a wastage of time exertion and cash.

Need And Scope Of The Study

Until a couple of years prior, social media was not an essential worry for most brands and organizations. Just renowned individual powerhouses and makers used to be dynamic via social media and drive discourse but now in this tech time the vast majority of the organizations have as of now utilized web-based media for advertising. Whether or not it is for clear checking purposes, web based standing organization, or regardless, selling things and making drives, electronic media advancing can be an incredibly remunerating movement at whatever point done effectively. The extent of web-based media advertising is characterized by its capacity to target explicit fragments of the crowd. Brands and organizations which prior relied upon customary advertising turned to computerized once they understood they could take advantage of the act of focusing on explicit sections of the crowd. Using focusing on abilities of web-based media stages, brands can target clients dependent on various factors like age, sex, area, interests, etc. Furnished with these capacities, the extent of a web-based media showcasing effort is for all intents and purposes interminable. One way web-based media stages have figured out how to keep up with their ubiquity is by setting up natural local applications for their clients. The moving pattern towards versatile has left numerous web organizations in the residue. Local applications are not just ideal for clients to get to web-based media on their versatile yet in addition extraordinary for stages that need to be near their clients.

Objectives Of The Study

The use of social media is valuable and is likely to become an enduring part of the organizations' strategy.

Research Methodology

The main course of this study is to analyse and understand the scope of CVA in creating strategies to sustain & get profitability in heterogeneous social marketing. Also understanding of CVA based strategies to provide a fundamental and essential key component in highly competitive consumer markets. The consumers are significantly identified by their heterogeneous behaviour structures and how SMM strategies as heterogeneous marketing approach are utilized by the businesses to get the customers satisfaction which is a crucial objective.

Conclusion

As a conclusion of this study, CVA strategies for businesses have become an enduring part while using social media as heterogeneous market and is significant for better marketing. The utilization of social media is significant and is probably going to turn into an enduring part of the businesses methodology. CVA impact is momentous when creating SMM strategies to build a strong relationship with customers in heterogeneous marketing trend. CVA also provides a better understanding to businesses about the customers' expectations (interns of demands), choices, habits, nature, and needs. With this information and using social media platforms, businesses are able to draw more attentions of customers effectively and efficiently. It has been found that there is effect of appropriate marketing strategies in a heterogeneous market on customers on social media if they are satisfied. Hence, able to deliver highly trusted value to customers.

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MODERNIZING AND ELEVATING THE TEACHING PROFESSION IN PURSUIT OF NEP 2020

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ABSTRACT

One of the main concerns all over the World is "Education." It doesn't matter that what we are doing and what is our job or profession education is important for every person living in the world. The impact of education system can only be analysed with the help of the teacher's performance. Schools and teachers should keep them up to date with the latest developments done in the education field and for this they should keep them up to date with the latest national education policy. The National Education Policy 2020 accepted on July 29, 2020 by Union Cabinet of India with the vision of new education system in India. The new policy came in the place of old education policy of 1986. New policy is the complete framework from elementary to higher education and as well as vocational training programs in all the sectors of India. For analysis of the study both primary data and secondary data has been taken into consideration. For primary data Google form have been developed and circulated among the teachers working in the schools and colleges. 200 teachers 100 from school level private and public both and 100 from college level private and government institutions from Pune were taken as sample. secondary data has been collected from various websites, books, research papers, Journals etc. For testing the dependence level of two factors chi-square test has been taken into consideration. The aim of the policy is to transform the education system of India by 2040. This study will help in understanding the role of new education policy on teaching profession and how the new and modern techniques enhance the performance of the teachers and the schools. Teachers are the leaders and play a very important role in shaping up the future of the country and for better shape of the future the leaders should keep them up to date with the latest practices of this sector. Focus to be done on the Teachers education and training programs so that teaching quality and process of learning can be enhanced. A teacher is an educational leader who create a positive change among the students and the classroom and helps in shaping the environment. The National Education Policy is a developmental and progressive policy which came into existence with many aims like sustainable development, inclusive and equitable education quality and will help in promoting learning opportunities lifelong

***Keywords**: Education, National Education Policy, Sustainable Development, Educational Leader, Higher Education*

INTRODUCTION

Education is a instrument which helps in providing knowledge, techniques, skills, information and helps the people in understanding their rights and duties towards the Nation, It helps in developing a vision towards the life and develops different capabilities to fight against any injustice of the society. It doesn't matter that what we are doing and what is our job or profession education is important for every person living in the world. The impact of education system can only be analysed with the help of the teacher's performance. Education provides the knowledge of the world and helps in understanding the world. It helps in developing a perspective towards the life. It is the most important part of nation and without education no one can explore new ideas and development of the nation is not possible without education.

Education is very important for getting success in life and it has the ability to shape up the future. The significance of education in years is huge. It assists in excellence learning, inculcates information, faith, ability, principles. It advance the method of livelihood and lift the communal and status of individuals. Education build better and peaceful life. It changes individual's personality became them confident in life. Education is very influential weapon for changing the world.

It is the base of the society which helps in enhancing economic wealth, societal wealth and political constancy. It provide a power to put views, make stronger democracy by giving citizens a tool to contribute for the society. It acts as a strength to promote communal consistency and nationwide identity. Education is a legal right of each citizen. Persons from different age group, belief, class, caste or

region free to get education. A knowledgeable person is appreciated everywhere and treated in a good way in the society. Well learned public have new chances to obtain a better job which make them feel satisfied.

The Government approved the Right to Education Act on 4-8-2009 and this act came into effect on April 1, 2010. Education is the basic right of every child and it helps in providing no cost education and compulsory elementary education to the child from 6 years to 14 years of age. School education includes customary learning which offer students theoretical knowledge. Today a variety of efforts have been taken into consideration the established integral application-based learning by addition of several experiments, extracurricular activities in the school curriculum. Today in digital education era everyone is accessing the information online on their fingertips and enhance their knowledge by learning new skills.

The worldwide growth and development of schooling in the past is extraordinary. Enrolment in primary schools is increased unexpectedly but at the same time it is a great challenge for the global system of education that outcomes through learning are not coming in expected way. The National Education Policy 2020 approved on July 29, 2020 by Union Cabinet of India with the vision of new education system in India. The new education policy replaces the old education policy of 1986. New policy is the broad framework which includes all the programs from elementary education to higher education and make it important for every sector of India either rural or urban area.

The main objective of this new education policy is to change the whole education system of India by 2040. This study will help in understanding the role of new education policy on teaching profession and how the new and modern techniques enhance the performance of the teachers and the schools. Teachers are the leaders and play a very important role in shaping up the future of the country and for better shape of the future the leaders should keep them up to date with the latest practices of this sector. Focus to be done on the Teachers education and training programs so that teaching quality and process of learning can be enhanced. A teacher is an educational leader who create a positive change among the students and the classroom and helps in shaping the environment. The National Education Policy is a developmental and progressive policy which came into existence with many aims like sustainable development, inclusive and equitable education quality and will help in promoting learning opportunities lifelong.

REVIEW OF LITERATURE

Skills and hierarchy inspiration model given a complete structure to inspire faculties at different levels of ability and hierarchy by Tiwari in 2018. To expand a society of entrepreneurship, faculties must be supported to participate, contribute actively for the establishment of the new entrepreneur's development by Tiwari in 2017. M. Maruthavanan in 2020 conducted a study on the consciousness on New Education Policy in Madurai District and analysed that the awareness plan should be planned by the government at least for teachers. Bocker and Lavy in 2018 anlaysed that Making profession of teaching significant and profitable will improve the relationship of the students and teachers. Mamidala Jagdish kumar in 2020 conducted a study on the impact of latest education policy on the higher education of India and analysed that NEP is suitable and innovative in approach and has the probability to change the Indian educational system. The emphasis of Education policy is on encouraging critical thinking, enhancing capability and creating learning empirical and it will help a lot to the students to make them ready for future revolution. PS Aithal and Shubrajyotsna Aithal in 2020 conducted a study on Analysis of challenges faced by higher Education with respect to national Education Policy Proposal 2019 and found that methodical policy in education is necessary for providing school education and college education in a country. Different countries make use of diverse system of education with diverse stages during school and College education levels. Nigam in 2017 studied about the educational institution management should take care of the essential needs of faculties by

giving them sufficient reward, professional development and good quality working situations. PS Aithal in 2020 done a study on National Education Policy 2020 and implementation strategies of higher education as a part of towards attaining the objectives and analysed that methodical accomplishment of the planned policies by creating different methods directed by extremely focused and dedicated teachers as academic property which help in creating an environment of inventive and imaginative thinking. Kartik Murlidharan in 2021 conducted a study on the evidences and challenges of the new education policy 2020 in India and observe the NEP's discussion of school education in light of building up research proof that may be appropriate for the successful implementation of the goals.

NEED AND SCOPE OF THE STUDY

NEP includes a broad range of subjects starting from elementary education to higher education. NEP have a changing effect on school as well as higher education in India. In order to achieve the objective of learning with brilliance and the equivalent amount of benefits to Nation the education policy should be properly applied in the teaching profession for the betterment of students as well as teachers. Effectual learning need a widespread approach that involve proper curriculum, attractive pedagogy, constant evaluation and sufficient support of student. The curriculum have to be attractive and appropriate which must be regularly updated to gain latest knowledge and meet up the requirements. Teachers are the backbone of the future generation, they shape the future with their knowledge and skills and if a country want a good future generation that helps in the development of the country then they need to polish the backbone the teachers of the country and this education policy brings a lot of changes for the development of the teaching profession. Super pedagogy is essential for the students and the teachers because it directly influence the learning result, the evaluation methods should be scientific and continuous to improve and enhancing the learning and knowledge of the society.

OBJECTIVES OF THE STUDY

1. To study and understand the New Education Policy 2020.
2. To analyze the impact of New Education Policy on elevating Teachers and Academicians performance.
3. To understand the role of Education Policy on the modernization and elevation of teaching profession.

For supporting the objectives null hypothesis was framed

H_0- New Education Policy 2020 and Performance of the Teachers are independent to each other.

SIGNIFICANCE OF THE STUDY

This study will certainly helps in studying and knowing the core features of new education policy 2020 and helps in analyzing the impact of this education policy on the enhancement and modernization of teachers and teaching profession. In order to encourage institutions creativity teachers will have the independence to innovate substance of syllabus, pedagogy, and evaluation in a wide framework of education that ensures reliability among the institutions and the programmes. In schools, anganwadis and colleges the teachers should be given training through various efforts for enhancing their skills in teaching field. As the part of this study author wants to focus on the latest techniques bring and applied by the government for elevation and modernization of the teachers in India.

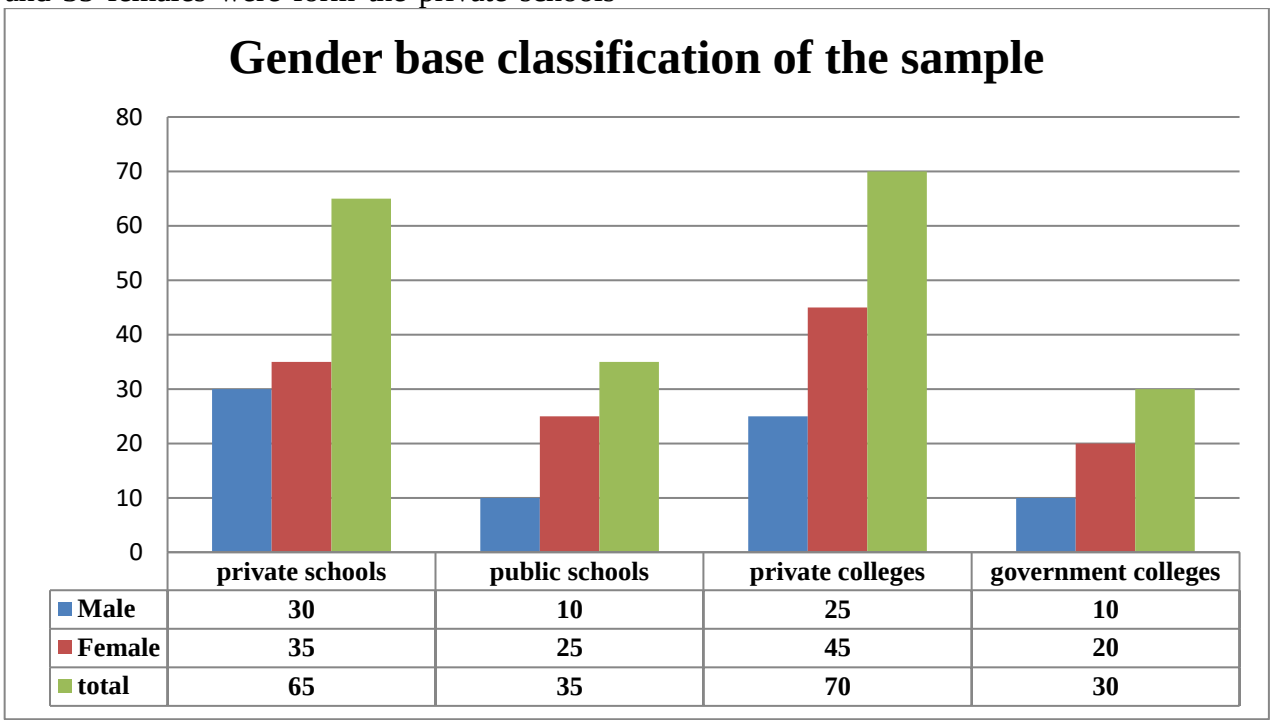
RESEARCH METHODOLOGY

For analysis of the study both primary data and secondary data has been taken into consideration. For primary data Google form have been developed and circulated among the teachers working in the schools and colleges. 200 teachers 100 from school level private and public both and 100 from college level private and government institutions in Pune were taken as sample. secondary data has been collected from various websites, books, research papers, Journals etc. For testing the dependence level of two factors chi-square test has been taken into consideration.

ANALYSIS OF DATA, FINDINGS AND SUGGESTIONS

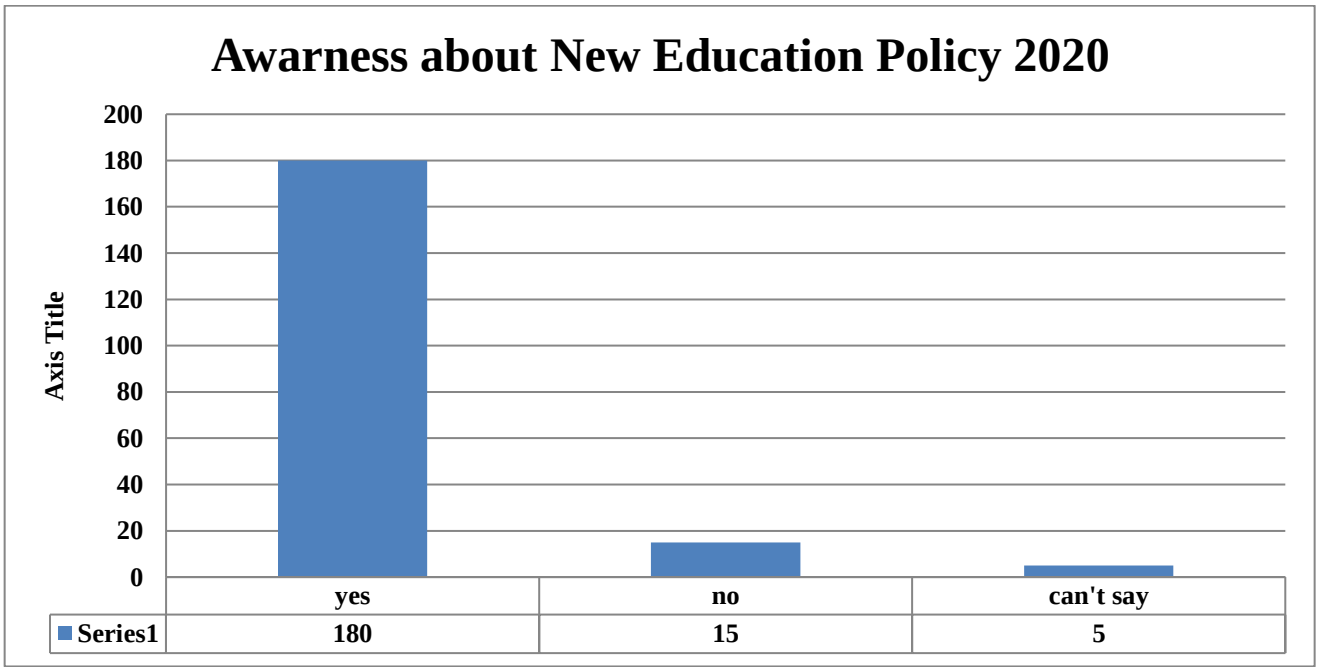
For analyzing questionnaire various graphs and pie charts were prepare

On the Basis of gender the teacher working in the private and public schools and colleges were categorized. It was found that 30 males and 35 females were form the private schools and 10 male teachers, 25 female teachers were from public schools. whereas if we talk about higher education 25 Male faculties, 25 female faculties from private colleges and 10 male faculties, 20 female faculties from government colleges were taken as sample.



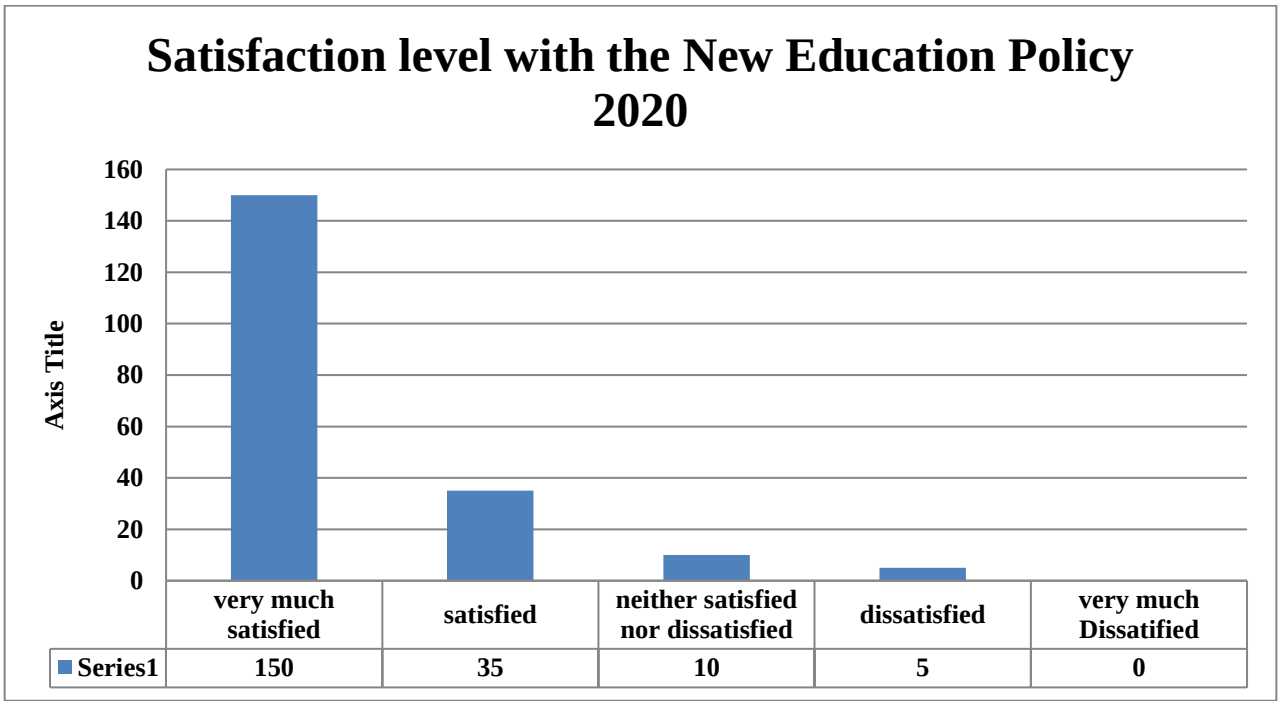
	private schools	public schools	private colleges	government colleges
Male	30	10	25	10
Female	35	25	45	20
total	65	35	70	30

When Faculties were asked that they are aware of the New Education policy than 90% were aware about the policy, 7% were not aware and 3% were in confusion zone.

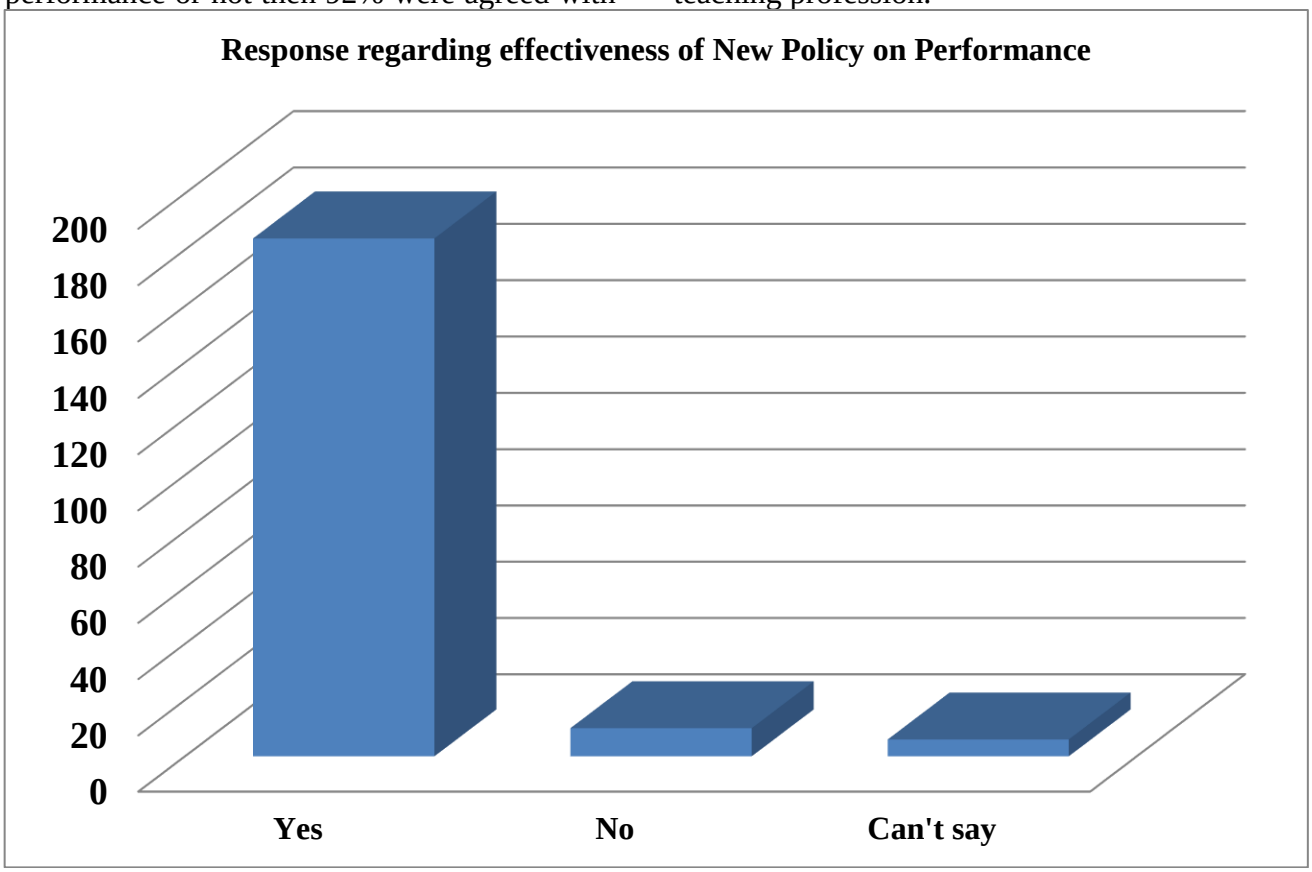


	yes	no	can't say
Series1	180	15	5

When respondents were asked that how much they are satisfied with the new education policy than 75% very much satisfied with the policy, 17% were satisfied, 5% were neither satisfied nor dissatisfied and only 3% were dissatisfied with the policy.



When the teachers were asked that new education policy helps them in enhancing their performance or not then 92% were agreed with the statement and believes that new education policy helps in enhancing their efficacy and performance and helps a lot in enhancing the teaching profession.



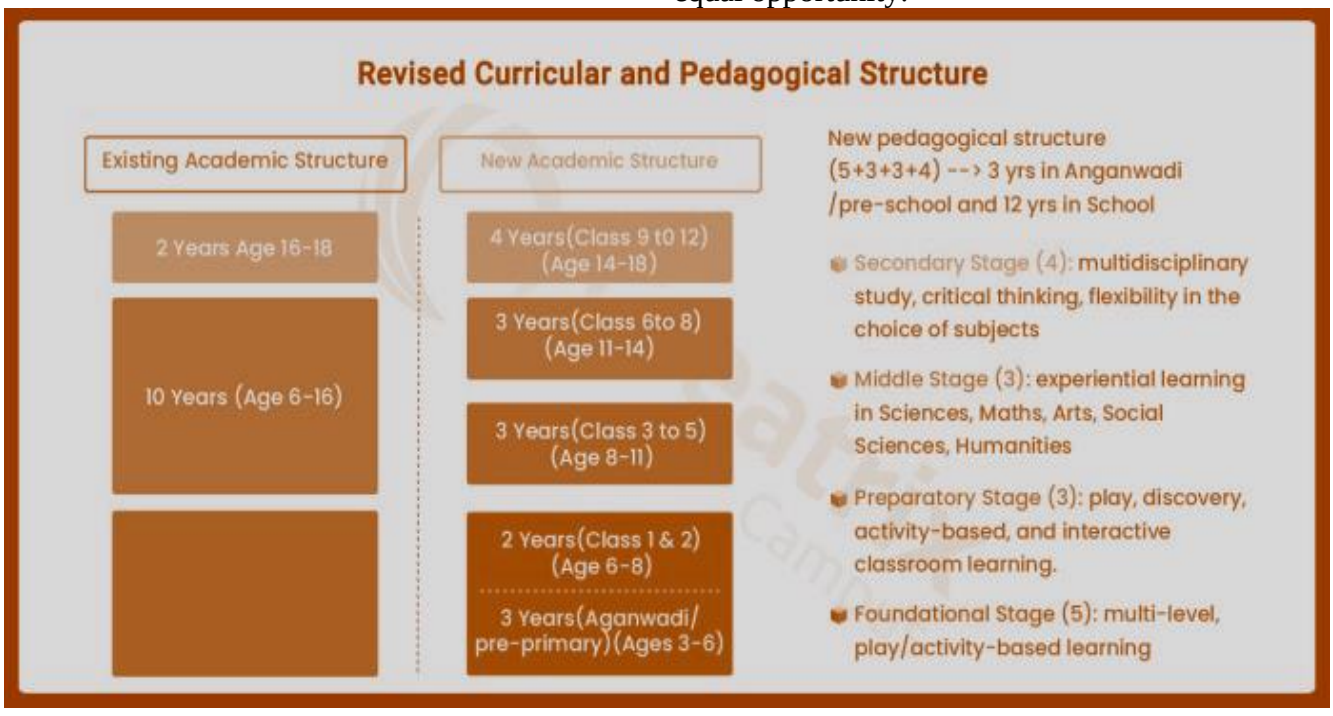
H_0- H_0- New Education Policy 2020 and Performance of the Teachers are independent to each other.

For testing this hypothesis chi-square test has been taken into consideration

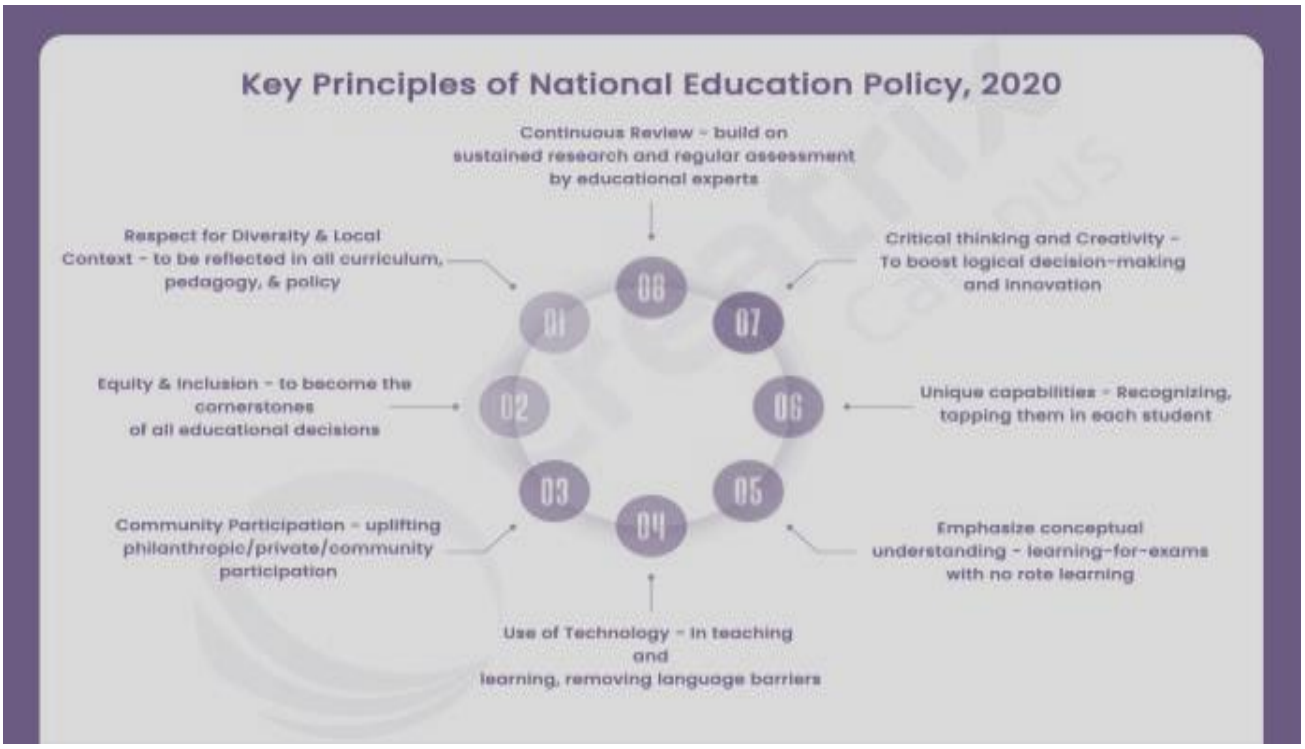
National Education Policy 2020 factors	Performance of the Teachers			Total
	High	**Medium**	**Low**	
High	45(52.5)(1.07)	45(29.0)(8.83)	10(18.50)(3.91)	100
Medium	40{34.12)(1.01)	10(18.85)(4.16)	15(12.02)(0.74)	65
Low	20(18.38)(0.14)	3(10.15)(5.04)	12(6.48)(4.71)	35
Total	105	58	37	200

The respondents were asked to rate different parameters of the policy and performance on 5 point likert scale and then it has been converted to three point scale for proper analysis of chi-square test and at 4 degree of freedom α=.05 the table value is 9.49 and calculated value is 29.60. hence the hypothesis falls in rejection zone that new education policy and performance of the teacher is independent to each other hence it can be said that new education policy helping a lot in increasing and enhancing the performance of teaching faculties.

The teachers should be placed in centre position for the essential improvements in the education scheme. The new education policy 2020 facilitates the reestablishment of teachers at different levels. Teachers are the most valued and important members of the society. Teacher helps in shaping the future generation and make them the good citizen of the society. The new education policy helps in recruiting the best and the brightest people in teaching profession on different levels and helps in ensuring respect, dignity of this profession. This policy will definitely provide quality education to the students and helps them in achieving the social and economic addition and equal opportunity.



NEP is well-timed and has innovative approach with the potential to change the education system of India. The main focus of the education policy is to provide equal opportunity of education to every child and promotes decisive thinking, give confidence for facing competition and focus on experiential learning . The basic principles of this new education policy is to use technology in teaching, learning and removing the language barriers, Unique capabilities for recognizing for each student, critical thinking and creativity which will help in enhancing the logical decision-making and innovation, to bring equity and inclusion in the teaching field, community participation will increase, to create a respect for diversity and locals, continuous review to be done in research field and regular assessment by educational expertise. New education policy focused on the interactive learning and decrease the curriculum, decrease the burden of books and course material, reduced the dependency on books, increased the experiential learning, exploratory activities in classroom. With the help of the above study it is confirmed that the new policy of education bring a lot of positive changes in the society and helps in enhancing the performance of the teachers and the students of the society. It improves the thinking pattern of the society which helps in making them a good future generation.



In the field of higher education, policy aims at increasing GER in the field of Higher education. A new complete national curriculum framework for teacher education, national educational technology forum to be formed for promoting the use of technology, aims to achieve hundred percent literacy in young and adults, the aim to promote mother language at higher education, to reach 6 percent GDP in education sector, open and distance learning education to be expanded, to setup multidisciplinary education and research universities, multidisciplinary holistic education at undergraduate level etc. High-class education system works well in enhancing the quality of the performance of the students and brings equity. these different system focus on high standards which support the students and teachers to face challenges of life in simple way. India will definitely achieve high in future with this new education policy framed in the leadership of Shri Narendra Modi and win combination of equity and excellence.

Conclusion

With the help of the above study it can be analysed that the new education policy is not looking only at one field it aims to enhance the

performance at every level either primary secondary or higher education, not only the students but at the same time teachers will also be benefited from this new policy. New education policy paying attention on the interactive learning and reduces the curriculum, reduces the burden of books and course material, diminishing the dependency on books, improving experiential learning, exploratory activities in classroom. For country's development well-educated people having relevant knowledge, outlook and skills are required and this can only be achieved by dispersing awareness about the significance of Education in every area. The National Education Policy identifying the vital role of Education and working for the enhancement of education in every field. The study also analysed that the new education policy helps in enhancing the performance of the teachers in near future. India will definitely achieve high in future with this new education policy and win combination of equity and excellence. NEP have a altering result on school as well as higher education in India. In order to achieve the objective of education with brilliancy and equivalent amount of benefits, the education policy should be properly applied in the teaching profession for the betterment of students as well as teachers.

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BUSINESS SCHOOL EFFECTIVENESS IN DEVELOPING AND DEVELOPED COUNTRIES WITH REFERENCE TO STUDENTS' NURTURING AND STUDENTS' PLACEMENTS

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ABSTRACT

The executive schools or B-Schools are frequently considered as a blade that cuts both ways when one attempts to fundamentally assess its effect on nurturing spirit of entrepreneurship. On one hand it upholds youthful personalities having innovative outlook to refine their endeavour thoughts, foster understanding of different parts of maintaining a business and building networks. On the other hand, it hinders them in venturing out by offering great position openings and initiating them to dream about a remunerating profession. The most saddening part of these B-Schools is that today maximum number of these institutes have become a source of getting students placed or agencies which help a potential individual in getting job. It is irony of today's reality. Now a days these institutes focus on getting their candidates placed rather improving the quality of their education. In order to attract students to their institutes their school's prospectus, ads and even their financed events each one has a lucrative line regarding the placement. A majority of B-schools are still following an outdated curriculum. But, there are a few exceptional institutes who have already taken the necessary steps for curriculum rebuilding which would help their students to cope up with the global competition.

***Keywords**: Business schools, placements, developing, developed countries.*

Introduction

The executives schooling or education about management is the present most sizzling theme across the globe. 93% of students choose MBA in different streams after finishing their graduation. Today students have shifted to specializations of MBA identified with their field of graduation from traditional post-graduation courses. India has more than 6000 B-Schools which offer MBA & PDGM, a large number of these Business Schools guarantee to offer an extraordinary nature of executives training and a noteworthy number of these Business Schools claim to offer a great quality of management education and placements. The quantity of specializations and the B-Schools are expanding at a high speed. A large portion of the B-Schools are privately owned and funded.

To draw students in to business colleges, placements is outweighing studies. This is perceptible from the prominence given to placements by a larger part of business schools across India. Official sites of these schools, admission prospectus, printed ads and number of B-Schools financed events all have invariably cited various sentences regarding placements like "the school furnishes placement help to students and promises a wonderful career". Today, most business schools admission prospectus and introductions for the potential MBA students quite often highlight middle and greatest pay scales of the students from the same school. Also, numerous business schools effectively draw in specialists in preparing students for placements.

The millennial age students assess an MBA program normally based on "return on money invested for training". Students and their families are affected to accept that admission to a business college gives a door to lucrative positions. Approaching students admit that positions weigh intensely on them in settling on a decision to join up with a school. This could likely be the motivation behind why many individuals mark the B schools as agencies for placement, rather than sanctuaries of learning and focuses of greatness.

This research bestows its interest in knowing how business schools in various developed and developing countries have effected nurturing and placements of the students. Around the globe, management studies show its importance to nurture entrepreneurial spirit and evaluate its critical impact with reference to development in various ways. Such type of courses helps to generate and develop a mindset that flourish the quality in entrepreneurial thinking. The major role of these business schools are to provide navigation to understand various ideologies and aspects about to setup ventures, businesses

and build networks that significantly improves the development as well as infrastructure of developing and developed countries.

LITERATURE REVIEW

According to Hayter and Cahoy in 2018 Academic Entrepreneurship (AE) has gotten expanding consideration in the fields of advanced education, business venture, and development. In the words of Wadhwani it 2017, contemporary investigations portray AE as a generally new wonder, an aspect of college innovation move and college based new businesses. As per Grey in 2007, generally, progressed business instruction has been the centre space of business colleges, and the participation of a business college has for quite some time been a soul changing experience for hopeful chiefs. "Ongoing international occasions, for example, Brexit and the US betraying multilateral exchange and collaboration [has created] rushes of vulnerability in advanced education in regards to global participation, the free development of understudies, scholastic, logical information and thoughts" (Van der wende, 2019, p.9). In the words of Thomas Various districts and nations have begun to create (Asia) or reaffirmed (Europe) their own business college models, which differentiate it from the predominant U.S. approach and are progressively adjusted toward various social, political, and financial frameworks. According to Fong in 2004, at the point when installed in colleges, business colleges need to battle for their authenticity and are considered as "treasure troves" instead of as agents of a genuine scholastic discipline.

Research Gap

This is the saddening part that today maximum number of B-Schools have become a source of getting students placed or agencies which help a potential individual in getting job. It is irony of today's reality. Now a days these institutes focus on getting their candidates placed rather improving the quality of their education. In order to attract students to their institutes their school's prospectus, ads and even their financed events each one has a lucrative lines regarding the placement not only this these schools pamphlets and brochure carry photos and details of the old students who have post graduated from the same school with their salary packages. In today's scenario these schools have made the environment that parents and students themselves think that an MBA program is away to get return on the money invested guardians and potential students are made to think that these B-Schools are a entry point of high-paying jobs. This placement ailment is so much deep in the mind of MBA aspirants that majority of these potential MBA students when asked about why they choose MBA from the selected B-School instead of any other post-graduation course from any other institute they answered that this school has an excellent placement record top MNCs and corporate firms recruit from their campus. The students who graduated from the school are having jobs with high salary package.

Need And Scope

Management training is frequently considered as a blade that cuts both ways when one attempts to fundamentally assess its effect on nurturing spirit of entrepreneurship. On one hand it upholds youthful personalities having innovative outlook to refine their endeavour thoughts, foster understanding of different parts of maintaining a business and building networks. On the other hand it hinders them in venturing out by offering great position openings and initiating them to dream about a remunerating profession. A decent business college will explore its job and adjust these clashing objectives to accomplish both – sustain enterprising dreams and guarantee that they are upheld comprehensively to develop quickly, and soundly. The entire process from student's admission to developing of a curriculum, extra-curricular exercises and placements are equipped to accomplish this mission.

The current youthful age is impacted by effective business visionaries like Bill Gates Kiran Mazumdar-Shaw, Elon Musk, Steve Jobs, and Narayana Murthy, or new age business visionaries like Byju Raveendran. They distinctly follow their live stories, value their accomplishments, and comprehend the worth they have made for their partners and the general public. It is encouraging to see that they are similarly enchanted by the main social

business people like Ela Bhatt Muhammad Yunus, and Dr. Verghese Kurien among others. Their role models become the hottest discussion topic in the classroom in nearly every class weather it is of marketing, economics or human resource management (HRM). They are an incredible method to comprehend the use of the executives speculations, warm up the participation of the class and prompt students to discover imaginative answers for a given issue.

The administration educational program is likewise changing proactively to meet the changing goals of the students New courses, for example new venture investment, their marketing, innovating and creating business and social entrepreneurship are introduced to students to make them ready for the exposure to the chances and difficulties in the thrilling universe of venture creation.

The focal point of learning and evaluation is likewise going through changes. Business venture or Entrepreneurship blossoms with collaboration, building associations with clients and proper finance. Current teaching methods lay emphasizes on group execution instead of individual execution.

These B-Schools try to assemble strong ecosystem of entrepreneurship by drawing in the youthful personalities in, and outside the study hall discussions and preparing programs giving experiential learning experience through live ventures, working with new companies, empowering them to join different understudies' councils to get hands on experience of maintaining a business. Now a days various entrepreneurship cells are made which carry out many business plan tournaments and centres for broadening imagination of a potential entrepreneur. These schools provide mentors who support the students through networks of alumni and placement sabbaticals which lay a base to create an successful entrepreneurs

Objective Of The Study

- To evaluate the effectiveness of B-Schools in students' growth and nurture
- To analyze the involvement of B-Schools in developing and developed countries in the growth and nurturing of students and their placements

Research Methodology

This study has been conducted to analyse effect of B-Schools in students' growth and nurture. This study is based on content analysis, also known as study of content communication. The data has been collected through various magazines, journals, papers etc. This study will help in understanding the role of B-Schools in the students' growth and their placement and nuturement.

Figure1. Top 10 Non-IIM colleges in India

Faculty of Management Studies (FMS), S.P.Jain Institute of Management and Research(SPJIMR),Indian Institute of Foreign Trade(IIFT),Xavier School of Management(XLRI),Higher Educational institution(MICA),National Institute of Industrial Engineering(NITIE),Symbiosis International university, Narsee Monjee

Institute of Management Studies(NMIMS),Tata Institute of Social Sciences(TISS) and Jamnalal Bajaj Institute of Management Studies(JBIMS) are top ten Non-IIM colleges in India.

According to a survey on best five IIM in India following results were got

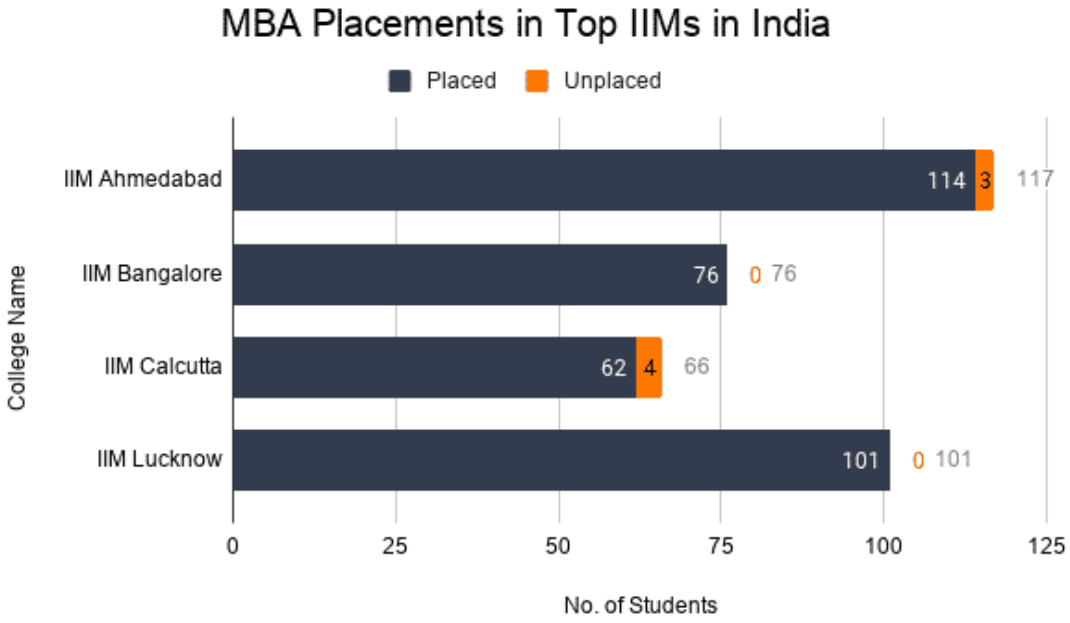

Figure 2. Placements of IIMs in India

AS the figure shows out of total 101 students in IIM Lucknow all 101 students got placed which was followed by IIM Calcutta out of 66 students 62 got jobs only 4 students remained jobless. In IIM Bangalore all 76 MBA students were placed and got good jobs in corporate sector. In case of IIM Ahmedabad out of total 117 students 114 students were placed only 3 remained without job

Suggestions

A majority of B-schools are still following an outdated curriculum. But, there are a few exceptional institutes who have already taken the necessary steps for curriculum rebuilding. In today's scenario B-Schools should invest their time and resources in program research due to following reasons:

- Fulfill industry requirements: Maximum B-Schools lay emphasis only on theoretical knowledge and memorization of the bookish knowledge and pay little attention on practical education and skill development for jobs. A number of employers are raising their voice and showing dissatisfaction against the MBA passed out students. If these schools intends to expand their employment chances of their passed out students so it is need of the hour that these schools modify their syllabus as per the industry's anticipations.
- Increase the number of students enrolling: Management students expectations level is quite high and they want technology driven and creative teaching methods from these management institutes. In case they found these career shaping factors missing they change their choices and move towards the institute which fulfil their expectations.
- Brand value: Education of business management has a cut throat competition. There are huge number of existing institutes and new ones are on their way so bringing changes in ones curriculum is the only option left with these institutes to make them unique and different from others and acquire a leading position in the list of top B-Schools.
- Be futuristic: According to a report by a reputed institute maximum number of jobs will become automated in coming 20 years, so B-Schools should keep themselves ready for the moving scenario of business in terms of convolution and arbitrariness and train their students in such a way that they are ready to face global competition. Those institutes who do not pay adequate attention towards these needs may face consequences.

Conclusion

Institutes of Management relishes an raised status and are viewed as impetuses of progress in the general public, so it is vital for such organizations to put forth a fair attempt to change the public impression of seeing them as dignifying agencies for placement. Learning can be perceived as a course of evolving conduct so it is fundamental for the institutes of management to set up a training biological system that braces students' interest and make them learn, how to think logically, get students ready to face challenges and failures in life, and create such abilities in students that they can apply theoretical knowledge provided in study halls in actual situations. Business schools has to lead in nurturing students with potential and make them learn to stretch their limits.

Schools should accept a comprehensive way to design an MBA programme so that its delivery is done effectively and efficiently. They should work with various corporates to rephrase courses and curriculum which are relevant to the corporate industry including gathering support in opportunities on project-based learning to MBAs. Periodical review of curriculum, uninterrupted academic and practical adaption is the need of the hour. There is an urgent need for students to emphasize that the education of management is along-lasting trailing.

Each and every member of faculty should motivate students to be optimistic and make them understand that positive result requires coordinated endeavours. In the light of waning public discernment, it is significant for B-Schools to lay emphasis on their essential job of supporting deep rooted students as opposed to turning into a channel of producing graduates looking for generously compensated positions.

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MSMEs: AN ENGINE OF GROWTH FOR 5 TRILLION ECONOMY IN 2025

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ABSTRACT

This year the country, as it has been experiencing the worst cases of the epidemic year-round, has experienced a budget deficit that impacted with an increase in estimated deficit. Government looked into the crisis throughout the year and took necessary steps to prevent a complete fall down and in that process help the economy to recover to a certain extent. In these critical situations the preparation of the budget was a major test in itself. The $ 5-trillion economy vision will only happen when MSMEs become global players. India's vision of a USD 5 trillion economy by 2025 will encourage MSMEs to play an important role in to it. India has a visualization or dream to host a trillion-dollar network by 2025 and encourages MSMEs to perform a key role in it. It took a budget for the government to take steps to promote the production of imported goods below 'Make in India' and many export initiatives. When the whole globe is depressed due to the epidemic, it is praiseworthy that the country already have two vaccines and two more on the way and become a global supplier of pharmaceutical products and might do this with other goods as well. This budget has unlock the way for innovative businesses and startups. The paper is based on qualitative research and try to find out the role of MSMEs as an growth engine of the economy and how these MSMEs will help the economy in achieving its target of 5 trillion economy by 2025, what the steps are taken by the government for strengthening this sector in the development of the economy.

***Keywords**: MSMEs, 5 Trillion Economy, Deficit, Economic Crisis, Global Players.*

Introduction

The MSMEs is one of the main contributor to economic and nationwide development. In India, this sector has put on great prominence due to its involvement in country's exports and Gross Domestic Product.

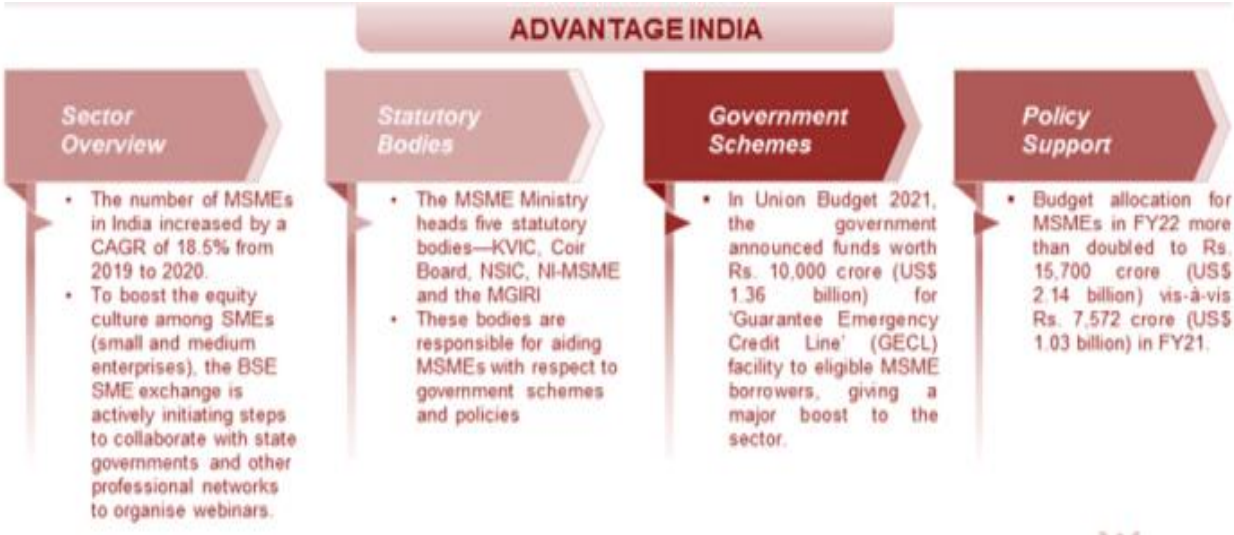
The MSME sector has important contributions in growth and expansion of the business, especially in the rural and urban areas of India. In terms of the requirements of the Small, Micro and Medium Enterprises enlargement Act, 2006. These enterprises were divided into two group namely Service and Manufacturing enterprise.

Categorization of MSMEs in India is

Criteria	Manufacturing		Service	
	Turnover	**Investment**	**Turnover**	**Investment**
Micro	Rs. 5 cr	< Rs. 25 lakh	Rs. 5 crore	Maximum Rs. 10 lakh
Small	Rs. 50 cr	> Rs. 25 lakh but < Rs. 5 crore	Rs. 50 crore	Minimum Rs. 10 lakh but maximum Rs. 2 crore
Medium	Rs. 250 cr	Rs. 5 crore above but < Rs. 10 crore	Rs. 250 crore	More than 2 crore but not more than Rs. 5 crore

Vision 2025

In addition to the economic stress caused by COVID-19, India's vision of a USD 5 trillion economy by 2025 will encourage MSMEs to play a major role in to it. India has a dream to host a trillion-dollar system by 2025 and encourages MSMEs to play a significant role in it as one of the world's most important B2B commerce platforms, we have more than 120 Lakhs customers from more than 190 regions and countries, with more than 300,000 daily inquiries on the display place.



Prime Minister Modi had announced a major goal of securing the Indian economy at 5 trillion dollar 2024. If found, India is the third major economy in the world. The aim is to increase the contribution of the service sector to 3 trillion-dollar, production to 1 trillion dollar and farming to 1 trillion dollar. The present economic downturn has caused some to query the legitimacy of the protests. Simply put the 5-trillion economy is the largest of the nationwide economy which is measured by the Gross Domestic Product yearly.

Economic Gross domestic product is the whole amount of money of each and all services and goods produced in the country in a year. GDP is a method between to determine who is bigger. GDP of India was 1.8 trillion dollar in 2014 and now it is 2.9 Trillion dollar, with India's sixth major position across the globe. India is the sixth main economy. But this do not mean that Indians are the prosperous people across the globe. In response to the challenges of growth, Government is taking numerous steps to restore the country's wealth.

Government was focused on rising spending to improve economic growth. Introducing the steps use in the government a little months ago to bring the financial system out of growth for less than six years, he said the events included tax cut for companies to get better corporate return on risk.

Review Of Literature

Sowmya D N 2020 conducted a study to analyze students' perceptions of the relationship between IPR and MSME in the current context. It acknowledges that the COVID-19 threat creates a heated pan of problems and difficulties. Amar Kakaria 2020 conducted a study to understand the strategies adopted by MSMEs for their recovery after the epidemic. Jonika Lamba 2021 conducted research to match the significant contribution of experts in building a confident India. It also contains the challenges facing the MSME sector and the policy changes taken by the Indian government to accelerate growth and investment in small and medium enterprises and other aspects of how investment in the MSME sector will help India create momentum for growth and development in the COVID-19 financial and economic crisis. Madhu Bala 2020 reviews the way forward to the Indian economy of $ 5 billion in terms of the role of the manufacturing sector. Anil Kumar 2020 conducted a study to understand the role of the agricultural sector in stabilizing the 5 trillion economy in the epidemic. Krishnaswamy Ramaswamy 2020 conducted a critical analysis with the help of Public Sector banks on MSMEs and their impact on their operations. Emphasis on Aparajita Dixit 2021 on why and how to use big data for small, medium and micro enterprises (MSMEs) by defining SME and MSME data storage features in the cloud for better access to filtered data access functionality. Ficci's report on Vision 2020 analyzes the growth and future prospects of MSMEs in India. Shreewas 2021 plays a role in the MSME sector in empowering sustainable and inclusive development following the acquisition of COVID, as well as supporting India's desire to address the USD 5

trillion economy by 2025, especially if the sector is approved through targeted support mechanisms.

Need And Significance Of The Study

With the survival and growth of MSMEs in this competitive era, digitalization is an important step forward. It is clear that the benefits of the fragmentation of a healthy digital payment system are evident in MSME. India's USD 5 trillion economic vision by 2025 will encourage Small, Micro and Medium Enterprises to play a bigger position in it. India has a vision to host the economic system by 2025 and encourages MSMEs to play a chief role. The current crisis is having a profound effect, leaving the nation, the economy, or industry untouched. In this context, it is important that the country's revenue-generating engines, Micro, Small & Medium Enterprises are fully funded and not just by the government for innovating the network. The benefits of being part of a healthy digital payment system are evident in MSMEs. From a Covid-19 point of view it simply accelerates the transformation of digital inclusion into payments. The Covid-19 epidemic could be a major challenge to deal with soon. This paper is a qualitative study based on secondary data and basically focuses on the 2025 government's vision of 5 Trillion economy with the help of MSMEs and the government's focus on empowering and reviving MSMEs as a result of the epidemic. MSMEs using digital technology will be better able to climb the economic recovery mark and show the way to growth as before.

Objectives Of The Study

1. To study the current status of MSMEs in India.
2. To analyze the role of MSMEs in attaining vision of 5 trillion economy 2025.
3. To trace the steps uses by the government for boosting the economy and attaining the aim of 2025.

Research Methodology

The data used in the study is second in nature and the research is natural, the data collected mainly in the annual reports, within government, research journals, papers, books, magazines and publications by the department of public departments, MSMEs data publishes by various websites.

Findings And Discussion

In India Small, medium and micro enterprise are the important drivers of economic development and growth. The sector is highly skilled and talented, employ over 12 crore people, who make up 40 percent of the personnel. With the potential to create new jobs of approx 10 million over the next four to five years, it is one of the largest institutions in the world after China. As the government uses its power to increase the MSME allocation of 29% to 50%, it all depends on how each institution contributes to this development.

There are a number of factors that insist MSMEs to follow like lack of sufficient credit, partial awareness, increased competition, be short of of market access, limited technical knowledge, lack of skillful staff, long certification, procurement costs, and insufficient infrastructure. The intention of the Honorable Prime Minister Shri Narendra Modi to turn India into a 5 billion dollar economy and global power base by 2024-2025 and has led to significant growth and expansion in the MSME sector.

MSME Minister provides practical action that will enable Indian MSMEs to compete globally - promote co-operation, reduce capital, labor, and energy costs, integrated development of rural and agricultural enterprises and urban businesses, rehabilitation and development bio, bamboo, food processing, fishing, honey, transportation industries and entrepreneurial incentives.

"To achieve the vision of our esteemed Prime Minister to build a $ 5 billion economy, we must realize that it cannot be done by only 50 companies. But if one million SMEs can build $ 1-100 each, they can build more than $ 5 billion Every household should build businesses and that is an example of the education we promote. This is also the reason why we work closely with the SME sector. one becomes an entrepreneur and innovation. "

The epidemic has clarified one thing that digitalization is the way forward. In order for MSMEs to stay pace for that they must adopt

digitalized technology and deliver a cross performance model to attain unparalleled growth in the future. The incorporation of modern youth skills will go a long way in growth of the sector. Also, if new preparation and implementation is supported by sufficient credit facilities, MSMEs' may be at the forefront of ensuring economic growth of India. Approx fifty lakh people in 5.1 crore tiny businesses at present receive bank grants. Some people still rely on personal loans when interest rates soar.

The allocation of 15,700 crore Rs. in the budget 2021 will assist the MSME sector to make stronger foundation and importance is given to infrastructure, digitalization, and capacity building where all course encourage increased investment, improved credit, and funding the plan of Atma Nirbhar Bharat. Innovative collaborations and partnerships with foreign firms to expand, more staff development skills and IT skills, training centers, entrepreneurship incentives centers, greater use of data and new technologies, higher user experience building by facilitating trade-offs with appropriate policies and infrastructure, improved infrastructure and investment are which can make MSME sector more stronger and to help in achieving the $ 5-Trillion Economy.

In addition to the economic stress caused by COVID-19, Stephen Kuo, Asia Pacific Head of Alibaba.com - believes that India's vision of a USD 5 trillion economy by 2025 will encourage Micro, Small and Medium Enterprises to play an important role. Vision of India to host a trillion-dollar economy by 2025 and encourages MSMEs which play an important role in it. Approx 12 million customers from more than 190 regions and countries, with over 300,000 daily inquiries on the platform.

The strategy is to help more SMEs travel to the world, especially those from India. Today there are more than 600,000 products listed on our Indian supplier list, and those suppliers received more than 50,000 inquiries in last 30 days to continue to play a significant position in this important journey of MSMEs in India. Notably, last September, the MSME Trade Union Minister stressed that the role of MSMEs in making India a 5 trillion dollar economy is very essential. India is a fast-growing economy and at the similar time our Prime Minister's vision to make India making 5 trillion dollar economy and the position of MSMEs are equally significant.

December last year, the MSME department said it expected MSMEs to contribute $ 2 trillion to the country's goal of a $ 5 billion economy by 2024-25. India's economy is likely to emerge as one of the world's leading economies, with a projected GDP of 5 trillion-dollars by 2024-25. Our vision is to ensure that at least 2 trillion dollars in contribution comes from the MSME sector,"

The MSME sector is a driver of economic growth not only in India but also globally. Apart from reducing poverty, these businesses are major contributors to job creation and GDP. For example, Domestic MSMEs account for 30% of India's GDP. This figure is the highest in the world where the contribution of MSMEs is 50% of global GDP and 70% of total employment. Clearly, India has a huge potential to expand its MSME sector.

The Government of India places great emphasis on the promotion of the sector through consensus action, entrepreneurship policies, and financial support. In addition to contributing to self-employment and entrepreneurship, MSMEs tend to create a large number of jobs for people in the disadvantaged community. Typically, staff members working in MSMEs consist of women and youth from rural and impoverished areas.

This means that MSMEs are critical to bringing prosperity to the equitable distribution of income under the social pyramid. The ongoing epidemic has led to widespread economic depression. Long-term reductions, which are important to prevent the spread of the virus, have had a negative impact on sales. Needs have also suffered. In this context, small, medium and micro enterprises (especially MSMEs), especially those run by small business owners, SC & ST entrepreneurs and women entrepreneurs face challenges in various sectors. Apart from the importance of employment and economics, MSMEs, by and large, are socially responsible, and accountable.

Being lean and dependent, they are quick to adapt to the changing needs of the nation.
This skill was well demonstrated during the Covid explosion. MSMEs are at the forefront of large-scale production of masks, PPE kits, sanitizer, and many such items that were suddenly sought after. The rapidity of MSMEs ultimately helped to reduce India's dependence on the importation of these materials, influencing Atmanirbhar Bharat's view.

The Government of India through the MSME Department has launched a series of efforts to ensure that MSMEs can withstand the ongoing economic crisis as a result of the epidemic. These include interest financing, hand-to-hand action at all stages, 4% Public Procurement policy, special approvals for women-owned businesses and SC / ST entrepreneurs, to name a few. Recognizing the unparalleled role of MSMEs around the world, International MSME Day declared at 27
june. The aim is to raise public awareness about MSME's contribution to the sustainable development of the global economy. In commemoration of MSME International Day, India greets its former economic heroes - MSME entrepreneurs - and reiterates its commitment to moving the industry to the next level.

India has not experienced a 5 per cent recession and carry on to be the best growing economy in the world, with a few steps uses by the government to strengthen the financial system including the merger of banks and industrial tax clearance. “There is no 5% decrease. the country is facing a recession. India continues to grow the world's fastest growing economy despite the fact that many countries in the world are facing a recession. “By 2025, India will have a $ 5 billion economy,” which is a footstep taken by the government to strengthen the economy, industrial tax approvals, foreign direct investment and the MSME sector.
Many banks were affiliated with the central banks and the government's main objective was to keep the four banks strong and to ensure economic growth. drastic measures have been taken against black money and the number of taxpayers has doubled as a result of demon activity and the implementation of the GST regime.
The government has been taking a number of steps to address the level of fixed investment rates, higher private equity prices and increased export performance, with the aim of increasing the country's GDP growth. Over the past five years, the government has used radical changes to create an investment climate in the country with a US $ 5 billion economy. The introduction of the Insolvency and Bankruptcy Code (IBC) in 2016 is an important step in refining and strengthening the financial system in the country.
The introduction of the Inventory Tax in 2017 has emerged as a critical step in improving business support in the country and the Make-in-India program is a major step towards

increasing the country's indigenous capacity to produce world-class goods and services. Continued emancipation has led to higher inflation and increased foreign and national investment to maintain inflation, efficient spending and account losses are currently being managed to ensure macroeconomic stability to maintain a healthy investment climate in the country.

The government has recently reduced corporate income from 30 percent to 22 percent to increase investment in India which is facing a 5 percent inflation rate and continues to be the best growing economy in the globe, there are a few steps in use by the government to strengthen the economy including mergers of banks and industrial tax approvals. There is no 5% decrease. the country is facing a recession. India continues to grow the world's fastest growing economy despite the fact that many countries in the world are facing a recession. By 2025, India will have a $ 5 billion economy, to strengthen the economy, industrial taxes, direct foreign investment and the MSME sector.

New MSME incentives such as the dispute resolution system, the definition of little companies expanded, the LLP act of criminalization to decrease the severity of incentives, penalties for individual company, and extended tax holidays to begin with. The government has also proposed reducing funding requirements from 25 percent to 15 percent initially. The Minister of Finance has provided R7,700 million to the Department of Small and Medium . government additional spending will also bring opportunities in business. Various measures announced by the government to boost the economy.

1. Economic research has revealed a map to make India a 5 trillion dollar economy by focusing on raising money. The government has taken steps to assist HFCs and NBFCs.
2. Government has provided funding to HFCs and NBFCs under a fractional credit guarantee program. Govt authorized Rs 4.56 lakh crore funding for NBFCs & HFCs including Rs 1.30 lakh crore for lake procurement.
3. Within two days of the approval of the cabinet, 17 proposals of approx Rs 7,000 million were accepted. Proposals costing Rs 20,000 crore is permitted in the next two week beneath the fractional credit assurance program.
4. Government has taken various steps to promote investment, subsidize housing, increase debt, corporate taxation and restructuring of banks.
5. To increase inflation in the market, the government has waived payments that cost more than 60 percent in the past two month.
6. The novel outside valuation plan publicize by the RBI, in addition to a loan of more than 8 lakh or Rs 72,201 approved under the new regime until November 27.
7. FDI inflows of 35 billion dollar in the first half 0f 2020 has been achieved.
8. Rs 1.6 lakh cr tax returned this year to revenue Secretary. This initiative will improve economic utilization. Revenue tax returns have increased by 27% so far in FY20.
9. The actual R25,000 construction fund has been set aside for the final milestone of standing projects. The necessary changes to IBC have been made to allow projects facing debt default to receive funding under the program.
10. **Increase Business Freedom and Lower Livelihoods to encourage private investment**- Over the past four years government has repealed more than 1,300 antiquities legislation, It has removed many ancient customs, laws, and regulations. India reached to 65th position but challenge is that it should be in top 50 companies and after five years it should reach under the 25 position.
11. **Urbanization** - a major growth in the Cities make up less than 6 percent of the world's gross domestic product, but account for more than 75% of global GDP! Therefore, migration to city is significant as these are the hub for growth of the economy.
12. **Global trade growth** - Country survive in a global and mutually dependent world. Share of the country in globalised exports is less than 3% and for this it must find out the skill of scale and size, to make it to the dimension of the scale and to the entry.

13. **Women's contribution is important** - India can't produce at high rates above a time of 3 years with no gender equality. only 27 percent of women are working in India, the average at global level is 48 percent. If this mass of people does not work and unknowingly does not put women at power position then it will be much hard for India to grow.
14. **Agricultural restructuring is important** - It is not possible to grow long without major changes in the agricultural sector because that is where 60% of India live. You cannot continue to grow with subsidies, you cannot continue to provide help to farmers without make sure improved markets, without setting up expertise and without agreement farming changes in the agricultural sector are critical.

The Government working diligently to ensure that all the benefits of these MSME programs reach MSME on time. To provide immediate assistance in the field of MSME, various declaration with the MSMEs scheme have been prepared under the Atmanirbahar Bharat like

- 3 lakh crore automatic loans designed for MSMEs to purchase immature goods, meet up operating bills and start again the businesses.
- Review of MSME definition for extended major benefits in this sector.
- Not allowing international tender in up to INR 200 cr purchases to make attractive prospects for local players
- Deletion of the payments of MSME by public and government institutions within 45 days

Conclusion

Money spent by the government in extra will bring opportunities in business in MSME sector. The 5-trillion dollar economy vision will only happen when MSMEs become global players. India is at present in context of GDP the fifth largest economy and holds growth goals in the face of globalization. The closure period due to pandemic led to a disturbance of sales which resulted in loss of income and reduced demand. Enterprises and businesses are facing a major financial crisis due to the severe collapse of the business and the hard work of low or no employees throughout this pandemic since workers migrate to their hometown. Loans taken out of NBFCs could therefore see a significant increase in automatic repayment rates. Reductions have disrupted purchases that have pushed the cost of unwanted items to the detriment of money. Therefore, the closure of delays had a significant impact on the resources / management provided to small firms. There were many incentives associated with the changes bring in by the government to give confidence to growth and development in the industrial sector. Alteration in the definition of MSME, bank transfers, share financing, and many other financial permits were bring in. The strengthening industry has also responded with vitality and energy. The rigid and tough work done by industry and trade has shown recovery and results which can be measured by GST figures. The 5-trillion dollar economy vision will only happen when MSMEs become global players. It took a budget for the government to take steps to promote the production of imported goods below 'Make in India' and many export encouragements. When the whole globe is depressed beneath the epidemic, it is praiseworthy that we by now have two vaccines and two more on the way. We became a global supplier of pharmaceutical products and that can be done with other products as well. This financial plan has unlock the way for new businesses and enterprises. The extra money spent by government will also bring opportunities in the business in the MSME sector.

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PROSPECTS OF AGRO-TOURISM IN INDIA: EMERGING CHALLENGES AND SUSTAINABLE STRATEGIES

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ABSTRACT

Nowadays the concept of conventional tourism has changed. Some new tourism destinations have already come out such as Agro-Tourism. The encouragement of tourism will carry many indirect and direct advantages to the people. Agro-tourism offers an exclusive opportunity to integrate the tourism and agricultural sectors to offer specific educational, financial and social benefits to producers, tourists and communities. Agro-tourism provide producers the opportunity to make more money and a way to sell directly to customers. It improves the tourism business by rising the volume of tourists in the region and the span of their stay. Agro-tourism as well empowers community to grow their bases of tax and new job opportunity. In addition, agriculture offer opportunities in the field of education for the community, help conserve agricultural land, and allow countries to develop businesses. While tourism can create new incoming streams, it also raises new legal issues for farmers and landowners. Agricultural tourism is a new agricultural doings related to both agriculture and tourism. Maharashtra is the main centers for the tourists and has a large area and has huge potential to give confidence to the farmers to set up little and efficient businesses such as tourism of agriculture in rural India. Agricultural tourism can be a useful way to expand and diversify a farm, but it does not work well in all cases. This paper seeks to identify problems in agricultural tourism in India and what can be done to solve these problems. Prospects for the future of tourism in India and what the government is doing to promote this tourism in India. The pilot research project is used as a device to study the concept, to gain in-depth knowledge of the scope and challenges of agricultural tourism.

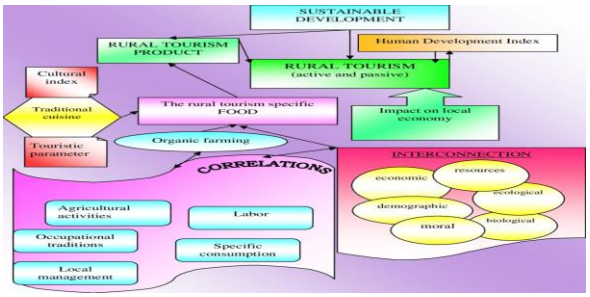
***Keywords**: Agro-tourism, Educational Opportunities, Tourists, Rural India, Tourism.*

Introduction

Agriculture is measured as the backbone of the Indian economy. About 85 percent of the populace is indirectly or directly dependent on agriculture and associated activities about 26 percent of the GDP of India comes from agriculture and approx 90 million farmers live in 0.65 million valleys growing more than 20 Metric Tonnes food grains in the country.

In addition to technology or agriculture or business is deeply entrenched in Indian culture. Farmers are eager to try new ways away as of the more common and common patterns to build direct customer relationships and get more. Therefore, increasing agricultural income through specific tourism activities brings new prospects and improved lives. Great hard work are now being made on Agro-Tourism. Agricultural tourism as an idea which is not very new but its access is limited only to some regions.

Agricultural tourism is an essential means of survival for small-scale farms. By diversify operations of business, farm workers are capable to make sure a steady income. This is since tourism activities can take place throughout the off-season when crops may not be in season, and provide a totally different benefit.



Some study have found that agricultural activities often advantage neighboring communities by attracting tourists to the area. Growth of the economy growth through traffic can help rural areas that need a variety of income streams. 85% of Indians depend indirectly or directly on agriculture and associated behavior.

Agriculture accounts for 26% of India's GDP. Kerala and Maharashtra and are Indian provinces that benefit from agricultural opportunities. Agro-tourism in Maharashtra is developed by Agri Tourism progress Corporation. Wayanad, Kuttanad, Palakkad

and Idukki are some of the most vital agricultural areas in Kerala.

The 'Green Farm' scheme launched by the Kerala Government which aims to promote agricultural visit in Kerala. Apart from Maharashtra, Nagaland, Kerala and Sikkim are also doing well in agricultural tourism. This category of tourism belongs to a major industry known as agro-tourism. Agro-tourism is "a commercial farm business that operates, on a farm, or in the agricultural industry designed to entertain visitors who generate income for the owner."

Tourism and environmental-tourism businesses can comprise:

- Outdoor activity (hunting, fishing, wildlife studies, horseback riding).
- Educational knowledge (canned visits, cooking classes, or tasting wine).
- Entertainment (crop festivals or warehouse dances).
- Hospitality services (guided tours or merchant services).
- Direct sale on the farm (optional jobs or street stands).

Agro-tourism is the foundation of a major sector called rural tourism that include resorts, smallholder farmer markets, non-profit agricultural tourism, and additional recreational and hospitality business that catch the attention of tourists to the countryside. industry, which frequently occurs on farms. It provides you the chance to experience real contact with genuine rural life, taste real local foodstuff and get acquainted with a variety of farming activities throughout the visit. It gives you a welcome break out from everyday life busy in a quiet rural setting. It provides a possibility to unwind and rejuvenate a pure natural environment, surrounded by the best placement.

Literature Review

Priyanka Singh 2016 tries to point out the prospective of agricultural tourism in the country by highlighting main challenges in this regard with a number of practical recommendations. Pitrova 2020 adopts the operating system of modeling three different farms, rated according to official data. In addition, an airline controller is used in the case study case. In both cases, we are examining the impact of agricultural tourism on the economic performance of the farm economy. Saurav Rauniyar 2020 conducted a systematic review of research literature in the field of agro-tourism. In the study, a systematic review of literature, established and emerging research collections was obtained for expert analysis. UDK Krishna 2020 is exploring the impact of agricultural tourism as seen by its stakeholders. Sudhanshu Joshi 2020 recognizes key achievements (CSFs) that determine the effectiveness of tourism groups using an integrated management analysis system (AHP) - a process of strategic preference similar to the actual solution (TOPSIS). Alok Kumar 2020 conducted research on the origins and status of Agri-Tourism in India. S.N. Wanole 2020 explores the challenges facing agricultural and tourism institutions in the Konkan region. Michal Roman 2021 introduces the context of agro-tourism in the literature on the topic of its benefits during the COVID-19 epidemic. Hemani Kothari 2021 strives to reflect the impacts of agricultural tourism on improving the environment and climate of the state and the nation.

Need And Significance Of The Study

Agro-tourism offers a sole chance to integrate the tourism and agricultural sectors to provide specific educational, financial and social benefits to tourists, communities and producers. Agro-tourism provides producers the chance to make more money and a way to sell directly to customers. It improves the tourism industry by raising the volume of tourists in the area and the length of their stay. Agro-tourism also empowers communities to grow their tax bases and new job opportunity. In addition, agriculture provide educational opportunities for the community, help conserve agricultural land, and allow countries to build up the businesses. While tourism can create new incoming streams, it also raises new legal issues for farmers and landowners. Seeing agriculture as a means of sustainable tourism, provides a powerful, two-way solution to the problem of cultural erosion. The first is to ensure the continuous flow of urban money through tourism to help communities grow. Second, by saving cultural money by storing information in communities - using this knowledge and information can also be

economically beneficial. This paper seeks to identify problems in agro-tourism and what can be done to solve these problems. Prospects for the future of tourism in India and what the government is doing to promote this tourism in India.

Objectives Of The Study

1. To study the current status of Agro-tourism in India.
2. To find out the challenges and future prospects of Agro-tourism.
3. To give suggestions for the Up-Liftment of Agro-tourism in the country.

Research Methodology

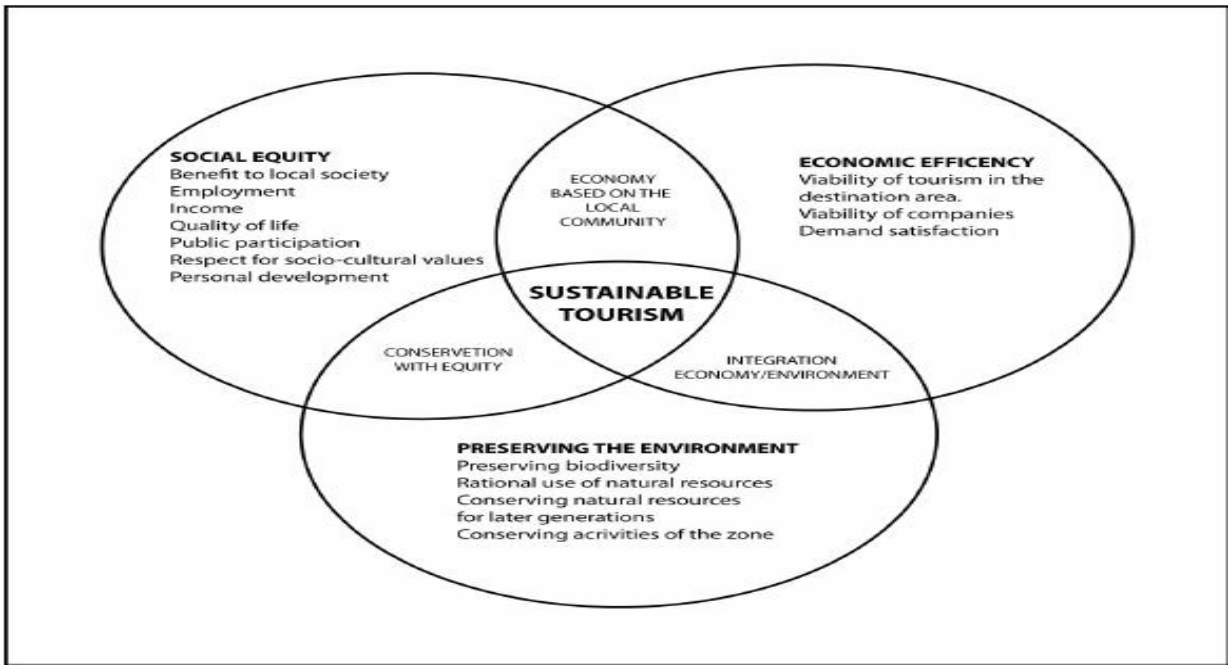
This paper strikes the notion of agricultural tourism development in India. The position of Public Institutions favors Agro Tourism Development Corporation and others in developing the concept of agricultural tourism. The design of investigative research is used as a instrument for the study of the concept, to gain in-depth knowledge of the challenge and scope of agricultural tourism. Secondary information has been used as of a diversity of sources such as, Official Government Sites, Books, Magazines, Publications and the Internet.

Findings And Discussion

The GDP of the Indian agricultural sector reaches an impressive 262 billion dollar. The sector remains one of the main contributors to the Indian economy, though its GDP share has dropped from more than 30% and about 14.5% in FY 11. On the way to encourage private sector contribution, the government of India allowed 100% direct investment foreign exchange (FDI) in a number of sectors of the farming sector.

These comprise of fertilizer, machinery in agriculture, farming, seed breeding, stock farming, fish agricultural, and the F&V component. These funds can be used to encourage agricultural development and research and to defend the environment, which can donate to the overall growth of production in agriculture. As an outcome of the 100% FDI allocation, the agricultural services sector saw foreign investment of 1.5 billion dollar.

Aside from FDI being a main game changer, the green revolution in the 70s in fact played an important position in making the nation independent. This was marked by the use of chemical-based agricultural inputs that enable farmers to pay higher prices next year. Improper use of chemicals makes the soil infertile, leading to loss of output, environmental deprivation, and ultimately inferior yields.



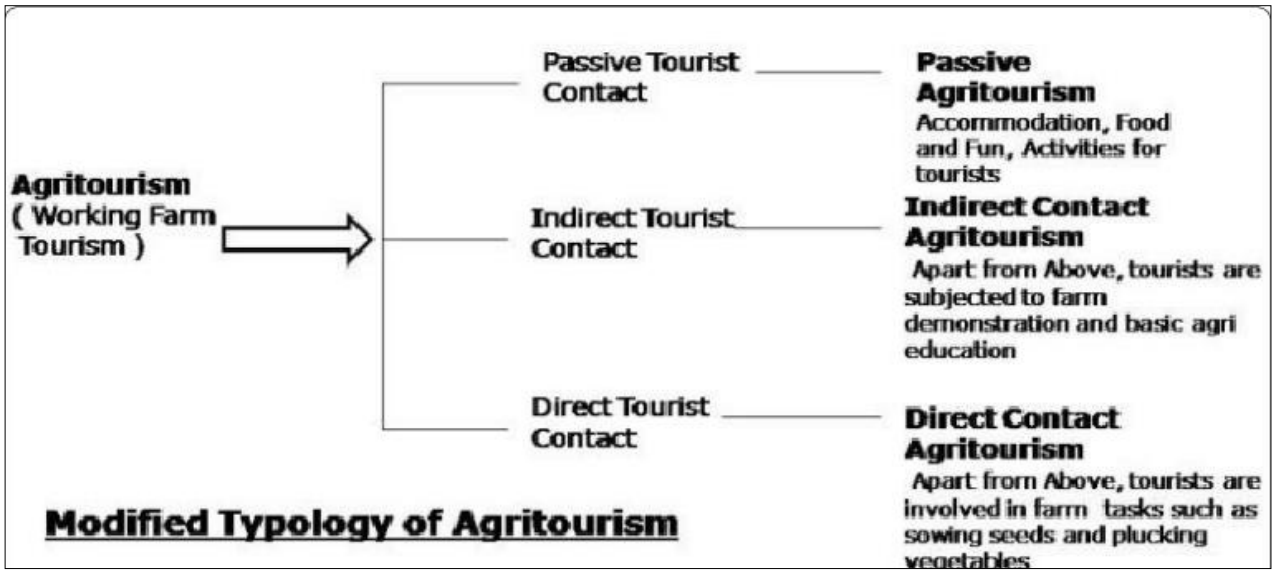
Given the current state of agriculture and the enlargement plan to be considered, we need to work on the indicators below to understand and develop the agricultural growth trajectory in India:

- delivery pressure due to lack of resources
- Scope to get better yields
- chance to reduce losses in the diet chain.
- Technical disturbance directly to farmers, Agricultural debt.
- Soil nutrient administration.
- Investigation / technology crops

Programs and investments of government, as well as a variety of agro community programs, have proven to be a rotating point in the agricultural sector. Some major agricultural and development investments are as follows:

The first jumbo park in Rajasthan opened in 2018 March. In 2017, India's agricultural segment saw 18 deals 251 million dollar.

320 million dollar loan agreement signed among the Indian Government, the Government of Tamil Nadu and the World Bank on December 2017 of the 'Tamil Nadu Irrigated Agriculture transformation Project' which is expected to give advantage to approx five lakhs farmers by the government.

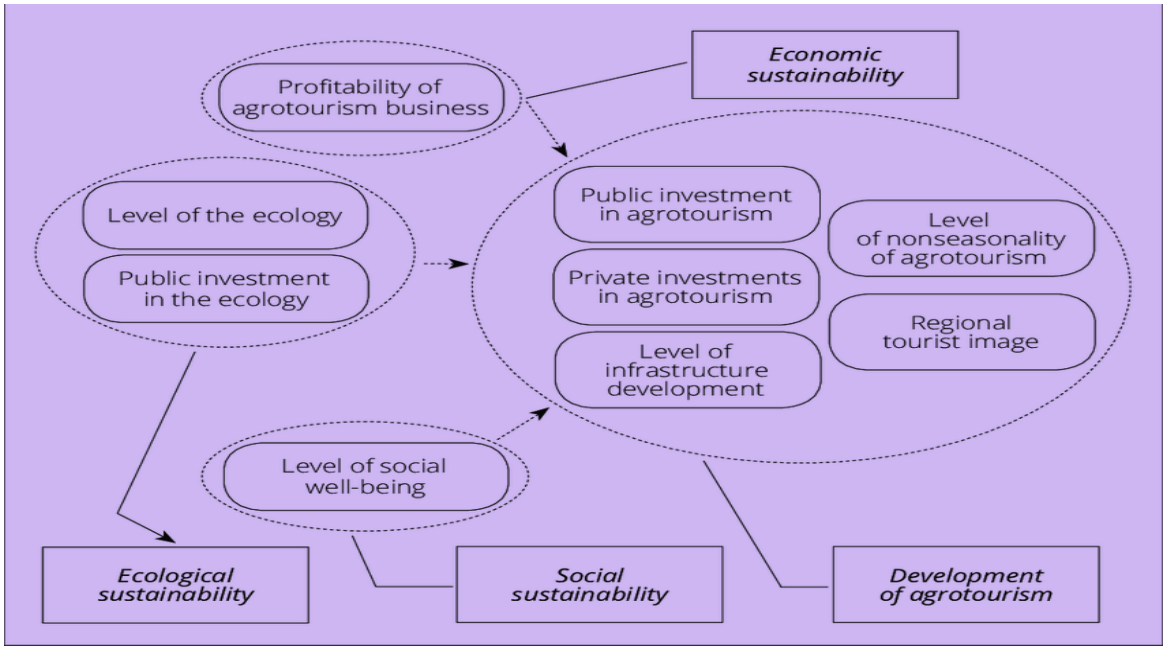


Resources should be provided for agricultural tourism:

- Offer real Indian / Maharashtra food for lunch, breakfast and dinner. Farmers should promise to see and contribute in agricultural activities.
- Provide a chance to contribute in rural areas games for guests.
- Give details on culture, dress, arts, crafts, festivals, rural cultures and offer the possibilities a demonstration of a particular art.
- Give the chariot to ride and ride horses, buffalo in the water, a kilogram fishing or at a nearby lake.
- Offer fruit, maize, nuts, sugarcane as well other agricultural goods as per the availability.
- Show home animals, birds and waterfalls etc. and provide accurate information related to these things.
- Should provide security for visitors' support of federal hospitals.
- Organize a traditional dance program, traditional Shekoti songs, kirtan, Bhajan etc.
- Other agricultural products are available for purchase guests.
- Provide free pollution to visitors. Attempt to build interest in the customs of the village future tourism business.
- Bring in guests and people around you in the village.
- Use well-trained or humorous staff (jokes) people with good communication skills to entertain. Having accurate information about train timetables and buses to help guests.

Problems with agricultural tourism

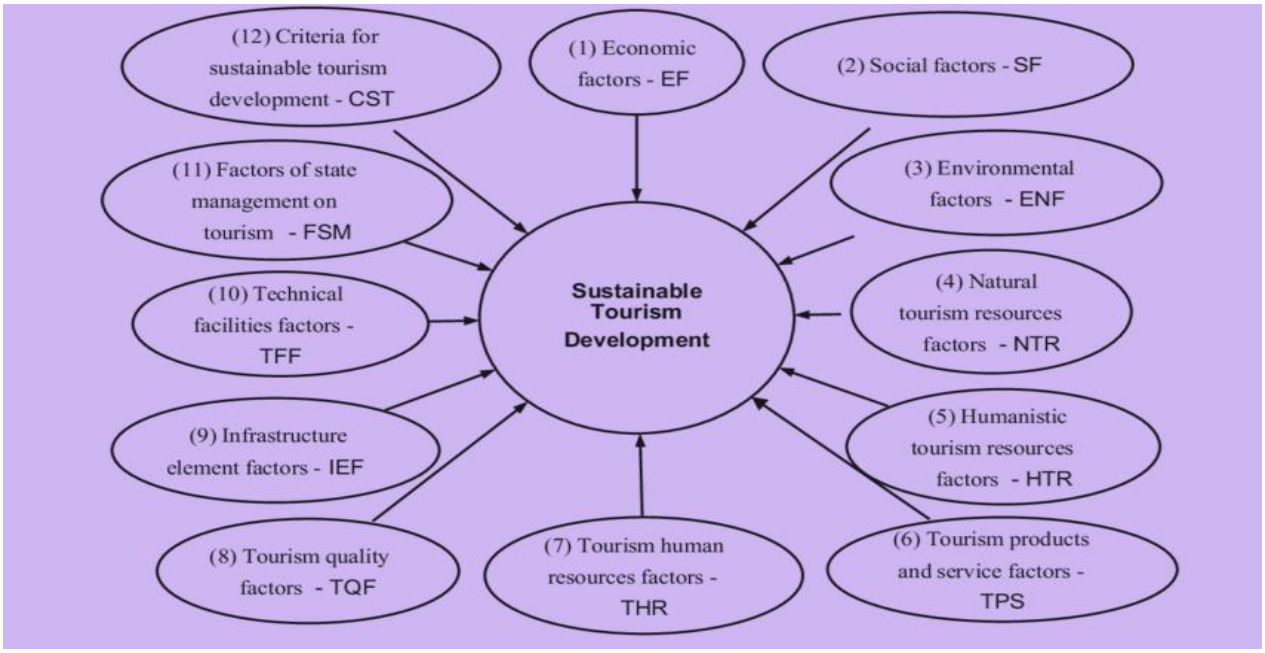
- Be short of complete knowledge concerning agro tourism.
- Lack of communication skills and lack of commerce smallholder farming approach. Lack of funding to build essential infrastructure for agricultural tourism.
- Farmers' ignorance about such varieties of jobs. - Presence of the informal segment in the agricultural and tourism business.
- Ensure cleanliness and basic needs.
- Taking into consideration urban tourists.
- High value land with little access to credit.
- Service quality
- Complexity in service delivery
- Lack of infrastructure
- The multi-level channel incorporates these local tourism developments and area level.
- Literacy rank of farmers and farm owners
- Government sustainability and Identification.



Key strategies for successful future of agricultural tourism in India

Agricultural tourism is basic of all business activities, therefore, farmers should have a sense of trade and a number of marketing strategies for success. For improved success at tourism and agriculture should follow the following tips:

- Inform the youth tourism center papers, television etc.
- Upgrade acquaintances with colleges, schools, NGOs, unions, clubs, organizations etc.
- Train the staff or members of the family to be accepted and hospitality.
- Recognize about the customers that what they want as well expectations and work accordingly.
- Charge large expenses and rent for services in the commercial domain.
- Use local objects incorrectly on entertain / serve visitors .
- Upgrade the website regularly to draw attention of foreigner visitors.
- Take their comments and feedback about suggestions and service for further growth as well conversion.
- Build up good relationships with visitors commercial distribution and chains in the future.
- Upgrade different agro-tour packages different types of guests and their prospects.
- Keep a book with remarks about visited future tourism.
- Be honest with visitors and contribute with them.
- Smallholder farmers can improve their agriculture and tourism institutions.
- Proper appreciation of Agro-tourism Industry.
- Government support policy arrangement of Agro-tourism
- Edification of the farmers and owner of farms for the advancement of the Entrepreneurial ability in their work operations.
- Appropriate Financing Solution for its improvement.
- Legal responsibility and Risk administration Programs.
- Product and Service excellence development in terms of the quality of Product, enhancement as well as the freedom of the service to be raised up to the standard.
- A private public Strategic model of Partnership Development to be created.
- Proper promotional help and Marketing to be given



Not just biological systems or government programs, public-private partnerships will yield improved outcomes in the agricultural space to support improvement and capability building. India is anticipated to reach the goal of doubling-up farmers' incomes by 2022. In the upcoming years, India is estimated to become more independent. The Indian Government intends to raise the farmer's average income to Rs. 220,725 in 2022-23 from Rs. 96,000 in 2015-16 on current rates. The Indian Government implemented a lot of projects to sustain the agricultural sector like:

Pradhaanmantri Graam Sinchaai Yojanaa: The plan of the scheme is to irrigate farmers 'fields and get better water efficiency to attain the saying More crop per drop. The whole system ensure improved access to irrigation.

Paramparaagat Krishee Vikaas Yojanaa (PKVY): This program aspire to encourage farmer grouping to start farming naturally.

India at present ranks prominently among 175 countries that practice natural farming globally. More than 6, 50,000 organic producer, 669 exporters, 700 processors, and 7,20,000 hectares are at present cultivated in the country. Though, with only 0.4% of sum agricultural land for natural farming, it is obvious that the industry still has a extended way to go in requisites of growth. Farmers still have the option of organic agricultural using Metabolites-based bio agriculture contribution which can completely change chemical-based input and help keep without charge farming. The future will be determined by technology and investigation. This will unlock many opportunity for investment and growth and ultimately the growth and expansion of the sector and the whole nation..

Agricultural tourism and its children's initiatives and research talent can certainly make a difference in the lives of farmers and consumers and will also benefit from it.

• Agriculture must benefit 130 million Indian farmers and their families

• Farmers need to be made more resilient, able to thrive at certain times of the year

• Indian food systems must produce more calories and provide complete nutrition for all

• The environmental impacts of agriculture must be mitigated, and sustainable solutions must be prioritized

CONCLUSION

Agricultural tourism can produce weekly income that can cover weekly farm operating cost. While the farmer earns money as of agriculture once or twice a year and has to spend money on agriculture approximately every week. Farmers get it extremely difficult to stay alive under such conditions. Agricultural tourism gives him the chance to earn a living and be able to make farming and his life safer and extra sustainable. The Federation's governing body consists of twelve representatives from the agricultural and rural co-operatives and eleven farmers in charge of the agricultural and rural tourism center as well as female directors from each farmer and two government-appointed directors. Agricultural and tourism co-operatives receive funding for the establishment of a diary, poultry, crèche, etc., as well as funding from the National Agricultural Bank. It has now been a decade since the development of rural areas in India with the help of agricultural tourism. However, the journey was not simple. There have always been doubt about the need for agro-tourism and other forms of tourism. One more major obstacle have been the be short of adequate support of the government as well as access to and access to local facilities and access to basic infrastructure such as transport services, medical facilities, water supply, etc. There is as well the risk of overuse of natural resources, which need to be considered starting to ending. Farmers in particular had little or no awareness of the tourism industry, no knowledge of business and understanding related to the agricultural tourism market. However, we should come a long way and nowadays agriculture and tourism are thriving and serving farmers everywhere and empower them. Extension and Advisory Services play a significant position in recognizing the prospective of agricultural tourism amongst farming community and encourage them to get up agricultural tourism efforts. Organizations

like National Institute of Agricultural Extension Management and the State Agricultural Management and Extension Training Institutes be supposed to organize the training of EAS provider in this upcoming area. Agri tourism has marvelous potential for rising farm incomes and inspiring the growth of a dynamic, diversify rural economy. The progress of these interlinked enterprise generate other benefits to rural women area such as improved environmental and educational awareness, conservation of cultural heritage sites, and agro organic variety. Keeping in mind the sufficient time, liability issue and employees wanted when drawing up the agro tourism business enterprise. Making a business strategy will help to keep a track and in return the agro tourism business will boom.

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A LITERATURE REVIEW ON SOURCES OF HEAVY METALS POLLUTION OF INDIAN WATER BODIES AND THEIR IMPACT ON THE AQUATIC LIFE

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ABSTRACT

The fast population growth, industrialization, and new agricultural practises have destroyed India's water resources. Acute and chronic toxicity of heavy metals pollute aquatic environments. For numerous reasons, heavy metals can alter the trophic status of aquatic environments. Also a major health issue. Indian sediments in inland water systems are poisoned by heavy metals. It also addresses pollution sources. Various thresholds for sediment contamination were evaluated. Separate from natural factors, unmanaged manmade activities have deteriorated the environment in India. It is vital to raise public awareness of these issues and establish preventive and corrective measures. The country cannot afford high-tech remediation, thus prevention must be emphasised. Concerns about poverty, crowding, and malnutrition must be addressed through indigenous mitigation and remediation studies.

***Keywords**: Heavy metal, environment, aquatic life, Indian water bodies.*

1. Introduction

Recent threats to freshwater ecosystems include industrial pollution, agriculture, and waste management (Meijide et al., 2018). Precipitation and temperature have changed, influencing daily operations including reproduction and feeding. Ecosystems affected by invasive species (Schmeller et al., 2018). Water species and functions must be maintained globally, as must major pollution sources and fates (Liu et al., 2018; Zhao et al., 2018). We can conserve anthropogenic activity in freshwater aquatic species (Sumon et al., 2018a). Insights from natural processes can help design freshwater (Schmeller et al., 2018). Its main goal is to study pollution's effects on freshwater organisms.

India's ecological situation is deteriorating due to urbanisation, population expansion, industry, and other factors. Ecological conservation and energy efficiency are current socioeconomic problems Industrialization and agricultural development are important for human survival, but they must be done properly.

In aquatic ecosystems, household and municipal waste degrades more rapidly. India collects and processes fewer than 6 billion litres of waste water daily. 120,000 tonnes of MSW are generated everyday, however only 70% is collected and managed. Large concentrations of nonbiodegradable components, such heavy metals, raise the risk of bioaccumulation and biomagnification (Malik et al., 2010). Ocean pollution accounts for 59% of India's major annual environmental costs, while aquatic resources are declining at a 2%-3% annual rate. People put the stress on city water resources, causing them to deplete faster. This affects the local aquatic ecosystems. Cities harm water resources (Khan et al., 1988).

In the sediment are heavy metals and other contaminants. Due to the fact that sediments represent actual pollution levels, metal analysis of sediments helps identify sources of aquatic trace metal contamination. Luoma (1990) proposes that heavy metal concentrations in sediments can operate as an early warning system for contaminated hydrological systems. pH affects heavy metal solubility, chelating agents, particle size, and sediment composition (Jain, 2004). Metals go through many physicochemical, hydrological, and biological processes before they are given in particulate or soluble form. Adsorption, inactivation, transport, and inclusion (da Silva et al. 2000).

Because cation exchange systems absorb soil solutions, surfaces, and fluids, aquatic and benthic animals and plants have easy access to metals (Kumar et al., 2011). Metals highly bonded to sediments or complexed with other chemical substances are unlikely to be biologically accessible. Metal buildup and near-bottom water layer degradation are produced by sediment mobilization/immobilization (Kumar et al.,

2011). Metals have different fates and transportations depending on chemistry and biology. While all metals have the same environmental impact, their bioavailability and toxicity vary.

2. The Sources Of Pollution

Heavy metal pollution is caused by both natural and man-made sources. Examples of natural sources include volcanic activity, forest fires, and water seepage from rocks. The most significant anthropogenic sources of pollution are waste from homes and businesses. There is very little pollution from natural sources; however, sewage and industrial wastes contribute significantly.

Untreated sewage discharge into bodies of water is India's most significant source of water pollution. Water pollution in India is largely due to sewage, according to the country's Tenth Plan Document, prepared by the Indian Planning Commission. Of the 38000 million litres of waste generated each day, only about 12000 million litres can be treated. As a result, India's wastewater generation and treatment facilities are located at opposite ends of the country. Even with the existing treatment capacity, utilisation is hampered by operational and maintenance issues. Approximately 39% of plants fail to comply with the Environmental (Protection) Rules for discharge into streams because existing plants and sewage pumping stations are poorly operated and maintained. Class I cities in India are home to 2277 lakh people spread across 498 locations. Their total wastewater production is 35558 MLD, but they only treat 11553 MLD (32% of it) (CPCB 2009-10). India's ClassII towns are home to about 300,000 people. There is still a treatment gap between what they create (2696 MLD of wastewater) and what they can treat (234 MLD) (equal to 8.6 percent). (CPCB 2009–10). The rest of it is dumped in waterways.

About 57,000 polluting Indian industries generate 13,468 MLD wastewater from large and medium industries (of which approximately 60% is treated) generate approximately 57,000 polluting industries (Sengupta, 2006). Environmental damage is being inflicted by both large and small businesses these days. These polluting industries have been singled out by India's Central Pollution Control Board (CPCB): manufacturing industries such as cement mills and sugar refining facilities as well as thermal power plants, distilleries and fertiliser refineries, in addition to oil refineries, as well as the manufacture of caustic soda and petrochemical products. The distillery, textile, engineering, and pulp and paper industries also have an impact on aquatic water bodies. Nearly 40% of India's industrial wastewater is generated by 3.2 lakh small businesses, many of which are very polluting (Maria, 2003). When it comes to wastewater generation, engineering plays the largest role in these businesses.

Heavy metals have become a problem in some Indian cities like Ranipet in Tamil Nadu, Kanpur in Uttar Pradesh, and Vadodara in Gujarat as a result of excessive waste generation. Ratlam, Madhya Pradesh, and Vadodara, Gujarat, both have high levels of lead contamination. Similarly to Tamil Nadu's Kodaikanal, both Tuticorin and West Bengal's Tuticorin are contaminated with As (CPCB 2009-10).

80 percent of India's pollution is attributed to Gujarat, Maharashtra, and Andhra Pradesh (CPCB 2009-10). CPPB launched a national water quality monitoring programme in 1978 as part of a global environmental monitoring system to combat pollution in India's waterways (GEMS). Urbanization and industrialization without proper planning, on the other hand, have had disastrous consequences for our waterways (Singh et al. 2002).

3. Indian water bodies

toxic metal pollution is a major environmental issue in the United States. These toxic metals enter ecosystems via a variety of mechanisms, including geoaccumulation, bioaccumulation, and biomagnification. Heavy metals including Zn, Fe, Pb, Cd, Hg, Ni, and Cr are the most polluting. A record of prior pollution in urban runoff, atmospheric deposition, and upstream runoff is preserved in soil and sediments by contaminants like industrial effluents (Jain 2004). Singh et al. (2005) claim that sediment in water bodies contains heavy metals from both natural and human sources. Sediment from industrial water bodies can be used to

improve management strategies and identify existing pollution control operations at the source. Aside from physical and chemical interactions, heavy metals can be harmful in sediments and have a wide range of mobility (Singh et al. 2005). Bioavailability and toxicity of metals have therefore been important research topics for a long time (Singh, 2001). About 30% of the world's oceanic sediment load comes from aquatic ecosystems on the Asian continent, which act as major transporters of continental weathering products into the ocean.

River Ecosystems: An Overview

River sediments are an important source of information for determining whether human pollution has contaminated the water (Forstner & Wittmann 1983). River quality has deteriorated dramatically in the last few decades as a result of increased population and waste discharge into rivers. 70 percent of metals are transported by the world's oceans, which are linked to river sediments (Gibbs 1977). The metal content of river sediments was influenced by numerous factors, including geology, land use change, agricultural activity, industrialization, and biological productivity (Aurada, 1983).

Ganges, Brahmaputra, and Meghna river

The Ganges, Brahmaputra, and Meghna river systems are interconnected Considering its location, size, population density and rapid sediment deposition, the Bengal Basin holds a unique place in the world's basins. This system transports 1060 million tonnes of dissolved solids, 1330 km3 of freshwater, and 744106 tonnes of sediment per year to the Bay of Bengal. A large sediment dispersal system is found in the Bengal Basin due to the high rate of chemical denudation (Datta & Subramanian, 1998). A total area of about 2,000 square kilometres is serviced by this system. Despite its lack of industrialization, this region has one of the world's highest densities of population, with a density of 400 to 1200 people per square kilometre. Mn, Zn, Cr, Ni, Cu, and Pb concentrations in the G-B-M surface sediment range from 460 to 2655 parts per million (ppm) (Datta & Subramanian 1998).

The Ganges

This river, the Ganges, had the worst pollution, and the sediment in its bed could act as a place for metals to settle out of solution. The Damodar and Hooghly stretches had become polluted with runoff from refineries, industries, and mines, as well as agricultural runoff (Subramanian et al. 1988). Comparing Meghna's main channel and its tributaries to standard shale values revealed higher levels of Fe and Mn, as well as Zn and Cr.

Gomti River

In addition to agricultural runoff, it also receives sewage, industrial waste, and municipal waste before discharging them into the river. Gomti. For Cd, the average concentration in river sediment was 2.43 mg/kg, and for Cr it was 8.15 mg/kg. For Ni, the average concentration in river sediment in the Gomti was 15.17 mg/kg, with Pb at 40.33 mg/kg and Zn at 41.66 mg/kg. Because heavy metals precipitated and settled in river sediment as carbonates, oxides, and hydroxides, the danger of heavy metal exposure to benthic biota is higher (pH range: 7.22- 8.27). This system's Cd and Pb levels were higher, but the heavy metal content was lower.

Cauvery River

The Cauvery River in India There is a lot riding on the Cauvery River in India. This 764-kilometer-long river carries 1.5106 tonnes of sediment per year across a 90000-square-kilometer basin (Alagarsamy & Zhang, 2005). Irrigation is vital throughout the Tanjore delta region, but it is especially important. Earlier heavy metal concentrations for Mn, Cr, Ni, Cu, Zn, and Pb were 1300, 150, 150, 60, 500, and 40 ppm. Incorporating agricultural, industrial, and household waste increased the Mn, Cr, Ni, and Zn concentrations above the global average.

Damodar River

East India's Damodar River flows through this region.. The catchment area covers an area of 23170 km2 and receives an average annual rainfall of 1200 mm. A number of smaller rivers and streams flowed into the main river at various points along the way. There were

7894-30188 parts per million (ppm) of Fe, Mn, Cu, Zn, Ni, and Cr heavy metals in the sediment, with concentrations ranging from 10-33 ppm. Heavy metal pollution in the Damodar River Basin was less severe due to human-induced increases in Cu and Zn concentration along the river's course.

The Ganges River in India is the world's third-largest sediment transporter, behind the Yellow and Amazon rivers. Sediment loads on the river average around 1600 billion kilogrammes per year, with a mean annual flow of 5.9 billion cubic metres. Because of the high concentrations of heavy metals in the Ganges river sediment, this was reflected in the sediment's textural composition and geochemical characteristics of its tributaries (Singh et al., 2005). As a result of the findings reported in Jha et al. (2002) The most abundant elements in the upper Ganges were Mn, Fe, Co, Cu, and Cd, while the least abundant were Cr, Zn, Ni, and Pb.

Yamuna

Cu, Pb, Cd, and Zn concentrations in the Yamuna River Sediment averaged 22.2 mg/kg (Jain 2004). Because of their alkaline nature and high organic content, the sediments tested positive for higher levels of lead and cadmium than the region's average. The Delhi area had excessive levels of heavy metals because of massive sewage and industrial waste discharges from municipal and industrial areas. Notably, Delhi is the river's most significant source of pollution, with various drains accounting for nearly 80% of the pollution load. In Delhi, Cr concentrations were 821 ppm, Mn 678 ppm, and Fe 31 ppm, according to Rawat et al. (2003). As a result of these industries, the average shale value was higher than the average municipal waste value (except for Mn). Cd, Pb, and Zn were rated as high, medium, and low risk, respectively, by Jain (2004).

Subernarekha River

Jharkhand's south Chhotanagpur plateau is bisected by the Subernarekha River. It's a 470-kilometer-long, rain-fed river. As a result, heavy metals contaminated the river near Jamshedpur, India's largest metallurgical hub. Upadhyay et al. (2006) found Zn concentrations of 32.84 parts per million, Pb concentrations of 9.77 parts per million, copper concentrations of 35.55 parts per million, and cadmium concentrations of 0.036 parts per million in this system. The lithogenic and human influences on the Kharkhai tributary lead to greater metal concentrations in specific locations.

The Jhanji River

The Jhanji River System is a tributary of the Brahmaputra. The river's catchment is 1350 km2. It's a vital water source for residents downstream, but it's also a dump for rubbish. This system transports around 100 tonnes of wastewater every day from various sources. The surrounding settlements of Tuli and Nagaland Industrial Township pollute the river heavily. Due to direct and indirect waste dumping, the river has become a vast chemical storage facility. Pb, Zn, Cu, Ni, Co, and Cr contents were 14.78, 103.53, 44.37, 48.62, 49.57, and 171.44 ppm, respectively, according to Baruah et al (1996). The river is polluted with metals from decades of rubbish disposal.

Uppanar River

The Uppanar River Sediment Study reported average Fe values of 1.146 ppm, along with Mn (1.827), Cr (1.372), Cu (2.116), Nickel (1.194), Copper (1.201), Lead (0.902), and Cadmium (0.902). (1.430). as per Ayyamperumal et al. (2006). The metals were marginally polluted and had lower concentrations than usual, but could be a future source of heavy metals due to their low concentration.

Aril River

Region tributary and primary artery, the Aril River. The Bilari region's biggest pollutants are urban trash and agricultural enterprises. As a result, the river's chromium and iron levels dropped. Ni, Cu, and Zn concentrations were also lower (Sharma et al., 2003). The Gangan River System was built to help drain Moradabad's western portion. This company handles sewer and industrial garbage. Heavy metals (102 ppm Cr, Fe, Ni, Cu, Zn) (Sharma et al., 2003). Heavy metals were present in this river due to industrial and urban trash.

The Haldi and Rupnarayan rivers

These two rivers meet in West Bengal's Hugli estuary. It powers, navigates, and irrigates. It also supplies the river towns. The nearby Kolaghat thermal power plant and Haldia industrial city and port. These sediments contained 22.4 mg/kg Ni, Pb, Zn and 11.8 mg/kg Cu (Kumar et al. 2011). Although these rivers' sediments do not contain heavy metals, the tides can sweep them away and dump them elsewhere.

Table 1. Other indian water bodies and their description

Other water bodies	Description
Dal Lake	Dal Lake, Srinagar, 11.50 km2. 9.83106 m3. The lake supplies water for drinking, agriculture, fisheries, recreation, and tourism. sewage and domestic waste have eutrophied it. This lake is polluted by the Telbal and Peshpaw drains. The Telbal drain contributes over 80% of the total lake input. Fe, Mn, Zn, Co, Cu, Pb, and Ni values were 0.84-1.26 ppm, according to Jeelani & Shah (2006). Metal mining, industrial, and municipal trash enriched lake sediment. The higher concentration was due to multiple causes of Pb deposition. So the river got Zn, Cu, and Pb.
Hussainsagar Lake	In Hyderabad and Secunderabad, Hussainsagar Lake is a 446-hectare hub. There is also industrial waste. Rao et al. (2004) found 72.19, 45.07, 337, 113, 1.99, 7.28, and 74.55 ppm Cr, Ni, Zn, Cu, Hg, Cd, and Pb. Festivities near the lake produced metals. Except for Cr and Ni, Hussainsagar Lake has higher heavy metal concentrations than shale.
Nainital Lake	The town's only supply of drinking water is the Nainital Lake, but increased human activity and modern farming methods are increasing heavy metal concentrations. Jha et al. found higher heavy metal concentrations in Nainital lake silt than in shale. Heavy metals have been dumped into the Nainital Lake, increasing the risk of them hurting aquatic creatures.
	This is Andhra Pradesh's largest natural freshwater lake, with a 4763 km2 catchment area. Locals rely on it for aquaculture and fishing. Heavy metals enter the system through agricultural runoff, household and industrial waste, and drains and channels. With the exception of Cu and Zn, the food chain accumulated less Cr (52.31 ppm) and less Ni (0.02 ppm).
Nal Sarovar	Large amounts of heavy metals were detected in the sediment of Nal Sarovar Lake from agricultural runoff and sewage effluents from periphery communities. Except for Zn and Cd, this lake was not toxicologically alarming, yet Zn and Cd limits in the research area were advised.
Lonar Lake	Lonar Lake is in the Indian peninsula. Like Mono, Owens, Karakul, and Magadi it is a soda lake (pH 10). (Kenya). It's the world's only basaltic meteoritic crater. It is an 1830 m diameter and 150 m deep depression. 7900 ppm Fe, 3.7 Co, and 8.25 Ni in lake sediment (Surakasi et al. 2007). Because there were no dumping sites in this lake, they were low.
Mansar Lake	Mansar Lake lies in Jammu's sub-Himalayan area. It is the region's largest and deepest lake, 1015 m long, 35 m deep, and 640 m wide. Subterranean springs and rainfall provide water. On average, this location receives 1500 mm of rain each year. ppm Fe, Mn, Pb, Co, Ni, Cr, Cu, and Zn in the lake silt. However, the others are unpolluted.

Kanewal Reservoir	The Kanewal Reservoir had 66.40, 26.29, 4773, 50.47, 8.01, and 1012 ppm Cd, respectively. Because of this, the sediments were contaminated with Zn. It was due to the local farming methods.
Lalbagh tank	The Lalbagh tank had Cr 17, Fe 4230, Ni 17, Cu 45, Zn 49, and Pb 29 mg/kg heavy metal concentrations (Lokeshwari & Chandrappa 2006). Seasonal factors influenced it. For Fe, Zn, Ni, and Co, the Lalbagh tank sediment is unpolluted.
Kolleru lake	Metal speciation, complex nature, metal-metal interaction influenced temperature, pH, and organic content. However, heavy metal concentrations were below average (excluding Cu and Zn) despite Cu and Zn stress.
Bheris pond	These were found in the pond: Cr 8.7; Mn 68.5; Fe 1353; Cu 74.92; Zn 3723; Pb 7.52. Except for Cu and Zn, heavy metal concentrations were below normal shale values.

4. Impact on aquatic life

Like metals, they are not easily biodegradable. Metals are re-distributed in water and sediments, or biota consume them. Metals are desorbed and remobilized by sediments. Contaminated habitats' metal deposits can infiltrate the human food chain, causing health issues (Hasan et al., 2017). Co-precipitation with Fe or Mn oxides or species bound as carbonates in sediments can cause metal accumulation in sediments (Equeenuddin et al., 2013).

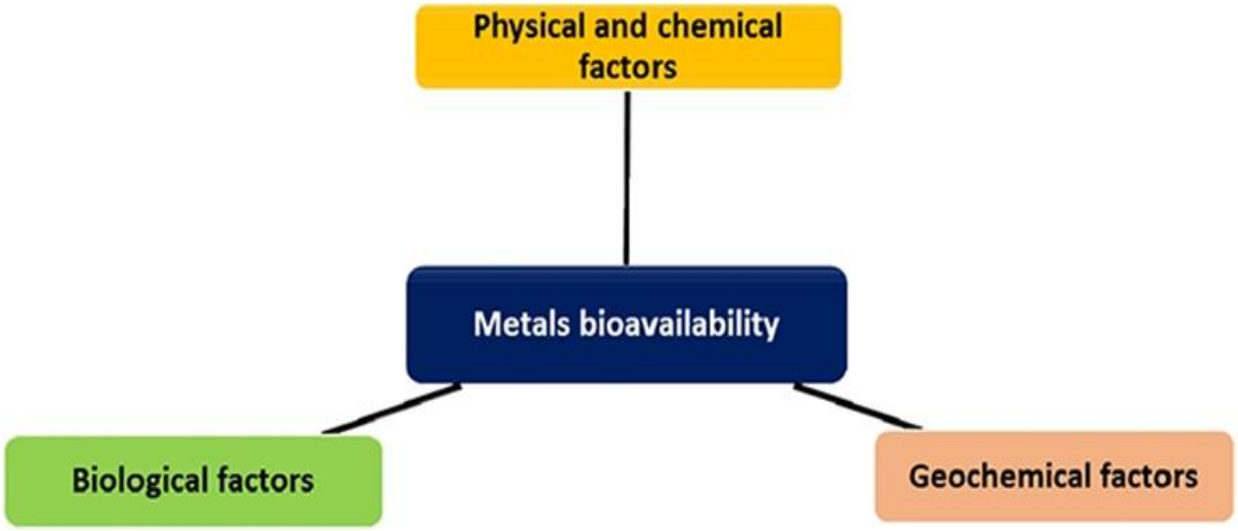

Figure 1. Factors that influence metal bioavailability (Source : Gheorghe et al., 2017).

The body can absorb a certain percentage of a metal's total concentration. Several factors affect metal bioavailability (Figure 1): Physical and chemical factors (temp, salinity, dissolved organic carbon, and total suspended particles); reproductive stage (Roosa et al., 2016).

Bioavailability determines metal intake. Drinking water contains metals, which are absorbed via the epidermis; food contains metals. It is important to note that metal toxicity is affected by pH, temperature, salinity, and oxidative conditions. Feeding rate and intestinal transit time affect swallowed uptake.

Most Cu, Cd, Zn, and Pb free hydrated metallic ions are found as (Wojtkowska et al., 2016). The use of low-molecular-weight organic ligands should be considered. They do this by diffusing hydrophobic compounds through lipid membranes in mussels and fish. The bioavailability of metal organic compounds has been questioned (Chapman et al., 1998). Chemical mercurials that dissolve in lipids make ingestion easier (Bryan et al., 1976).

Adsorption on suspended particles modifies the water's Metal absorption requires a metal-solid particle connection (Eggleton et al., 2004). The metal was soluble in interstitial water when

certain circumstances were satisfied. Sediment-borne toxins may be a key source of bioaccumulation in planktonic and benthic species. More research is needed to understand dissolved and suspended metal accumulation/bioaccumulation mechanisms.

Metal bioavailability is size dependent in filter-feeding bivalve snails. Extracellular polymers or fulvic acids improved Cd, Zn, and Ag bioavailability. Metal binding decreased soil metal bioavailability (Rosado et al., 2016).

Endogen macromolecules (such protein or ADN) or certain cellular structures interacting with lipopolysaccharides induce toxic consequences. Metals are detoxified enzymes in operation.

Heavy metal exposure slows growth of phytoplankton, zooplankton, and fish. Heavy metals can damage molluscan development, byrsus, and reproduction Fish and crustaceans with gill necrosis and fatty liver degeneration. Metals impact aquatic creatures' enzymatic metabolism and physiology.

Metals found in crustaceans killed them by blocking respiratory enzymes. In fish and crustaceans, antioxidant enzyme suppression alters histology (El Basuini et al., 2016). Proteasome inhibitors slowed the organism's growth and development. The effects vary depending on the metal, altering bioaccumulation and enzyme sensitivity.

5. Conclusion and Recommendations

There are a number of human activities that have a negative impact on the quality of Indian river water, including overcrowding, inadequate sanitation treatment or non-existence, and massive discharges of untreated industrial waste waters into the riverine system that are not under government regulation. Increases in agricultural and industrial activity, as well as population growth, may be to blame. Industries are leaking wastewater into localised areas as a result of water pollution, endangering human health and aquatic life. Tanneries, mining, and other industries dump toxic metals like chromium and other heavy metals into rivers. These industries' effluent should be treated chemically and biologically before it is released into the river. Help ensure that water pollution control legislation and regulations are applied correctly and consistently. Agricultural and industrial effluents discharged into rivers must be regulated and monitored rigorously by the government. Further research is needed on the speciation of chromium (+3 and +6) and arsenic (+3 and +5) in Indian rivers. A metal fractionation study in river sediments is needed to figure out the inorganic load. Specialized studies on specific river segments may be carried out by the basin organisation as well. The number of variables and sampling frequency can be increased in order to better monitor, analyse, and simulate new significant factors such as biological characteristics.

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BIOACCUMULATION OF HEAVY METALS IN AQUATIC LIFE: A LITERATURE REVIEW

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ABSTRACT

The poisoning of aquatic systems with heavy metals as a result of natural human sources has grown into a global problem that is threatening ecosystems and natural communities. A result of these findings, this research investigates the repercussions of metal bioaccumulation in aquatic organisms. Cadmium is thought to accumulate in aquatic species through a range of organs, including the gills, liver, stomach, and intestines, according to current estimates. These dangerous heavy metals are brought to the public's attention because of the harm they can cause.

Keywords: Bioaccumulation, Heavy metals, Aquatic life, ecosystem.

1. Introduction

Heavy metals are chemical elements having a high density, which are dangerous or lethal even in trace amounts. Mercury (Hg), chromium (Cr), thallium (Tl), and lead are examples of heavy metals (Pb). Heavy metals are naturally found in the earth's crust. Their level of quality won't deteriorate. Because of their toxicity, heavy metals can accumulate in the body and cause problems with bioaccumulation. Bioaccumulation, on the other hand, is the process through which a chemical's concentration in a living creature increases over time. When compounds are taken up and stored quicker than they can be broken down (metabolised) or expelled, they build up in living organisms. Acid rain destroying soils, industrial and consumer waste polluting rivers and groundwater can all lead to water contamination.

Metals that can't be absorbed by the body build up in organs and soft tissues. The human body absorbs heavy metals from industrial and agricultural surroundings through food, drink, air, and skin absorption. Asthma episodes in children and adults are common. Most youngsters are exposed to these substances by eating or drinking them (Roberts, 1999). Children who eat non-food objects (such dirt or paint chips) or touch contaminated soil are at risk of ingesting hazardous quantities due to their frequent hand-to-mouth behaviour (Schachter et al., 2020). Exposure through radiological treatments, improper dosage or monitoring during feeding, broken thermometers, or self-harm attempts is rarer. (Chartier al., 2014).

Heavy metal pollution is linked to a variety of illnesses, including organic mercury poisoning in Japanese, cadmium poisoning in Taiwanese, and arsenic acid pollution in humans in the United States and Europe (Rahman & Singh, 2019). Heavy metal pollution is also a major cause of asthma caused by air pollution in the United States and Europe. In marine ecosystems, there are numerous internal and external linkages that can change over time, making them very complex and dynamic. Pollutants that enter estuaries and inshore waters cause major problems, endangering aquatic life and activities and even causing mass fatalities. Heavy metal buildup in marine environments is one of the most serious contaminants.

Several heavy metals have been distributed through water and beach transport. Water systems can be seriously harmed by activities that release large amounts of heavy metals into the environment into the ecosystem (Masindi & Muedi, 2018). Poisoning by heavy metals can have major consequences for the ecological balance and aquatic species richness of the recipient ecosystem (Kolarova & Napiórkowski, 2021). Fish are particularly vulnerable to pollution since they are water-dependent creatures (Avni & Jagruti, 2016). Many fish are utilised in aquatic ecosystem health evaluations due to the fact that toxins build throughout the food chain and cause

severe harm or death (Bhateria & Jain, 2016). According to the Environmental Protection Agency (EPA), heavy metals enter waterways through atmospheric deposition or erosive processes such as mining waste or human-caused geological substrate erosion. Metal pollutants in aquatic systems are typically soluble or suspended, and they either settle to the bottom or are consumed by organisms before being cleaned up. Toxic metal accumulation in the organs of marine species causes long-term metal-related disorders, putting the aquatic biota and other organisms in danger. Because fish are a major aquatic organism in the food chain, toxic metals can accumulate in them. Toxic metals for fish include Fe, Zn, Pb, Cd, Cu, and Mn, all of which can harm them directly or in combination. These (potential) contaminants move up the food chain through processes and routes known as bioaccumulation and bio magnification, which demonstrate a greater capacity for bioaccumulation in the species exposed to them. Hazardous chemicals are retained for longer in food chains with increasing concentrations than in those with lower concentrations. "Individual metals and metal complexes, such as "heavy metals," have been shown to be toxic to humans. Many of these metals are only required in trace amounts to sustain life. When consumed in large quantities, however, they become poisonous. They can accumulate in biological systems and pose a serious health risk " (OSHA, 2004).

Table 1. Common types of heavy metals

Metal Name	Description
Arsenic	The ATSDR's "Top 20 List" says arsenic is the most prevalent acute heavy metal poisoning in adults. It is also released during the manufacture of chemicals and glass. Insecticides contain arsenic, which produces arousine gas. Arsenic in water threatens shellfish, cod, and haddock globally. Poisoned rats, fungicides, and wood preservatives are culprits. Blood, kidneys, CNS, digestive system, skin (Roberts, 1999).
Lead	The ATSDR's "Top 20 List" includes Lead. It is the most common harmful exposure in kids (Roberts, 1999). Pipelines, drains, and soldering supplies use it. Mold, mildew, and mildew are issues for millions of pre-1940 homes that contain lead (e.g., in painted surfaces). Every year, over 2.5 million tonnes of lead are produced. It's mostly batteries. The rest goes to cable covers, plumbing, and fuel additives. The compound is also used to make insecticides and PVC plastics.
Mercury	Mercury comes on third rank, it is naturally created by volcanic eruptions. Inorganic mercury is elemental mercury. All three industries produce a lot of mercury (Gworek et al., 2020). Due to wind and rain carrying it, it accumulates in lakes and rivers (Budnik & Casteleyn, 2019). Paints used mercury-based fungicides until 1990. However, ancient paint supplies and painted surfaces still exist. Aluminium dental amalgam contains mercury. Many scientists assume dental amalgam contains mercury (Homme et al., 2014). They are still available. These include algaecide, childhood illnesses, and vaccinations. Most people inhale mercury. GIT readily absorbs organic mercury (90-100%) but also inorganic mercury at high doses (7-15 percent). The brain and kidney are targets (Roberts, 1999).
Cadmium	It is a by-product of lead and zinc mining. ATSDR ranks it 7th. It's in nickel cadmium batteries and PVC plastics. Cadmium-containing pesticides and fertilisers have been identified in the soil. Cadmium in shellfish Cadmium is in smoke. Tooth alloys, electroplating, motor oil, and exhaust Cadmium absorbs 2–7% of what is consumed in the GI tract. Inhalation contributes for 15% to 50% of respiratory absorption. Heart, liver, kidneys, lungs, bones (Roberts, 1999).

Iron	Iron is a dangerous heavy metal to eat, especially in young children, due to the possibility of serious poisoning. Due to its fast absorption in the gut, iron is most commonly ingested. Abrasion improves absorption. It happens when kids mistake red-coated ferrous sulphate tablets or adult multivitamins for candy. Childproof packaging has decreased overdose deaths. For iron containing 250 mg or more, use child-proof bottle closures to reduce accidental ingestion and overdose. Iron is present in iron pipes and cookware. Heart, liver and kidneys (Roberts, 1999).
Aluminium	Despite not being a heavy metal, aluminium is the third most abundant element (specific gravity: 2.55-2.80). Aluminium ToxFAQs Aluminium foil, aluminium cookware, cans, ceramics, and pyrotechnics all include it. Is in pyrotechnics and water (ATSDR ToxFAQs for Aluminium). Around 20 years ago, researchers began looking for a link between aluminium and Alzheimer's disease. Aluminium has been detected in non-brain Alzheimer's tissue, but consumers are advised to avoid it. Several groups and individuals have been banning all aluminium cookware, storage containers, and even water (Roberts, 1999). Aluminium poisoning can harm the brain, kidneys, and gut.

2. How does heavy metal contaminate into the water

It's critical to keep toxic trace metals out of our waterways and soils. Natural water bodies, sediments, and soils are polluted by metals after they have been released into the environment from anthropogenic and natural sources. As a result of volcanic eruptions and other industrial pollutants returning to the ground, heavy metals discharged into the atmosphere are contaminating water and soils. Metals stay in the environment for long periods of time, causing biota accumulation or leaching into the groundwater. There are significant implications for human health if biota and groundwater are contaminated with hazardous heavy metals. Investigating heavy metal concentrations and distribution in riverine ecosystems is critical for determining the extent of pollution by these elements (Islam et al., 2018). All of these variables have an impact on heavy metal dynamics and biogeochemical cycling in the environment.

Water, according to some, is a necessity for human survival. Water is a universal solvent because it dissolves both inorganic and organic pollutants. The freshwater and marine ecosystems are both at risk from contaminated runoff. Drinking water and soil contamination by heavy metals damages plants, animals, and people because of particulate matter (Rezania et al., 2016). Heavy metals are lethal to aquatic life even at low concentrations (Pacle Decena et al., 2018). These chemicals have the ability to change the histopathology of tissues. Aquatic environments are teeming with heavy metal pollution from myriad sources. Mining effluent is where heavy metals that end up in water get their start (Zhuang et al., 2013). Surface and groundwater, as well as agricultural runoff and industrial effluent, are contaminated with high levels of heavy metals. Surface and groundwater pollution are both exacerbated by untreated industrial effluent discharge (Afzal et al., 2018). Because of heavy metals' persistence, bioaccumulation, and biomagnification in food chains, heavy metal pollution of water bodies is a global issue (Rajaei et al., 2012).

3. Bioaccumulation of heavy materials among aquatic animals

Metal uptake by aquatic species occurs in two stages. In the first case, quick surface adsorption occurs, while in the second, gradual metal transport occurs within the cell (Abbas et al., 2014). It is the rate-limiting step in epithelial metal transport. A carrier protein or metal ion diffusion through the cell membrane aids intracellular transit (Brezonik et al., 1991).

- **Metal gill absorption**

Metals in water attack gill surfaces first, with the gill surface microenvironment, phospholipids create an epithelial membrane covered in mucus. Environmentally important pH values (pH>5) result in negatively charged

gill surfaces and probable gill-metal interaction sites (Gill-Metal Interaction Sites, GMIS). The pK value of the external gill surface epithelial components is 3.6. (de Paiva Magalhães et al., 2015). In equilibrium, the pK value is 1 when both anion and conjugate concentrations are 1. (HA). Many approaches have been developed to anticipate complexation patterns since the degree of metal interaction with biological complexes varies substantially between metals.

"Metal electronegativity" is a measure of a metal's propensity to form ionic vs covalent bonds. Thus, metal binding to gill surfaces may be mediated via ionic interactions with epithelial tissue (Cook-Auckram, 2019). They may operate as metal sensors because they have oxygen-rich cores. Conversely, covalent interactions occur between nitrogen or sulfur-rich chemicals, such as sulphydryl (Cook-Auckram, 2019).

- **Metals plasma uptake**

In the blood, metals are transported by binding to plasma proteins. Bentley (1991) discovered a serum albumin with strong zinc affinity in channel catfish (Ictalurus puntatus) (Zn). There are steric variables that influence access to non-sulphydryl, non-electrostatic sites such as imidazole groups that alter Zn binding specificity, as shown here. If this protein was present, more competitive metals would lose plasma binding sites. Because of this, this protein kept physiologically active "free" Zn at low doses. Crichton (2016) found that nearly all Zn associated to plasma proteins is easily exchangeable. The protein transferrin binds iron in plasma to prevent it from leaching (Bentley, 1991). A high ambient Cu level boosted the production of copper-binding protein MT in Anguilla anguilla gill tissue, according to Noel-Lambot et al. (1978).

- **Absorption of metals by the liver**

According to this study, fish have a liver that controls metals like mammals (Heath, 1987). Metal exposure generates MT, which then binds metals to protein targets (Rubino, 2015). Pickering (1993) asserts that fish use the stress response to avoid or overcome potentially harmful circumstances. It appears that all types of environmental stress have a basic characteristic. Activated sympatheticochromaffin system, HPI axis secretes corticosteroids into circulatory system, and hypothalamic-pituitary-interrenal axis. That is true. As a result of increased oxygen carrying capacity and intermediate metabolism, catecholamine production helps fish survive. It has been shown that catecholamines cause glycogenolysis, gluconeogenesis, and lipid mobilisation in fish liver (Ardeshir et al., 2017). Most likely, further adaptive changes in liver tissue are caused by catecholamines (or to hormones such as growth hormone or cortisol). Stress hormone secretion may have triggered internal metal fluxes, freeing naturally bound metals from the liver. This is a fascinating theory, these metals were probably excreted by bile or kidney.

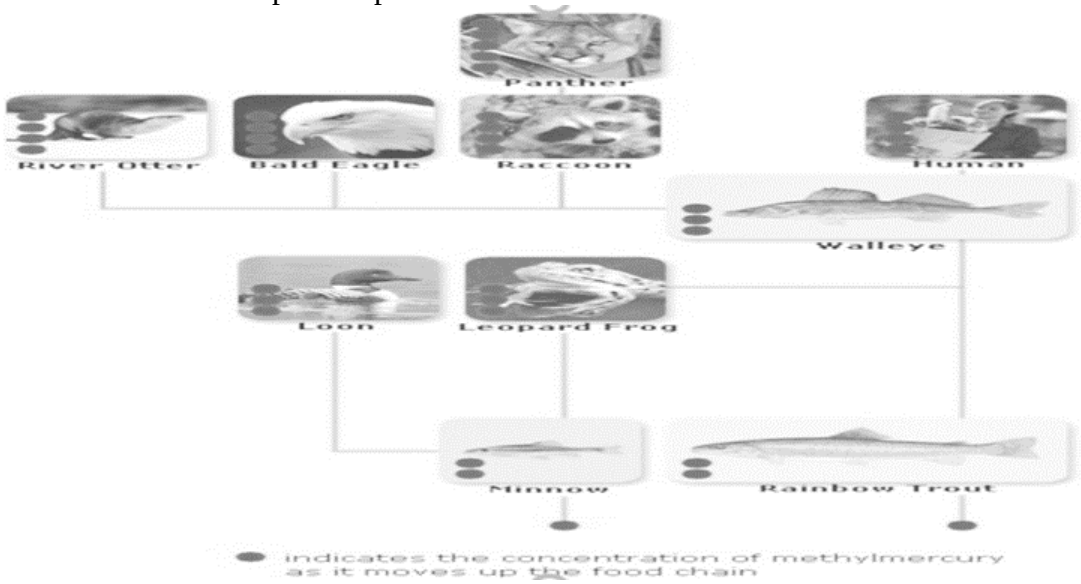

Figure 1. Heavy metals and the food chain (source: Baby et al., 2010)

4. Water pollution control with heavy metals

Most widely used processes for the removal of metals from water are chemical precipitation (which involves adding lime to the water) and solvent extraction (which involves using water to separate the metal ions from the water) (Yadav et al., 2020). Each method's steps are outlined in the following sections.

- **The process of reverse osmosis:** Toxic metals are removed from contaminated water using a semi-permeable membrane and a high pressure greater than the osmotic pressure. This approach has the drawback of being prohibitively expensive.
- **Electrodialysis:** separates heavy metals (ions) using semi-permeable selective membranes for ions. Electricity between two electrodes causes cations and anions to move to their respective electrodes. The alternation of cation and anion permeable membranes forms salt cells. Metal hydroxides block the membrane..
- **Ultrafiltration:** Porous membranes are used to remove heavy metals in pressure-driven membrane processes. Due to this process's ability to generate sludge, it has some drawbacks.
- **Ion-exchange:** Metal ions in diluted solutions are exchanged with ions trapped on an exchange resin by electrostatic forces in this procedure. High costs and incomplete elimination of some ions are some of the drawbacks.
- **Precipitation of chemicals:** Precipitation of metals involves the use of coagulants such as alum, lime, iron salts, and other organic polymers. As a result, a significant volume of hazardous sludge with poisonous chemicals is generated during the process.
- **Phytoremediation:** Phytoremediation is the process of cleaning up sites contaminated with heavy metals by using specific plants. The drawbacks include the fact that metal removal takes a long period, and that the plant needs to be regenerated for additional biosorption. Due to drawbacks such as incomplete metal removal, high reagent and energy requirements, and the generation of toxic sludge or other waste products that must be carefully disposed of, a cost-effective treatment method to remove heavy metals from aqueous effluents is now required to overcome these issues.
- **Biosorption:** Biological materials with metal binding capacities have been studied in the hunt for innovative methods of removing harmful metals from wastewaters. Biosorption is the ability of biological materials to absorb heavy metals from wastewater metabolically or physicochemical. Metal biosorbents can be made from algae, bacteria, fungi, and yeasts. Biosorption has a number of advantages over more traditional treatment approaches, including the following Efficiency at a low cost; The use of fewer chemicals; In addition, no additional nutrients are required, and the biosorbent regenerates; There is a chance that the metal can be recovered (Lutzu et al., 2020).
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5. Conclusion

The high concentration of heavy metals could be harmful to aquatic and human health. Heavy metal pollution in the ecosystem has the potential to harm marine species at the cellular level, which could have a negative impact on the ecological balance. Heavy metals are absorbed by aquatic organisms in three ways: through the skin, gills, and food. Aquatic microorganisms collect metals, which are then ingested by small fish as an added bonus. For the second time today, predatory fish exhibit higher levels of aggression than their prey. Those that live at the end of the food chain must deal with trophic level enrichment, when they excrete less than they take in. Enrichment has taken place. In order to eliminate heavy metal contamination in aquatic environments, it is necessary to implement preventive measures.

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AN ASSESSMENT OF PHYSICOCHEMICAL PROPERTIES AND WATER QUALITY OF BUDHASAGAR POND WATER

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ABSTRACT

Water pollution is one of three major pollutions threatening the environment today. Disposal of domestic, sewage, agricultural, and industrial waste change the physicochemical properties of water. They could result in an increased pH level, affect the hardness of the water, or change the chloride levels. These changes in physicochemical property of the water affect the aquatic habitat, may change the flavour of the water, could result in an increased heavy metals uptake by fishes, and pose health risks in other ways. The objective of the present study is to record physicochemical properties and assess the water quality of Budhasagar pond. Water samples were collected from the pond across three seasons twice between 2015-16 to 2016-17. It has been found that the water quality was fair (requires treatment) during both summers and the post-monsoon season in 2016-17. During the rest of the study period, the water quality was found to be of good class (requires no treatment). Filtration and disinfection of the pond should be carried out to minimize the health risk posed to people depended on the pond.

***Keywords**: Budhasagar pond, physicochemical properties of freshwater, overall water quality index (OWQI).*

Introduction

Even though two-third of the Earth's surface is covered with water, only 1% of this is freshwater. This freshwater is mainly found in ponds, rivers, lakes, and groundwater. These sources have served and supported evolving needs of the human civilization for millennials. Unfortunately, the latest evolution in the human civilization that took place in the form of industrial revolution in the 18th century has come to threaten the freshwater security for the whole human civilization as well as various animal and plant kingdoms. Researchers have attempted to bring attention to this growing insecurity and have predicted water insecurity to be the biggest crisis of the 21st century.

Water pollution is one of three major pollutions threatening the environment today. It is a broad term defined by the presence of unwanted contaminants in water and includes seawater as well as freshwater contamination. Seawater pollution threatens ocean and sea habitats such as seawater plants and fishes. Disposal of plastic at beaches and oil spills are two major sources of seawater pollution. Freshwater contamination is due to three primary sources: domestic, agriculture, and industrial. Disposal of domestic waste and sewage discharge into rivers and ponds pollute these freshwater sources. Agricultural runoffs containing chemical fertilizers and discharge of untreated industrial waste are major lethal sources of freshwater contamination.

Disposal of domestic, sewage, agricultural, and industrial waste change the physicochemical properties of water. They could result in an increased pH level, affect the hardness of the water, or change the chloride levels. These changes in physicochemical property of the water affect the aquatic habitat, may change the flavour of the water, could result in an increased heavy metals uptake by fishes, and pose health risks in other ways.

The research has been carried out with water samples from the Budhasagar pond. Budhasagar is a man-made perennial pond and is filled with water year-round. It is also connected with the municipal sewage of the Baldeobagh town. It also used to carry the industrial waste of a cotton mill in the town. The mill shut a couple of years ago, however. The pond serves the bathing and washing needs of town residents and fishing culture has also been continued since it was first started in 1961. Given the fact that the pond is sewage-fed and once served the disposal of a cotton mill, it is imperative to think that the pondwater may have faced deterioration in quality and physicochemical properties of the pond water. We collected water samples from

the pond across three seasons twice between 2015-16 to 2016-17. The objective of the present study is to record physicochemical properties and assess the water quality of Budhasagar pond.

Literature Review

Researchers have noted of seasonal variations in physicochemical properties, e.g., temperature, chlorine level, etc. of water bodies such as lakes, ponds, and rivers (Birge, 1911; Birge, 1916; Chandler, 1944; Hannan and Young, 1974; Hutchinson, 1957; Harshey et al., 1982; Juday, 1929). Chandler (1944), Welch (1952), Jolly and Chapman (1966), and Wetzel (1983) have also found influence of water temperature on its physicochemical, biological, and physiological parameters and activities.

Admse (1968), Ingols and heukelekian (1940), Luklema (1969), and Oswald (1960) have studied the effects of sewage discharge on the pH level of the water bodies. Chapman and Kimstach (1992), Hannan and Young (1974), and Lee et al. (2009) investigated the effects of industrial discharge on the pH level of water. Khalique and Afser (1995), Islam and Islam (1996), Rochar et al. (2004), Atkinson et al. (2007), Roldin et al. (2012), and Haiyan et al. (2013) further studied the variations in pH level with additional disposal of sewage into the water bodies.

Hutchinson (1957), Reid (1961), Ruttner (1963), George et al. (1966), DeSmet and Evens (1972), King (1981), Goldman and Home (1983), Wetzel (1983), and Kara et al. (2004) have carried out studies seasonal and otherwise variations in the level of dissolved oxygen in water bodies. Wetzel (1983), Hamoda et al. (1995), Schmitz (1996), Schmitz (1996), Panswad and Anan (1999), Glass and Silverstein (1999), and Lee et al. (1999) have studied the presence of chloride in water bodies and found that anthropogenic activities such as bathing domestic animals and washing clothes result in an increased concentration of chloride in the water bodies.

Mairs (1966) and Cole (1975) studied the hardness of water bodies and found two minerals, e.g., calcium and magnesium ions, to be the primary causes of an increased hardness of the water. The total hardness of water is a complex mixture of cations and anions (Maris, 1966). Other researchers have studied the effects of sewage and industrial disposals on the hardness levels of water bodies (Moyle, 1949; Thomson, 1952l Chapman and Kimstach, 1992; and Meybeck et al., 1992).

Lawson (2011) studied the role of physicochemical properties of water bodies in the ability to dissolve heavy metals by its fish habitats. Merlini and Pozzi (1977) recorded the concentration of heavy metals in freshwater fish at different pH levels. Pascoe et al. (1986) investigated the heavy metals toxicity of fishes in the context of a changing hardness level of the water. Pascoe et al. found that an increase in hardness resulted in slower uptake of heavy metals in fishes. Del-Ramo et al. (1987) studied temperature as the independent variable affecting the heavy metals toxicity of freshwater crayfish.

Research Methodology

Sampling

Water samples were collected across three seasons, e.g., winter, summer, and post-monsoon, twice between 2015-16 to 2016-17. The samples were measured for their various physicochemical properties and the concentration of heavy metals. In each sample, three replicas were collected. Samples were collected from surface-level in 500ml polyethylene bottles between 9:30 A.M. to 11:00 A.M. To study dissolved oxygen in water, samples were fixed with manganous sulphate and alkaline iodide in 250ml B.O.D. bottles in the field itself.

Physiochemical analysis

Standard methods as suggested by Trivedy and Goel (1986) and APHA (1989) were followed to calculate the physicochemical parameters of sample water. We recorded temperature, pH level, dissolved oxygen, chloride, and total hardness of the sample water. Temperature was recorded on spot by using a graduated Celsius thermometer by dipping the thermometer bulb into the water for at least two minutes. pH levels were recorded using a composite digital device.

Dissolved oxygen: Dissolved oxygen was computed using Winkler's method (1888). 6.205g of $Na_2S_2O_3$ .5 H_2O was dissolved in a

small quantity of distilled water. To this 0.4 g of solid NaOH was added and the solution was diluted to one litre. Alkaline potassium iodide solution was then prepared by dissolving 100g of KOH and 50g of KI in 200ml of boiled distilled water, and manganese sulphate solution was prepared by dissolved 100g of $MnSO_4$ $4H_2O$ in 200ml of boiled distilled water. We later dissolved 1g of laboratory-grade soluble starch in 100ml of boiled distilled water and added a few drops of formaldehyde solution to obtain the starch solution.

The water sample was poured into a 250 ml reagent vial and allowed to stand for several hours before analysis. To this mixture, 1 ml of manganous sulphate and 1 ml of alkaline iodide were added, and the mixture was quickly stopped without allowing any air to enter. The contents of the bottles were fully mixed by shaking them, and the precipitates were evenly spread. To dissolve the precipitates, 1 ml of concentrated sulphuric acid was applied. We used the first 25 millilitres of the sample, and then we added 1 millilitre of starch solution and titrated with 0.025 N sodium-thiosulphate until the blue hue was gone. Dissolved oxygen was then computed using the following formula.

$$DO = \frac{\mathrm{V} * \mathrm{N} * 8 * 1000}{\mathrm{V1} - \mathrm{v}}$$

where,

N = normality of sodium thiosulphate,

V = ml of titrant used,

V_1 = volume of sample bottle, and

v = volume of $MnSO_4$ and KI added.

Total Hardness: To measure the total hardness of sample water, 1.179g of disodium salt of ethylene diamine tetra acetic acid dehydrates and 780mg of magnesium sulphate ($MgSO_4.7H_2O$) were dissolved in 50ml of distilled water. We then added 16.9g of NH_4Cl and 143ml of concentrated NH_4OH and diluted the solution to 250ml of distilled water. We then grounded 200mg of Eriochrome Black T and 100g of solid NaCl in a mortar and pestle and dissolved 3.723g of disodium ethylenediamine tetraacetate dehydrate in 100ml of distilled water.

1ml of buffer solution and a pinch of Eriochrome Black T indicator were added to a 25ml water sample. It turned the solution pink indicating hardness. This was titrated against EDTA solution until the blue hue faded and the total hardness was calculated as follows:

$$\text{Hardness (EDTA) as Mg/L CaCO3} = \frac{\mathrm{V} * 1000}{\text{ml sample}}$$

Chloride: We added two drops of potassium chromate ($K_2Cr_2O_4$) indicator to a 100ml water sample, which turned the solution yellow. This was then titrated against N/50 $AgNO_3$ solution until a brick red colour appeared. Chloride level was then calculated as follows.

$$CL = 7.1 \times V_1$$

where V_1 is the volume of silver nitrate used for titration.

Overall water quality index (OWQI)

There are five levels of surface water quality as defined by the OWQI, which was developed by Singh et al. (2015). The levels range from excellent to polluted, with excellent being the best possible. According to Indian Standards (BIS) and CPCB (CPCB) standards, as well as other international standards from the World Health Organization (WHO) and European Commission, concentration ranges have been specified for this purpose (EC). It was decided on the basis of social and environmental impact that 16 parameters would be chosen, and weights would be assigned depending on the importance of each parameter to water quality. Integrating complicated data increases knowledge of water quality issues, and a score describing water quality is generated as a result of the suggested index.

$$OWQI = \sum_{i=1}^{n} \mathrm{wi.Yi}$$

where,

w_i = weight of the i^{th} water quality parameter

Y_i = sub-index value of the i^{th} parameter

Table 1 Assignment of significant weight to water quality parameter

S.No.	Parameter	Weight factor
1.	pH	1
2.	Dissolved oxygen	4
3.	Total hardness	1
4.	Chloride	1

Table 2 Sub-indices function for various parameters

S.No.	Parameter	Range of Parameter	Sub-Index Function
1.	pH	6.5 - 8.5 6.0 - 6.4 & 8.6 - 9.0 5.5 - 5.9 & 9.1 - 9.5 < 5.5 & > 9.0	Y=100 Y=50 Y=25 Y=0
2.	Dissolved oxygen	8 and above 6 - 7.9 0 - 5.9	Y=100 Y=10*X+15 Y=12.5*X
3.	Total hardness	100 - 300 301 - 400 > 400	Y=100 Y=-0.2*X+155 Y=-0.25*X+175
4.	Chloride	200 and below 201 - 250 251 - 600	Y=100 Y=-0.4*X+175 Y=-0.0714*X+92.86

Table 3 Corresponding class and water quality as per OWQI

Class	OWQI Value	Status of Water
Heavily Polluted	0 - 24	Unsuitable for All Purposes
Poor	25 - 49	Special Treatment (Special Treatment)
Fair	50 - 74	Needs Treatment (Filtration & Disinfection)
Good	75 - 94	Acceptable
Excellent	95 - 100	Pristine Quality

Results and Discussion

Temperature (ºC)

Table 4 lists the two-year temperature data across three seasons. Tables 5-7 presents some descriptive findings based on the data in Table 4. The water temperature ranged between 18.5 ºC to 31.1 ºC during the study period (Figure 3). It ranged between 18.8 ºC to 27.8 ºC in the year 2015-16 and between 18.5 ºC to 31.1 ºC in 2016-17. Seasonal variations in surface water temperature are illustrated in Figures 1-3.

Table 4 Year-wise and Season-wise Temperature (ºC) of Budhasagar Pond Water

Season / Sample	2015-16				2016-17			
	A	B	C	Mean±S.D.	A	B	C	Mean±S.D.
Winter	19	19.2	18.8	19±0.2	18.5	19.3	18.7	18.8±0.41
Summer	27.3	27.7	27.8	27.6±0.26	29.4	30.6	31.1	30.3±0.87

Post-monsoon	23.5	23.6	23.7	23.6±0.1	24.3	24.7	25.1	24.7±0.4

Table 5 Descriptive Statistics on Temperature (ºC) for the Year 2015-16

	Winter	*Summer*	*Post Mon.*
Mean	19	27.6	23.6
S.E.	0.11547	0.152753	0.057735
Median	19	27.7	23.6
S.D.	0.2	0.264575	0.1
Sample Variance	0.04	0.07	0.01
Skewness	0	-1.45786	1.6E-13
Range	0.4	0.5	0.2
Minimum	18.8	27.3	23.5
Maximum	19.2	27.8	23.7

Table 6 Descriptive Statistics on Temperature (ºC) for the Year 2016-17

	Winter	*Summer*	*Post Mon.*
Mean	18.83333	30.36667	24.7
S.E.	0.24037	0.504425	0.23094
Median	18.7	30.6	24.7
S.D.	0.416333	0.873689	0.4
Sample Variance	0.173333	0.763333	0.16
Skewness	1.293343	-1.11608	4E-14
Range	0.8	1.7	0.8
Minimum	18.5	29.4	24.3
Maximum	19.3	31.1	25.1

Table 7 Descriptive Statistics on Temperature (2015-16 to 2016-17)

	Winter	*Summer*	*Post Mon.*
Mean	18.9	28.95	24.15
S.E.	0.1	1.35	0.55
Median	18.9	28.95	24.15
S.D.	0.141421	1.909188	0.777817
Sample Variance	0.02	3.645	0.605
Range	0.2	2.7	1.1
Minimum	18.8	27.6	23.6
Maximum	19	30.3	24.7

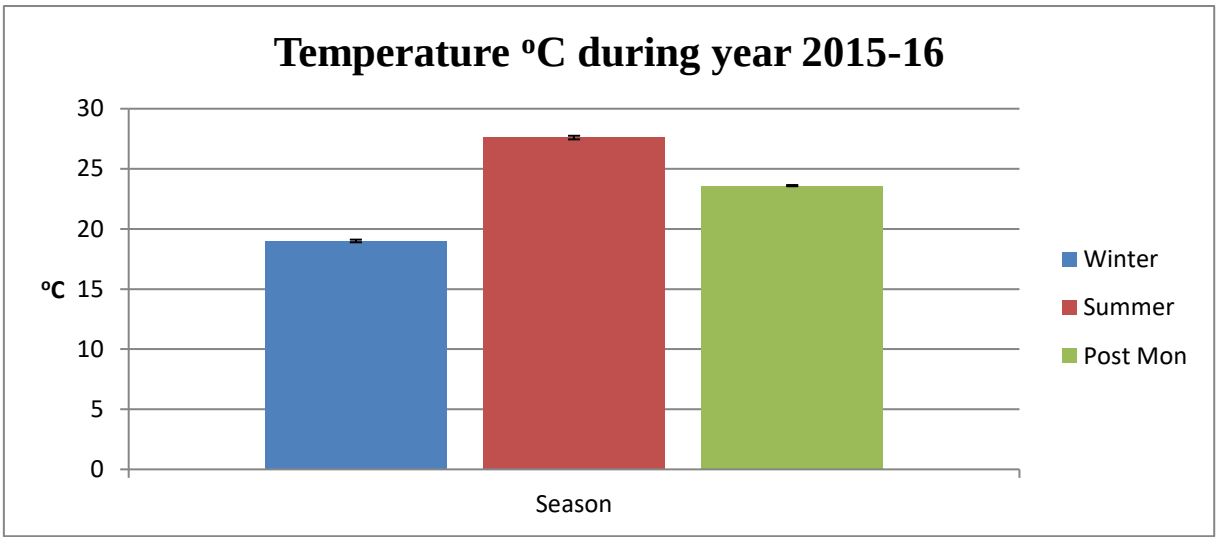

Figure 1

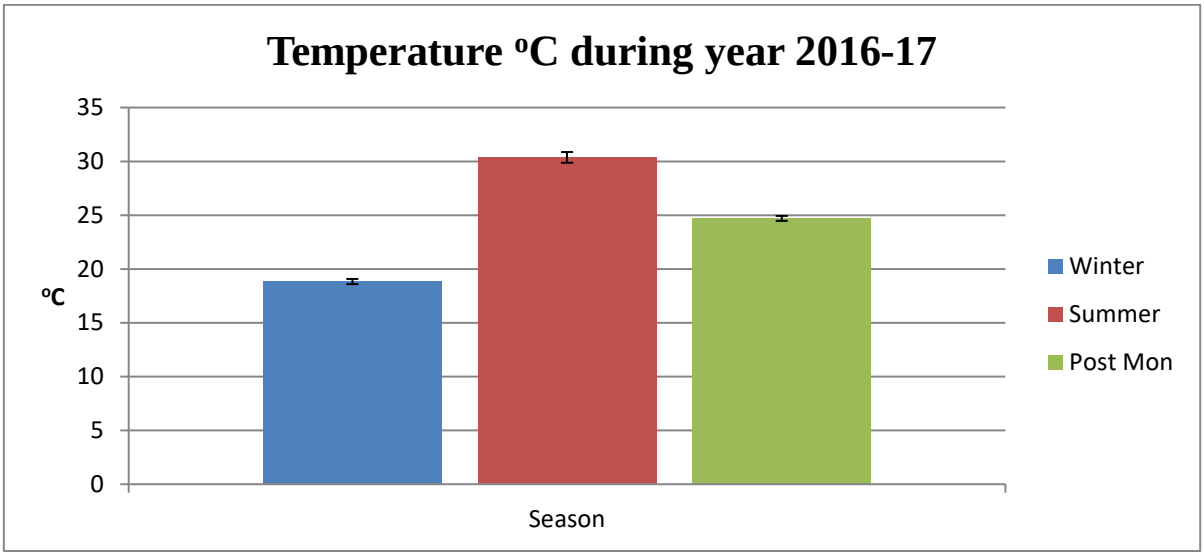

Figure 2

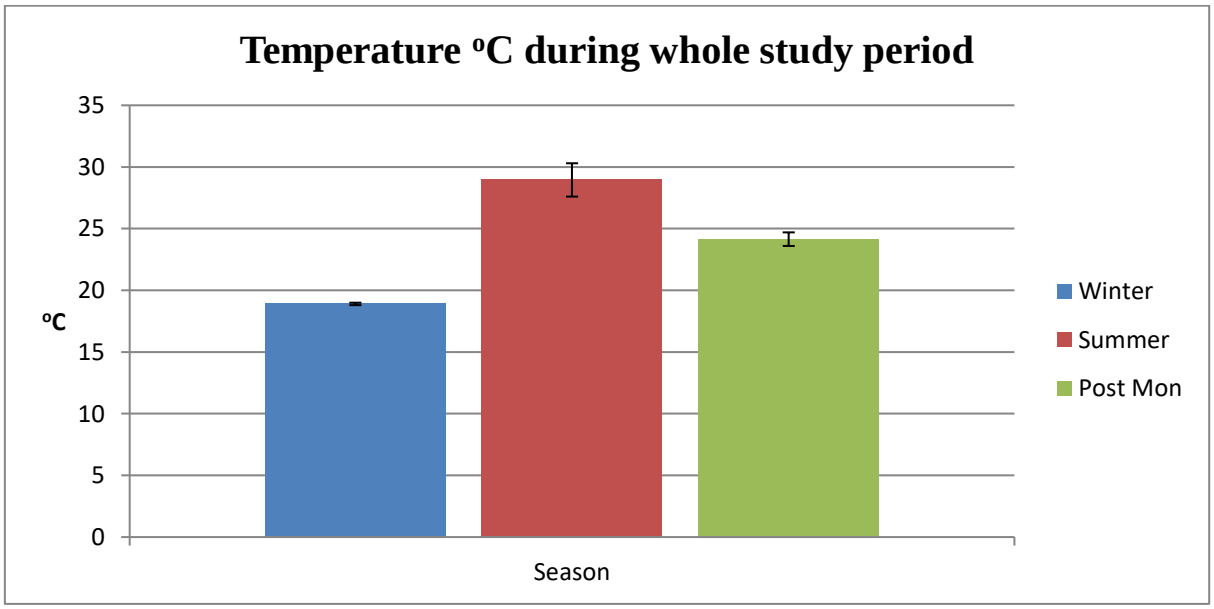

Figure 3

pH

The pH index is a useful tool for determining whether or not something is acidic, alkaline, or neutral in nature. The growth of aquatic Flora and Fauna is restricted by pH. Water's hydrogen ion content (H+) controls the pH. There are fourteen possible outcomes. Any amount above or below 7 is alkaline, and any value in the middle falls somewhere in the middle. At a given temperature, pH measures the activity of hydrogen ions in solution. It is the inverse of hydrogen ion (H+) and is expressed as a mole per litre concentration (APHA 1989). Table 8 lists the two-year pH data across three seasons. Tables 9-11 presents some descriptive findings based on the data in Table 8. The water pH level ranged between 18.5 ^{o}C to 31.1 ^{o}C during the study period (Figure 6). It ranged between 18.8 ^{o}C to 27.8 ^{o}C in the year 2015-16 and between 18.5 ^{o}C to 31.1 ^{o}C in 2016-17. Seasonal variations in pH levels are illustrated in Figures 4-6.

Table 8 pH Year wise and Season wise Budhasagar Pond

Season / Sample	Year 2015-16				Year 2016-17			
	A	B	C	Mean±S.D.	A	B	C	Mean±S.D.
Winter	6.7	6.9	6.8	6.8 ± 0.1	6.8	6.8	7.2	6.9±0.23
Summer	6.9	7.2	7	7.1±0.1	7.5	7.4	7.5	7.4±0.05
Post-monsoon	6.8	7.1	6.8	6.9±0.15	7.2	7.4	7.4	7.3±0.11

Table 9 Year 2015-16 pH Descriptive Statistics

	Winter	*Summer*	*Post Mon*
Mean	6.8	7.033333	6.9
S.E.	0.057735	0.088192	0.1
Median	6.8	7	6.8
S.D.	0.1	0.152753	0.173205
Sample Variance	0.01	0.023333	0.03
Range	0.2	0.3	0.3
Minimum	6.7	6.9	6.8
Maximum	6.9	7.2	7.1

Table 10 Year 2016-17 pH descriptive statistics

	Winter	*Summer*	*Post Mon*
Mean	6.933333	7.466667	7.333333
S.E.	0.133333	0.033333	0.066667
Median	6.8	7.5	7.4
Mode	6.8	7.5	7.4
S.D.	0.23094	0.057735	0.11547
Sample Variance	0.053333	0.003333	0.013333
Skewness	1.732051	-1.73205	-1.73205
Range	0.4	0.1	0.2

Table 11 Whole study period pH descriptive statistics

	Winter	*Summer*	*Post Mon*
Mean	6.85	7.25	7.1
S.E.	0.05	0.15	0.2
Median	6.85	7.25	7.1
S.D.	0.070711	0.212132	0.282843
Sample Variance	0.005	0.045	0.08
Range	0.1	0.3	0.4
Minimum	6.8	7.1	6.9
Maximum	6.9	7.4	7.3

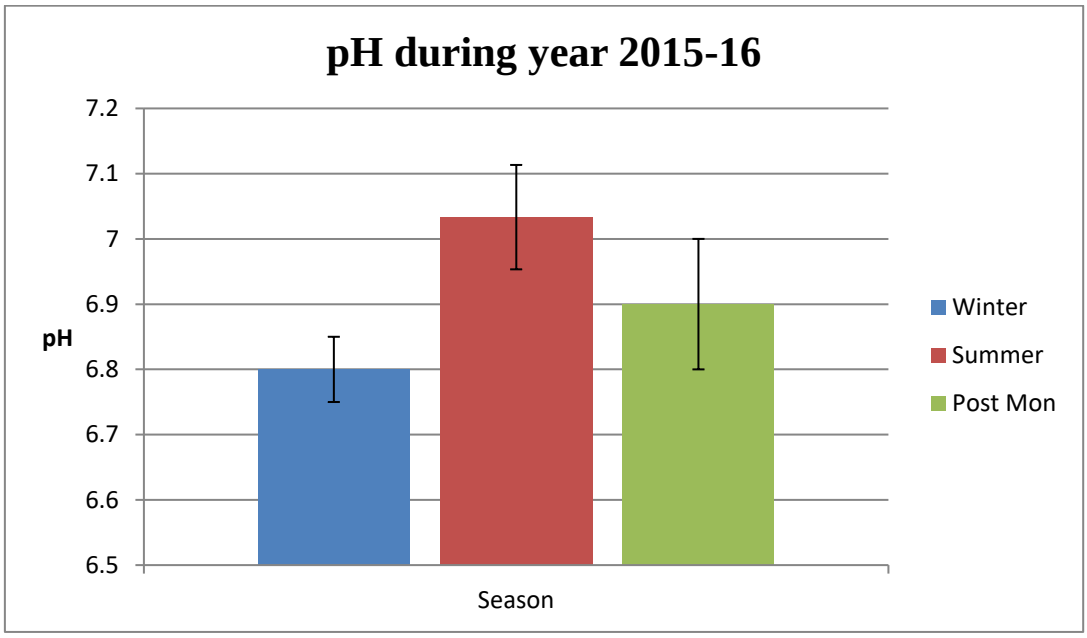

Figure 4

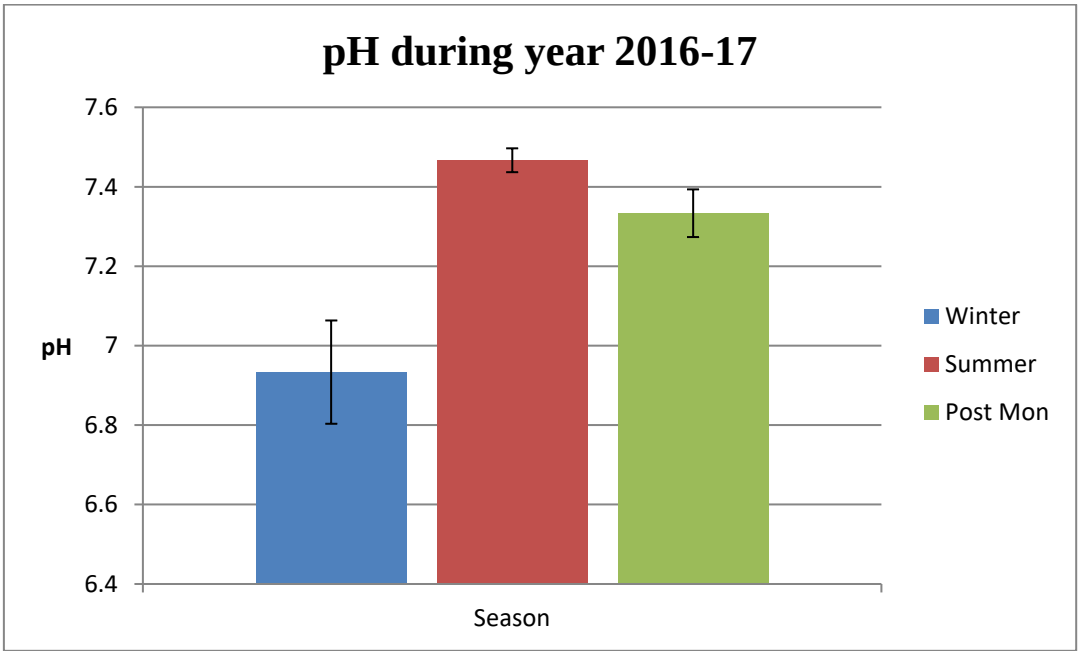

Figure 5

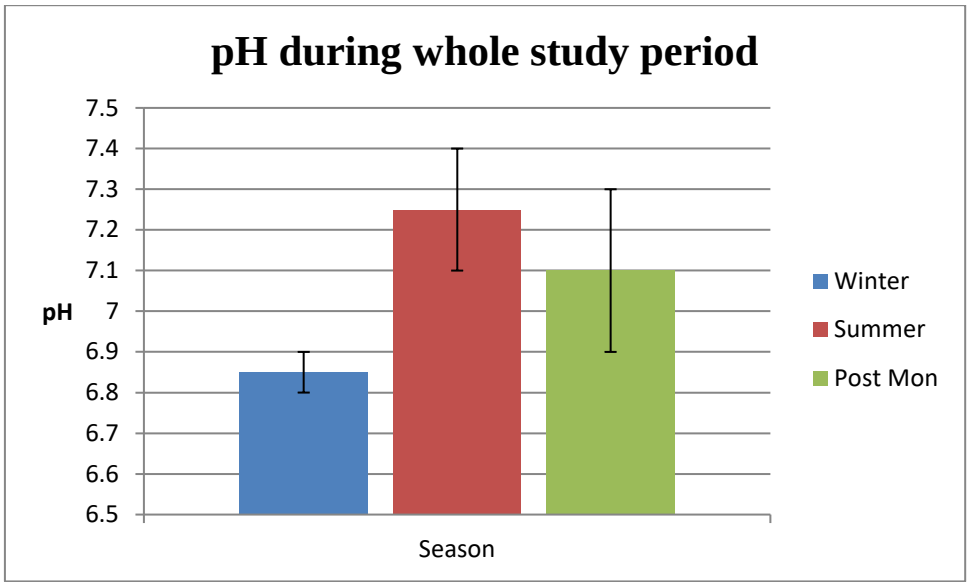

Figure 6

Dissolved Oxygen

All aquatic plants and animals rely on dissolved oxygen for proper metabolism. It's a crucial water quality indicator since it tells us a lot about what's going on biochemically in the water. Dissolved oxygen levels in ponds can fluctuate a lot in a day. As a result of photosynthesis, oxygen is created during the day. During the day, photosynthesis generates more oxygen than is consumed, therefore oxygen levels are typically lowest just before dawn and highest in the late afternoon. Table 12 lists the two-year dissolved oxygen data across three seasons. Tables 13-15 presents some descriptive findings based on the data in Table 12. The water dissolved oxygen level ranged between 18.5 ^{o}C to 31.1 ^{o}C during the study period (Figure 9). It ranged between 18.8 ^{o}C to 27.8 ^{o}C in the year 2015-16 and between 18.5 ^{o}C to 31.1 ^{o}C in 2016-17. Seasonal variations in surface water dissolved oxygen levels are illustrated in Figures 7-9.

Table 12 Dissolved Oxygen (mg/L) Year wise and Season wise Budhasagar Pond

Season / Sample	Year 2015-16				Year 2016-17			
	A	B	C	Mean±S.D.	A	B	C	Mean±S.D.
Winter	4.5	4.7	4.6	4.6±0.1	4.9	4.7	4.5	4.7±0.2
Summer	3.8	3.8	4.2	3.9±0.230	3.8	3.8	3.5	3.7±0.173
Post-monsoon	6.2	6.1	6.3	6.2±0.1	4.4	4.5	4.4	4.4±0.057

Table 13 Year 2015-16 dissolved oxygen descriptive statistics

	Winter	*Summer*	*Post Mon*
Mean	4.6	3.933333	6.2
S.E.	0.057735	0.133333	0.057735
Median	4.6	3.8	6.2
S.D.	0.1	0.23094	0.1
Sample Variance	0.01	0.053333	0.01

Range	0.2	0.4	0.2
Minimum	4.5	3.8	6.1
Maximum	4.7	4.2	6.3

Table 14 Year 2016-17 dissolved oxygen descriptive statistics

	Winter	*Summer*	*Post Mon.*
Mean	4.7	3.7	4.433333
S.E.	0.11547	0.1	0.033333
Median	4.7	3.8	4.4
Mode		3.8	4.4
S.D.	0.2	0.173205	0.057735
Sample Variance	0.04	0.03	0.003333
Range	0.4	0.3	0.1
Minimum	4.5	3.5	4.4
Maximum	4.9	3.8	4.5

Table 15 Whole study period dissolved oxygen descriptive statistics

	Winter	*Summer*	*Post Mon.*
Mean	4.65	3.8	5.3
S.E.	0.05	0.1	0.9
Median	4.65	3.8	5.3
S.D.	0.070711	0.141421	1.272792
Sample Variance	0.005	0.02	1.62
Range	0.1	0.2	1.8
Minimum	4.6	3.7	4.4
Maximum	4.7	3.9	6.2

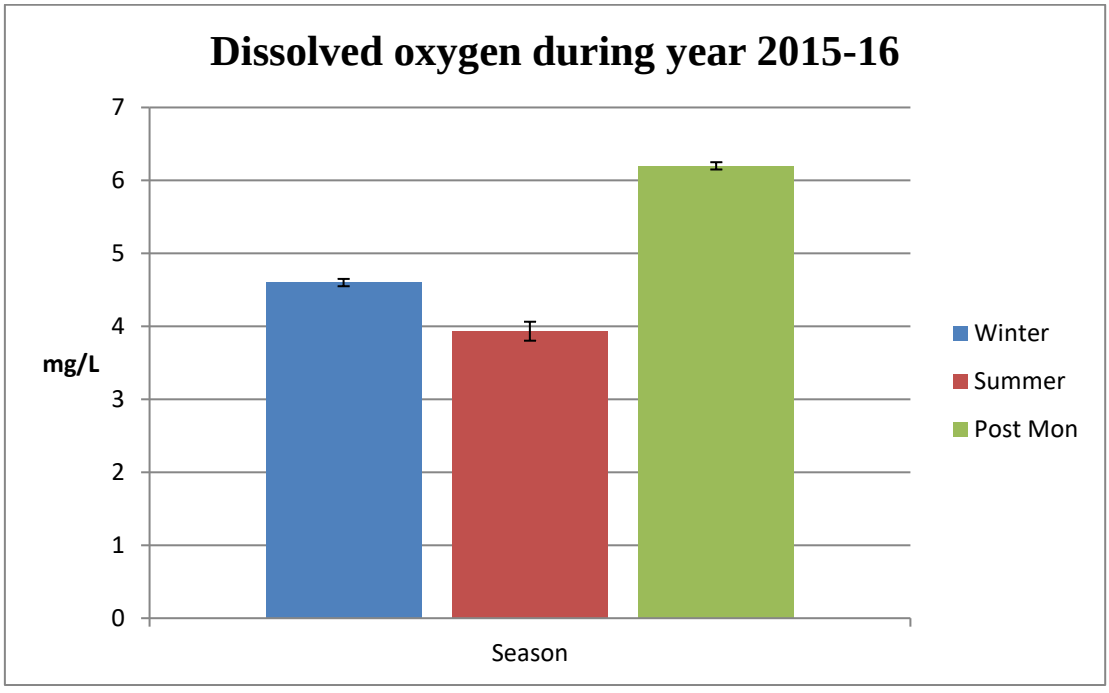

Figure 7

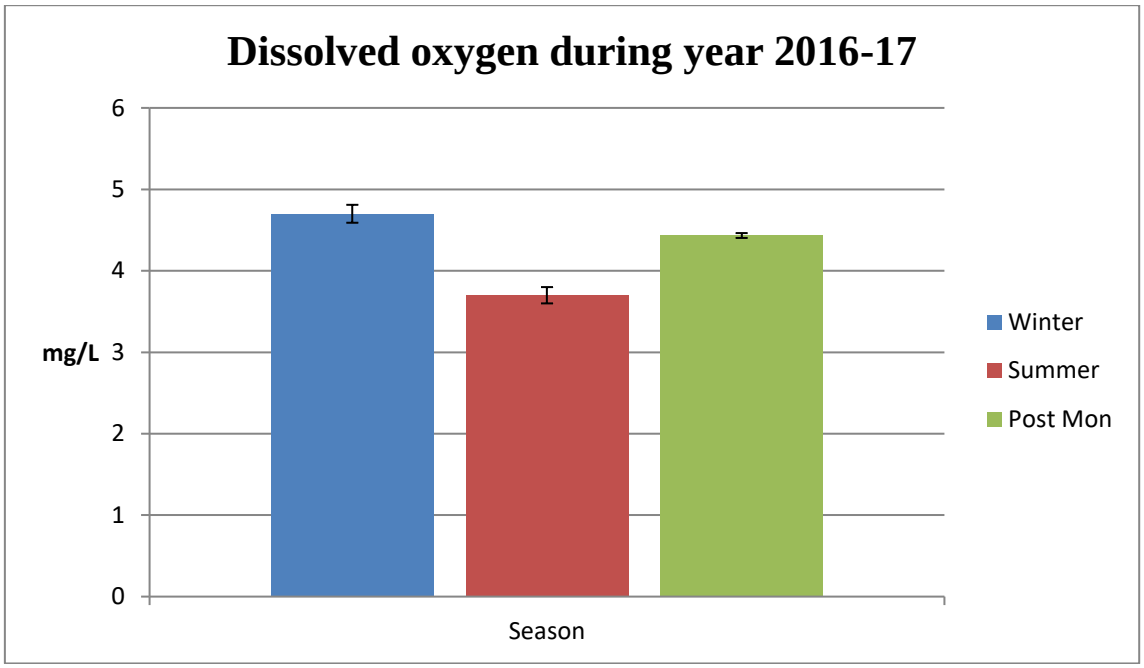

Figure 8

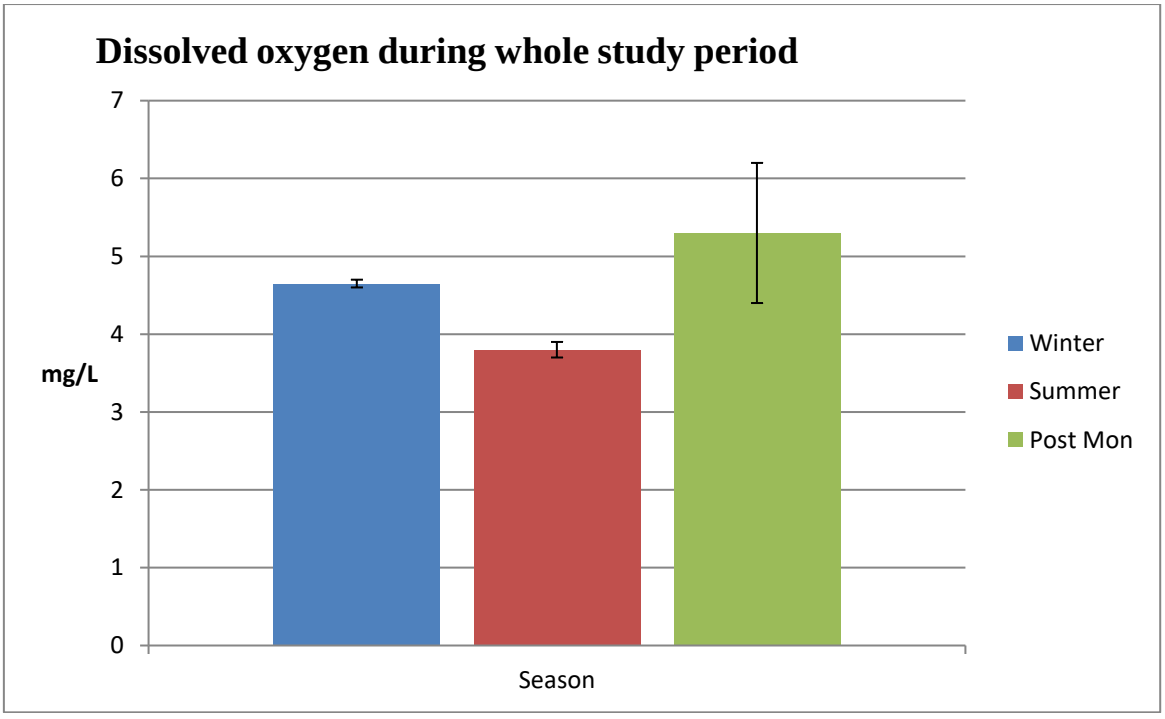

Figure 9

Total Hardness (TH)

Bivalent cations like Calcium and Magnesium, which are abundant in nature, are the primary cause of hardness. Calcium and Magnesium concentrations, both given as mg/L of CaCO3, are used to calculate total hardness. Temporary hardness is caused by calcium and magnesium carbonates and bicarbonates. Permanent Hardness is the result of exposure to sulphates and chlorides. Table 16 lists the two-year total hardness data across three seasons. Tables 17-19 presents some descriptive findings based on the data in Table 16. The water total hardness ranged between 18.5 ^{o}C to 31.1 ^{o}C during the study period (Figure 12). It ranged between 18.8 ^{o}C to 27.8 ^{o}C in the year 2015-16 and between 18.5 ^{o}C to 31.1 ^{o}C in 2016-17. Seasonal variations in total hardness levels are illustrated in Figures 10-12.

Table 16 Total Hardness Year wise and Season wise Budhasagar Pond

Season / Sample	Year 2015-16				Year 2016-17			
	A	B	C	Mean±S.D.	A	B	C	Mean±S.D.
Winter	140	142	141	141±1	145	149	148	147.3±2.08
Summer	171	173	172	172±1	197	193	194	194.6±2.08
Post-monsoon	120	126	126	124±3.46	129	131	130	130±1.00

Table 17 Year 2015-16 Total Hardness Descriptive Statistics

	Winter	*Summer*	*Post Mon.*
Mean	141	172	124
S.E.	0.57735	0.57735	2
Median	141	172	126
S.D.	1	1	3.464102
Sample Variance	1	1	12
Skewness	0	0	-1.73205
Range	2	2	6
Minimum	140	171	120
Maximum	142	173	126

Table 18 Year 2016-17 Total Hardness Descriptive Statistics

	Winter	*Summer*	*Post Mon*
Mean	147.3333	194.6667	130
S.E.	1.20185	1.20185	0.57735
Median	148	194	130
S.D.	2.081666	2.081666	1
Sample Variance	4.333333	4.333333	1
Skewness	-1.29334	1.293343	0
Range	4	4	2
Minimum	145	193	129
Maximum	149	197	131

Table 19 Whole Study Period Total Hardness Descriptive Statistics

	Winter	*Summer*	*Post Mon*
Mean	144.15	183.3	127
S.E.	3.15	11.3	3
Median	144.15	183.3	127
S.D.	4.454773	15.98061	4.242641

Sample Variance	19.845	255.38	18
Range	6.3	22.6	6
Minimum	141	172	124
Maximum	147.3	194.6	130

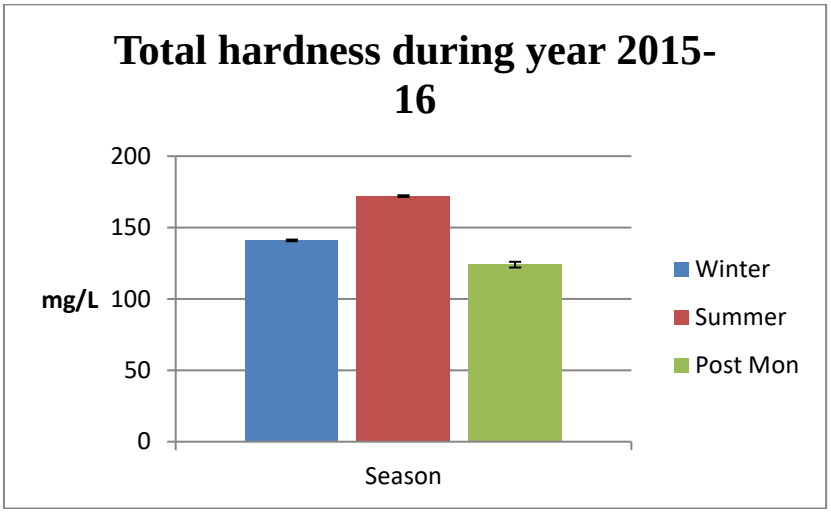

Figure 10

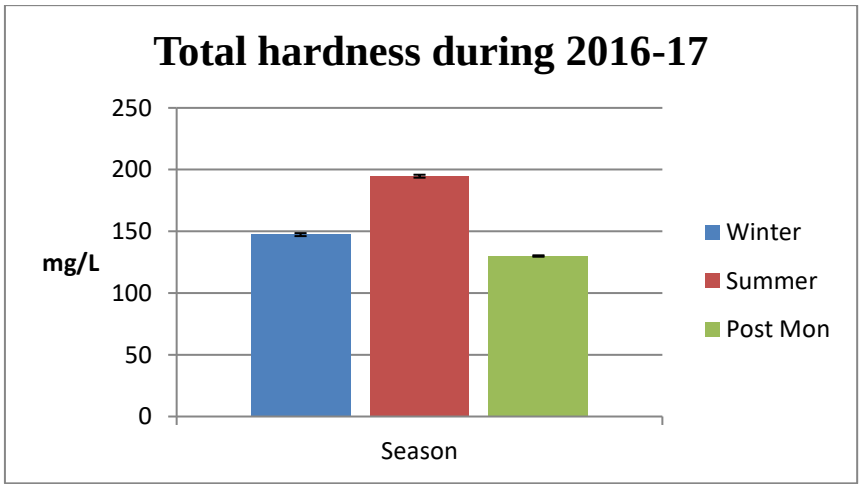

Figure 11

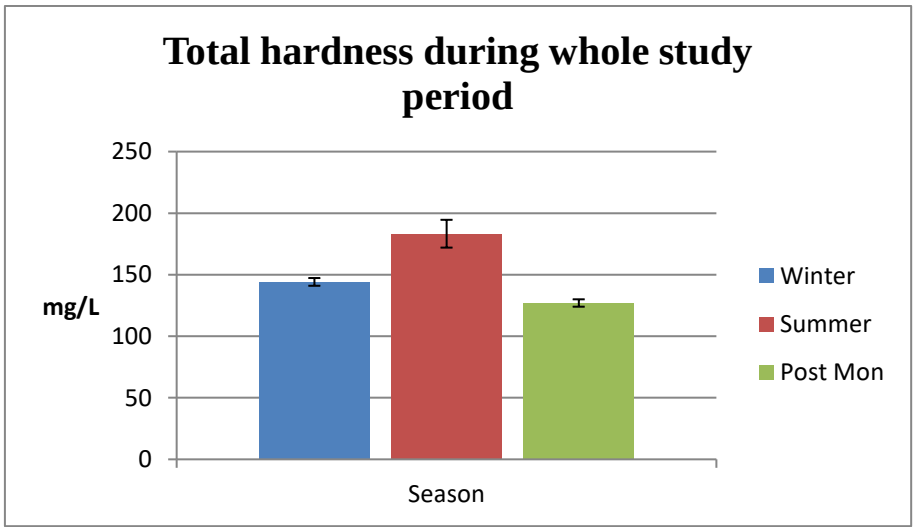

Figure 12

Chloride

Chloride is a salt of sodium, potassium, and calcium that naturally exists in water. Except when transformed into toxic oxides, chloride is relatively non-toxic to plants and animals. A high chloride value degrades flavour and has the potential to corrode metal surfaces. Table 20 lists the two-year chloride data across three seasons. Tables 21-23 presents some descriptive findings based on the data in Table 20. The chloride level ranged between 18.5 ^{o}C to 31.1 ^{o}C during the study period (Figure 15). It ranged between 18.8 ^{o}C to 27.8 ^{o}C in the year 2015-16 and between 18.5 ^{o}C to 31.1 ^{o}C in 2016-17. Seasonal variations in chloride levels are illustrated in Figures 13-15.

Table 20 Chloride Year-wise and Season-wise Budhasagar pond

Season / Sample	Year 2015-16				Year 2016-17			
	A	B	C	Mean±S.D.	A	B	C	Mean±S.D.
Winter	94	89	91	91.33±2.51	89	92	91	90.66±1.52
Summer	100	95	94	96.33±3.21	99	95	97	97±2
Post-monsoon	84	82	79	81.66±2.51	83	80	84	82.33±2.08

Table 21 Year 2015-16 Chloride Descriptive Statistics

	Winter	*Summer*	*Post Mon*
Mean	91.33333	96.33333	81.66667
S.E.	1.452966	1.855921	1.452966
Median	91	95	82
S.D.	2.516611	3.21455	2.516611
Sample Variance	6.333333	10.33333	6.333333
Skewness	0.585583	1.545393	-0.58558
Range	5	6	5
Minimum	89	94	79
Maximum	94	100	84

Table 22 Year 2016-17 Chloride Descriptive Statistics

	Winter	*Summer*	*Post Mon*
Mean	90.66667	97	82.33333
S.E.	0.881917	1.154701	1.20185
Median	91	97	83
S.D.	1.527525	2	2.081666
Sample Variance	2.333333	4	4.333333
Skewness	-0.93522	0	-1.29334
Range	3	4	4
Minimum	89	95	80
Maximum	92	99	84

Table 23 Whole Study Period Chloride Descriptive Statistics

	Winter	*Summer*	*Post Mon*
Mean	90.995	96.665	81.995
S.E.	0.335	0.335	0.335
Median	90.995	96.665	81.995
S.D.	0.473762	0.473762	0.473762
Sample Variance	0.22445	0.22445	0.22445
Range	0.67	0.67	0.67
Minimum	90.66	96.33	81.66
Maximum	91.33	97	82.33

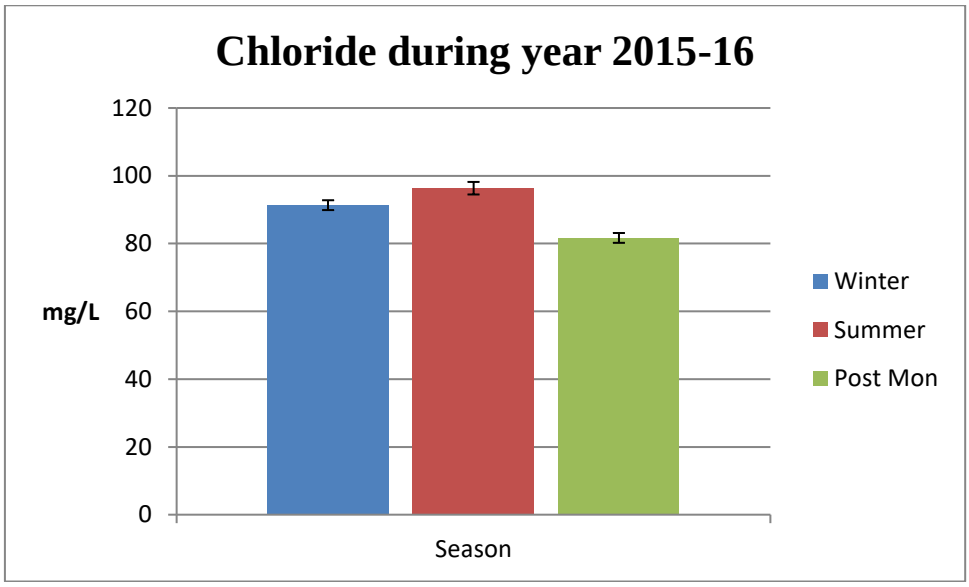

Figure 13

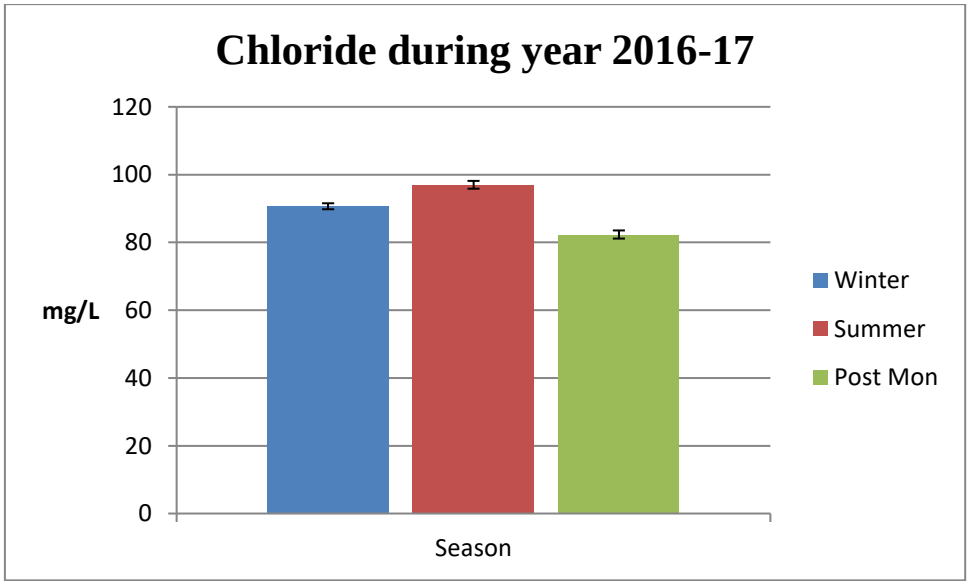

Figure 14

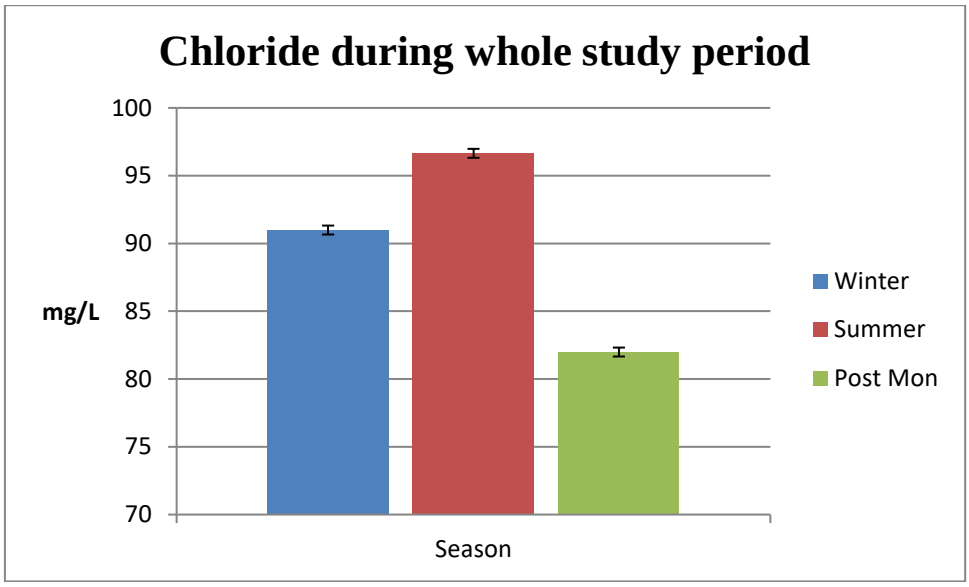

Figure 15

Overall water quality index (OWQI)

Overall water quality index shows status of water based on physiochemical properties. In the present study, it ranges from fair to good class. Fair indicates that the water body is contaminated and requires treatment such as filtration before consumption. Good class is indicative of acceptable quality of water. Good class water is safe to consume without treatment. Continuous evaporation due to high ambience temperature during the summer season in both years resulted in fair class categorisation of the pondwater. It was recorded as fair also during the post-monsoon season in 2016-17. In 2015-16, during the post-monsoon season, and during winters in 2015-16 and 2016-17, the water quality was recorded as good.

OWQI ranged between 69.28 to 86.85 during the two-year study period. It is recommended filtration and disinfection be carried out to clean the pondwater as it poses health risks to the aquatic life of the pond and to people dependent on the pond in one way or the other.

Summary and Conclusion

In the year 2015-16, the mean surface water temperature was recorded at 19±0.2 ^{o}C in winters, 27.6±0.26 ^{o}C during the summer season and 23.6±0.1 ^{o}C during the post-monsoon season. In 2016-17, the mean surface water temperature was recorded at 18.8±0.41 ^{o}C in winters, 30.3±0.87 ^{o}C during summer and 24.7±0.4 ^{o}C during the post-monsoon season.

In 2015-16, during the winter season, the mean dissolved oxygen value was found to be 4.6±0.1 mg/L. During the summer season, the mean dissolved oxygen value was found to be 3.9±0.23 mg/L. In the post-monsoon season, it was 6.2±0.1 mg/L. In 2016-17, during the winters, the mean dissolved oxygen value was 4.7±0.2 mg/L. The mean dissolved oxygen value was 3.7±0.17 mg/L in summer and 4.4±0.057 mg/L during the post-monsoon season.

The mean total hardness values ranged between 124±3.36 mg/L during the post-monsoon season to 141±0.1 mg/L in winters and 172±1 mg/L during summers in the year 2015-16. In 2016-17, the mean total hardness values ranged between 130±1.00 mg/L (post-monsoon seasons) to 147±2.08 mg/L (during winters) and 194.6±2.08 mg/L (during summer).

In 2015-16, the mean chloride value was 91.33±2.51 mg/L in winters, 96.33±3.21 mg/L in summer, and 81.66±2.51 mg/L during the post-monsoon season. Comparatively, it ranged between 80 mg/L (post-monsoon) to 99 mg/L (summer) in 2016-17.

Over the course of two years, the water temperature at Budhasagar Pond fluctuated between 18.5°C and 31.1°C, with the majority of the variation reflecting changes in air temperature. This pattern was observed by Welch (1952), Rao (1955), Munawar (1970a &

b), Hannan et al. (1974), Swarup et al. (1979), Harshey et al. (1982), Bagde and Verma (1985a & b), Sarwar (1985c & b), and Hannan et al. (1987) as well.

Over the course of the research, the pH of the water varied from 6.7 to 7.5. In the summer, the pH was found to be a little higher (May-June). After the monsoon season, pH values dropped substantially, with the lowest pH occurring in the winter. Higher pH values during summer have also been reported in different water bodies by Seenayya (1971), Zutshi and Vass (1978), Singh et al. (2009), Sithik et al. (2009), Godghate et al. (2013), Wanganeo (1984), Mishra (1988), Bandopadhyay and Gopal (1991), Khalique and Afser (1995), and Narain and Chauhan (2000).

During the summer, the pond's dissolved oxygen levels were lower and during the winter they were greater. The dissolved oxygen levels were highest following the monsoon season. Hutchinson (1957), Reid (1961), Ray et al. (1966), Badola and Singh (1981), Bandopadhyay and Gopal (1991), Munshi and Singh (1991), Shastree et al. (1991), Pandey et al. (1993), and Esmaeili and Johal (2005) have all come to similar conclusions.

The total hardness value ranged between 120 and 197 mg/L during the study period. Chloride levels were highest in summer, mild in post-monsoon, and lowest in winters. Ganpati (1940) and Zafar (1967), Hosmani (1975), Bhattacharya (1988), and Borker et al. (1988) have observed similar patterns in their research.

OWQI ranged between 69.28 to 86.85 during the two-year study period. It is recommended filtration and disinfection be carried out to clean the pondwater as it poses health risks to the aquatic life of the pond and to people dependent on the pond in one way or the other.

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HEAVY METALS UPTAKE BY OREOCHROMIS MOSSAMBICUS OF BUDHASAGAR POND

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ABSTRACT

Food consumption is a major source through which humans as well as other animals are exposed to toxic heavy metals. Many reported studies have confirmed that contamination of heavy metals via the food chain can cause human health risk because of their toxicity, long persistence, bioaccumulation, and biomagnification. Heavy metals disrupt cellular events including growth, proliferation, damage-repairing processes, and apoptosis. Studies have widely used fishes as a bioindicator of metal pollution in the aquatic ecosystem for advantages discussed in the previous sections. Studying heavy metals presence in fishes has another advantage. Since we eat fish, it also tells us about possible health risks it poses for us to consume contaminated fish. We measured the presence of heavy metals, namely, mercury, lead, cadmium, and chromium in gills, livers, and muscles of Oreochromis mossambicus of Budhasagar pond using Target Hazard Quotient (THQ) and Hazard Index (HI). An HI of >1 indicates health risks, that <1 indicates a safe level of exposure. HI was recorded at safe levels in gills, livers, and muscles for both adults and children. Similarly, THQ too was found within the safe limits of 1 for each of the four heavy metals across the study period.

***Keywords**: Oreochromis mossambicus, heavy metals contamination, Budhasagar pond.*

Introduction

Even though two-third of the Earth's surface is covered with water, only 1% of this is freshwater. This freshwater is mainly found in ponds, rivers, lakes, and groundwater. These sources have served and supported evolving needs of the human civilization for millennials. Unfortunately, the latest evolution in the human civilization that took place in the form of industrial revolution in the 18th century has come to threaten the freshwater security for the whole human civilization as well as various animal and plant kingdoms. Researchers have attempted to bring attention to this growing insecurity and have predicted water insecurity to be the biggest crisis of the 21st century.

Water pollution is one of three major pollutions threatening the environment today. It is a broad term defined by the presence of unwanted contaminants in water and includes seawater as well as freshwater contamination. Seawater pollution threatens ocean and sea habitats such as seawater plants and fishes. Disposal of plastic at beaches and oil spills are two major sources of seawater pollution. Freshwater contamination is due to three primary sources: domestic, agriculture, and industrial. Disposal of domestic waste and sewage discharge into rivers and ponds pollute these freshwater sources. Agricultural runoffs containing chemical fertilizers and discharge of untreated industrial waste are major and most lethal sources of freshwater contamination.

The presence of heavy metals such as iron, lead, and cadmium in agriculture runoffs and industrial water make contaminated freshwater unsafe for human use. Heavy metals are elements with an atomic density of more than 4 g/cm^3 (Nriagu, 1988). Some of the major sources of heavy metals pollution of freshwater bodies include sewage discharge, agricultural runoffs, battery industry, metal electroplating, chrome plating, tanning and leather industry, and dyes industries (Farmaki and Thomaidis, 2008).

While the human body needs certain heavy metals such as iron, zinc, chromium, copper and manganese up to a limited extent for proper functioning of organs, other heavy metals such as mercury and lead are non-essential and even the slightest presence of these metals in the human body can prove to be lethal (Unger, 2002). International and national authorities such as the European Union and the United States Environmental Protection Agency have defined permissible limits for the presence of different heavy metals in food products (see Table 1). Above these permissible limits, the food is considered unsafe for human consumption (Nolan, 2003; Young, 2005).

Table 1 Permissible limits of different heavy metals in drinking water

Heavy metals	USEPA (mg/L)	Indian Standards (mg/L)
Cadmium (Cd)	0.005	0.01
Chromium (Cr)	0.05	0.05
Iron (Fe)	0.3	0.3
Lead (Pb)	0.05	0.1
Manganese (Mn)	0.05	0.1
Mercury (Hg)	0.002	0.001
Nickel (Ni)	0.1	0.05

Source: Gautam et al. (2016)

Certain properties of heavy metals make them more toxic to consume than other contaminants. First of all, consumption of heavy metals such as mercury and lead or even the essential ones like iron and zinc, if taken in a dose more than a certain limit, can lead to deadly diseases such as cancer (Unger, 2002). Secondly, heavy metals tend to accumulate as they pass from one stage to another in the food chain. This phenomenon is known as bioaccumulation and results in an increased concentration of heavy metals in tertiary-level fishes which makes them unsafe for human consumption.

Mercury (Hg)

Some heavy metals are also more toxic than others. Consumption of mercury even in the slightest amount can result in nervous system disorder such as Minimata. The Minimata disease was unknown until 1952 when consumption of local fish and shellfish contaminated with mercury compounds lead to the rapid spread of the disease at Japanese coasts and erupted into an epidemic (Takeuchi, 1968; Vandecasteele and Block, 1991). Mercury is also the only common metal that exists in the liquid form at room temperature. It is found mainly in compound forms in nature. Consumption of mercury can lead to disruptions in the nervous and excretory systems, disrupt brain activities, damage DNA aberrations and male sperm, lead to miscarriages and birth defects in pregnant women, and develop allergic reactions like rashes and headache.

Lead (Pb)

Burning of petroleum products is the primary source of lead pollution. Lead emissions from petrol engine contain lead bromides, oxides, and chlorides. Smaller particles pollute the air while bigger particles fall and pollute soil and water bodies. Corrosion of pipelines and pesticide runoffs from agricultural fields may as well contaminate freshwater bodies with lead which may then bioaccumulate through various stages of food chain, eventually entering the human body either through air or via consumption of contaminated fish or water (Jarup, 2003). Use of contaminated water in agricultural field can also result in contaminated vegetables, fruits, and agricultural produce.

Lead is one of the four most toxic heavy metals for human consumption. It can disrupt the biosynthesis of haemoglobin and anaemia, increase blood pressure, result in kidney failure, miscarriage, damage brain activities, affect the fertility of men, and result in behavioural changes in children (Duruibe et al., 2007). Lead is also capable of transplacental penetration and could damage the nervous system of an unborn body as well (Jarup, 2003).

Cadmium (Cd)

Industrial as well as natural phenomenon can result in cadmium pollution of water. The phenomenon whereby rocks weather and break into sand release cadmium into the environment which may then runoff into water bodies (Hagino, 1961). Industrial waste such as nickel-cadmium batteries too contain cadmium untreated discharge of which into water bodies contaminate these sources of freshwater (Nordberg et al., 2007). Cadmium tends to enter the human body via consumption of cigarettes and fish and sea animals (Bernard, 1986). Diarrhoea, bone disease, reproductive dysfunction, and psychological disorders are some of the adverse health effects of lead consumption (Sethi et al., 2006).

Chromium (Cr)

Chromium is radiant, brittle, dim color metal. The human body requires it to perform certain

vital functions like catabolism of fat and carbohydrate and to control the optimum level of glucose and blood pressure (Anderson, 1989). It is found in two forms in the environment - trivalent and hexavalent. Hexavalent chromium is not found naturally, it is produced by different industrial activities. Hexavalent chromium is loosely dissolved in water and leached into underground water. Sometimes underground water may contain a higher level of chromium (Sullivan, 1969; Towill, 1978). Some industries are directly responsible for releasing chromium into the environment. Industrial establishments like steel, leather tanneries, textile dyeing, printing, photography, and chrome electroplating are mainly responsible for this. Chromium accumulates in aquatic flora and fauna and tend to bioconcentrate at the higher levels of the chain (Hantson, 2005; Adeniyi and Yusuf, 2007; Gupta et al., 2009; Raphael et al., 2011).
Consumption of chromium above the permissible limit of 0.05 mg/L could result in allergic reactions such as rashes, nose irritations, nose bleeding, stomach disorders like ulcers, respiratory complications, nephrological and liver damage, genetic aberrations, and lung cancer (Braver, 1985; Cohen, 1993; Geller, 2001).

Iron (Fe)

Iron contamination of freshwater are generally due to mining activities. Iron pyrites (FeS_2) found in the coalfield releases iron by weathering and bacterial action. Mining and oxidation of iron pyrite results in the production of sulphuric acid and the formation of Ferrous iron (Fe^{2+}) (Smith et al., 1973). Different types of iron ores like hematite and magnetite when comes in contact with acidic water releases ferrous and ferric ion. Ferrous ion (Fe^{2+}) is considered more toxic to fish than the ferric ion (Fe^{3+}) (Decker et al., 1978).
Iron plays a vital role as a part of enzymes such as catalase and cytochrome, and most importantly, as a part of hemoglobin and myoglobin. It is commonly found in all freshwater environments (Livingstone, 1963; Forstner et al., 1979). High iron content in water causes corrosion and rust formation of pipelines and can be toxic at high concentrations (Theis et al., 1974). Iron's ability to transfer electrons means that it can form free radicals; it can convert hydrogen peroxide into free radicals. Free radicals can damage the structure of the cell and ultimately kill the cell (Crichton et al., 2002).

Research Geography and Objectives

The research has been carried out with fish samples from the Budhasagar pond situated in the Indian state of Chhattisgarh. Budhasagar is a man-made perennial pond and is filled with water year-round. It is also connected with the municipal sewage of the Baldeobagh town. It also used to carry the industrial waste of a cotton mill in the town. The mill shut a couple of years ago, however. The pond serves the bathing and washing needs of town residents and fishing culture has also been continued since it was first started in 1961. Given the fact that the pond is sewage-fed and once served the disposal of a cotton mill, it is imperative to think that the pond and its fish habitats may be contaminated with heavy metals. We collected samples of *Oreochromis Mossambicus* from the pond across three seasons in 2016-17 and measured the concentration of heavy metals in their gills, livers, and muscles.

Literature Review

The toxicity of heavy metals in fish was studied by Khangarot and Ray (1987). Kureishy and D'Silva (1993) carried out experiments on *Perna viridis, Villorita cypriniides*, and *Oreochromis mossambicus* and found cadmium, lead, and mercury accumulation in these fishes. Hepatic, renal, and gill histopathological abnormalities were seen in fish treated with copper, cadmium, and mercury by Manoj and Ragothaman (1999). Heavy metals have been studied in freshwater *Channa punctatus* by Shukla et al. (n.d.) and Gupta and Dua (2002). The effect of heavy metals on *Cirrhinus mrigala* was studied by Sharma and Jain (2004).
Heavy metal levels in soil, water and fish from the sewage-fed pond were examined by Pandey et al. (1995). The build-up of nickel, copper, and cadmium in fish tissues was also investigated by Balasubramanian et al. (1997) in a sewage-fed pond. The iron, lead, nickel, chromium, zinc, manganese, and cadmium levels discovered in tissues of Yamuna River fish were attributed to fertiliser and chemical

industry effluent, according to Ajmal et al. (1985). Fertilizer, agricultural ashes, industrial effluents, and rubbish contaminated the Cauvery River, and the researchers found high levels of heavy metal in the fish. To find out how much heavy metal is in freshwater, scientists have done a variety of tests. Fish muscle from home sewage and industrial effluent was investigated by Nayaka et al. (2009).

Heavy metals in tissues of *Mystus vittatus* were studied by Rao and Patnaik (2000). Maiti and Banerjee (2002) and Vinodhini and Narayanan (2008) conducted a similar study in Kolkata's various freshwater bodies in *Cyprinus carpio* fish. Heavy metal build-up in fish tissues were studied by Begum et al. (2009b) in Bangalore's Madivala Lake. As the muscle is the most consumed and most heavily contaminated section of fish, Gupta et al. (2009) examined the contamination of *Aorichthys aor* and *Channa punctatus* to check if they were infected. Other studies investigated the presence of heavy metals in freshwater fish tissues and tested them up to the maximum allowable level (Gupta et al., 2002; Shrivastava and Sohani, 2002; Chandrasekhar et al., 2003; Chakraborty et al., 2003; Raja et al., 2009).

Heavy metals in *Oreochromis mossambicus*

Fishes are great bioindicators of metal contamination of a water body as they appear at higher trophic levels allowing for metals to accumulate (Palanichamy and Baskaran, 1995). Since fishes are also eaten by humans, investigating the contamination in fishes also allows us to measure the health risks posed by contamination simultaneously.

James (1990) examined individual as well as combined effects of the heavy metals' contamination on *Oreochromis mossambicus'* respiratory and behavioural responses, their oxygen consumption, and opercular movements. Chatterjee et al. (2006) found that metal concentrations were lowest in muscle and highest in liver in *Oreochromis mossambicus* sampled from coastal waters of Kolkata. Dye et al. (2007) studied the histological changes in the livers of *Oreochromis mossambicus* following exposure to cadmium and zinc. Dye et al. found that longer exposure affected results.

Oreochromis species had a higher metal contamination index value in Malaysian aquaculture ponds where they were compared to Penaeus monodon species (Mokhtar, 2009). Hossein et al. (2015) looked at the build-up of heavy metals in fish tissues from Egypt's Nile River and concluded that species like *Oreochromis* are suitable candidates for bio-monitoring pollution since they can tolerate the harsh circumstances of the ecosystem. Noorjahan and Jamuna (2015) used *Azolla Microphylla* as a biodegradation agent in their study of sewage wastewater treatment and repurposed the treated water for aquaculture. To treat sewage water in a sustainable and environmentally friendly manner while also promoting aquaculture, researchers used *Oreochromis mossambicus* farmed fish.

Research Methodology

Samples of *Oreochromis mossambicus* were collected across winter, summer, and post-monsoon seasons in 2016-17 and their gills, livers, and muscles were studied for presence of heavy metals. The concentration of select heavy metals were recorded in different organs of sample and results analysed using SPSS v. 26. The selection of *Oreochromis mossambicus* is based on the following criteria (Widdows, 1985; Adelman and Smith, 1976).

i) Edible status – Whether the fish is widely consumed by people.
ii) Availability – Whether the fish is available in the pond throughout the year.
iii) Omnivores – Sample fishes should be omnivores to allow bioaccumulation.
iv) Environment tolerability – Sample fishes should have greater tolerability to a wide range of environmental conditions.

Oreochromis mossambicus fulfils all the above criteria. They are widely eaten fish specimen across the state of Chhattisgarh. They also have an advantage over other fish species as they are prolific breeder and eat blue-green algae, insects, and weeds, therefore, contaminants found in these insects and organisms could also be observed in *Oreochromis mossambicus* (Jhingran, 1984). *Oreochromis mossambicus*

are also found in abundance and throughout the year.

Target Hazard Quotient (THQ)

After computing the heavy metals concentration in fish samples, we compared the findings on two indices, e.g., the Target Hazard Quotient (THQ) and the Hazard Index (HI). THQ was developed by the United States Environmental Protection Agency in 1989 and is used for the assessment of potential non-carcinogenic threat associated with exposure to contaminants such as heavy metals in food. The THQ is a ratio of the determined dose of a pollutant to a reference dose level. It has a binary interpretation. A THQ value of < 1 indicates that the contamination is within safe permissible limits, whereas a THQ value of > 1 is indicative of potential risk (USEPA, 2010). One should take care in interpreting THQ as the values are additive but not multiplicative. That is, a THQ value of 20 does not indicate that the risk is tenfold of those at THQ value of 2. THQ doesn't measure risk but is indicative of the level of concern.

We computed the THQ values based on Chien et al.'s (2002) method as follows.

$$THQ = \frac{\text{EF. ED. FIR. C}}{\text{RFD. WAB. TA}} \times 10^{-3}$$

where,

E_F is the exposure frequency measured per 365 days/year,

E_D refers to the exposure duration,

F_{IR} is the food ingestion rate (g/person/day),

C is the total concentration in food (mg/kg),

R_{FD} is the oral reference dose (Table 2),

W_{AB} refers to the average body weight (55kg for adults and 20kg for children), and

T_A is the averaging exposure time for non-carcinogens.

Table 2 USEPA Oral Reference Dose

Heavy metals	**R_{FD} value (mg/kg) (USEPA)**
Cadmium	0.001
Lead	0.004
Mercury	5×10^{-4}
Chromium	0.003
Iron	0.7

Hazard index (HI)

Hazard Index (HI) is based on EPA's guidelines for health risk assessment of chemical mixtures (USEPA, 1986). It is used to measure the overall risk hazard for non-carcinogenic effects posed by more than one heavy metal. HI is given by the sum of THQ as described in the below equation. An HI value of > 1 indicates potential health risks (USEPA, 1989).

$$HI = \sum_{i} \text{THQi}$$

Heavy Metals Analysis

Inductively coupled plasma-optical emission spectrometry (ICP-OES) was used to examine fish samples for heavy metal contamination. The study focused on heavy elements like lead, cadmium, chromium, iron, and mercury. Using the methods provided in the American Public Health Association (2005) and the United States Department of Agriculture, samples were crushed and examined inductively with ICP-OES (Perkin Elmer, 2008). Glassware used in the experiment was rinsed with 10% (v/v) nitric acid and deionized water before the samples were digested. Sterilized surgical blades and scissors were used to defrost fish samples and remove tissues. Acid-washed petri dishes were used to oven-dry fish tissues at 80°C to a consistent weight. Desiccators were used to chill the fish samples. The fish tissues were ground into a fine powder and weighed after being homogenised with a mortar and pestle. Microwave digestion was used to breakdown fish tissues processed in Nitric acid (Table 3). 2 mL of 30% hydrogen peroxide were given to digests after digestion to reduce nitric acid vapours and speed up organic component digestion by raising the temperature (Dig-Acids, 2001).

Blanks are used to ensure that the analysis is authentic. Triplicate analyses of fish samples were performed to ensure high analytical quality. Digested fish samples were diluted in acid-washed standard flasks with 50ml of ion free water and filtered through a 0.45-m filter paper. ICP-OES was used to evaluate digested materials after they had been filtered and purified. Table 4 lists the parameters for the Perkin Elmer Optima 4100DV ICP-OES

system. Standardization was carried out by diluting 1000 mg/L stock solutions of multi-element standard solutions (Merck) (Mohammed, 2007). Heavy metal concentrations in sample fishes were measured in mg/L of dry weight. All tests were carried out in threes to ensure reproducibility and a detection limit of 0.01 mg/kg was used. The results indicated below detection limit (BDL).

Table 3 Microwave digestion program used for fish (Source: USDA, 2008)

S. no.	Temp. (ºC)	Time (min.)	Power (Watt.)
1	25-96	20	1000
2	96	30	1000
3	180	10	1000
4	180	10	1000

Table 4 Summary of the operational parameter setting used for the ICR-OES

Characteristics	Instrument condition
RF Generator	Fully solid-state generator. Operating frequency ~40 MHz
RF Power	Adjustable power between 750 to 1300 Watts
Spray chamber	Scott type
Nebulizer	Cross flow
Plasma gas flow	15 L/min
Auxiliary gas flow	L/min
Nebulizer gas flow	0.60 L/min

Results and Discussion

Table 5, 6 and 7 list the season-wise heavy metals concentrations in gills, livers and muscles of *Oreochromis Mossambicus*, respectively. Figures 1, 3 and 5 indicate the min., max., and other descriptive values of recorded across three seasons for the concentration of mercury, cadmium, chromium, and lead in gills, livers, and muscles, respectively. Figures 2, 4 and 6 respectively indicate the descriptive stats for iron concentration in gills, livers and muscles.

In general, higher concentrations of heavy metals were found in gills except for iron which shows a much greater concentration in livers than gills. On the other hand, muscles had the least concentration for heavy metals across the three seasons for all five metals. Mercury was the only heavy metal (out of the five selected heavy metals) which was not detected at all in summer and post-monsoon samples. A slight amount of mercury from 0.05 to 0.151 mg/Kg was detected in all three organs during the winter season. Cadmium was not detected in gills during the post-monsoon and in muscles in summer as well as post-monsoon seasons.

Table 5 Heavy metals concentration in gills

	Summer	Post Mon	Winter
Mercury	BDL	BDL	0.148
Lead	3.94	2.98	2.88
Cadmium	0.614	BDL	0.04
Chromium	1.08	2.4	3.77
Iron	336	347	286

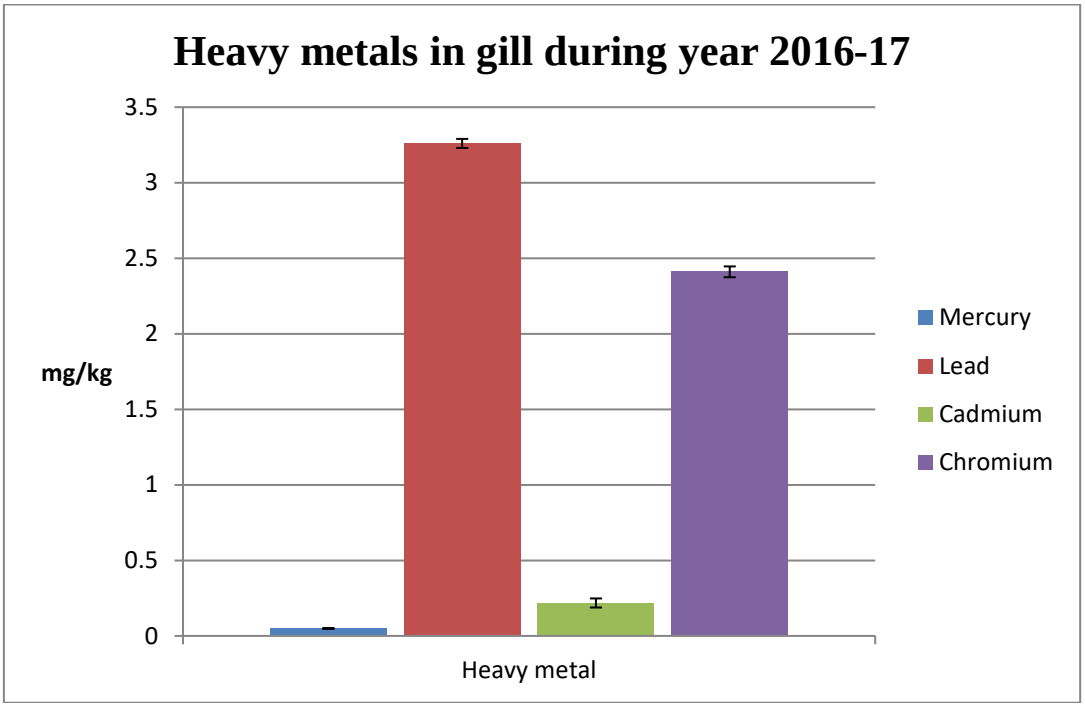

Figure 1

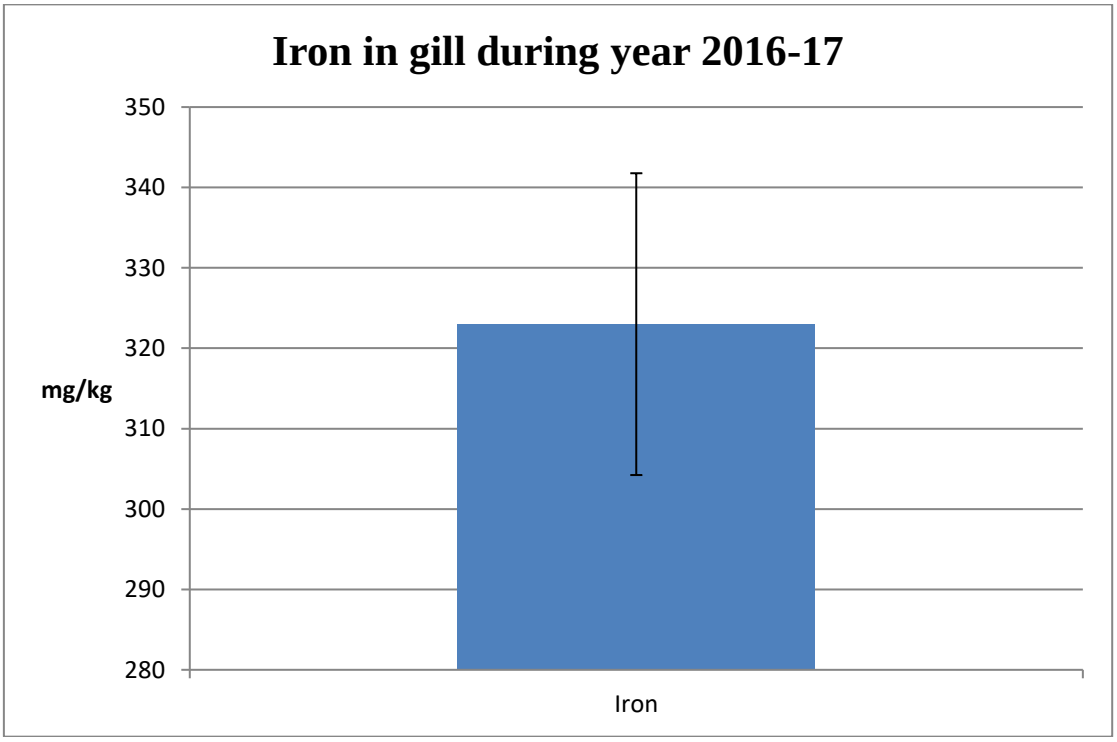

Figure 2

Table 6 Heavy metals concentration in livers

	Summer	Post Mon	Winter	Mean
Mercury	0	0	0.147	0.049
Lead	4.36	3.38	2.85	3.53
Cadmium	0.044	0.85	0.04	0.31
Chromium	5.91	1.72	3.74	3.79
Iron	6649	9351	1784	5928

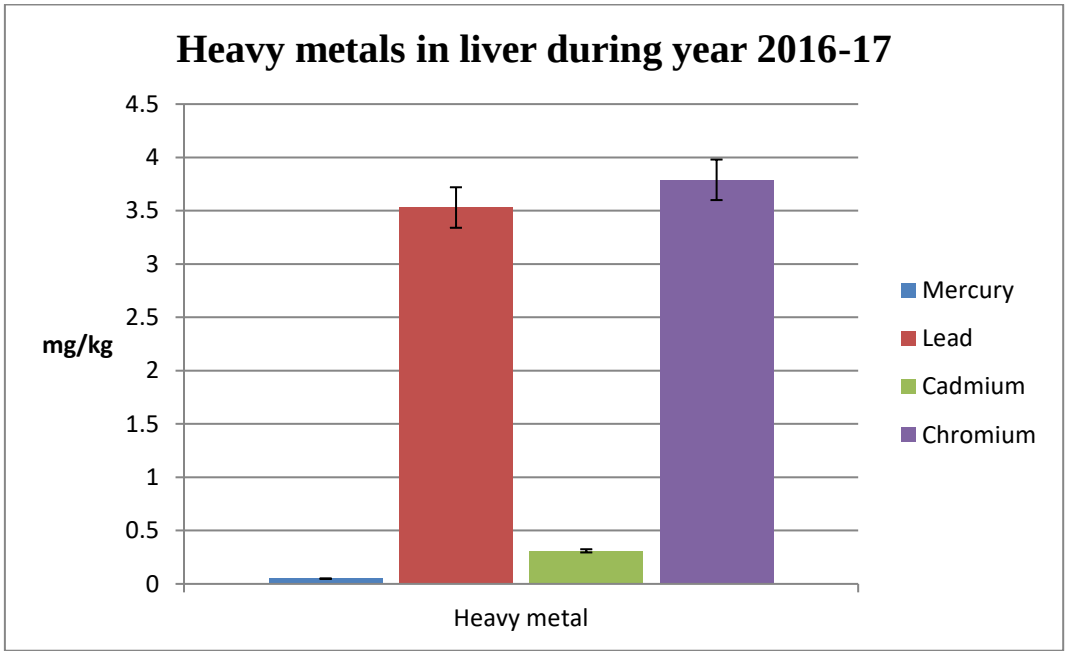

Figure 3

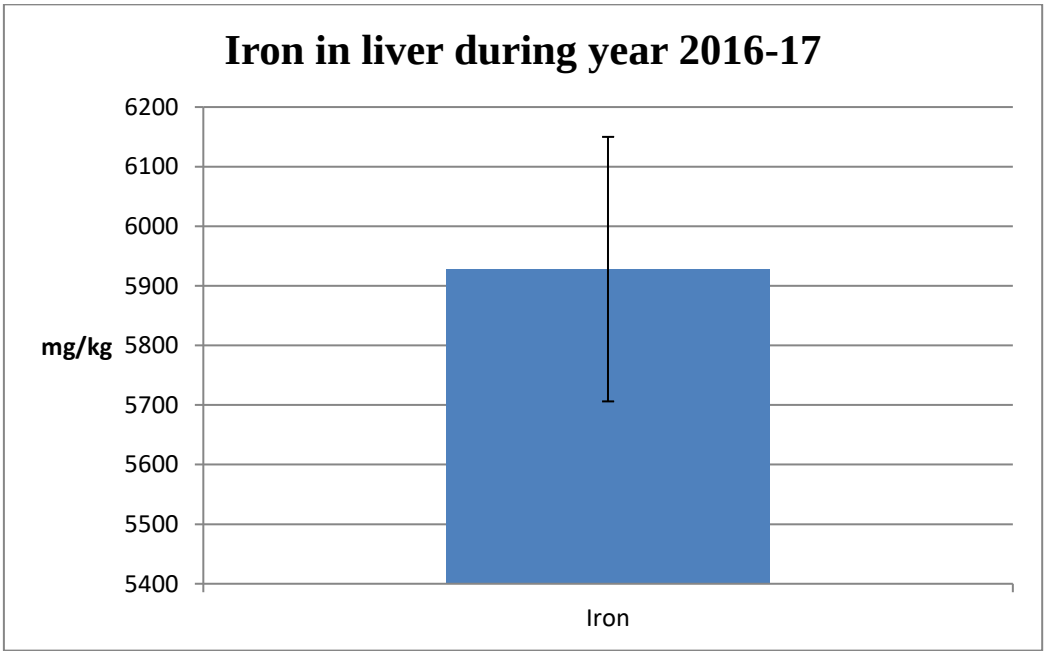

Figure 4

Table 7 Heavy metals concentration in muscles

	Summer	Post Mon	Winter	Mean
Mercury	BDL	BDL	0.418	0.139
Lead	2.83	0.96	0.343	1.377
Cadmium	BDL	BDL	0.015	0.005
Chromium	0.824	2.23	0.762	1.272
Iron	65.5	126	105	98.83

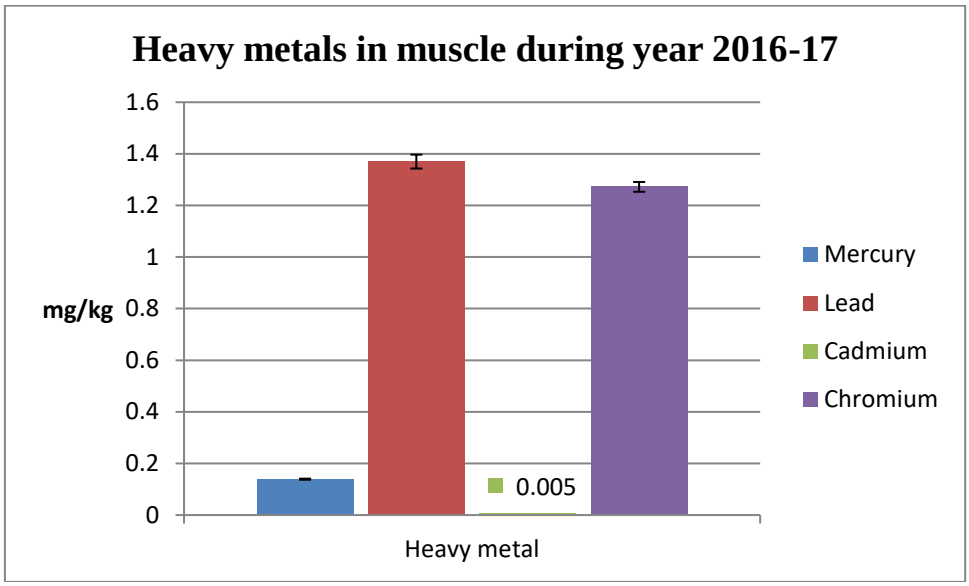

Figure 5

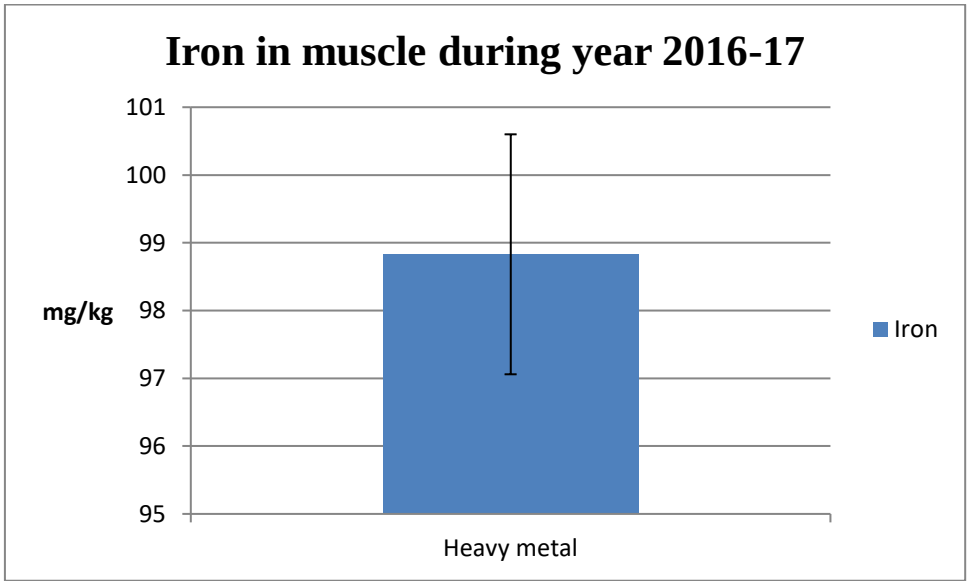

Figure 6

Potential Health Risks

We examined THQ and HI values to determine the health risks posed from the concentration of mercury, lead, cadmium, chromium and iron in *Oreochromis mossambicus* samples collected from Budhasagar pond. The previous section covered these indices. The previous section discussed safe levels of exposure for adults and children, measured in mg/Kg per day for each of the four heavy metals examined. There was 0.001 Cadmium in the air, 0.004 Lead in the soil, 0.0005 Mercury in the water, and 0.003 Chromium in the soil. Hazard index measures the health risk posed by multiple heavy metals exposure. The total hazard presented by all heavy metals, as determined by THQ, is what this represents. A HI value of > 1 should raise alarm as it indicates potential health risks to consumer of contaminated food.

Tables 8 and 9 respectively indicate the THQ and HI values for children. Tables 10 and 11 respectively indicate the THQ and HI values for adult consumers. One could observe from these tables that the THQ and HI values are well within permissible limits. That is, to say, it is safe to eat *Oreochromis mossambicus* of the Budhasagar pond.

Table 8 THQ (Children)

Metal	Gill			Liver			Muscle		
	Summer	Post Mon.	Winter	Summer	Post Mon.	Winter	Summer	Post Mon.	Winter
Mercury	0	0	0.070	0	0	0.069	0	0	0.197
Lead	0.232	0.176	0.170	0.257	0.199	0.168	0.167	0.056	0.020
Cadmium	0.145	0	0.009	0.010	0.201	0.009	0	0	0.003
Chromium	0.085	0.189	0.297	0.465	0.135	0.294	0.064	0.175	0.060
Iron	0.113	0.117	0.096	2.246	3.159	0.602	0.022	0.042	0.035

Table 9

Metal	Gill			Liver			Muscle		
	Sum.	Post Mon.	Wint.	Sum.	Post Mon.	Wint.	Sum.	Post Mon.	Wint.
HI	0.462	0.365	0.546	0.732	0.535	0.540	0.231	0.231	0.280

Table 10

Metal	Gill			Liver			Muscle		
	Summer	Post Mon.	Winter	Summer	Post Mon.	Winter	Summer	Post Mon.	Winter
Mercury	0	0	0.025	0	0	0.025	0	0	0.0718
Lead	0.084	0.064	0.061	0.093	0.072	0.061	0.060	0.020	0.007
Cadmium	0.052	0	0.003	0.003	0.073	0.003	0	0	0.001
Chromium	0.030	0.068	0.108	0.169	0.049	0.107	0.023	0.063	0.021
Iron	0.041	0.042	0.035	0.816	1.148	0.219	0.008	0.015	0.012

Table 11

Metal	Gill			Liver			Muscle		
	Sum.	Post Mon.	Wint.	Sum.	Post Mon.	Wint.	Sum.	Post Mon.	Wint.
HI	0.166	0.132	0.197	0.265	0.194	0.196	0.083	0.083	0.100

Conclusion

Food consumption is a major source through which humans as well as other animals are exposed to toxic heavy metals. Many reported studies have confirmed that contamination of heavy metals via the food chain can cause human health risk because of their toxicity, long persistence, bioaccumulation, and biomagnification. Heavy metals disrupt cellular events including growth, proliferation, damage-repairing processes, and apoptosis. Comparison of the mechanisms of action reveals similar pathways for these metals to toxicity including ROS generation, immunity weakening, enzyme inactivation, and oxidative stress.

On the other hand, some heavy metals have selective binding to certain macromolecules. The interaction of lead with aminolaevulinic acid dehydratase and ferro chelatase is within this context. Some toxic metals like chromium and cadmium cause genomic instability. Defects in DNA repair following the induction of oxidative stress and DNA damage by cadmium and chromium have been considered as the cause of their carcinogenicity. Mercury and lead, on the other hand, disrupts the functioning of human body in other ways. Mercury could cause thiol binding, inhibit glutathione peroxidase and enzymes, reduce aquaporins mRNA, and affect ROS production. Lead causes increased serum and inflammatory cytokines and a reduction in GSH, SOD, CAT, and GPx levels. The incidence of heavy metals poisoning remains considerable and requires preventive and effective treatment.

Studies have widely used fishes as a bioindicator of metal pollution in the aquatic ecosystem for advantages discussed in the previous sections. Studying heavy metals presence in fishes has another advantage. Since we eat fish, it also tells us about possible health risks it poses for us to consume contaminated fish. The present research was carried out at Budhasagar pond to investigate the presence of heavy metals in *Oreochromis mossambicus* and the health risks for humans upon the consumption of *Oreochromis mossambicus*. We investigated the health risks due to the consumption of contaminated *Oreochromis mossambicus* of the pond.

We measured the presence of heavy metals, namely, mercury, lead, cadmium, and chromium in gills, livers, and muscles of *Oreochromis mossambicus* of Budhasagar pond using THQ and HI. These indices were discussed in the previous section. In brief, a THQ of <1 is considered safe whereas a THQ of >1 poses health risks. Healthy limits of exposure, in mg/kg/day, for adults and children for all five studied heavy metals were mentioned in the previous section. These were 0.001 for Cadmium, 0.004 for Lead, 0.0005 for Mercury, and 0.003 for Chromium. Hazard index assesses the health risk posed from the combined exposure to multiple heavy metals. It is basically the sum of risk posed by all heavy metals measured in THQ. An HI of greater 1 is a cause of concern for it poses health risks for humans.

Between gills, livers, and muscles, it poses the most danger to human health of have a greater level of heavy metals presence in the muscles as this is the edible part in the fish. The presence of heavy metals in sample *Oreochromis mossambicus* of Budhasagar pond was found to be in controlled levels. That is, the consumption of *Oreochromis mossambicus* of Budhasagar pond does not pose health risks for adults or children and are safe to eat.

HIs were measured to assess health risks associated with exposure to the four heavy metals for adults and children. An HI of greater than 1 indicates potential health risks, that below 1 indicates a safe level of exposure. Across all three seasons, HI remained below

the safe level of 1 in gills, livers, and muscles for both adults and children. Similarly, THQ too was found within the safe limits of 1 for each of the four heavy metals across the study period.

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PERCEPTION OF DIVERSITY AND INCLUSION INITIATIVES FOR EMPLOYEE INNOVATIVE BEHAVIOR

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ABSTRACT

Purpose: *This paper aims to clarify the correlation between diversity and innovative behaviour of employees. Employee creativity and innovative behavior is the organization's hallmark, and employee inspiration for creative and innovative action is primarily determined by the Diversity and Inclusion Initiatives. The conventional authoritarian model of leadership can no longer respond to the psychological characteristics of workers who use new-era job ideas, strategies, and social laws as society develops economically (hereafter, new generation employees).*

Design/Methodology/Approach: *In this research study, researcher has observed, through the path analysis and structural equation modelling that how both diversity and innovative behavior variables are correlated to each other. Under the heading of employee diversity, there were factors such as age diversity, demographic diversity, organizational tenure diversity, educational history diversity, working experience diversity, faith diversity, and geographic diversity. To assess the influence of these diversity factors on employee innovative behavior, 120 senior managers have been interviewed, primarily in information technology companies in NCR Region to assess the Perception of the employer about Diversity and Inclusion Initiatives for Employee Innovative Behavior.*

Findings: *The paper provides empirical insights about how diversity brought innovative behaviour in employees. It suggests that Education, Ethnic, Regional diversities have positive impact on the Innovative Behavior of the employees except education diversity which negatively correlated with innovate behavior. It may have been because of generation gap between experienced one and new entrants.*

Research Limitations/Implications: *Sample size of 120 is not feasible to make a judgment about workforce diversity and challenging to discern meaningful correlation.*

Practical Implication: *The paper includes implication for the development of various approaches to coping with organizational diversity and provide guidance for successful diversity management to create effective workplace diversity.*

Originality/Value: *This paper fulfils an identified need to study how workforce diversity can enabled innovative behaviour.*

Keywords*: Perception, Diversity, Inclusion, Initiatives, Innovative Behavior.*

Introduction

Enterprise growth is powered by creativity, and enterprises are constantly dependent on their workers' creative efforts to sustain and boost their productivity (Odoardi et al., 2015). "Next-generation" have increasingly evolved into the new workers for businesses. Traditional leadership models may not be successful in guiding such workers, which is why we are performing this research. Orthodox leadership and governance approaches are being challenged by new generation workers who have different job values than past generations (Hou et al., 2014). An increasing number of analysts are focusing their attention on problems such as high attrition and poor organizational engagement (Cheng & Lin, 2017).

Employers must learn how to handle cultural gaps and human job behaviors as a result of globalization developments and rising racial and gender diversity. Managing workers in a dynamic work setting pose both benefits and obstacles as the working force gets more diverse. Embracing change in the marketplace and the workforce will help you achieve a competitive advantage. Managing workers with differing personalities, interests, and opinions, as well as escaping responsibility when leadership mishandles different job conditions, are both obstacles.

Human resource strategies must be impossible to replicate or mimic for an organization to retain a competitive edge. Companies should take one of three approaches to organizational diversity. Employees and the company profit most from the incorporation and learning viewpoint. However, being an employer who can successfully handle diversity and escape the

obstacles. The capacity of a group to function efficiently as a dynamic entity can be influenced by historical circumstances and the often-complex interplay between different organizational units over time. Best practices for attracting diverse candidates or managing conflicts between employees based on cultural differences can emerge organically and then become codified into the organizational culture. However, the beginnings of diversity strategies are often unclear because they originated from coordination between various organizational fields (e.g., marketing and human resources collaborating strategically with leadership to create recruiting ideas) that happened so long ago that neither the organization nor other organizations could duplicate the procedure.

According to research, having diversity in an organization has inconsistent outcomes in terms of its effectiveness. There is a favorable association between diversity and success in some research, a negative relationship in others, and no relationship in others. Some scholars suggest that, while the evidence for a causal correlation between diversity and consumer growth is mixed, the association may be attributed to other causes that are not considered.

Most managers agree that having a diverse staff benefits the company, but it can be difficult to confirm or measure, particularly when it comes to determining how diversity impacts a company's ability to innovate. However, recent analysis shows that diversity unlocks creativity and fuels business expansion, a discovery that could bolster efforts to ensure that the executive ranks reflect and promote the strength of diversity.

Rather than scientific data, today's diversity and inclusion policies are largely founded on insight and experience. Some organizations in the United Kingdom have banded together to develop benchmarking tools or guidelines. For example, in the United Kingdom, the Equality and Human Rights Commission is a federal department that supports and regulates human rights and seeks to implement equality and inclusion policies through a code of conduct and guidance.

When diversity and inclusion efforts are conducted for emotional purposes or as a public relations tactic, or when employers are not serious, they can have little or no effect. As noted in a qualitative study, managerial techniques to encourage diversity and inclusion can inadvertently promote different forms of disparities and exclusions, which may have unintentional implications of exclusion and which workers can avoid. The degree to which the language of diversity and inclusion truly matches fact and the representation of minority voices in today's organizations needs to be examined. As a result, it is important to make sure that diversity and inclusion strategies are not limited to tokenism, as minority community members view it, and that they are treated as equal by those in the organization.

It is also necessary to note that one size does not always suit everything. It is important to understand that the complexity and importance of aspects of diversity differ across communities, and corporate leaders must be mindful of this. India is widely recognized as one of the world's most populous nations, and Indians have an innate ability to handle diversity. To make this competence aware, Indian leader might start by looking at the underlying assumptions that underpin their perception of diversity and inclusion. In South Asia, for example, issues of exclusion are largely based on gender, but also include caste, clan, and birder, language, income, position, and status as a resident, migrant, refugee, or internally displaced individual, among other factors. As a consequence, comprehending inclusion necessitates using a local lens and becoming mindful of the relevant subtexts that characterize exclusion inclusion in the organization.

Inclusion, which allows workers to be respected and included by an organization, is used to leverage diversity. It advocates for valuing disparities in and through individuals in organizations by both understandings and overcoming them. The theory of equity and justice is central to the discussion of diversity. Individuals need to belong, to be valued, to be handled equally, and to be recognized, regardless of where they get their name. Investing in diversity, it is argued, benefits organizations in both obvious and economic respects, as well as in other implicit aspects of

deeper loyalty, broader well-being, and recognition that they command.

Creating an inclusive community includes moving beyond diversity-based recruiting and recruitment to include holistic approaches to leveraging diversity. It entails shifting the focus from ethnic diversity to cognitive diversity, and then to inclusion, as well as tackling both explicit and implicit inequalities that can stymie acceptance and integration. Employees who are truly included, rather than just lip service, can bring their entire self to work, sharing and giving expression in a manner that allows for fruitful problem solving, imagination, innovation, and improved results in a variety of ways.

Review Of Literature

The term "innovative action" was coined in the 1970s. The organizational, squad and human creative practices are the three levels of innovation. The individual creative behavior of enterprise workers is studied in this article. Employee innovation, according to Amabile (1988), is a new, potentially profitable concept or item that employees can produce, which can help businesses succeed, evolve, and flourish in a competitive environment. The ideas produced during the invention process, according to Woodman et al. (1993), maybe new or have already been used by others. Person innovative activity, according to Zhou and George (2001), requires not only the conception of an innovative idea but also its promotion and execution.

Employee inventive activity, according to Woodman et al. (1993), involves the method of creating new ideas and their effective execution. According to Scott and Bruce (1994), there are three steps to innovation: (1) finding challenges and designing solutions; (2) pursuing approval for their ideas; and (3) developing new standards or models that can be broadly marketed, mass-produced, and then used in large quantities. Person creative activities were divided into five phases by Kleysen and Street (2001): seeking opportunities, producing proposals, forming surveys, endorsing, and submitting.

Employee creative behavior has also been observed by Indian scholars. Employee creative activity is described by Liu and Shi (2009) and Han and Yang (2011) as the development and application of novel and realistic methods when employees perform relevant activities in the company. Employee innovative action, according to Li (2017), is the mechanism by which workers identify challenges, create innovative ideas, encourage, and execute them over the life of the company.

One of the most critical leadership roles of today's institutions is to cultivate creative action (Pundt, 2015; Hakimian et al., 2016). Leadership style has a huge effect on workers' desire to innovate (Lee and Chang, 2006). A leader with a sense of humor, for example, may promote the expression of new thoughts as an imaginative activity (Pundt, 2015). Furthermore, by using their intellect and inspiration, transformational leaders are effective at motivating workers to innovate (Zhang and Zhou, 2013).

From an Indian cultural viewpoint, progressive leadership, like those traditional leadership types, has a positive influence. When employees are more engaged, they are more creative and they believe their contributions have earned the praise of their bosses (Abdullan et al., 2015). Leadership reinforcement affects employees' creative conduct. Employees are more daring and creative when their bosses back them up (George and Zhou, 2007).

Diversity is characterized as the recognition, value, and celebration of differences among people based on age, class, nationality, gender, physical and mental capacity, race, sexual orientation, spiritual activity, and public assistance status. Organizations are increasingly recognizing that diversity is critical for optimizing efficiency, and now must pay attention to it. (Nair & Vohra, 2015)

Organizations that excel at maximizing diversity, such as recruiting and promoting women and non-white men into senior management positions, and creating an environment that encourages contributions from people of diverse backgrounds, can outperform non-diversity adherent companies or companies that are ineffective at managing diversity in the long run (Perumal, 2010)

According to Randel et al. (2017), collaborative leadership is a collection of

constructive leadership practices that can make team members experience a sense of cohesion while also maintaining their individuality. As a result, executives who have an egalitarian leadership model have higher optimistic attitudes and tolerance towards their staff, allowing them to feel more supported by their bosses and produce more ideas (Zhu and Wang, 2011). Such inclusiveness combining motivation and empathy is more effective for young generation workers who have more innovative solutions but hold opinions that differ from conventional leadership styles.

Values-based approaches to transformation and success improvement are becoming more popular in businesses. Since principles inform the convictions that decide what is most important and what motivates behaviour, they are the cornerstone of decision-making (Schwartz, 2012). Values-based policies should offer a concrete path for putting together "different viewpoints" (Hall and Davis, 2007) to meet important priorities and identify aspects of inclusion and diversity. Organizations also use the Schwartz Theory of Basic Human Values to help explain how to recognise and handle potential. Schwartz draws on previous studies (such as Hofstede's cultural aspects theory) by identifying ten motivationally distinct ideals with core motivators underneath them, as well as describing how they communicate. Values-based approaches offer perspective that can be used to maximise gaps and minimise tension through informed negotiation.

Cennamo and Gardner (2008) examined facets of ‘organizational fit' using a values-based study across three demographic categories (generations x, y, and baby boomers), and observed substantial disparities among the younger groups, which valued equality and status job values most. However, there was no significant difference between them in terms of ‘extrinsic, intrinsic, social, and altruism-related ideals,' and no generational disparities in perceived organizational values (p902). The EMS must develop capacity to fulfil potential demands, and the gaps in the younger generation are essential factors.

When Moore (1999) looked at various ways to handle diversity, they discovered that establishing diversity authority (e.g., a diversity officer, a diversity council, or an affirmative action plan) is the most successful way to increase diverse managers. The research demonstrates the efficacy of diversity strategies in increasing the inclusion of women and minorities in the workplace, especially at the executive level. It's worth noting who businesses that voluntarily pursue diversity management do so because their corporate goals align with the interests of women and minorities, such as increasing revenue and client base.

Discrimination is the concept of handling workers differently depending on their skin colour, race, or gender rather than their ability, while fairness is the principle of treating all employees equally and without prejudice. The aim of the discrimination and justice paradigm is to maximise the number of underrepresented employees in a company. As a consequence, one of the benefits of this paradigm is that it increases ethnic diversity within an organisation, which will lead to more equal care.

The second model is one of legitimacy and access. This model applies to a business that takes advantage of its workforce's diversity by facilitating access to a wide variety of consumer markets in order to achieve credibility while selling new goods or services to them. Organizations can reach out to these customers by comparing the demographics of the company to the demographics of the market or vital community. One of the benefits of this model is that it assists the enterprise by offering a motivation-based demand with future strategic advantages.

(Brown-Glaude, 2009) Globalization is a phenomenon driven by accelerated technological growth, implying that global jobs must possess appropriate expertise, be technologically adaptable, and be able to communicate with diverse populations both locally and internationally. This condition allows businesses to need not only professional labour and training, but also the ability to collaborate through cultures. Organizations who can promote and maintain a diverse population are best able to develop their innovation and ingenuity, as well as reach out to more employees and consumers, achieving

comparative advantages and increasing sustainability.

Fujimoto et al. (2004) Diversity is a reality in the workplace, and it has resulted in a variety of noteworthy activities among industry, government, and civil society leaders over the years. The findings of a report on group diversity indicated that diversity has a positive impact on organisational performance, with a highly diverse team outperforming a less diverse group in some situations, especially in terms of innovation and job satisfaction. Individuals from various backgrounds now integrate themselves into the group's outlook on how to complete assignments and have access to various opportunities, which improves innovation and success and leads to a more appealing environment and higher job satisfaction.

Research Gap

Even though there is a lot of research on the impact of Diversity and Inclusion, although as far as the impact of Diversity and Inclusion Initiatives for Employee Innovative Behavior is concerned, very few have focused its impact on Employee Innovative Behavior, very few studies have looked at the connection between inclusive leadership and employee innovative behavior. Employee performance and other factors have been studied in depth. Therefore, following objectives have been taken the fill the gap.

Research Questions

1. Does diversity impact innovative behavior in the organization?
2. Does Inclusiveness also impact innovative behavior?

Objectives of the Study

The analysis aims to see how workforce diversity affects employee Innovative Behavior. This will be accomplished by doing a literature analysis and determining the variables that could influence Employee Innovative. The effect of each diversity factor on Employee Innovative Behavior will also be studied. Therefore, the study objective is to assess the impact of Diversity on Employee Innovative Behavior, Inclusion Initiatives and its impact on innovative behavior is also discussed in the paper.

Hypotheses

H1: Diversity and Inclusion Initiatives do not have a positive impact on Innovative Behavior.
H2: Educational diversity, Age diversity, Ethnic diversity, and regional diversity do not have a positive impact on Innovative Behavior.

Methodology

Data were collected from a cross-sectional study and senior level manager ($n =$ `120) from different multinational companies were chosen. Senior level personnel have been asked about their perception about the impact of Diversity and Inclusion Initiatives for Employee Innovative Behavior. Multiple regression analysis and Structural equation modeling technique were used to assess the mentioned objectives. The study was supported by a literature review, which tended to minimize challenges to scientific validity. To validate the relationship between the variables, SPSS version 23 was used to conduct statistical analysis on the study queries, dependent and independent variables.

Working professionals ($n =$ `120) from different multinational companies' senior managers, in the National capital region have been selected and handed over close ended questionnaire for primary data collection and numerical scaling technique was used and responses were rated 1-10. The two ends of continuum represent the two extremes of the measuring phenomena.

Data Interpretation, Analysis & Results

Table 1 Descriptive Table				
	Edu Div	**Age Div**	**Eth Div**	**Reg Div**
N	120	120	120	120
Missing	0	0	0	0
Mean	7.85	7.39	7.82	7.85
Median	8.00	8.00	8.00	8.00
Standard deviation	1.60	1.83	1.59	1.81
Minimum	3	2	4	3
Maximum	9	9	9	9

As depicted in the Table 1 total 120 respondent have been interview for the study and lessor difference in the mean value and standard deviation values indicates that most of the respondent has similar observation and opinion about diversity and innovative behavior.

Table 2 Regression Model Summary				
Model Summary[b]				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. The error of the Estimate**
1	0.936[a]	0.876	0.871	0.55438
[a]Predictors: (Constant), Regional Diversity, Age Diversity, Ethnic Diversity, Education Diversity				
[b]Dependent Variable: Innovative Behavior				

R-value of 0.936[a] states that Predictors: regional diversity, age diversity, ethnic diversity, education diversity are positively correlated with innovative behavior and positively impact the behavior in an organization, whereas R Square (0.876) indicated that Predictors: regional diversity, age diversity, ethnic diversity, education diversity explain the innovative behavior by 87%, although they may have been other factors too, which may affect innovative behavior, as depicted in Table 2.

Table 3 Correlations						
		Innovative Behavior	**Education Diversity**	**Age Diversity**	**Ethnic Diversity**	**Regional Diversity**
Pearson Correlation	Innovative Behavior	1.000	0.897	0.821	0.883	0.918
	Education Diversity	0.897	1.000	0.854	0.836	0.923
	Age Diversity	0.821	0.854	1.000	0.825	0.881
	Ethnic Diversity	0.883	0.836	0.825	1.000	0.900
	Regional Diversity	0.918	0.923	0.881	0.900	1.000
Sig. (1-tailed)	Innovative Behavior	0.000	0.000	0.000	0.000	0.000
	Education Diversity	0.000	0.000	0.000	0.000	0.000
	Age Diversity	0.000	0.000	0.000	0.000	0.000
	Ethnic Diversity	0.000	0.000	0.000	0.000	0.000
	Regional Diversity	0.000	0.000	0.000	0.000	0.000
N	Innovative Behavior	120	120	120	120	120

	Education Diversity	120	120	120	120	120
	Age Diversity	120	120	120	120	120
	Ethnic Diversity	120	120	120	120	120
	Regional Diversity	120	120	120	120	120

Pearson Correlation value of 0.897, 0.821, 0.883, and 0.918 for education diversity, age diversity, ethnic diversity, and regional diversity respectively show a positive relationship between dependent independent and dependent variables

Table 4 ANOVA Table

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	248.648	4	62.162	202.258	0.000[b]
	Residual	35.344	115	.307		
	Total	283.992	119			
a. Dependent Variable: innovative behavior						
b. Predictors: (Constant), regional diversity, age diversity, ethnic diversity, education diversity						

Thus, the null hypothesis Ho_1 is rejected and the alternate hypothesis Ha_1 is accepted. Table 4 gives us the following regression equation for the relationship between innovative behavior and education diversity, age diversity, ethnic diversity, and regional diversity

$$Innovative\ Behavior = 0.330 \times Education\ Diversity + -0.042 \times Age\ Diversity + 0.290 \times Ethnic\ Diversity + 0.321 \times Regional\ Diversity$$

Table 5 Regression Coefficients Impact Of Diversity On Innovative Behavior

Coefficients							
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Significance**
		B	**Std. Error**	**Beta**			
1	(Constant)	0.772	0.280		2.754	0.007	Significant
	Education diversity	0.330	0.085	0.342	3.894	0.000	Significant
	Age diversity	-0.042	0.061	-0.049	-0.684	0.495	Non-significant
	Ethnic diversity	0.290	0.074	0.299	3.907	0.000	Significant
	Regional diversity	0.321	0.097	0.376	3.310	0.001	Significant
a. Dependent Variable: innovative behavior							

The intercept value is (0.772), education diversity (0.330) value, age diversity (-0.042), ethnic diversity (0.290), and regional diversity (0.321) that indicates that, except age diversity whose values is (-0.042), make a positive impact on innovative behavior. Hence, we can conclude that education diversity, ethnic diversity, and regional diversity having a positive impact on innovative behavior, therefore the null hypothesis is to be rejected and the alternative is to be accepted. As far as

age diversity is concern it does not have a positive impact on innovative behavior as its sig value 0.495>0.05, hence we accept the null hypothesis in the case of age diversity. The Regression Analysis can be used to validate the following model as illustrated in Figure 1.

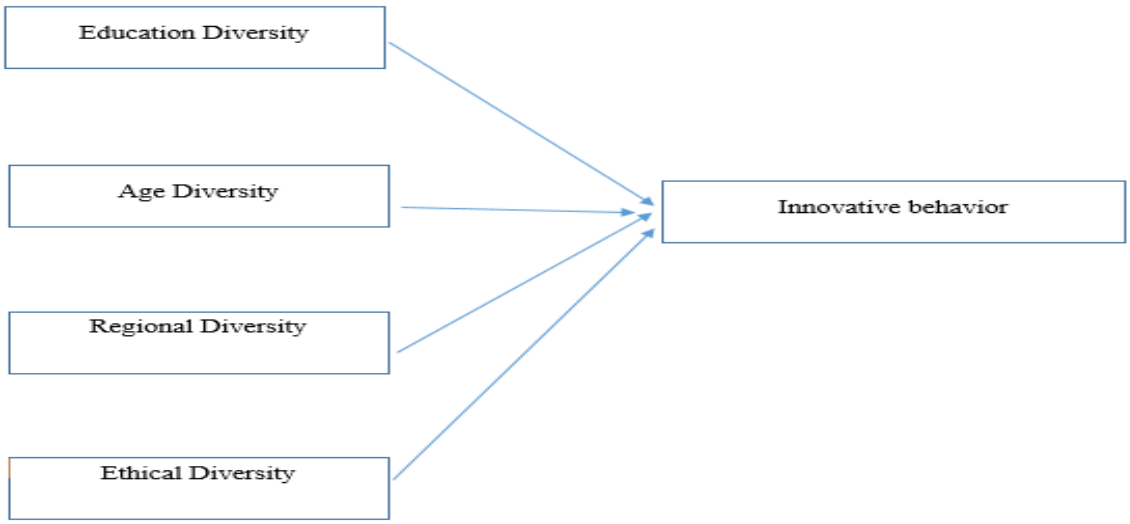

Figure 1 Validated Model of Impact Of Diversity On Innovative Behavior

The data sets were combined, and a unified model was created to understand the impact of various factors such as education diversity, age diversity, ethnic diversity, and regional diversity on innovative behavior using partial least square, a structured equation model was created that is illustrated in Figure 2 as below:

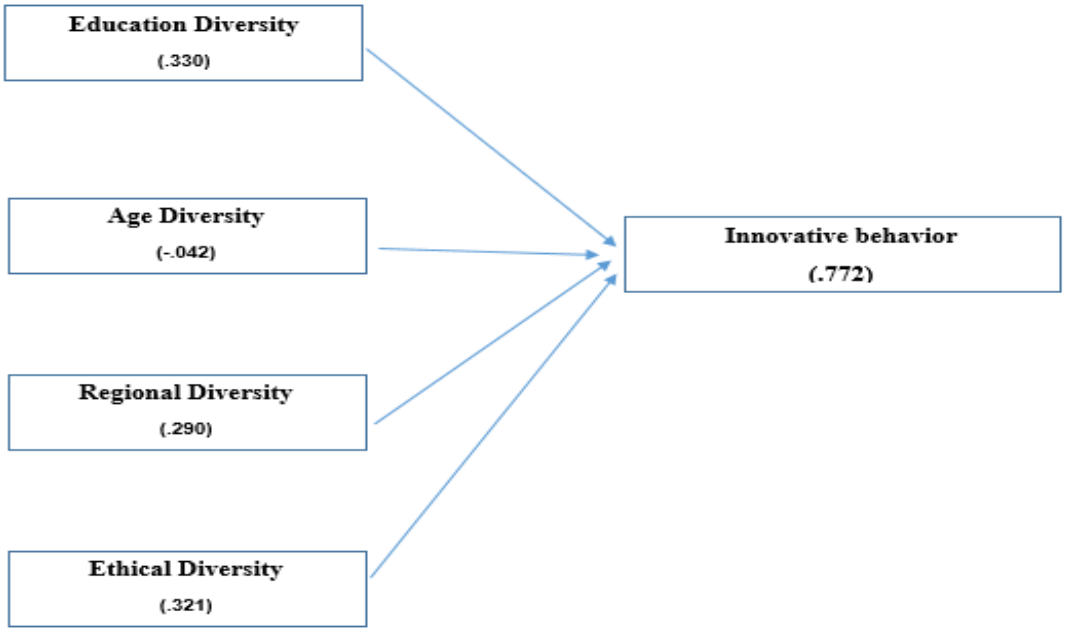

Figure 2 Estimated Model Using Pls

All the four factors education diversity, age diversity, ethnic diversity, and regional diversity have an impact on the innovative behavior of the employees. It is also clear that ethical diversity and education diversity have a much greater impact on innovative behavior as compared to the other remaining factor of convenience.

Conclusion

New generation workers have increasingly been the core part of workplace and business growth today. Since this group's professional

ideals and culture dynamics vary from those of the conventional labor force, many traditional human resource management and leadership models face significant pressure and challenges. Psychological capital may be a strong antidote to such pressures (Shabir et al., 2014). Researcher also concludes that education, ethnic, regional diversities have positive impact on the innovative behavior of the employees except education diversity which negatively correlated with innovate behavior. It may have been because of generation gap between experienced one and new entrants. It is also clear that ethical diversity and education diversity have a much greater impact on innovative behavior as compared to the other remaining factor of convenience.

Limitations

Since statistical experiments usually need a greater sample size to ensure a representative representation of the population and to be considered reflective of groups of people to which findings would be generalized or transmitted, it will be challenging to discern meaningful correlations from the data as the sample size is 120 only. Sample size of 120 is not feasible to make a judgment about workforce diversity and its impact, secondly NCR Region does not represent the different part of country.

Practical Implication

This study is to explore the various approaches to coping with organizational diversity and to provide management with the requisite guidance for successful diversity management in small and large international organizations, in order to demonstrate to the reader how to create an effective workplace diversity by using various diversity management resources hence it would enhance organizational productivity.

Societal Implication

This has been observed in other studies that workforce diversity ensures employee satisfaction and diversity management requires far more than equal work opportunities. Managers should be aware that progress takes time, but they should try to promote it. Dealing with diversity often necessitates creating a safe place for managers and employees to collaborate, such as social gatherings and corporate events where everyone is at ease and there is a relaxed atmosphere where people can talk openly and listen to others. Employees can be directed on how to obtain knowledge by mentoring services. Employees can be offered constructive guidance after they have learned from their experiences and have been good in using the lessons learned to gain progress.

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STUDY OF ANTIBIOFILM ACTIVITY OF BUTEA MONOSPERMA SILVER NANOPARTICLES ON CANDIDA ALBICANS, PROTEUS MIRABILIS

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ABSTRACT

Silver nanoparticles are deemed the most positive, considering their strong volume surface region, and is of concern for study because of the improved microbial tolerance to antibiotics and medicines. Therefore, green synthesis of nanoparticles of silver using biomolecules derived from various plant sources in the form of extracts can be applied for the screening of different diseases which trigger microorganisms and for the physical and biological characterisation of plant-derived silver nanoparticles. The experiment involved the green synthesis of silver nanoparticles (AgNPs) from Butea monosperma leaf extract. Biosynthesized Butea monosperma -AgNPs were characterized by UV-visible spectroscopy, fourier-transform infrared (FTIR) spectroscopy and scanning electron microscopy (SEM). The intensity of peak broad range 200-800nm in UV-vis spectra, EDS test. The SEM shows the actual size of the nanoparticles. Antibiotic-resistant and biofilm-forming bacteria have surprisingly increased over recent years. the rate of development of new antibiotics to treat these emerging issues is very slow. Therefore, the aim of this study was to prepare novel nanoparticles formulations to improve the antimicrobial activity. In the present work, I have attempted to test the prepared nanomaterials against the biofilm of C. albicans and P. mirabilis. the cells of Candida albicans, Proteus mirabilis and mixed culture cells were allowed to form biofilm in presence nanoparticles synthesized from Butea monosperma, viz., A-Y water AgNPs & B-Y ethanol AgNPs, the biofilm formation got inhibited. Form the biofilm inhibition data, it seems that A-Y (water AgNPs) is most active inhibitor of Candida biofilm (5 uL), whereas B-Y (ethanol AgNPs) is most active inhibitor of Proteus biofilm (2.5 uL). Mixed biofilm was most efficiently inhibited by B-Y ethanol AgNPs (5 uL)., viz., A-Y, B-Y, C-Y and D-Y, A-water, B Ethanol, C methanol & D acetone Butea monosperma AgNPs solutions.

***Keywords**: Nanoparticles, Butea monosperma, AgNPs, UV-visible spectroscopy, fourier-transform infrared (FTIR) spectroscopy and scanning electron microscopy (SEM), Anti-biofilm, C. albicans , P. mirabilis.*

1. Introduction

Bacterial infections are the second acknowledged cause of death worldwide and the third in developed countries. The therapeutic efficiency of antimicrobials has become more complex due to the emergence of multidrug resistance. *(Hwang et al. 2016.) B. monosperma* has numerous pharmacological activities such as anthelmintic, anti-conceptive, anticonvulsive, antidiabetic, antidiarrheal, antiestrogenic and antifertility, anti-inflammatory, antifungal, antibacterial, antistress, anticancer, antioxidant, chemopreventive, haemagglutinating, hepatoprotective, thyroid inhibitory, antiperoxidative, hypoglycemic effects, wound healing activities, anti-giardiasis, antifertility, chemo preventive activities and radical scavenging activities (Sindhia *et al* 2010 More et al 2012 Sharma and Deshwal 2011 Chandraker 2014 Madhavi 2013)Candida albicans is commonly found as a commensal fungus in the mucosa lining of humans. Normally, this organism does not provoke immune responses in individuals with a normal immune function. When the immune system fails and the host's environment changes, infections can develop that are superficial to life-threatening. A high rate of mortality and morbidity is associated with systemic candidiasis. As much as 10-24% of patients with invasive Candidiasis die. This opportunistic pathogen can survive on abiotic surfaces for up to four months. As a result of its ability to form biofilms and change its morphology, the organism can survive on abiotic surfaces. An extracellular matrix surrounds polymorphic cells (yeast, hyphal, pseudo-hyphal cells) of this organism. The extracellular matrix contains proteins, polysaccharides, glycerolipids, and DNA. Extracellular DNA is essential for establishing structural integrity of the biofilm and safeguarding it from external agents, such as antifungal therapeutics. Additionally, it prevents the penetration of antifungal agents into the biofilm. In addition to colonizing medical devices such as catheters, pacemakers,

prosthetics, and other abiotic surfaces, biofilms may act as reservoirs for pathogenic cells. Biofilms are inherently resistant to antimicrobial agents because of their composition. Therefore, disrupting the biofilm might be crucial to infection treatment. C. albicans pathogenesis relies heavily on biofilms, so novel strategies to inhibit and disrupt the formation of biofilms are needed. Scientists are considering nanotechnology as a possible strategy to inhibit Candida biofilms. Physico-biological concepts are integrated in nanotechnology for the development of novel therapies.

A common cause of catheter-associated urinary tract infections (CAUTIs) is Proteus mirabilis, a Gram-negative bacterium. Infections caused by such bacteria are mainly caused by the formation of biofilms on catheter surfaces. Virulence factors expressed by P. mirabilis are necessary for forming biofilms. Factors such as adhesion molecules, quorum sensing molecules, lipopolysaccharides, efflux pumps and urease enzymes may be involved in this process. Developed on catheter surfaces, P. mirabilis biofilms have the unusual characteristic of being crystalline due to their ureolytic biomineralization. The result is catheter encrustation and blockage, often accompanied by urine retention and ascending UTIs. Bacteria embedded in crystalline biofilms become highly resistant to conventional antimicrobials as well as the immune system. Being refractory to antimicrobial treatment, alternative approaches for eradicating P. mirabilis biofilms are urgently required. The term nanomaterial refers to materials with a diameter smaller than 100 nanometers. Among the traditional methods used to synthesize these nanoparticles are precipitation, wet chemical synthesis, sol-gel, and pyrolysis. However, these methods are highly energy-intensive and, therefore, not environmentally friendly. In the present work, we have attempted to test the as-prepared nanomaterials against the biofilm of C. albicans and P. mirabilis. Proteus mirabilis is a common pathogen responsible for complicated urinary tract infections (UTIs) that sometimes causes bacteremia. Most cases of P. mirabilis bacteremia originate from a UTI. Candidiasis is a fungal infection caused by a yeast (a type of fungus) called Candida. Some species of Candida can cause infection in people; the most common is Candida albicans. Candida normally lives on the skin and inside the body, in places such as the mouth, throat, gut, and vagina, without causing any problems. Candida can cause infections if it grows out of control or if it enters deep into the body (for example, the bloodstream or internal organs like the kidney, heart, or brain). *(Chi-Yu Chena et al. 2012).* Metals such as metals and metal oxides, silicates, non-oxide ceramics, polymers, organic materials, biomass and biomolecules may be used for producing nanoparticles. In many morphologies, nanoparticles occur, including balls, cylinders, platelets, tubes etc. Inorganic nanoparticles such as golden and silver metal nanoparticles have superior material properties with mechanical flexibility, with broad availability, comprehensive mobility, strong compatibility, selective therapeutic products and regulated drug release capabilities (Xu *et al*., 2006). For the synthesising and stabilisation of silver nanoparticles, many physical, chemical and biological methods were used (Senapati *et al*., 2005). The word biofilm has been used to refer to the thin coated condensations of microbes (for example bacteria, fungi, protozoa, etc.) which can appear in different types of surface structures. Antifungal performance may be calculated by means of well diffused methods on various fungal strains. Free floating bacteria, classified as planktonic microorganisms in an aqueous climate, are a requirement for the development of biofilms. Thus, such films may be formed on every organic or inorganic substratum where planktonic microorganisms prevail in a water solution (Choudhary *et al*., 2012). Because of its unusual physical and chemical properties, silver nanoparticles (AgNPs) are progressively being used in numerous fields, including medical, fruit, patient treatment, consumption and industrial uses. This involves visual, electronic, thermal, heavy electrical and biological characteristics (Gurunathan *et al* 2015). Because of its unusual properties, it has been used for many applications in the medicinal, food processing, surgical, orthopaedic, medication distribution,

anticancer industries, as well as for numerous applications such as non-bacterial agents, automotive, domestic and health goods, electronic products, medical equipment jackets, optical sensors and cosmetics AgNPs have been widely used lately in numerous textiles, keyboards, wound dressings and biomedical instruments. The nanosized metallic particles are peculiar and, because of their surface to volume ratio, can greatly alter physical, chemical and biological properties; thus, nanoparticles have been used for different purposes. In order to satisfy the AgNPs criterion, different methods for synthesis have been introduced. In general, current approaches of physics and chemistry appear rather costly and risky. It is important to notice the high yield, solubility and high stability of biologically prepared AgNPs (Gurunathan *et al* 2015). Biological methods for AgNPs seem simplistic, quick, nontoxic, reliable and green among. A range of analytical methods are used, including UV spectroscopy, Xray diffractometry (XRD), Fourier infrasound transform spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS), DLS scanning, SEM, transmission electron microscope (TMM), atomic force microscopy (AFM). Several competent books and studies have identified different styles of methodological methods for characterising AgNPs. A highly effective and accurate technique for the primary characterization of synthesised nanoparticles used for tracking the production and stabilisation of AgNPs is UV-Visible Spectroscopy. (Sastry *et al* 1998).

2. Materials and methods

2.1 Sample preparation:

The young and disease-free leaves of Butea monosperma were selected.

Drying of leaves: Samples were dried in room temperature for more than two weeks, so that they may be converted into fine powder.

Preparation of fine powder: after proper drying of leaves, thick mid ribs of the leaves were removed, dried leaves were grinded into fine powder using a grinder.

Preparation of extracts: aqueous extracts using distilled water, 50% ethanol, 50%methanol & 50% acetone were prepared.

2.2 Synthesis of Silver Nanoparticles from Butea monosperma extracts:

AgNPs were synthesized by the following method. 10mM AgNO3: plant extracts in different solvent in 9:1 ratio in a reagent bottle mixed thoroughly, forming a uniform mixture. The mixture was then rested at room temperature for 24 hours at 37°C, with continuous monitoring. After about few minutes, the mixture was observed to start changing from pale green to yellowish brown. After about 24 hours, the mixture had completely changed colour to brown in all solvents. This color change is visual evidence of formation of AgNPs. (Kasthuri et al., 2009).

2.3 Characterization of silver nanoparticles.

For determination of the time point of maximum production of silver nanoparticles, the absorption spectra of the samples were taken200–8000 nm using a UV–vis spectrophotometer. The silver nanoparticles were synthesized by novel green chemical route. The nanoparticles were characterized by UV- spectral analysis, SEM -EDAX analysis (Scanning Electron Microscopy) was performed for studying the surface morphology & to predict the size of the nanoparticle. Also, FTIR analysis was conducted for identifying the presence of functional groups. (Anuja et al. 2020)

2.4 Anti-biofilm activity

Anti-biofilm activity was performed using MTT assay to check cytotoxicity of nano particles on the C. albicans, P. mirabilis. All 4 nanoparticles synthesized from Butea monosperma extracts: viz water, 50% ethanol, 50% methanol & 50 % acetone AGNPs were screened for antibiofilm activity, and a mixture as well into 96 well plate containing various volumes (0-10uL) of different nanoparticles, viz., A-Y (water), B-Y (50% ethanol,), C-Y (50% methanol) and D-Y (50 % acetone) In 96 well plate and incubated at 37oC. After incubations, 10 ul of 10 mg/mL MTT solution was added in each well, and plate was incubated for 2 hours in dark at 37oC. After incubation, 100uL DMSO were added to each well and the solutions in each well was read at 570 nm on multimode plate reader. Control

samples were without nanoparticles under similar conditions. (Tereza 2018)

3. Result & Disscussion

3.1) The detailed study on biosynthesis of silver nanoparticles by natural ***Butea monosperma*** extracts such It was observed that the color of the solution turned from yellow to bright yellow and then to dark brown after 1,24 and 48 h of the reaction, which indicated the formation of silver nanoparticles (fig 1).

3.2) The formation and stability of the reduced silver nanoparticles in the colloidal solution was monitored by UV–vis spectrophotometer analysis. The UV–vis spectra show maximum absorbance at 420 nm, which increased with time of incubation of silver nitrate with the plants extract. The curve shows increased absorbance in various time intervals (1 h, 24 h and 48 h) and the peaks were noticed at420 nm corresponding to the surface plasmon resonance of silver nanoparticles. The observation indicated that the reduction of the Ag+ ions took place extracellularly. It is reported earlier that absorbance at around 430 nm for silver is a characteristic of these novel metal particles (Nestor *et al*., 2008). The synthesis of AgNPs from the ethanolic, aqueous, methanol & acetone extract of leaves of ***Butea monosperma*** was further confirmed by ultraviolet - visible spectroscopy (UV/VIS) in the range of between 200 nm to 800 nm and solvents were used as a blank. The spectrum has a maximum absorption peak at a which is reported to have an absorption maximum of between about 400nm to about 450nn. The presence of the maximum peak absorption peak at 400nm to about 450nn is therefore an indication and confirmation that the AgNPs were present. (Fig 1)

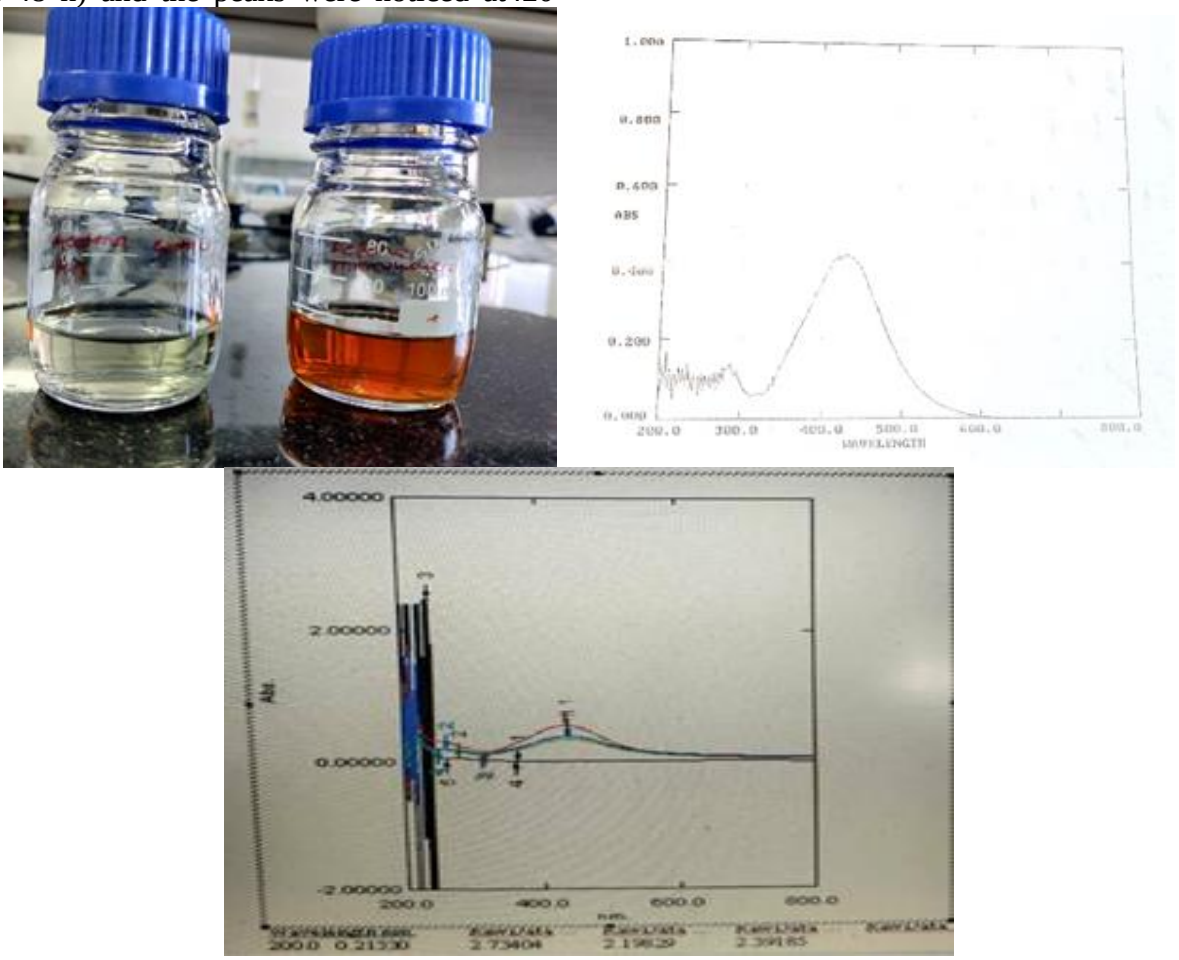

Fig 1. Synthesis of nanoparticles & presence of the maximum peak absorption peak at 400nm to about 450nn

3.3) Fourier Transform Infra-Red Spectrometer (Equipped With ATR) Model Tensor 600 Brucker. As seen in figure given below, FTIR spectra of all samples shows similar pattern.

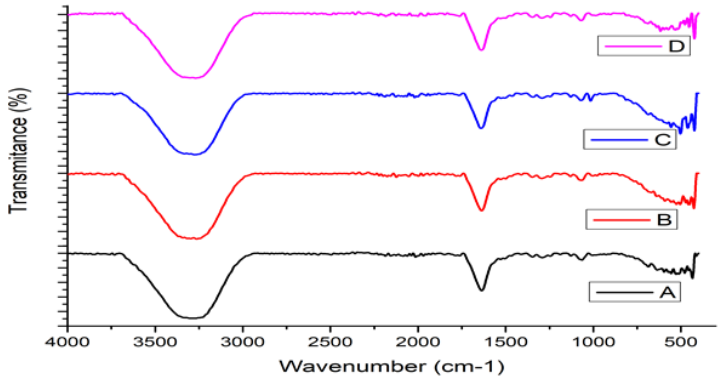

Fig 2. FTIR spectra of all four solvents of ***Butea monosperma*** synthesized Sliver AgNPs

FTIR spectra depicts bands at ~3200-3300 corresponding to alcoholic O-H stretching, bands at ~ 1620 corresponds to; where as small band at ~1100 is corresponds to alcoholic C-O bond, metallic silver bond is seen at ~450 cm-1. Fig 2 where A-water, B Ethanol, C methanol & D acetone solvents respectively.

3.4) Field Emission Scanning Electron Microscopy (Fe-SEM) & Energy Dispersive X-Ray spectroscopy (EDS) Analysis. Thin film of the as obtained sample was prepared on cleaned glass plate using drop casting technique. This film is dried under Infra-Red lamp at room temperature. As depicted in electron micrographs, sample consist of clusters of ultrafine nanoparticles of size ~40-75 nm. Fig 4 To confirm the composition of the sample, EDS analysis is done. As seen from the spectra depicted in chart 1, Sample prominently consist of Ag along with S, P, O and Si.

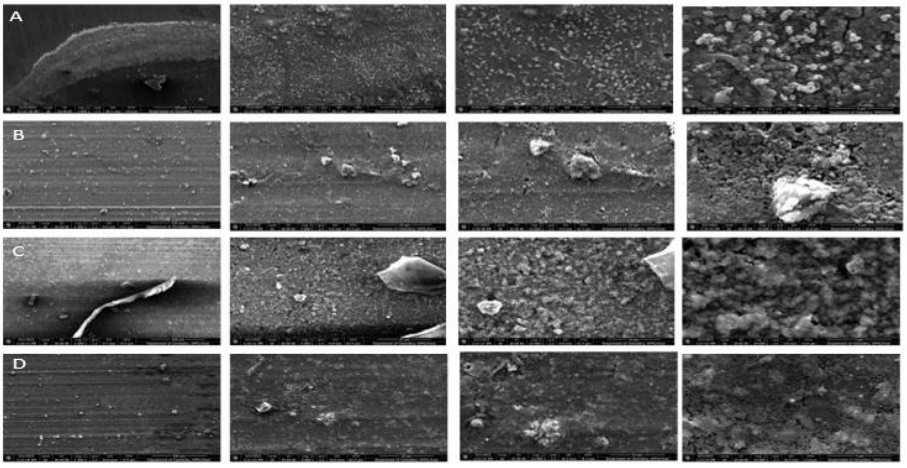

Fig 3 Field Emission Scanning Electron Microscopy (Fe-SEM)

Table 1. Elemental composition of as synthesized sample

Element	Atomic No	A	B	C	D
Carbon	6	23.81	20.64	19.07	22.53
Aluminum	13	10.18	ND	ND	ND
Silver	47	47.10	45.49	44.70	45.60
Sulfur	16	5.20	ND	ND	ND
Phosphorus	15	1.50	ND	ND	ND
Silicon	14	1.23	ND	ND	ND
Oxygen	8	10.98	9.91	36.24	31.88

3.5. ANTIBIOFLIM ACTIVITY

Anti-biofilm activity was performed using MTT assay to check cytotoxicity of nano particles on the ***C. albicans, P. mirabilis.*** All 4 nanoparticles synthesized from ***Butea monosperma*** extracts: viz water, 50% ethanol, 50% methanol & 50 % acetone AGNPs were screened for antibiofilm activity, and a mixture as well into 96 well plate containing various volumes (0-10uL) of different nanoparticles, viz., A-Y (water), B-Y (50% ethanol,), C-Y (50% methanol) and D-Y (50 % acetone) In 96 well plate and incubated at 37°C. After incubations, 10 ul of 10 mg/mL MTT solution was added in each well, and plate was incubated for 2 hours in dark at 37°C. After incubation, 100uL DMSO were added to each well and the solutions in each well was read at 570 nm on multimode plate reader. Control samples were without nanoparticles under similar conditions. When the cells of *Candida albicans*, *Proteas mirabilis* and mixed culture cells were allowed to form biofilm in presence nanoparticles, viz., A-Y, B-Y, C-Y and D-Y. A-water, B Ethanol, C methanol & D acetone solutions, the biofilm formation got inhibited (figure 4 A-C)

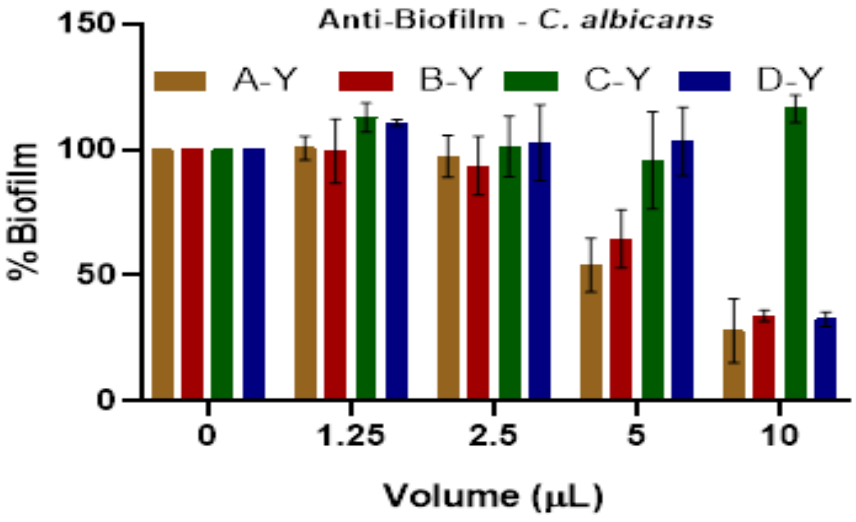

Figure 4 (A): *Candida* Biofilm inhibition

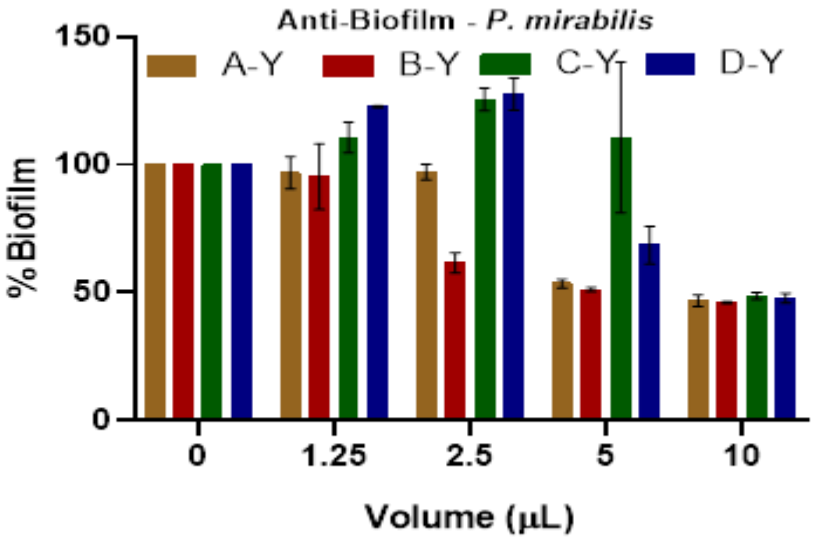

Figure 4 (B): *Proteus* Biofilm inhibition

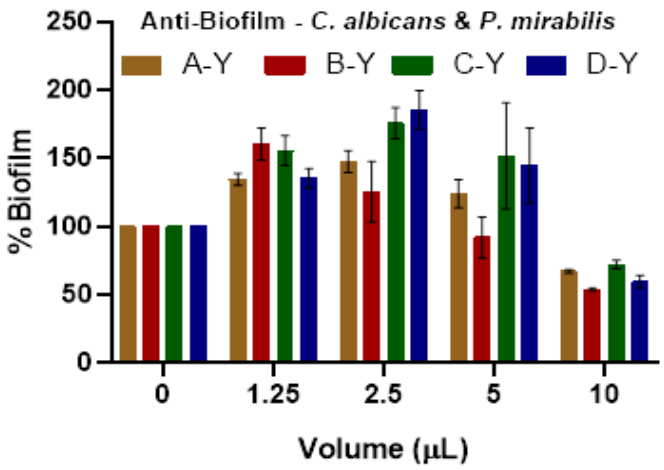

Figure 4 (C): Mixed Biofilm inhibition of *Candida* and *Proteus*

Form the biofilm inhibition data, it seems that A-Y (water AgNPs) is most active inhibitor of *Candida* biofilm (5 uL), whereas B-Y is most active inhibitor of *Proteus* biofilm (2.5 uL). Mixed biofilm was most efficiently inhibited by B-Y (Ethanol AgNPs) (5 uL).

Conclusion

The extract from the leaves of ***Butea monosperma*** synthesized Sliver AgNPs multiple solvent concentrations showed antifungal as well as antibacterial activity capable of inhibiting the growth of *Candida & Proteus* species as well as the formation of C. albicans &, *P. mirabilis* biofilm, Mixed Biofilm inhibition of *Candida* and *Proteus* was clearly observed.

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ESTIMATING FACULTY' SATISFACTION IN TECHNOLOGY ADOPTION IN HIGHER EDUCATION BY USING KANO'S MODEL

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ABSTRACT

Student is a worldwide marvel. Sound considering students will prompt Healthy politics and a solid vote based situation. Youth can be the light transporters to get a nation freed from social financial and political inclines if they are basically earnestly loved by the teachers and the educators in the schools and the colleges. Students of today are the future gatekeepers of our country's predetermination. They are the disintegrates and developers of future India. Political awareness is, hence, a key factor adding to the development and improvement of a country. Student of India should develop a wonderful feeling of control, which would one say one is of the fundamental essentials of vote based system should students participate in governmental issues? It has been perhaps the most astounding inquiries before our national leaders. The paper aims to examine the fact whether the politics is healthy for students or not.

***Keywords**: Student politics, Democracy, Advantages & Disadvantages etc.*

Introduction

Technology can support educators by connecting them to information, data, skills, tools, experience, and learning opportunities, inspiring them to provide more meaningful instruction to all students. Faculty needs continuous, prompt guidance, including career development mentors and day-to-day jobs, as technology progresses. Without incorporating technology-based programming into the programs themselves, this aim would be impossible to achieve. If technology is introduced in teaching and learning across this means, further course and program evaluation must promote, enhance, and reaffirm the effectiveness of a student's learning outcomes across these approaches. According to some scholars, faculty satisfaction is one of the five foundations of quality and plays a significant role in teaching technology (Vasilik, O. & Bolliger, D. 2009; Hagedorn, L.S. 2000). When it comes to forecasting teaching performance with technology, faculty satisfaction and student outcomes are correlated (Hartman & Moskal, P., 2000). Additionally, there is a significant association between faculty satisfaction with the structure and efficacy of classes and student satisfaction with courses (Bolliger & Wasilik, 2009; Wendt & Wendt, 2012). Faculty satisfaction is less well studied in the literature, as are the variables how it effect on the adoption of technology in teaching and learning. This study researcher aims to measure the faculty satisfaction index towards technology adoption by combining the UTAUT model and ECT model.

Moreover, combining both models' factors influences most in technologies adoption in teaching and learning. These 129 samples of faculty members have been taken to study the measure the faculty satisfaction. Researcher shows that ease to use, effort expectancy and facilities condition plays a vital role in faculty satisfaction. The current study will be focused on three areas.

1. How to measure faculty satisfaction towards technology adoption?
2. Which factors influence most to build faculty satisfaction towards technology adoption?
3. How do we go beyond developing faculty satisfaction into faculty gratification?

Theoretical Background

Faculty satisfaction is the satisfaction of basic and explicit consumer needs through the sum of a service's or product's attributes. As a result, it becomes critical to ascertain how their success can affect consumer loyalty. According to the Kano Model, the association between the presence or success of attributes and consumer

loyalty is nonlinear, with attributes classified as "Must-have," "One-dimensional," "Attractive," "Neutral," or "Reverse" (Kano et al., 1984; Berger et al., 1993; Nilson and Fundin, 2005). Satisfaction is proportional to results with "one-dimensional" attributes—increased success results in increased happiness, and vice versa. "Must-be" qualities are associated with the service's fundamental features. Customers often do not perceive the existence of these attributes, but their lack results in significant disappointment. When present, "attractive" characteristics provide superior satisfaction; however, they do not provide disappointment when absent or inadequate. The Kano Model also identifies two additional attributes: "Indifferent consistency", has neither pleasure nor disappointment and "Reverse", attributes are missing. They have more pleasure than when they are present.

Expectation confirmation theory (ECT) is a cognitive theory that explicates post-purchase fulfillment. The theory explains that satisfaction is formed when expectations are coupled with perceived performance (Almarzooq, Lopes, & Kochar, 2020). This perception of educational technology allows learners to connect in an inventive way supporting their education. The Unified Theory of Acceptance and Use of Technology (UTAUT) model has been utilized extensively in predicting system usage and using technology usage and adoption decisions in different fields (Almaiah, Alamri & Al-Rahmi, 2019). The theory explains four different constructs: performance expectancy and effort expectancy, social influence, and facilitating conditions. Students and educators in India accept and adopt information technology in schools and incorporate it into the curriculum as the chief enabler of education.

Methodology

The items obtained from all the tasks were combined Kano model for faculty technology adoption and continue use of technology. The respondent data was gathered from 129 higher education colleges in Delhi and the NCR, both public and private, as well as deemed universities. The Kano table and the faculty satisfaction index are used to measure faculty satisfaction of technology adoption and use. Items were taken well-known scales from the UTAUT model and ECT model. The questionnaire was designed to categorize and evaluate the variables that affect faculty satisfaction with technology adoption and usage. It included 44 items organized into 13 constructs (effort expectancy, social influence, performance expectancy, hedonic motivation, facilities condition, risk, trust, habit, perceived satisfaction, confirmation, perceived usefulness, perceived value, and continuance intention). Each question was graded by a scale of 0-5, with scores ranging from extremely satisfied, slightly satisfied, neither satisfied nor dissatisfied, slightly dissatisfied, extremely dissatisfied Likert scale.

Faculty Satisfaction Coefficients

The faculty satisfaction coefficient indicates whether satisfaction can be increased by introducing technology in teaching and learning or by introducing technology satisfy the faculty from becoming dissatisfied. The objective of this paper is to determine the extent to which factors influencing technology adoption influence faculty satisfaction or dissatisfaction. The formula to determine Better and Worst index stated as follows:

$$\text{Better} = \quad A + O \,/\, A + O + M + I$$

$$\text{Worse} = \quad -(O + M \,/\, A + O + M + I)$$

Interpretation

To measure the level of satisfaction, survey was conducted among faculty who has used a technology-based teaching and learning environment in higher education in Delhi NCR, the following was discovered. The must-one (M) category appeared frequently in the result among all four out of thirteen constructs. The faculty satisfaction index provides data and information to help management, institute, and colleges determine if they are looking for specific requirements. The better index is most extensive for performance expectancy and facilities condition, and it seems very important to faculty for adopting technology in teaching and learning. Its absence will lead to dissatisfaction. Habit and effort expectancy to use technology in teaching and learning is the second-highest index. Trust, compatibility,

personal innovation, and perceived usefulness have the third-highest index and its present effect the faculty satisfaction. Construct social influence, risk, perceived value, and hedonic motivation scoreless in the better index. This means that faculty does not bother about social influence, risk, and perceived value, and hedonic motivation construct. The worst index interpretate that performance expectancy, effort expectancy, facilities condition, and continuance intention to use causes dissatisfaction among the teachers because the worst index for these values is high.

Table 2: Satisfaction (Better) Index and Dissatisfaction (Worst) Index

Drivers	Categories	Better index	Worse Index
Performance Expectancy	M	0.71	0.62
Effort Expectancy	A	0.65	0.63
Hedonic Motivation	I	0.32	0.23
Social Influence	I	0.45	0.34
Facilities Condition	M	0.78	0.62
Continue Intention	M	0.52	0.65
Trust	O	0.56	0.43
Risk	R	0.48	0.34
Compatibility with system	O	0.52	0.52
Habit	M	0.63	0.44
Price Value	A	0.49	0.52
Personal Innovation	A	0.55	0.51
Perceived Usefulness	O	0.52	0.55

Figure 1 interpretate that the greatest number of average values is in the must-be quadrant, according to the regression based on the highest frequencies of the existence of those responses. It is understandable that when it comes to implementing technology in teaching and learning, faculty are more involved in how college and university administration have necessary resources, instruction on how to use technology in the classroom, and how technology improves results. With improved training tools and a user-friendly atmosphere, the framework will be more effective in applying technology in the educational field.

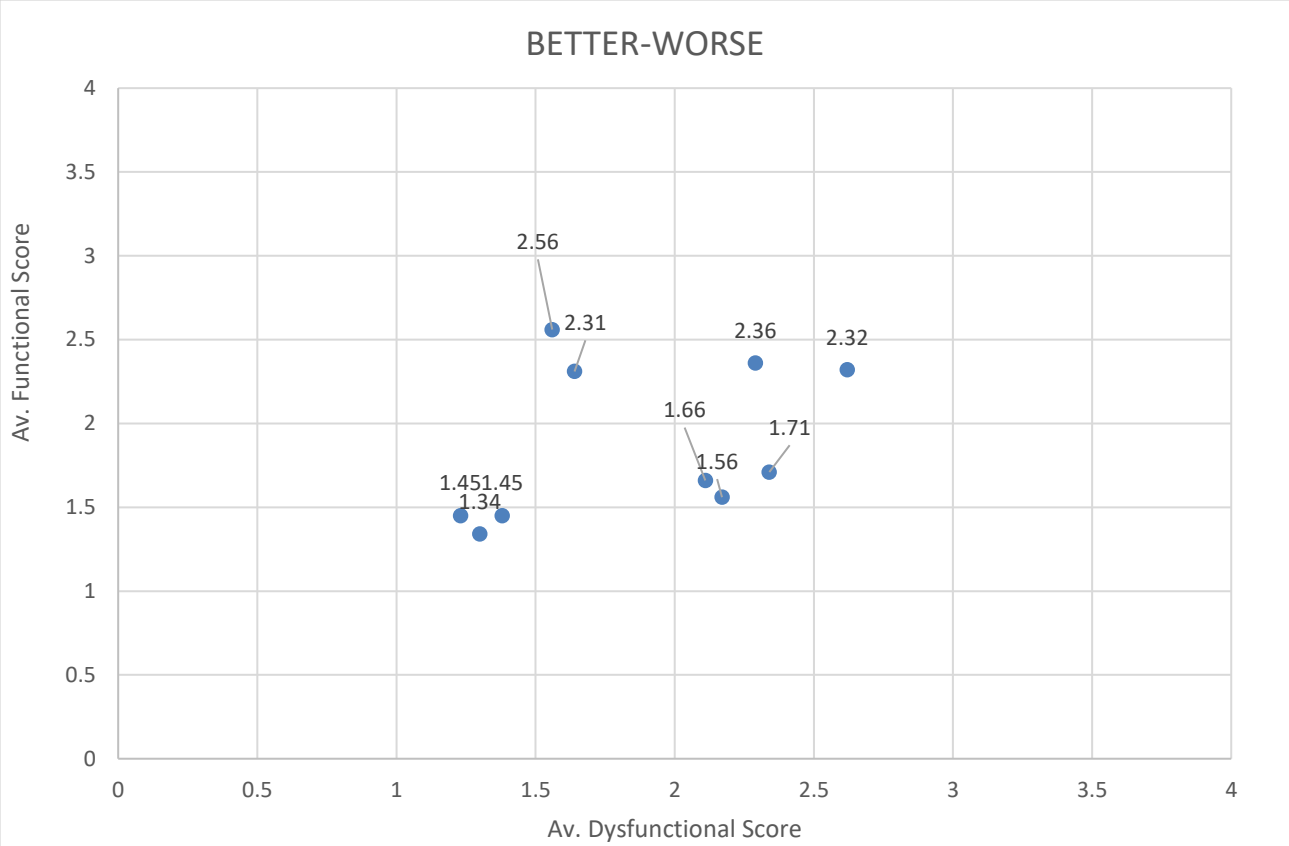

Figure 1 Map of functional and dysfunctional points.

Discussion and Finding

The shift from traditional to online education has been the standard in the last decade. Online applications and technologies have shown to be an important way for teachers and students to communicate. Educators, on the other hand, are less enthusiastic about the current learning platform. Faculty will be more open and creative in their content creation and lecture delivery to students as a result of technology acceptance. For rapid technological acceptance, it is therefore essential to have an interest in and an ability to learn new technology. Faculty must be adequately updated on technical capabilities and tools in order to use technology in the classroom effectively. It allows them to relax while still allowing them to adapt to new procedures easily and smoothly.

This study will fill in the gaps and assist the institute in determining the factors that will allow faculty to implement technology in a satisfactory manner. Second, the UTAUT model has been so influential in the education field that many scholars have used it to study the implementation of technology in education over the last ten years. In this model, the researcher introduces several new constructs.

Our findings suggest that the Kano model can identify the correct constructs to feed into the UTAUT model, which can aid researchers in making more reliable predictions by identifying non-influencing constructs. This method can be used to generate further potential work. We also assume that, as we did in Higher Education, additional research is needed in other fields.

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ANALYTICAL STUDY OF DIELECTRIC PROPERTIES OF SOIL AT KORBA CITY OF KORBA DISTRICT OF CHHATTISGARH

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ABSTRACT

Prime objective is to this research, Soil is a complex mixture of minerals, water, air, organic materials, and innumerable organisms that have decomposed from once-living objects. Soil features such as physical properties, chemical properties, and geographic properties are extremely significant in agricultural output. A microwave test bench is commonly used to do dielectric constant measurements. The soil characteristic has an impact on grain production. There are several variables to consider, but the moisture content is the most crucial. The qualities of soil are studied in the laboratory, which is highly useful in agriculture.

Keywords: *Microwave, Remote Sensing, Soil Quality, fertility, dielectric, dielectric constant, nutrients, texture.*

Introduction

When exposed to an external electric field, dielectric characteristics of materials are defined as a molecular property that is basic in all materials capable of impending electron migration resulting in polarization inside the material[1], [2].

Remote sensing is the sensing of an object or phenomena from a remote distance, signal, sensor, sensing or the component of remote sensing[3], [4]. Microwave remote sensing has emerged as a new area of study for natural resources over the last two decades. It emphasises the interaction between electromagnetic waves and the research materials[5], [6]. Soil has different properties as physical, chemical and Geographical. In physical properties, soil texture (sand, silt and clay), bulk density, WHC, particle density, porosity, volume expansion, melting point, transition moisture, water content, dielectric constant exists etc.[7], [8]. Now in chemical properties pH, EC, OC, Heavy metals viz Fe, Pb, Mn, Zn, Cr, Micro nutrients metals viz Fe, Mn, Zn, Cu and macro nutrients N, P, K, Le, Mg further Geographical properties is denoted by LALA, i.e., Latitude, Altitude, Longitude, average rain fall. Recently new term is introduced in concerned research is hydraulic pressure[9].

The pH of a soil indicates whether it is acidic or alkaline. For plant growth, eighteen components known as nutrients are required[10]–[12]. Based on the amount necessary, they are categorised as macro- and micronutrients. Plants extract the nutrients they require from the earth as they grow. There is a lot riding on soil's ability to serve as a link between rock, air, water, and life as a natural body (the biosphere). The experimentally obtained values of the complex dielectric constant's real and imaginary components have been presented for sand, silt, and clay samples with varying moisture contents[9], [13], [14]. It is required to artificially replace these nutrients in order to maintain the soil productivity. In present research paper in physical properties following parameters have been studied as well as measured as textural class, bulk density, particle density, water holding capacity, porosity, welting point, transition moisture, hydrant conductivity and colour etc.

Materials & Methods

Soil Sampling:

Soil specimen are gathered from different locations of Korba city of Korba district at Chhattisgarh, a depth spanning from 0 to 20 cm following a crisscross sequence. Five holes were drilled for each sample. After properly integrating all of the preceding soil specimens,

a composite specimen weighing 3 to 4 kg was taken, suggesting one site. This procedure was used again while preparing composite samples that represented all of the locations. The coarser particles are removed first using the gyrator sieve shaker, which also aids in the removal of topsoil samples. These fine particles are sieved out and then dried in a hot air oven for nearly 24 hours at a temperature of around 110°C to remove any remaining moisture.

Theory

The chemical and physical features of soil samples are measured in the analysis laboratory. A huge number of soil samples with diverse chemical and physical features are used in the investigation. Only the physico-chemical and dielectric properties of soils are examined in this study. The field capacity can be calculated using an empirical calculation based on soil composition (FC).

FC= 25.1 - 0.21 (% Sand) + 0.22 (% Clay)

Wilting coefficient (Wp) is calculated by using the Wang and Schmugge model.

Wp = 0.06774 − 0.00064 × sand + 0.00478 × clay

weight = 0.45 ×wp + 0.165

The complex dielectric constant is calculated using the relation

ε*= ε'-jε"

Where ε'=dielectric constant, ε"=dielectric loss factor. Because the moisture content of soil determines its dielectric constant, the salt content of water will impact its dielectric properties. Salt makes it more difficult for crops to collect soil moisture in agriculture, limiting plant development and production. Monitoring was necessary to keep track of salinity changes and predict further deterioration. The experimentally determined dielectric constant and dielectric loss values for soil with various salt levels are presented in this work.

The dielectric constant ε', dielectric loss ε" emissivity ep(q) and a.c. conductivity (σ) of these soil samples are then determined from the following relations:

ε*= ε'-jε"

Where ε'=dielectric constant, ε"=dielectric loss factor. Since the dielectric constant of a soil depends on the moisture, the presence of salts in water will also affect its dielectric properties.

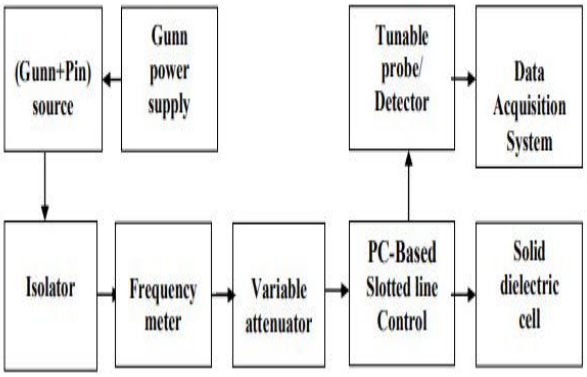

Fig 1: Block diagram of microwave bench setup for the measurement of dielectric constant of Soils.

Soils samples of different moisture contents are prepared by adding measured amount of distilled water to dry soil. The moisture content is percentage by dry weight Wc (%) is calculated using following relation.

Wc (%) = [(weight of wet soil - weight of dry soil) / (weight of dry soil)] x 100

This soil sample is considered as dry or 0 % moisture content soil sample. Then on the basis of volumetric analysis 5%, 10%, 15%, 20%, 25% and 30% moisture content soil samples were prepared and dielectric constant is measured using X band microwave set up.

Result & Discussion

The results showed that available potassium content range from 216 - 397 kg ha-1. Considering 3 the soils having 0-50 kg ha-1 as very low, 51-100 kg ha-1 as low, 101-250 kg ha-1 as medium and >250 kg ha-1 as high in available potassium contents. soil samples were observed under medium to High status in available potassium (table 1-3). The best attribute of soil for storing organic carbon is determined by its type (percent clay). Plant development will be enhanced while organic carbon emissions from the soil are minimized, resulting in the greatest amount of organic carbon retention in the soil. From graph 2-7, we studied the effect of different parameters on dielectric constant. it is observed that sand

percentages decrease with increase of dielectric constant whereas it increases with the increase in percentage of silt and clay in soil.

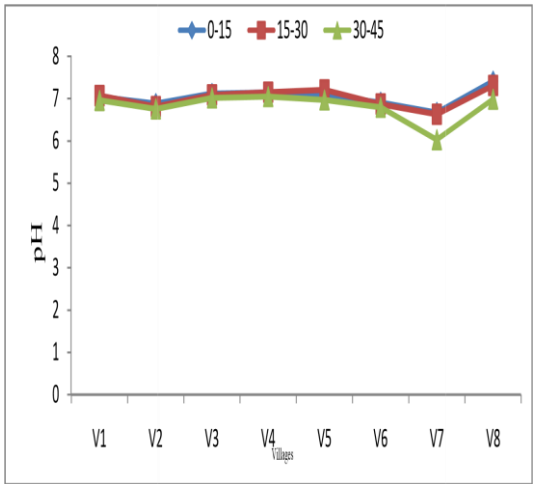

Fig. 2: Soil pH at different depths (0-15, 15-30 and 30-45 cm) of different villages of Korba district Chhattisgarh/ India

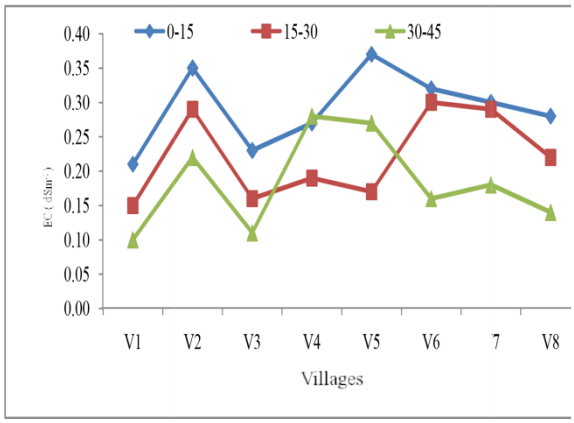

Fig. 3: Electrical Conductivity of soil at different depths (0-15, 15-30 and 30-45 cm) of different villages of Korba district Chhattisgarh/ India.

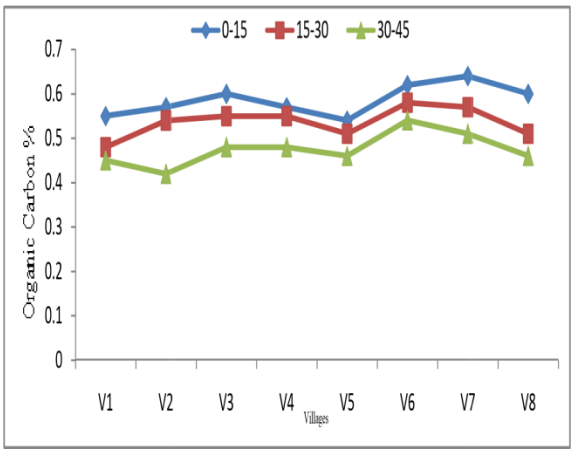

Fig.4: Soil Organic Carbon (%) at different depths (0-15, 15-30 and 30-45 cm) of different villages of Korba district Chhattisgarh/ India

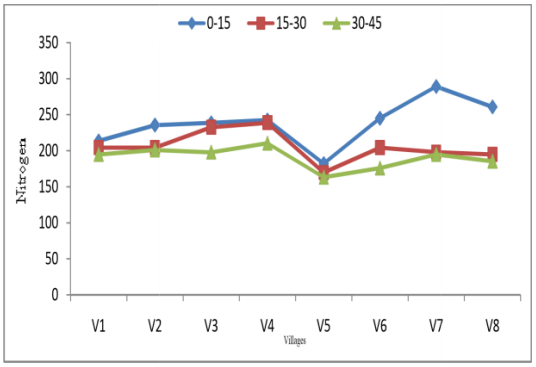

Fig. 5: Available Nitrogen (Kg ha-1) at different depths (0-15, 15-30 and 30-45 cm) of different villages of Korba district Chhattisgarh/ India

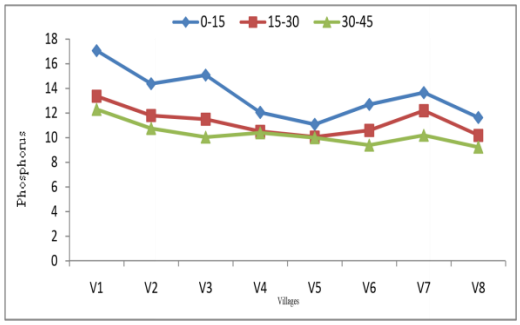

Fig. 6: Available Phosphorus (Kg ha-1) at different depths (0-15, 15-30 and 30-45 cm) of different villages of Korba district Chhattisgarh/ India

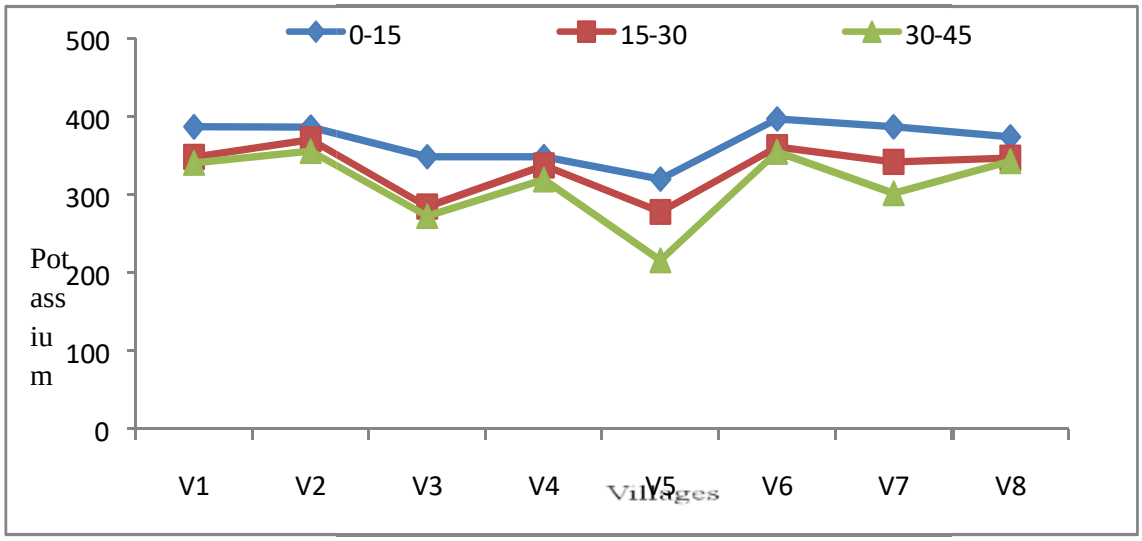

Fig. 7: Available Potassium (Kg ha-1) at different depths (0-15, 15-30 and 30-45 cm) of different villages of Korba district Chhattisgarh/ India.

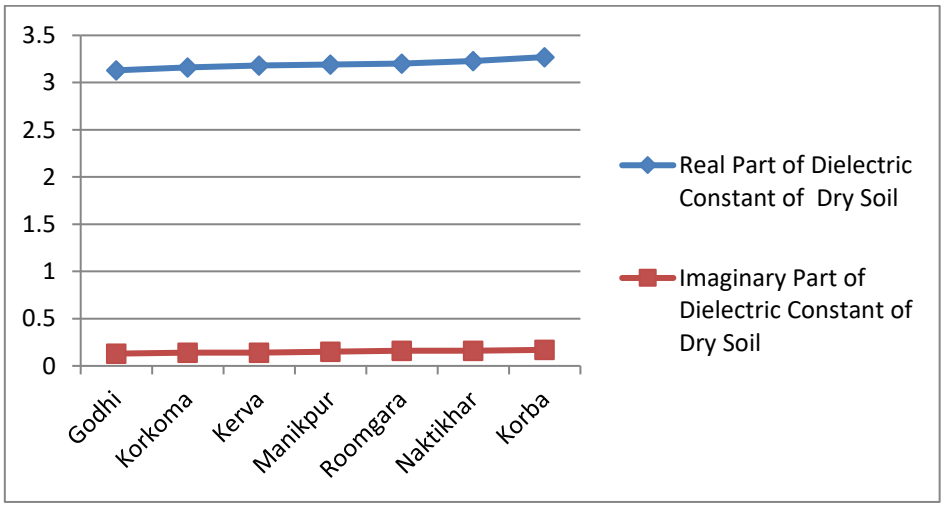

Fig. 8: Variation of Dielectric Constant with Dry Soil (0% Moisture Content)

Table 1: Soil Fertility Parameters Of The Soils Sample Under Study

Sample .N0	Village	Different depth	pH	EC dSm-1	OC %	Available nutrients (Kg/ha)		
						N	P	K
1	Ompur	0-15	7.04	0.21	0.55	213.76	17.06	387.00
2	Ompur	15-30	7.07	0.15	0.48	204.33	13.36	348.11
3	Ompur	30-45	6.96	0.10	0.45	194.9	12.3	340.70
4	Rajgamar	0-15	6.88	0.35	0.57	235.77	14.38	386.40
5	Rajgamar	15-30	6.81	0.29	0.54	204.33	11.8	370.60

6	Rajgamar	30-45	6.76	0.22	0.42	201.19	10.76	355.90
7	Kerakachhar	0-15	7.17	0.23	0.6	238.91	15.08	348.51
8	Kerakachhar	15-30	7.09	0.16	0.55	232.62	11.5	84.90
9	Kerakachhar	30-45	7.02	0.11	0.48	198.04	10.05	272.50
10	Patrapali	0-15	7.14	0.27	0.57	242.6	12.06	384.40
11	Patrapali	15-30	7.15	0.19	0.55	238.91	10.51	337.20
12	Patrapali	30-45	7.05	0.28	0.48	210.62	10.4	319.60
13	Tuman	0-15	7.07	0.37	0.54	182.33	11.09	320.00
14	Tuman	15-30	7.21	0.17	0.51	169.75	10.06	278.00
15	Tuman	30-45	6.97	0.27	0.46	163.46	10	216.00
16	Khodri	0-15	6.91	0.32	0.62	245.2	12.7	397.00
17	Khodri	15-30	6.87	0.3	0.58	204.33	10.6	361.00
18	Khodri	30-45	6.80	0.16	0.54	176.04	9.4	355.00
19	Sirki	0-15	6.67	0.3	0.64	289.21	13.66	387.00
20	Sirki	15-30	6.63	0.29	0.57	198.04	12.19	342.00
21	Sirki	30-45	6.03	0.18	0.51	194.9	10.2	301.90
22	Jatga	0-15	7.41	0.28	0.6	260.92	11.64	374.10
23	Jatga	15-30	7.31	0.22	0.51	194.9	10.19	347.00
24	Jatga	30-45	6.99	0.14	0.46	185.47	9.24	343.00

Table 2: Measured value real and imaginary part of dielectric constant of dry soil [15]

S. No.	Sample Place	Real Part of Dielectric Constant of Dry Soil	Imaginary Part of Dielectric Constant of Dry Soil
1	Godhi	3.13	0.13
2	Korkoma	3.16	0.14
3	Kerva	3.18	0.14
4	Manikpur (Risdi)	3.19	0.15
5	Roomgara	3.20	0.16
6	Naktikhar	3.23	0.16
7	Korba	3.27	0.17

Table 3

Sample	**Godhi**	**Korkoma**	**Kerva**	**Manikpur**	**Roomgara**	**Naktikhar**	**Korba**
pH (1:2.5)	6.30	7.30	6.50	6.90	6.78	6.90	6.50
EC (Dsm^{-1})	0.23	0.19	0.32	0.32	0.23	0.36	0.12

OC (%)	0.32	0.46	0.65	0.34	0.31	0.32	0.40
N (Kg/Ha)	110	140	180	190	88	110	100
P (Kg/Ha)	10.00	11.30	12.00	12.30	07.59	10.00	11.00
K (Kg/Ha)	270	334	336	415	320	270	430
Fe (ppm)	14.80	22.70	27.10	28.20	21.17	14.80	18.90
Zn (ppm)	0.35	0.41	0.16	0.46	0.32	0.35	0.61
Cu (ppm)	0.78	0.98	1.30	1.17	0.98	0.78	0.61
Mn (ppm)	10.70	17.60	18.30	21.10	16.34	10.70	14.60

Conclusion

The results under study of chemical parameters of soil samples in different villages of Korba district of Chhattisgarh was characterized moderately acidic to moderately alkaline in reaction and salt free in electric conductivity. The organic carbon lever exhibited under medium range. The soil samples of that area showed low to medium level in N, very low status of P content and medium to high level of K status. Therefore, attention and regular monitoring required for the soil to yield high crop production. Further to calculate the scattering coefficient of vegetation from measured dielectric properties. There are theoretical models for estimation of scattering coefficient viz. physical optic model, geometric optics model and perturbation model. But for estimation of scattering coefficient and selection of the model, some statistical parameters that are to be measured in units of wavelength viz. Standard deviation of surface height and surface correlation length. The roughness of the surface is characterized by these fundamental parameters. Now we are in search of an appropriate method to measure these statistical parameters for vegetation.

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FACTORS OF IMPROVING THE SOCIO-CULTURAL FUNCTION OF MUSEUMS IN THE TWENTIETH CENTURY (ON THE EXAMPLE OF MUSEUMS IN UZBEKISTAN)

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ABSTRACT

The article describes the factors of improving the socio-cultural function of museums in the twentieth century on the basis of an analytical approach using the example of museums in Uzbekistan. The structure of the exposition, the concept and development of museology of the newly created museums of Uzbekistan are analyzed.

***Keywords**: Museology, concept, exposition, labeling, education, fund, museum pedagogy, museography.*

Today museums play the role of institutions for the preservation of cultural heritage. In the process of fulfilling their social functions, museums are able to preserve the religious and cultural unity of mankind, relying on interethnic relations, various cultural traditions and peoples.

The concept of a museum is an institute or institution, a special space intended for collecting, studying, exposing material and non-material objects of a person and his environment. Over the centuries, the appearance and functions of museums have changed significantly.

By the twentieth century, the emphasis on the ability of people to gain knowledge as equals, worship reason and spread knowledge also led to a new interpretation of the museum. The revolutionary events of the early twentieth century changed all spheres of public life. Initially, museums will be open only to "sensitive people", but then they will be equally open to all segments of the population.

The first international museum organization, the International Bureau of Museums, began operations in 1926 in Paris as part of the International Institute of Intellectual Property under the auspices of the League of Nations. This organization operated under occupation during the Second World War. Although there has been some revival in the work of the bureau since 1944, it has not yet fully recovered.

When the United Nations was created in 1945, UNESCO was founded on November 16. The structure of the organization in the field of education, science and culture on a global scale allowed the creation of an international office of museums. In the same year, President of the American Museum Association Chauncey Hamlin (1881-19630) met with Georges Salle, director of the French Museums of Oriental Art in France, to discuss the creation of a new international museum organization. As a result, on November 16, 1946, a meeting of representatives of museum organizations from 14 countries began in the Louvre. On the first day of the meeting, Ch. Hamlen will be appointed secretary of the new organization and will soon take over as president. On November 18, the organization was renamed the International Council of Museums (ICOM) [1].

In 1947, the first formal agreement between ICOM and UNESCO was signed. According to him, ICOM has been appointed as the chief adviser to UNESCO on museums and heritage. This allowed ICOM to obtain consultative status of the highest category "A" at the UN

Economic and Social Council. In November of this year, Mexico hosted the first ICOM preparatory conference, which discussed issues such as the publication of periodicals of the Council, the international exchange of museum items, exhibition activities, and the organization of an international library. In the summer of 1948, the first full-fledged ICOM conference was held in Paris. Since 1950, the conference has been held every three years. The General Assembly will also be convened within its framework.

In 1977, the General Assembly of ICOM in Moscow decided to celebrate the International Day of Museums. According to the decree, International Museum Day is celebrated annually since May 18, 1977, and on this day, access to museums and galleries around the world will be free. Festive events can last from one day to a week [2]. First of all, their point of view should correspond to the following essence: "Museums are the most important means of cultural communication in the development of peace and cooperation, enrichment of culture and harmony between people."

On this day, all museums will host events related to the main theme of the holiday. International Museum Day is a great opportunity for museum staff to meet regular visitors in an unconventional setting and attract new audiences. As a result, museums will take their place in public life.

Towards the end of the twentieth century, ICOM began to pay more attention to people with disabilities. In 1988, in France, in cooperation with the UNESCO Foundation, the first international conference "Museums and the Disabled" was organized. There is a separate museum for rooms equipped for wheelchair users, for visitors with disabilities, a passenger elevator for going upstairs, specially staffed staff for people with various disabilities, such as deaf and hard of hearing visitors, guided tours with signs and actions, items for blind application and presentation of information in braille, and the creation of a number of similar conveniences.

In 1992, for the first time, “Museums and the Environment” became the common theme of the International Day of Museums. In 1997, for the first time on the International Day of Museums, an official poster was created to combat illicit trafficking in cultural heritage [3]. Now he regularly lists 100 lost items and a red sheet.

In 1997, as a result of joint efforts of the Ministry of Culture, the Academy of Sciences, the National Commission of the Republic of Uzbekistan for UNESCO and museum staff, the Council of Museums of Uzbekistan was established. On June 17, 1997, he became a full member of the International Museum Association by the Executive Committee of the International Council of Museums, which is a member of UNESCO [4].

In fact, it was accepted that the museum should serve the society and contribute to its development. According to foreign experts, a museum is an extremely complex concept, and it is difficult to give it a complete, indisputable and satisfactory definition [5].

Many states have established the concept of museums through legislation or their national organizations. The Law of the Republic of Uzbekistan “On Museums” defines a museum as follows: “A museum is a permanent non-profit cultural institution created by the owner for the storage, study and public display of museum items and museum collections” [6].

The concept of a professional museum, which has gained wider acceptance today, is defined in the 2007 International Council of Museums (ICOM) Statutes: a non-profit institution open to the public and operating on a permanent basis for society and society its development ”. The charter, approved 30 years ago in 1974, states: a non-profit institution that conducts research and propaganda is open to the public and operates on a permanent basis for society and its development ” [7].

At first glance, it is difficult to understand the difference between the two descriptions of this museum. The definition of “intangible heritage” was added to the definition in the 2007 Charter. The concept of intangible cultural heritage reflects traditions, expressions, knowledge and skills, as well as related equipment, objects, artifacts and cultural spaces, which, in turn, are

communities, groups and, in some cases, part of the cultural heritage of a particular person. ... means it is recognized as. Such intangible cultural heritage, passed down from generation to generation, is always created by certain communities and groups in accordance with their environment, nature and their own history, which instills in them a sense of identity, heredity and thus respect for human creativity and cultural heritage [8].

According to historical sources, in 1913 the number of museums in Uzbekistan was 3, in 1924 - 8, in 1940 - 17, in 1978 - 27 [9], in 1984 - 415 [10], in the first years of independence, the number of museums was more than 1200 [11]. According to the Information Service of the State Statistics Committee, in 2020 there will be 105 museums in the country [12].

Of course, analyzing these numbers, it is natural to ask why the number of museums has dropped dramatically in recent years. The reason is that, in accordance with the current legislation, the museum must be organized in the form of a non-profit cultural institution and duly registered as a legal entity [13]. Unfortunately, many non-state museums, university museums, corporate museums are not registered in the prescribed manner, so the number of institutions with museum status is 105.

According to the current legislation, museums in Uzbekistan are divided into state and non-state according to the form of ownership [14]. State museums include museums created by decrees and decrees of the President of the Republic of Uzbekistan, decrees and orders of the Cabinet of Ministers, as well as museums financed from the state budget in ministries and departments, territorial administrations. According to his specialization, the main activity is the preservation, study, public display of museum objects and museum collections, as well as the preservation and study of objects of cultural and natural heritage, as well as museum objects and museum collections. And reserve museums, which consist of public displays.

The Uzbekistan museums have gone through several development stages that reflect social, political and ideological changes in the evolution of society. The country's museums boast extensive assets that constitute the cultural heritage of the nation. Exhibits require careful handling, conservation, study and promotion. Museum work related to the preservation of the cultural heritage, collection contemporary art specimen and passinh them on the next generations has never been as relevant as it is today.

To preserve, study and pass historical heritage on to the new generationi is one of the top priorities of the government policy. This becomes even more important in the context of the globalization and 'mass culture' that pose a challenge to human identity and put traditional values at risk of extinction.

Over the past three to four years, a number of new museums have been created in Uzbeksitan with an aim to preserve cultural and spiritual heritage and introduce local public to the finest specimen of national andworld culture. These are, in particular, the Muynak Environmental, the Museum of Maqom Music in Shakhrisabz, the Erkin Vakhidov Memorial Museum, the Mutal Burkhanov House-Museum, the Khazini House-Museum, the Abdulla qadiri Memorial and House Museum, the Ergash Jumanbulbul oglu Memorial Museum and the Museum of Glory[15].

The city of Tashkent located at the crossroads of the world cultures has been a science, cultural and education hub for many centuries. Today, the nation's capital is a fast developing and one of the most beautiful cities. Until recently, however, there was no museums decidated to the city itself. In May 2020, on the initiative of the country's president, the Museum of the Tashkent city situated in the Writers' Alley was opened.

The building of the museum operating as a branch of the State Museums of the History of Uzbekistan, was redesigned and refurbished in keeping with local artitectural traditions, on the site of the former Uzbekistan Cultural and Art Exhibition Hall. The exposition design of the museum was developed by Discover Invest following the concept proposed by designer Anvar Yuldashev, while the academic concept was developed by Jannat Ismailova, Director of the State Museum of Uzbekistan History,

archeologist Otabek Aripjanov, and other experts.

The museum exposition covers the period from ancient times to the second half of the 19th century. The museums's primary objective is to show the milestones in the political, commercial, cultural and handicraft development of the first large urban centres that have evolved over two thousand years on the territory of modern-day Tashkent. The show-room has been designed as an integral complex of a unique look.

Not only historians, but also artists were involved in the making of the expostions to make sure it facilitates the procees of introducing the public to the exhibits in the most effective way.

According to the experts, setting up a permanent exhibition is a complex process were colour and light have in an important function as these can help harmonize the exposition elements, highlight key exhibits and compositions, and trigger an emotional response from the audience.

Once of the museums with a concept well-presented through the expositions design is the Maqom Music Museum opened in the city of Shakhrisabz in 2018. The museums was founded with an aim to create an asset of classical and modern specimens of the Uzbek maqom art, and to enable research using the museum exhibits and collections with subsequent publication of the research findings.

The museum displays items related to the Fergana-Tashkent maqom pieces and the Bukhara-Samarkand shashmakom (video, photos, performers' costumes) historical musical instruments from the Khorezm Province, as well as ethnographic exhibits from the Kahkadarya and Surkhandarya Provinces. The exposition design was developed by the City Size Design Production, and the academic concept – by art critic Shakhlo Abdullaeva. The exposition is set in a relatively small space where the use of installations takes visitior into the world of maqom music art. Listening to the recordings of the famous Uzbek performing artists the audience feels taken away by the flow of music[15].

The Victory Park and the Museum of Glory, now added to the list of the Uzbekistan museums visited bu local residents and foreign guests, have been created at the initiative of the head of state to demonstrate the contribution of the Uzbek people to the victory in World War II.

The art and architecture concept for the Victory Park and the Museum of Glory was developed with an input from the academic and artistic communities, as well as on the basis of international practice experience. The Almazar District of Tashkent allocatrd more than twelve hectares of land to accommodate the museum sities, with a major construction and landscaping effort invested. In the Victory Park one can see monumental statues, military hardware, memorials, and the Museum of Glory building.

The Museum of Glory exposition opens with a twenty-two meters wide panel entitled "Frontga" ("To the Front Lines") authored by Alisher Alikulov, People's Artist of Uzbekistan. The exposition created with the help of modern technologies and interactive methods tella about the fate of more than a million people from Uzbeksitan, those fighting at the war frontier and those who stayed behind to work heroically in the home front.

With many a highlight, the Victory Park still has things that could be improved. It would be nice put a schematic map in the entrance area to help visitors navigate and to guide their tour. There is no mentioning of the statue titles or their author's names, date of creation or the making technique. The design of the museum display windows makes it difficult to see objects in the background, especially for young children. Many of the military uniform specimens are folded inside a vertical display windows rather than being displayed unfolded and flat or on mannequins.

The cities of Samarkand, Bukhara and Khiva, included in the UNESCO World Heritage List and popular among tourists, are the open-air sanctuary museums – the status they have enjoyed since The Soviet times. After the attainment of independence, it was only in 2019 when the "Sarmishsoy", "Shakhrisabz", "Termez" and "Kokand" sanctuary museums

were created to protect the material and cultural heritage in the Navoi, Kashkadarya, Surkhandarya, and Fergana Provinces, along with its historical environment, and to the ensure its rational use.

Over the last three years, about a dozen museum buildings have been redesigned and repaired. A newly constructed building was given to the State Museums of History and Culture of the Surkhandarya Province; the Great Thinkers Museum in Kokand, the Sadriddin Aini Memorial House-Museum in Samarkand, and the Chirchik Municipal Museum of Local Lore were renovated.

The State Art Museum of Uzbekistan founded im 1974 by the group of young architects is one of the most prominent monuments of modernist architecture in Tashken. There has been no recent infrastructure upgrade or renewal in the museum, and the experimental materials used in the 2000s for the building façade ornamentation were not compatible with the local climates, also failing to meet the requirements for a museum building.

The Cultural and Art Development Foundation under the Ministry of Culture invited an international competitive bidding for the museum reconstruction project to be implemented in keeping with international standards. The project was awarded to a Japanese architect Tadao Ando, the winner of the Pritzker Prize. According to the reconstruction plan, the total museum meters, including the exposition space of seven thousand square meters. This will enable the museum to revise its exposition and increase the number of assets to more than a hundred thousand unique artefacts.

For the first time in the history of Uzbekistan museums, the Culture and Art Development Foundation ran an open international competition for the director's position at the State Art Museum of the Republic of Karakalpakstan named for Igor Savitsky. Applicants were required to have a degree in a art history, museum science, archeology and museum anthropology or other relevant field, along with at least four years of professional experience in administration and management in a culture-related institution. After the first competitive round, six candidates made their presentations and were interviewed. The winner of the competitive selecyion was Tigran Mkrtychev, director of the Roerich Museum in Moscow (the branch of the State Oriental Museum)/

To intensify training of qualified professionls in the field, host organizations have to open branches of the corresponding university departments or schools. For the purpose, the State Art Museum of Uzbekistan and the State Museum of History of Uzbekistan opened branches of the Museum Studies Department of the National Institute of Arts and Design named for Kamoliddin Bekhzod. Currently, subjects such as "physical and chemical examination of art works", "museum touring", "museum interior", "museology" and "photography" are thaught as practical sessions in museums showrooms and storerooms. This has helped to improve teaching quality and encouraged students' interest in the subjects of their specialist field.

Starting from September 2020, the first Sunday of every month has been declared an Open Door Day in the public museums. Meanwile, as part of the Live Museum project, the country's museums are to set up interactive zones, install electronic monitors enabling text translation for foreign tourists, as well as create positions of translator-guide, a marketing expert, and a museum services monetization officer. Comprehensive marketing and servivice measure include the development of museum websites, QR codes and software applications, as well as making the information about cultural sities available in airports, public places, railway stations, advertising sities and kiosks, on board air and rail transport.

In has been long time since the mankind faced a major global challenge such as the COVID-19 crisis. In the environment of the pandemic-induced lockdown, the scope of museum work is getting broader everywhere in the world as museums get more active in the social media amd closer to the audience. However, experts from UNESCO and the International Council of Museums express concern that one in eight museums in Uzbekistan, the government has been providing museums with financial support to keep them in operation.

Museums are not only a repository of our shared human heritage, but alsi a source of knowledge and inspiration, a place for social communication…Museums mirror the nation's history; they push the boundaries of our imagination abd teach us to look at the world different way, to value ourselves and our surroundings, to expose our hidden talents. Museums also show the connection between culture and sustainable development and produce an effective impact on the development of culture, tourism and urban planning.

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