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BRINGING STRATEGY AND SYSTEMS THINKING AND INDUSTRY 4.0 INTO URBAN PLANNING

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This paper brings together the diverse disciplines of urban planning, strategic management, systems thinking and Technology evolution through Industry 4.0. Cities have been evolving over thousands of years for accommodating societies. Human settlements are no longer a bunch of houses located closely but have evolved into complex living systems by themselves. These have grown into Mega cities and need a comprehensive approach for planning and managing their growth. Urban planning has evolved as a separate discipline over the years to meet this need. With the advancements in technologies, the concept of Smart cities has evolved, paving road to connected city. The latest technologies of AI/ML, Data Analytics, IoT etc have created the concept of Industry 4.0, which started influencing the smart cities and their management. However, over the years, it has focused more of the efficiency paradigm and control, which is changing slowly. This meant looking at the different aspects of a city as separate processes, ignoring the interconnectedness, interdependency and interactions among them, based on General systems Theory. This paper brings out this gap in the planning approach and suggests a new direction in terms of urban planning strategy, leveraging the technology and systems thinking. We propose a new approach to urban planning with a coherent and integrated aspect of strategic planning engulfing the overarching understanding of the technological push of Industry 4.0.

Keywords: Strategy, Systems Thinking, Industry 4.0, Urban Planning

STATUS OF ARTIFICIAL INTELLIGENCE IN HOSPITAL AND HEALTHCARE MANAGEMENT

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Artificial Intelligence or AI is essentially the field of computer science that deals with the computational comprehension of intelligence exhibited by a software or computer program. Where the "artificial" refers to "man-made" and "Intelligence" refers to the program's ability to apply "logic". In recent years this man-made technology has in some areas surpassed human efficiency. With the way this technology is growing to enhance human experience it is hardly a shock to see it being incorporated in day-to-day functioning of human life and business operations. Healthcare is one such sector that can be seen enjoying the ease this technology provides, it has been a long journey for the modern medicine to reach where it is now, and AI has been a favorable companion most would agree to. However, this prowess of Artificial Intelligence is mostly clinical application centric in this sector; despite the fact that healthcare isn't a one shoe fit all type of industry. It has various departments, areas and support services that could use the help Artificial Intelligence offers. One such area is the hospital administration & healthcare management; it can arguably be said that is the backbone of the industry since management workforce helps in the daily operations of an healthcare institute such as a hospital. However, there is a serious lack of research done pertaining to the incorporation of AI to this aspect of healthcare sector of India where healthcare is growing at higher rate compared to the excruciatingly low number of trained manpower. The countries like USA and Germany are utilizing the potential of AI in the management of hospitals, India is still just scratching the surface and further research plus implementation models can helps us see it's true potential in a country like ours.

Keywords: Artificial Intelligence, Healthcare management, Hospital Administration

MEASURING THE APPLICABILITY OF ENTREPRENEURIAL LEADERSHIP TEST (EAT) DEVELOPED BY TJAN, HARRINGTON & HSIEH AMONG INDIAN ASPIRING STUDENT ENTREPRENEURS

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The claim of testing entrepreneurial aptitude by the scales designed by Anthony K. Tjan, Richard J. Harrington, Tsun-Yan Hsieh on the scales of the leadership driven by heart (metamorphic use for compassionate leadership), smart (for logic driven leadership), gut (for courageous leadership) and luck (for network leadership) isn't sufficient to measure the entrepreneurial aptitude of Indian students aspiring for playing potential business leadership roles. The test prematurely measures only the aspects of a compassionate leadership indicator. The scale indicates false positive delta for the leadership by compassion and leadership by networking).

Keywords: EAT Entrepreneurial Aptitude, Entrepreneurship Leadership, Entrepreneurial Aspirations

INDIA'S SUPPLY CHAIN MANAGEMENT LATEST TRENDS AND ITS IMPORTANCE IN THE INDUSTRY SECTOR WITH SPECIAL REFERNCE TO THE GSCM PRACTICES

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This paper presents a comparative analysis of Supply Chain Management (SCM) practices of selected firms in India. The exploratory study covers a wide spectrum of firms. These comprise retail chains, logistic service providers, Fast Moving Consumer Goods (FMCG) companies, a hotel, a power generation unit, electrical and electronic goods manufacturers, automobile companies and their ancillaries. . These are supported with data and information from secondary as well as primary sources. The data is collected with the help of a structured Questionnaire and the secondary sources as journals, Magazines and companies information through Internet sources. Green supply chain management (GSCM) is the consideration of environmental issues in Supply Chain Management. Green Supply Chain Management practices in these firms are to be observed to identify emergent trends as well as areas of concern and also find scope for improvements. A wide spectrum of firms covering a wide nature of business are being covered so as to get a reasonable insight into SCM practices The study specifically focus on supply chain structures; facilities network design; transportation and logistics; collaborations and partnerships; and the role of Information and Communications Technologies (ICT). Comparative analysis of SCM practices of these firms indicates various similarities, differences, emergent trends as well as areas of concern. Finally, directions for future research are suggested

Keywords: Supply chain management practices, GSCM, comparative analysis, exploratory study

A POST-MERGER IMPACT STUDY ON FINANCIAL PERFORMANCE OF ACQUIRER – WITH RESPECT TO TATA STEEL

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Purpose of Research: Corporate restructuring and financial engineering are the prerequisite for the organization to be a leader in the globally competitive world. Expansion and diversification is most phenomenal corporate strategy to attain economic viability and competitive edge in the business world. For this they take some strategic decision like merger & acquisition. In the same alignment TATA steels have acquired four times bigger Corus in 2007at $12.15billion (around Rs. 55,000 cr.) to become 5th largest producer of the world. This deal was a milestone in the history of acquisition by the Indian companies, aimed to deliver increased $350 million profit by improved efficiency in production, integrated raw material procurement and marketing of steel and shipment of low-cost basic steel from Jamshedpur for finishing and value addition at the Corus mills. This corporate decision was a big challenge for the acquirer organization. The objective of this paper is to assess the impact on financial performance of the company after 14 years the acquisition of the Corus and its impact on its business.

Keywords: Mergers and Acquisitions, Corporate Restructuring, Financial Performance, Ratio Analysis.

COMPARATIVE ANALYSIS OF BAYESIAN REGULARIZATION AND MULTIPLE LINEAR REGRESSION MACHINE LEARNING ALGORITHM FOR THE PREDICTION OF NOISE LEVEL IN THE INDUSTRIAL ZONE OF LUCKNOW

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This study is an attempt to carry out the comparative analysis of Bayesian Regularization and Multiple linear regression machine learning algorithm and to determine the best algorithm for the prediction of noise level in the Industrial zone of Lucknow. The study found that Bayesian Regularization algorithm is more superior than multiple linear regression algorithm for the prediction of noise levels in terms of high value of R2 and low values of root mean squared error (RMSE), mean squared error (MSE), mean absolute error (MAE) and mean absolute percentage error (MAPE). Hence, this work is helpful for industrial researchers to maintain the balance between noise level and health condition of human.

Keywords: Noise Level, Bayesian Regularization, Multiple Linear Regressions.

STUDY OF DETERMINANTS OF FOREIGN DIRECT INVESTMENT IN INDIA

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Foreign Direct Investment (FDI) has become a vital route to raise the foreign capital. FDI acts as a bridge to fulfill the gap between investment and saving (Dr.Jasbir Singh & et al, 2012) and is an important vehicle of technology transfer from developed countries to developing countries. FDI has been a major contributor to economic growth in India. There are several factors that affect the FDI in India. The present study empirically explore the determinants of FDI inflow in India ,to investigate relationship between FDI inflow and these determinants by using the ordinary least square method from 2010 to 2020. The study uses some selected macroeconomic variables such as market size, inflation rate, trade openness, and exchange rate. The study used secondary data and the secondary data have been collected from different sources i.e., fact sheets on foreign direct investment, Annual reports of Reserve Bank of India, the web site of UNCTAD and different journals. The present study used the ordinary least square method to find the relationship between selected macro variables and FDI inflow in India. The empirical analysis concludes that market size, trade openness, exchange change rate, and FDI inflow have a positive and significant relationship.

Keywords: FDI, India market size, inflation rate

SUPERIORITY OF GMDH NEURAL NETWORK MODEL OVER HOLT'S AND ARIMA MODEL FOR FUTURE PREDICTION OF GENERAL FERTILITY RATE IN UTTAR PRADESH

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The present study aimed at the comparison of Group method of data handling (GMDH) neural network model with Holt's model and ARIMA model. In this study, time series data concerning about general fertility rate was collected for the period from 1995-96 to 2017-18 (23 years). To discover the best fitting model for the future prediction of general fertility rate in Uttar Pradesh, India, three distinct models were used: GMDH, Holt's, and Autoregressive integrated moving average (ARIMA). Forecasting errors namely mean absolute error (MAE), mean absolute percentage error (MAPE), mean squared error (MSE), Tracking Signal (TS) and Bias were utilised as model selection criteria. The study reveals the better performance and accuracy of GMDH model over two other considered models namely Holts and ARIMA model with the lowest values of MAE = 4.0812, MAPE= 4.4149, MSE = 51.2551, TS= 0.1715, Bias=0.0011.

Keywords: General Fertility Rate, GMDH, Holt's, ARIMA.

MACHINE LEARNING FOR EARLY PREDICTION OF ATTENTION DEFICIT HYPERACTIVITY DISORDER

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Attention Deficit Hyperactivity Disorder (ADHD) is most common mental disorder found among children. It starts from childhood and may continue till adulthood. It not only affects learning capability but also overall development of the child. Though ADHD can't be prevented or cured, but early ADHD diagnosis may help the patient to manage the symptoms. In our research work we have used HYPERAKTIV dataset to predict ADHD using Machine Learning models which has activity and heart rate data collected from 103 participants along with a patient attributes like age, sex, mental state and output data from a computerized neuropsychological test. Performance metrices were used to compare outcome of different machine learning models.

Keywords: Attention Deficit Hyperactivity Disorder(ADHD), Machine Learning,

NEW IMPUTATION METHOD FOR ELEVATED ESTIMATION OF POPULATION MEAN

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In this study, we suggest an optimal imputation strategy for the elevated estimation of the population mean of the main variable by utilizing the known auxiliary parameters for the missing observations. We suggest a new modified Searls type estimator and we study its sampling properties, mainly bias and Mean Squared Error (MSE), for the first order of approximation. The introduced estimator is compared theoretically with the competing estimators of the population mean under the imputation method. The efficiency conditions for the suggested estimator to be more efficient than the competing estimators are derived. These efficiency conditions are verified through the four natural populations, and to be sure about the efficiencies, we have also carried out a simulation study and generated four artificial populations with the same parameters as the natural populations. The estimator with the least MSE and the highest Percentage Relative Efficiency (PRE) is recommended for practical use in different areas of applications.

Keywords: Main Variable, Auxiliary Variable, Imputation, Bias, MSE, PRE.

AN EMPLOYEE MANAGEMENT SYSTEM APPLICATION USING PYTHON AND MYSQL

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In this project a graphical user interface application for managing typical employee operations has been developed. The graphical user interface and the application logic have been developed using Python and a MySQL database is used for maintaining employee data. The application provides the functionality for adding new employees, looking up for existing employees, updating existing employees, and removing existing employees. Password based authentication is used by the application to access the database and for performing various employee operations.

Keywords: Employee Management System, Python, MySQL

CONTROL CHART APPROACH TO OPTIMIZE SOJOURN TIMES OF CUSTOMERS IN K-POLICY QUEUES.

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This article presents a control chart approach that optimizes the sojourn times of customers in a dual rate queuing model for serving a single queue with a K-policy. Each member of the backup space D1 = [0, 1, 2,…, K] is served by a single server (S1), with an average service rate of µ1 per unit time. When the queue length increases to a higher space D2 = [K+1, K+2, ,…, ∞), an additional server (S2) is installed to join the main server (S1) to provide a service at a rate of µ2 = (µ1 +µ > 0) per unit time. When each service is started at a starting point with a queue length of j=0 or greater, no prioritization is allowed regardless of the amount of work available on the system. The arrival process is a Poisson process with an average rate of λ. Based on a predefined target level (i.e. maximum queue length or maximum latency), the K-policy is optimized using a modified control chart approach. By providing simulation time weights, each performance metric of interest is calculated and used in the proposed control chart. To find the optimal value for the queue length K = K0 and specify the second server, a number table is created numerically to plot this optimal value.

Keywords: Modelling of queues, time-weights, control chart, optimal K-policy.

A DISCRETE TIME GEOMETRIC QUEUE ATTACHED TO AN INVENTORY UNDER A (0, Q) POLICY.

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This article investigates how to manage inventory under a (0, Q) policy of single product provisioning to a Geo/Geo/1 service facility. Inventory system has a maximum level of 'S' and a lowest level '0'. An order for Q units is triggered under a threshold policy "f= [(0, Q),1]" when the stock I(t) at time t drops to 0 and the queue length X(t) value is at least one. If an incoming request finds the server empty, it will immediately go to the server or otherwise joins the queue. The lead times, inter-arrival times of demands and their service times are assumed to follow geometric distributions with parameters of success as "r, p, and q" respectively. Inventory level I (t) $\in$ {0, 1, …, Q} and number of customer requests X(t) $\in$ {0, 1, …,} are tracked by a Markov decision process (MDP) Z(t) = (X(t), I(t): t$\in$ [0 ∞)). We analyse the steady-state probabilities of the MDP, the distribution of client residence time in the server and thus measure some performances of interest. The average cost criterion based on the MDP is performed to calculate the optimal conditions for the assignment of the Q value. A numerical illustration is provided to demonstrate the results obtained under the control policy.

Keywords: Inventory system· Queueing system· Inventory policy · number of customer requests · Inventory level · Stationary distribution Optimal Policy.

DEPRESSION DETECTION USING MACHINE LEARNING METHODS

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Depression is a complex disease caused by psychological, physical and social factors. According to WHO 5% of the adults suffer from depression .It can not only result in drug abuse or physical problems but in worst cases, may lead to suicide. Recently the pandemic waves have hit the lives of many people in the world .This has not only impacted economical and physical condition of individuals but increase in mental disease cases have also been reported worldwide. Though there has been lots of research done in treatment of depression but earlier detection of its symptoms still presents challenges.
Machine learning is a branch of computer science that involves imparting intelligence on Machines. It is being successfully used in the area of classification. This paper presents some of the researches done in the area of depression detection using machine learning methods.

Keywords: Machine Learning, Depression, Detection, Artificial Intelligence, deep transfer learning.

EFFECT OF PLAN SHAPES ON THE PEAK FLOOR ACCELERATIONS OF RC BUILDINGS

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Previous earthquakes have clearly demonstrated that there is considerable failure of operational and functional equipments in buildings. This paper deals with the effect of plan shapes on Peak Floor accelerations(PFA) of buildings. The accelerations data is important for the seismic safety of non-structural elements (NSEs) as these are the input at the base of NSEs just like the ground accelerations are input at the base of buildings. Three seven story RC buildings having T, L and Y-shaped plans were subjected to fourteen recorded earthquake ground motion for performing Time history analysis. Floor response spectra and mode shapes have been compared for all the buildings. It was observed that there is considerable amount of acceleration in the higher modes especially in the lower stories. From this study it can be identified that NSEs need to be protected not only in strong earthquakes but also in the case of low moderate earthquakes.

Keywords: Peak floor accelerations, non-structural elements, Time history analysis, floor response spectra, mode shapes

THE INTEGRATION OF PEER-TO-PEER LEARNING METHODS AS A SYSTEMATIC APPROACH REGARD THE IMPOSTER PHENOMENON AMONG STEM LEARNERS

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Individuals that experience imposter phenomenon harbor resilient doubts about their abilities. The evidence of this study has determined how the imposter phenomenon (IP) impacts STEM students' academic achievement and professional development. The integration of peer-to-peer learning methods are used as outcomes to identify students in the STEM disciplines that suffer or have suffered from the imposter phenomenon (i.e., to determine the gaps in knowledge and skills). This learning method was vital to implementing best practices to assist counselors, faculty, and administrators in overcoming the IP symptoms through peer-oriented classroom environments. The evaluation of deploying strategies (e.g., what works and what requires change) was necessary to assess a proactive approach systemically in the manner of an investigation about institution effectiveness.

Keywords: Imposter Phenomenon, Project-based Learning, STEM Education, Experiential Learning, Imposter Phenomenon Cycle

PROJECT BASED LEARNING USING NASA DESIGN CONCEPTS FOR 3D PRINTING MAKERSPACE DEVELOPMENT IN STEM EDUCATION

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One of the most important aspects of STEM education is the engineering design process. When it comes to the design process, however, STEM education from kindergarten through 12th grade frequently overlooks the significance of modeling. The quick reproduction capability of 3d printers can be used to support modeling during the engineering design phase. This research will look into the usefulness of incorporating 3D printing technology into STEM project-based learning activities in terms of improving students' grasp of the engineering design process, particularly modeling. Six use categories are defined and presented as a result of research into the application of 3D printing in classrooms settings: (1) teaching students about 3D printing; (2) teaching practitioners about 3D printing; (3) as a support tool during teaching; (4) producing artefacts that aid learning; (5) creating assistive technologies; and (6) supporting outreach efforts. Evidence of 3D printing-based teaching techniques can be discovered in each of these six areas, and recommendations for further research and policy are given.

Keywords: STEM Education, Project-Based Learning, STEM, Engineering Design Process

DESIGNING A STEM INTERDISCIPLINARY APPROACH FOR PROCESS-DEVELOPMENT REGARDING THE POPULATION ECOLOGY OF PINFISH AND DYNAMICS IN THE NEARSHORE AREAS OF MARYLAND COASTAL BAYS

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Fluctuations in the abundance of forage fish impact marine ecosystems and economies because of their role in transferring energy and nutrients to higher trophic levels in the food web Predators rely on forage fish to thrive and stabilize the ecosystem that fisheries profit heavily on. The populations of forage fish in marine systems respond to changes in climate. Because forage fish provide energy to organisms of higher trophic levels and support lucrative fisheries, it is imperative for scientists to study changes in the demographics or population structure of species such as pinfish (Lagodon rhomboides) to determine what factors affect their abundance and distribution. Forage fish provide ecological support to predators such as fish, marine mammals and piscivorous birds and are key factors in commercial fisheries as well. It is possible that it would have similar ecological functions and responsibilities as other forage fishes within the system it inhabits. In southeast United States, it identified pinfish as a marine baitfish species that may use for aquaculture in the future. In the presence of these predators, pinfish also reduced their use of the upper water column, according to qualitative assessments. Predator avoidance mediated by behavior may thus help to explain observed patterns of variable habitat usage within estuarine mosaics of sand and seagrass habitats.

Keywords: Pinfish, Aquaculture, Ecological, Water Column, Paralichthys Lethostigma

STUDENT-CENTERED STRATEGIES IMPLEMENTED TO EXPLORE PEER-TO-PEER LEARNING METHODS IN STEM EDUCATION FOR ENGINEERING DESIGN USING INDUSTRY REQUIREMENTS

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The implementations of wind tunnels can be significant and without limit. Due to this, it is of the utmost importance to impose a repeatable plan for research into wind tunnels to make improvements in the field. The goals of this project were to usher in students to the real-world aspect of engineering, familiarize them to the design process, and making sure they follow through the process, which brought about the manufacturing of the wind tunnel. The only limitation placed was the wind tunnel should have a wind speed greater than 10 fps. The wind tunnel met this constraint, as it reached a wind speed of 15 fps in the test area. Wind tunnels are large tubes with air moving inside, they move air around an object, making it seem as if the object is flying. The tunnels are created to copy the actions of an object in flight or air moving on an object. Wind Tunnels are mostly used by researchers in NASA to determine how an aircraft will handle the air pressure in the air. In the project-based learning environment, the peers had discovered that how industry requirements could advance a horizontal built wind tunnel. The peers discovered the advantages and disadvantages regarding the advancement and challenges faced in building and design a wind tunnel.

Keywords: Peer-to-Peer Learning, Project-based Learning, STEM Education, Experiential Learning, Engineering Design, Student-Centered

VISUALIZING UNITED STATES COVID-19 CASES BY COUNTY

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The COVID-19 pandemic has dramatically reshaped social habits, financial markets, and medical technology on a global scale. The risk to public health has made the tracking of COVID-19 cases and deaths a top priority for major institutions including the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO), and the New York Times. These bodies publish extensive open-source statistical datasets available for public use.

Clinical research has shown, however, that data is more impactful when it is presented graphically, rather than textually. Virologists and other medical professionals benefit from information that is both accurate and easy to digest. This research thus focuses on plotting COVID-19 cases/deaths by county on a choropleth map of the United States. The application queries open-source data from the New York Times and generates a choropleth map that users can traverse by date. An animation is included to track general trends on a larger timescale. Visualization is handled by the open-source Plot.ly library implemented using the Python programming language.

Keywords: Choropleth map, COVID-19, Plot.ly, Visualization.

TO STUDY- SIX SIGMA AS AN EFFECTIVE TOOL IN QUALITY MANAGEMENT OF ELECTRONIC HEALTH RECORD (EHR)

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The purpose of this was to analyze the importance of Electronic Health Record (EHR) in quality healthcare services and need of effective process improvement tool to collect the complete and quality data across the continuum of patient care. Personal interviews were conducted with the healthcare providers to understand the various issues in effective implementation of EHR as duplication of data, lack of standardization in language, data entry error etc. Six Sigma emerged as a significant process improvement tool to streamline the implementation of EHR for quality health care in a cost-effective manner.

Keywords: Electronic Health Record (EHR), DMAIC (Define, Measure, Analyze, Implement, Control), Six Sigma.

AUTOMATIC RECOGNITION OF DIGITS SPOKEN IN THE GUJARATI LANGUAGE USING HIDDEN MARKOV MODELS

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Automatic Speech Recognition (ASR) is an important process with numerous applications in the age of Artificial Intelligence. Speech recognition in Gujarati language is very beneficial for the people knowing only the Gujarati language and also for the people with physical disability in finger or palm. In our experiments, we conducted ASR for the Gujarati language. After recording speech from speakers, the wavelet-based feature extraction technique was used to extract the speech features. The Gaussian Mixture Model (GMM) is then used to determine the likelihood of generating these features. These probabilities are then employed in Hidden Markov Models (HMM) to classify the features of the unknown speech. The findings produced using proposed method for the original and augmented datasets are discussed.

Keywords: Automatic Speech Recognition (ASR), Wavelet coefficients, Gaussian Mixture Model (GMM), Hidden Markov Model (HMM), Gujarati language

A STUDY ON EARNINGS MANAGEMENT OF FINANCIALLY DEPRESSED COMPANIES FILED IN NCLT

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The impact of financial depression on the scale of different earnings management systems, namely real earnings management and accruals earnings management, is investigated in this study. From 2006 to 2016, this study used a total of 250 companies filed in NCLT after the enactment of IBC-2016.
Financial depression leads real earnings management to increase significantly while accruals earnings management decreases significantly. It means that the larger the scale of real profits management that is accomplished through managing production costs and discretionary expenses, the healthier the organization is. On the contrary, the greater the size of accruals earnings management that is undertaken through managing the discretionary component of accruals, the worse the company's financial health.

Keywords: Earnings Management, Financially Depressed, Accruals Earning Management, Real Earning Management

MATHEMATICAL MODEL OF CANCER TREATMENT BY RADIOTHERAPY SOLVED BY FUZZY ADOMIAN DECOMPOSITION METHOD

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Cancer disease is a well-known killer of human beings in the world and it may take some months and years to treat and cure. The control model of cancer treatment by radiotherapy is based on the Lotka-Volterra model which gives the dynamics of cancerous and healthy cells. Such a system takes the semi-linear form. In this, paper, we are taking the initial condition and control to be fuzzy and obtain the solution for this model using Fuzzy Adomian Decomposition Method (FADM). It gives more realistic results for the concentration of healthy and cancer cells when treated by radiotherapy. The results of stability analysis for the system are discussed.

Keywords: Controlled Cancer dynamics, Radiotherapy, Fuzzy Adomian Decomposition Method, Fuzzy Initial Condition and Parameters.

RETAILER'S OPTIMUM INVENTORY DECISIONS UNDER CASH-DISCOUNT AND TRADECREDIT WITH PRESERVATION TECHNOLOGY INVESTMENTS

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An inventory model with trended demand is discussed in this paper. Products in the system deteriorate at constant rate. Preservation technology investments are used to reduce the rate of deterioration. To settle payment, manufacturer offers a short credit period for payment with cash discount on purchase or longer credit period without any discount to the retailer. Retailer's optimal policies which include optimal cycle time, order quantity, preservation cost are discussed. The objective is to minimize total cost of retailer with respect to cycle time and preservation technology investments.Numerical example is provided to validate the mathematical model. Sensitivity analysis has been carried out to study reactions on decision variables. The results obtained from study indicate that preservation technology investments help retailer to reduce the deterioration rate and earn more profit. It is observed that payment strategy for retailer depends on discount value and time limit offered by manufacturer to retailer.

Keywords: Inventory model; Deterioration; Preservation technology; Trended demand; Cash discount; Trade credit AMC: 90B05

MEDICAL KNOWLEDGE SUMMARIZATION AND TABULATION

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The critical activities in our information overload age are extraction, summarization, and tabular presentation of relevant information. This paper addresses several aspects of knowledge extraction for the medical case of Asperger's Syndrome and the graphical representation of this knowledge. The paper shows how the Language Model (LM) DaVinci can be useful as a knowledge extraction system in analyzing medical cases.

Keywords: *Language Models (LM), One-Shot Learning, Knowledge Representation, Asperger syndrome*

INVESTIGATIONS OF ENERGY AND CARBON EMISSION OF MANUFACTURER-RETAILERS DETERIORATING INVENTORY SYSTEM FOR TIME AND PRICE-DEPENDENT DEMAND UNDER UPSTREAM-DOWNSTREAM CREDIT PAYMENTS

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Supply chain management focuses on environmental assumptions. The effective and proper consumption of energy, be able to create a more efficient supply chain model. It comprises feasible energy intake, appropriate production rate, and higher goods delivered to the consumers with respect to the demand. This scenario deals with investigations of energy and carbon emission of manufacturer-retailer deteriorating inventory systems for time and price dependent demand under upstream-downstream trade-credit payments. The purpose of this article is to evaluate the total profit of the supply chain with respect to selling price, manufacturing rate, and cycle time. The model was solved using the classical optimization method. The concavity of total profit is displayed graphically. In the end, a numerical example along with a sensitivity analysis is performed to modify the problem.

Keywords: Time and price dependent demand, energy, Trade credit payments, Carbon emission.

EPQ MODEL TO PRICE-SENSITIVE STOCK-DEPENDENT DEMAND WITH CARBON EMISSION UNDER GREEN AND PRESERVATION TECHNOLOGY INVESTMENT

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Now-a-days, preserving products and environmental balance are alarming yet greater concerns in competitive market affairs. So, some countries are focused on reducing carbon emissions as it is considered to be the key factor for global warming. Most economists promote the carbon cap and carbon tax as an approach to reducing carbon emissions. Moreover, the deterioration of any products can be controlled by investing in many preservation technologies as per their respective products. Keeping this in mind, an inventory model for deteriorating items is investigated under a carbon cap and carbon tax policy for a controllable carbon emission by investing in a green technology investment collaborating with preservation technology investment. The proposed model is studied for three cases: (i) with green technology investment, (ii) with preservation technology investment and (iii) with both green and preservation technology investment. The proposed article deals with stock-dependent, price-sensitive demand. A solution procedure has been proposed for defining the optimal strategies of cycle time, selling price, green technology investment and preservation technology investment that maximizes the total profit in each case. Additionally, numerical examples are studied to validate the model and managerial insights are carried out with respect to key parameters.

Keywords: Carbon emission; carbon cap; carbon tax; deterioration; preservation technology; green technology; price-stock dependent demand.

AN EMPIRICAL STUDY OF EFFICIENT MARKET HYPOTHESIS (EMH) ON NATIONAL STOCK EXCHANGE (NSE)

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Investment is a common term and many young investors have come up to the stock market or stock exchange market to find an opportunity of a good investment. Stock exchange is a place where securities of companies are traded. Stock exchange helps the companies in their growth by selling its securities to the public. Investors need to know and understand in which securities they are investing. For this they have to make certain decisions and apply different techniques in order to get a good investment. There are a few theories which could help investors in making decisions. This study is based on one of the theories of investment and is called the Efficient Market Hypothesis (EMH). This theory states that share prices reflect all information whether public or private. This study mainly focuses on whether the prices of the stocks are affected by their past price. In other words, it shows whether a company's stock prices shows randomness or not. A total of 15 top traded securities are selected from the National Stock Exchange and is used for this study. Run test is used to show the p-value of the stocks and is compared with the level of significance. Conclusions are made on these comparisons and are shown whether the prices of the stocks of the companies are affected by their past prices or not.

Key words: Stock market, Efficient Market Hypothesis, National Stock Exchange, Investment and Run test .

CONVENTIONAL CONCRETE REINFORCED WITH BASALT FIBER

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Concrete is most widely used and essential ingredient in the construction sector. Cement being one of the key component in the concrete. Its production emits carbon dioxide in the atmosphere and hence sustainable material development has become very important in today's scenario. Cement itself is very weak in tension and therefore requires extra reinforcement to bridge this gap. Nowadays fibers have gained popularity in the industry for its various utilities in fields such as construction, aeronautics, mechanical and energy emission. Basalt fibers has gained attention due to its environment friendly nature and is used in this study as reinforcement in concrete. Basalt fibers are incorporated in this study from 0.1 to 0.5% volume fraction. Strength parameters are investigated such as compressive, tensile and flexure. Addition of basalt fiber has given positive results in increasing the strength. The highest compressive strength and flexure strength was achieved at 0.3% addition of basalt fiber whereas the maximum split tensile strength was achieved at 0.2% addition of basalt fiber. The workability of the concrete has been found to be decreased with the further addition of basalt fiber.

Keywords: Basalt fiber, concrete, cement, reinforcement , strength.

OPTIMAL PROCUREMENT OF COVID-19 VACCINE WITH TIME-DEPENDENT HOLDING COST AND SHORTAGES UNDER CLOUD FUZZY DEMAND RATE

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COVID-19 vaccine has emerged as the most powerful weapon against the spread of the coronavirus. Therefore, the management of the vaccine inventory is undoubtedly the most influential and important task for the global distribution of the vaccine. The present article is an attempt to model the vaccine inventory system having time-varying holding costs and partially backlogged shortages. The concept of fuzzy set and cloud pentagonal fuzzy number has been incorporated to make the models more realistic and applicable. Models are solved and validated through numerical examples and graphical representation. Further, sensitivity analysis has been done to identify the most sensitive parameters of all. Finally, managerial insights and conclusions have been drawn to make the vaccine inventory system more robust.

Keywords: Vaccine inventory, Pentagonal fuzzy number, Cloud pentagonal fuzzy number, Dense fuzzy set

A REVIEW: DESIGN AND ANALYSIS OF STREET DUST CLEANING MACHINE

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The purpose of this project is to clean the road in colleges, hospitals, auditoriums, malls and workshops. The aim of this project work is to design and develop process for cleaning the road. It is very useful for cleaning the road and ground. In modern days interior decorations are becoming an important in our life cleaning of road is very important for our health and the road cleaning machine reduces the effort required for cleaning. Hence this project is very useful in our day to day life. It is very simple in construction and easy to operate and little bit cheap, anybody can operate this machine easily. The overall cost of this machine is also cheap. Such type of machines is widely used for this purpose but they are working under different principles and the cost is very high. In recent years, floor cleaning machines are getting more popular for cleaning large area in minimum time. However in India, which is a developing country requires large type of such machines to satisfy the\ cleaning needs. Our study shows that dirt besides the road causes uncleanness and accident problems. We had developed a semiautomatic road side cleaning machine that insures that dust and dirt in sides of road should be clean. Our design proposes and successfully implemented the use of blower and high power vacuum that will remove the dust and throws it into the filter. This system is driven by solar power. The motion of vacuum system allows pushing the removed dust into the storage box.

Keywords: Dust cleaning machine, design, analysis, engineering

ENHANCED AUTHENTICATION SYSTEM FOR OPTIMAL PRIVACY AND SECURITY

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In today's computerized environment, authentication and privacy are essential. Biometrics, particularly fingerprint-based identification, are incredibly handy for unlocking doors, phones, and other electronic devices. n fingerprint biometrics, the characteristics of a fingerprint's minutiae are frequently as a user template, t's saved straight in the database. Original fingerprints can be created from such unsafe user templates, according to previous studies. If the database s breached, an attacker might create a user's fingerprint, posing a severe security and privacy risk. As a result, the original fingerprints' safety is critical. Ali et al. created fingerprint biometrics system that is secure. Their method, on the other hand, has a number of flaws and isn't optimized. First, we offer a technique that is safe, that is very optimized and fast n this study. Second, unlike other fingerprint biometrics, we've used the precision of minutiae points to develop an optimal template in addition to their location and orientation. We put the technique to the test on nine distinct fingerprint datasets. The outcomes of the studies are extremely promising and demonstrate the technique's efficiency.

Keywords: fingerprint; biometrics; revocability; authentication; privacy; security; user template.

OPTIMAL ALLOCATION OF DISTRIBUTED GENERATION RESOURCES IN A 14 BUS IEEE SYSTEM

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In comparison to massive fossil-fuel-based power plants, renewable energy-based electricity generators are quite modest. They are technically acceptable for installation near load centers on low voltage distribution systems. Electric power systems were originally constructed with a unidirectional power flow in mind, but the concept of distributed generation (DG) has prompted additional distribution network considerations. Voltage support, power loss reduction, ancillary service support, and better reliability are just a few of the benefits of DG. We will utilize a genetic algorithm-based strategy to optimize DG placement and reduce real power loss in the system in this paper, and we will find a considerable reduction in system loss. We'll go through the pros and drawbacks of various integration approaches, as well as the challenges that come with them and the solutions that may be employed to alleviate any negative outcomes. We'll also look at distributed power systems and make some diagrams to help explain the situation. We'll use an IEEE 14 Bus system for integration in this research and get to a solid conclusion. This dissertation also contains the necessary diagrams and flow charts to aid comprehension.

Keywords: unidirectional power flow, Distributed Generation, Genetic Algorithm, IEEE 14 Bus system, power system,

RISK FACTORS IN CRYPTOCURRENCY INVESTMENTS AND FEASIBLE SOLUTION TO MITIGATE THEM

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This systematic literature review, along with bibliometric analysis is intended to provide qualitative and quantitative knowledge on our research domain – risk factors affecting cryptocurrency market returns. Numerous review papers and research papers are considered for this study published in the years 2019-2021 out of which most influential papers were considered for thorough content analysis. These papers were segregated based on the resulting outcome of bibliometric analysis. Three major themes were identified using the clustering technique, Cryptocurrency Technology, Markets and Business aspects of Cryptocurrency, Security, and Governance. These clusters pointed out prominent keywords in this research domain and helped identify major and broader issues related to cryptocurrency markets. Furthermore, we also studied one of the highly proposed solutions to this risk and jotted down the literature review of that solution, Stablecoins. A research gap has also been identified which will give researchers a narrower pathway to follow and help mitigate the crypto market risks.

Keywords :Cryptocurrency, volatility, blockchain, stablecoins, bitcoin, bibliometric analysis, volume.

CRYPTOCURRENCY BLOCKCHAIN :A DRIVING FACTOR IN ANALYSIS OF MAJOR DECENTRALIZED CURRENCIES USING BIBLIOMETRIC ANALYSIS

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 Blockchain, often called Distributed Ledger Technology (DLT), refers to a chain of block that contains information. Blockchain uses concepts of data decentralization and cryptographic hashing to track and maintain a permanent record of all transactions in a immutable and secure manner.

All records are grouped into various lists called blockchains connected via mistreatment cryptography. All recent transaction are recorded in these blocks, and once finished are saved permanently in blockchain. Each block is stored with a cryptographic hash of the last block in the blockchain, dealing knowledge and a timestamp. Timestamp is used as a proof of transaction existence at the time the block was saved to generate its hash.

Hereby, a research study was conducted to analyze the difference between cryptocurrency and crypto-tokens. Also, to understand the complexities in mining cryptocurrencies based on blockchain technology. In the study Bibliometrix analysis was conducted on all related information pertaining to cryptocurrency and blockchain technology. The analysis is conducted using R (Bibliometrix R Package), and VOS viewer software which have been combined to create and review the consolidated metadata from Dimensions database. The analysis shows 194 articles on the dimension database published between 2013 and early 2022. The analysis results show the progressive evolution of blockchain technology used in Ethereum cryptocurrency.

Keywords: Cryptographic Currency, Bitcoin, Bitcoin Protocol, Ethereum, Shiba, Matic, Blockchain, SHA256 Hash Algorithm

CSR AND FINANCIAL PERFORMANCE OF KOREAN COMPANIES IN INDIA

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This study aims to investigate the relationship between CSR and financial performance of Korean companies in India.Data will be sourced from Prowess for financial performance indexes and CSR portal by the government of India for CSR data. Return On Asset (ROA) and Earning Per Share (EPS) will be used to represent financial performance, and CSR expenditure for CSR index. Multiple regression analysis will be used to find out the correlation between CSR and the financial performance.

No consistent relationship was found between the CSR expenditure and the financial performance. The relationship between the financial performance indexes and CSR index was found insignificant.

CSR expenditure of Korean companies in India can't be said it is significant or not since P-Value is too high, but at least its effect is limited due to the low coefficient of CSR on the financial performance.

Key words: CSR, CSR in India, Korean companies, CSR effectiveness, Mandatory CSR

INFLUENCE OF INDUSTRY 4.0 ON ESG AND COMPANY PERFORMANCE: AN INDIAN PERSPECTIVE

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This paper bridges the gap by exploring the impact of Industry 4.0 on the current ESG practices and how the technological changes are going to impact ESG and corporate performance. With the onset of the technology revolution in terms of industry 4.0, the impact of technology on ESG is well-documented in the context of developed countries. However, the same has not been explored and understood, particularly in developing countries like India. We have analyzed 582 data points from 97 companies spanning six years and used panel data analysis. We concluded that the ESG performance of a technologically adaptive and innovative company has a positive impact on the overall performance and profitability of the firm.

1. Introduction

This paper captures and discusses the challenges involved in tracking the effectiveness of the industry 4.0 (I4.0) transformation and its ability to influence corporate sustainability and firm performance. Companies have been transforming their core processes, including procurement, production, sales, and distribution for the past decade, driven by the I4.0 initiatives (Jabbour et al., 2019; Chen et al., 2020). Despite this, the impact the concept of I4.0 has had on industries is unclear (Madsen, 2019). It was suggested to examine the transformation journeys of companies using the emerging I4.0 mechanisms and how I4.0 impacts the firm performance (Buer et al. 2018).

While Alkaraan et al. (2021) explored this problem based on the context of the UK, the issues related to India and other similar developing countries were elaborately discussed by Venkatesh et al. (2021) and Sami El-Khasawneh (2012). One of the suggested remedies was process transformation and we argue that I4.0 presents a great opportunity for the developing south to become globally competent and competitive in the manufacturing sector. We focused our study on Indian manufacturing firms.

India offers an interesting space for study due to the following reasons. The govt. of India has been aggressively promoting "Make in India" to attract global firms to set up a manufacturing base in India. (Kamal, 2017) The Indian automotive industry is one of the core industries and the most matured in terms of manufacturing processes and technology due to the presence of global MNCs. Many globalautomotive brands arebeing manufactured in India.The total FDI received into the auto sector over a period of twelve years from April 2000 was US$7,518 million(Kamal, 2017). Hence, we selected the automotive manufacturing industry as the population for our study.

Machado et al. (2019) brought out the possible influence of I4.0 on sustainable manufacturing.While it was agreed that I4.0 would improve the profitability of the manufacturing industry (Fuchs, 2018), not

much work has been done to explain the impact of I4.0 on firm performance as well as ESG scores. We aim to fill this research gap.

This brought us to the following research questions.

1. Does Technology adaptation impact ESG performance?
2. What is the net impact of technology adaptation and ESG performance on firm performance?

2. Theoretical foundations

Carroll theory, and triple bottom line theory, along with stakeholder theorywere considered theoretical foundations. Carroll's pyramid brings together four different corporate responsibilities; being profitable, obeying laws and regulations,avoiding harm, and being a good corporate citizen.These are the expectations of society from organizations (Carroll, 1991).Triple bottom line theory (TBL) focuses on three performance dimensions namely economic, social, and environmental dimensions enabling sustainable results(Elkington 1998). Stakeholder theory describes the firm nature and how the interests of various parties are considered (Freeman, 2010). I4.0 canaffect firms through regulations related to suppliers, and customers (Awan et al., 2019). Stakeholder theory helpsus understand the interactions among the various interested parties and explain why organizations adopt universal social compliance codes (Venkatesh et al., 2021).

3. Literature Review

ESG is a system for evaluating a company's or investment's long-term viability. Torecognize large risks and possibilities, investors are including more non-financial aspects in their analyses. It's a way of assessing how much a firm works towards social goals in addition to its core purpose of profit maximization (Halbritter & Dorfleitner, 2015).

Most firms utilize innovation as a tool to begin their sustainable change journey, tackling accountability, earnings management, transparency, and corporate social responsibility (Lombardi & Secundo, 2020), by coming up with innovations that improve sustainability in terms of ESG (Barbieri et al., 2010). Firms should pursue an environmentally friendly process to achieve sustainable development(Xu et al., 2020). R&D expenditures indicated by patents can be used to measure a company's innovation capacity (Broadstock et al., 2020).

The literature suggests that R&D expenditure boosts green innovation, and ESG performance boosts the number of the green invention related to technology(Xu et al., 2020) andgives empirical evidence of innovation's ability to be an effective instrument for long-term industrial growth through R&D expenditures (Dicuonzo et al., 2022). Xu etal. (2020) also claimed that profitability is a guarantee for continued R&D investment. Companies that try to enhance their ESG performance should invest in R&D and engage in innovative initiatives (Aras et al., 2018). Therefore, we have considered R&D expenditure as a proxy for technological innovation and adaptation in our study.

Hypotheses Development

The link connecting ESG performance and profitability, along with valuation, has been thoroughly investigated. Several of these studies have discovered either a negative (Brammer et al., 2006)or nonsignificant relationship between ESG performance and corporate performance or value of the firm(McWilliams & Siegel, 2000; Renneboog et al, 2008a, 2008b).Some studies have also discovered a positive link (Wong et al., 2020; Do and Kim, 2020; Murashima, 2020). One of the most important factors in establishing a distinct competitive advantage for businesses is technological innovation. According to Gueguen and Isckia (2011), an organization's ability to innovate can help it gain a competitive advantage.

Based on the literature our argument is thatthe greater the level of technological innovation and adaptation within afirmtowards ESG score enhancement, the greater the positive effect on its financial performance. Therefore, we propose two hypotheses based on these arguments:

H1. Technological innovation/adaption(R&D exp) are positively associated with ESG

H2. ESG Firms that are technologically innovative and adaptive are positively associated with financial performance.

4. Methodology

The study sample comprises annual data for 97 manufacturing companies in various fields such as automotive, consumer goods, power generation, and oil production companies across India for the period of six years (2015-2016 to 2021-2022). The list of manufacturing companies was extracted from the Bloomberg database. The initial sample of this paper includes 588 companies. In the second step, we excluded the companies that are not involved in ESG practices and thereafter we filtered the other companies that miss the necessary data for the variables used in our analysis. We obtained a final sample of 97 companies across India that intended to step into the framework of "Industry 4.0" and the total sample size for six years became 582. The Study variables considered were given below.

Model-1 had ESG Disclosure score as the dependent variable and R&D expenditure(tech adaptation and innovation) as the independent variable. Model-2 had ROA (firm performance) as the dependent variable and R&D expenditure (tech adaptation and innovation) as the independent variable. Model-3 had ROA (firm performance) as the dependent variable and ESG disclosure score as the independent variable. All the three models had Size (Total assets),Growth (change in assets), and Leverage (TD/TA ratio) as control variables.

5. Research design

We have done panel data analysis using "Eviews" software where we have formulated three models to prove two hypotheses. To prove the first hypothesis, we presented the first linear model that explained the relationship between ESG and R&D expenses. For the second hypothesis, we presented two linear models to establish the relationship between ESG and firm performance. We have conducted the stationary test, Cointegration test, and Random-Fixed test for checking the basic assumptions of the models.

6. Results and analysis:

After proving all the assumptions true, we proceeded to test our hypothesis using PLS regression to control the random effect of variables.

H1: Technological adaptation and innovation has an impact on ESG disclosure scores.

The model-1 established a significant relationship between technological adaptation and innovation, growth, firm size, and leverage with the ESG disclosure scores. The model has significant F-statistic= 11.14048 which is less than p=0.01.

Model 1:

$$ESG_{it} = 0.76884 + (0.000392)R\&D\ exp{it} + (3.64E - 06)\text{SIZE} - (0.077326)LEVERAGE - (8.93E - 06)\text{GROWTH} + E_{it}$$

The model-1 portrayed that R&D expenditure was positively affecting the ESG performance at 1% significance level. As the ESG reporting formats in India lacks standardization so our study suffers from insufficient data which is one of the vital reasons for the low coefficient of R&D expenditure. The other control variables also show significant influence on ESG but at varied significance level.

H2: ESG performance of the technologically adaptive and innovative company have a positive impact on the overall performance and profitability of the firm.

To establish a relationship between profitability and the ESG performance of the companies under industry 4.0, we have built two inter-related hypotheses:

H2(a): Technological adaptation and innovation has an impact on performance of the firm.

Model 2:

$$ROA_{it} = \text{constant} + (0.000189)\text{R\&D} \exp{it} - (2.23E - 07)\text{SIZE} - (0.067111)LEVERAGE + (5.32E - 06)\text{GROWTH} + E_{it}$$

The model-2 provided empirical evidence that R&D expenditure hada positive and significant influence on ROA at 5% confidence level. The established relationship signified that with an increase in technologically adaptive and innovative capacity, the firms could increase their performance considerably. We also observed that the leverage of the firm had a positive and significant impact on the performance of the firm whereas growth and size of the firm had no significant impact on the profitability of the company.

H2(b): ESG has a positive impact on firm's performance.

Model 3:

$$ROA_{it} = \text{constant} + (0.25130)ESG{it} - (1.88E - 06)\text{SIZE} - (0.170650)LEVERAGE + (8.80E - 06)\text{GROWTH} + E_{it}$$

The model-3 provided statistical evidence that ESG performance of the firm was positively and significantly influencing the performance of the firm at 1% significance level. The coefficient of ESG was 0.25, indicating that with an increase in ESG performance the profitability of the firm increased by 25%.

7. Discussion and conclusions

Combining H2(a) and H2(b), we can conclude that the ESG performance of a technologically adaptive and innovative company has a positive impact on the overall performance and profitability of the firm. Hence, our second hypothesis is empirically proven.This is interesting as it can justify investments into ESG improvements as well as technology innovations and adaptations, which has always been a challenge for the managers.

References:

Alareeni, B. A., & Hamdan, A. (2020). ESG impact on the performance of US S&P 500-listed firms. Corporate Governance: The International Journal of Business in Society.

Alkaraan, F., Albitar, K., Hussainey, K., &Venkatesh, V.G. (2021) Corporate transformation toward Industry 4.0 and financial performance: The influence of environmental, social, and governance (ESG). Technological Forecasting & Social Change.

Awan, U., Sroufe, R., &Kraslawski, A. (2019). Creativity enables sustainable development: supplier engagement as a boundary condition for the positive effect on green innovation. J. Clean Prod. 226, 172–185. https://doi.org/10.1016/j. jclepro.2019.03.308.

Barbieri, J.C., Vasconcelos, I.F.G., de, Andreassi, T. & Vasconcelos, F.C.D. (2010), "Innovation and sustainability: new models and propositions", RAE Revista de Administracao de Empresas, Vol. 50 No. 2, pp.dcf gvbkm' 146-154

Brammer, S., Brooks, C.,&Pavelin, S. (2006). Corporate Social Performance and Stock Returns: UK Evidence from Disaggregate Measures. Financial Management 35 (3): 97–116.

Broadstock, D.C., Matousek, R., Meyer, M. & Tzeremes, N.G. (2020), "Does corporate social responsibility impact firms' innovation capacity? The indirect link between environmental and social governance implementation and innovation performance", Journal of Business Research, Vol. 119, pp. 99-110

Buer, S.V., Strandhagen, J.O., &Chan, F.T.S. (2018) The link between Industry 4.0 and lean manufacturing: mapping current research and establishing a research agenda. Int. J. Prod. Res. 56 (8), 2924–2940. https://doi.org/10.1080/00207543.2018.1442945.

Carroll, A.B. (1991) The pyramid of corporate social responsibility: Toward the moral management oforganizational stakeholders. Business Horizons, Volume 34, Issue 4, July–August 1991, Pages 39-48

Chen, J., Gao, M., Mangla, S.K., Song, M., &Wen, J. (2020) Effects of technological changes on China's carbon emissions. Technol. Forecast. Soc. Change 153, 119938.

de Sousa Jabbour, A.B.L., Jabbour, C.J.C., Godinho Filho, M., &Roubaud, D. (2018) Industry 4.0 and the circular economy: a proposed research agenda and original roadmap for sustainable operations. Ann. Oper Res. 270, 273–286. https://doi.org/ 10.1007/s10479-018-2772-8.

Dicuonzo, G., Donofrio, F., Ranaldo, S., & Dell'Atti, V. (2022). The effect of innovation on environmental, social, and governance (ESG) practices. Meditari Accountancy Research, (ahead-of-print).

Do, Y. & Kim, S. (2020), Do higher-rated or enhancing ESG of firms enhance their long–termsustainability? Evidence from market returns in Korea. Sustainability, Vol. 12 No. 7, p. 2664.

Elkington, J. (1998) Partnerships from cannibals with forks: the triple bottom line of 21st-century business. Environ. Qual. Manage. 8 (1), 37–51. https://doi.org/ 10.1002/tqem.3310080106.

Freeman, E. (2010). Strategic Management: A Stakeholder Approach. https://doi.org/ 10.1017/cbo9781139192675. Cambridge University Press.

Fuchs, C., (2018). Industry 4.0: the Digital German Ideology. Triple C: Communication, Capitalism & Critique 16, 280–289.

Gueguen, G. & Isckia, T. (2011). The borders of mobile handset ecosystems: is coopetition inevitable?Telematics and Informatics, Vol. 28 No. 1, pp. 5-11

Halbritter, G., & Dorfleitner, G. (2015). The wages of social responsibility—Where are they? A critical review of ESG investing. Review of Financial Economics, 26, 25-35.https://doi.org/10.1016/j.rfe.2015.03.004

Jabbour, C.J.C., de Sousa Jabbour, A.B.L., Sarkis, J., &Godinho Filho, M. (2019). Unlocking the circular economy through new business models based on large-scale data: an integrative framework, and research agenda. Technol. Forecast. Soc. Change 144, 546. -542.

Kamal, N. (2017) A Study on Impact of "Make in India" on Automobile Sector. International Journal of Business Administration and Management.

Lombardi, R. & Secundo, G. (2020). The digital transformation of corporate reporting – a systematic literature review and avenues for future research. Meditari Accountancy Research, Vol. 29 No. 5, doi: 10.1108/MEDAR-04-2020-0870

Machado, C.G., Winroth, M.P., &de Silva, E.H.D.R. (2019). Sustainable manufacturing in Industry 4.0: an emerging research agenda. Int. J. Prod. Res. https://doi.org/ 10.1080/00207543.2019.1652777.

Madsen, D.Ø., (2019). The emergence and rise of Industry 4.0 viewed, through the lens of management of theory. Adm. Sci. 9 (3) https://doi.org/10.3390/admsci9030071.

McWilliams, A., & Siegel, D. (2000). Corporate social responsibility and financial performance: correlation or misspecification? Strategic management journal, 21(5), 603-609.

Murashima, M. (2020). Do investors' reactions to CSR-related news communication differ by shareholder? An empirical analysis from Japan. Corporate Governance, Vol. 20 No. 5, pp. 781-796.

Peiró-Signes, A., & Segarra-Oña, M. D. V. (2013). Trends in ESG practices: Differences and similarities across major developed markets. In *Sustainability appraisal: Quantitative methods and mathematical techniques for environmental performance evaluation* (pp. 125-140). Springer, Berlin, Heidelberg.

Renneboog, L., Horst, J., & Zhang, C. (2008a). The price of ethics and stakeholder governance: The performance of socially responsible mutual funds. Journal of Corporate Finance, 14(3), 302-322. doi: 10.1016/j.jcorpfin.2008.03.009

Renneboog, L., Horst, J., & Zhang, C. (2008b). Socially responsible investments: Institutional aspects, performance, and investor behavior. Journal of Banking and Finance, 32(9), 1723-1742. doi: 10.1016/j.jbankfin.2007.12.039.

Sami El-Khasawneh, B. (2012), "Challenges and remedies of manufacturing enterprises in developing countries: Jordan as a case study", Journal of Manufacturing Technology Management, Vol. 23 No. 3, pp. 328-350.

Venkatesh, V.G., Zhang, A., Deakins, E., & Mani, V. (2021). Antecedents of social sustainability noncompliance in the Indian apparel sector. Int. J. Prod. Econ. 234
https://doi.org/10.1016/j.ijpe.2021.108038.

Wong, W.C., Batten, J.A., Mohamed-Arshad, S.B., Nordin, S. & Adzis, A.A. (2020). Does ESG certification add firm value? Finance Research Letters, p. 101593

Xie, Y., Xue, W., Li, L., Wang, A., Chen, Y., Zheng, Q. & Li, X. (2018). Leadership style and innovation atmosphere in enterprises: an empirical study. Technological Forecasting and Social Change, Vol. 135, pp. 257-265.

Xu, J., Liu, F., & Shang, Y. (2020). R&D investment, ESG performance and green innovation performance: evidence from China. Kybernetes.

REVISITING SERVICE QUALITY IN PUBLIC AND PRIVATE UNIVERSITIES: DEVELOPMENT OF A PROCESSAND OUTCOMEBASED CONCEPTUAL FRAMEWORK

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The direct introduction of service quality (SQ) frameworks from the context of business organizations to higher educational context, noticeably in universities (public and private), has been one of the global substantial issues. Besides, most of the extant frameworks considered only the process element and neglected the objective quality in terms of technical outcome. Moreover, the dynamic nature of the measures and antecedents of SQ still makes it a crucial topic of research, despite being studied substantially. In addition, understanding the gap concerning expected and perceived SQ between customers and the service provider is important to uncover potential insights into an improved perceived SQ. Given these concerns, an alternative conceptual approach to SQ in university education is required. The present paper sets out an alternative framework to SQ that gives priority to both process and outcome facilitating measurement of expected and perceived SQ for each aspect. A theoretical outlook relating to relevant existing studies on operationalization of SQ measurement and measures, antecedents of SQ, expected SQ, and perceived SQ is presented. Further, a review of the research gaps of SQ frameworks used in higher education studies, including universities is presented to support the current framework and to argue that the measures used in the present framework hold the potential to contribute towards improved perceived SQ in university education. This study would enable relevant future research for SQ assessment in university (public and private) education, which changes from and contribute to the existing knowledge based on the theoretical framework.

Keywords: University education, public and private, service quality, measures, antecedents, framework.

1. INTRODUCTION

Service quality (SQ) is defined as an after-effect of perceived and expected service performances (Zeithaml et al., 1990). This concept is based on Oliver's (1980) theory of expectation confirmation, where an outcome is viewed as a function of performance expected and perceived by an individual. Increased globalization of the job market has led SQ to act as a baseline for transformation in any sector (Yeo, 2009). The research on SQ has progressed due to the increasing recognition of the service industry for sustainability in many organizations, including the higher education sector, especially

universities (public and private), putting greater priority in meeting the anticipations of its participating clients, the pupils (primary stakeholders) (Van der Bij et al., 2016). However, studies have indicated that the operationalization of SQ in the education sector is complicated because of the different concepts of SQ and the perception of different stakeholders like parents, faculty, management, sponsors, etc. among others (Becket & Brookes, 2006). Nadiri et al. (2009) highlighted the importance of faculty and managements' perceptions of services provided to the students. Students are directly affected by the SQ and satisfaction of other stakeholders like parents (Ahmed et al., 2010). Therefore, the requirements and interests of several stakeholders need to be considered by universities for an improved SQ (Rozsa, 2010). In the rising competition between private and public universities, observing and assessing customer perceptions of SQ become important for the survival of universities (Gupta and Kaushik, 2018). Therefore, the need for recognizing the SQ perception of different stakeholders is apparent.

The prevalent landscape of universities is progressively more competitive and dynamic, where they need to amend their services invariably (Dehghan et al., 2014). This is driven by factors like the decrease in allocation of funds for state public universities, expanding the higher education market and the increasing participation of private universities (Quinn et al., 2009; Sultan and Wong, 2010; Halai, 2013). However, similar types of course programs among the universities, globally or regionally, have led these institutions to work on marketing strategy and image building (Alves and Raposo, 2010). This is particularly important for organizations that believe that a better image perceived by customers leads to a better perception of SQ. Universities must reinforce marketing strategies and prioritize the allocation of resources based on the information available on the quality of administrative, academic, and infrastructural services provided by them (Filip, 2012). Previous studies have well established that marketing strategies in universities may generate robust outcomes like institution image, customer satisfaction and retention and academic outcomes among others (Sultan and Wong, 2012; Fares et al., 2013; Asgari and Borzooei, 2014). In the present scenario, universities must find strategies to outperform their public or private competitors by delivering a high-quality service (Cardona and Bravo, 2012). It would seem suitable that universities need to make a transition from a product-oriented approach to a customer-oriented method (Angell et al., 2008). It is observed that students decide on the university based on the confirmation of SQ, as indicated by the management of universities (Angell et al., 2008; Bhuian, 2016). Thus, besides the quality assurance given by the universities, the perception of services also becomes crucial.

Most of the empirical evidence on SQ is in the context of business organizations. Possible differences between universities and business organizations in terms of their cause and effect relationship, processes, strategies, dimensions, and objectives among other vital issues are not considering while introducing and testing models directly to higher educational institutions (Hau et al., 2013). Moreover, three crucial points are evident when analysing SQ. The deficiency of consensus on SQ dimensions and the dynamic quality of its constructs are underlined. Several studies have highlighted the lack of consensus on SQ dimensions in universities in terms of its concept and operationalization (Wicks and Roethlein, 2009; Agarwal and Kumar, 2016; Gupta and Kaushik, 2018). Other researchers have highlighted that the models employed to evaluate SQ in the educational context lack emphasis on the SQ antecedents, which elucidate how customers view SQ altogether (Gounaris et al., 2003; Sultan and

Yong, 2010). Thus, the models may lack reliability (Oldfield and Baron, 2000; Voss et al., 2007). Furthermore, SQ is a potent construct and its measures are likely to change gradually. Service expectation of customers changes over time due to competition in the education market (Seth et al., 2005). Many studies focus only on perception and not much emphasis is given on the gap between expectation and perception (Abili et al., 2011; Sultan and Wong, 2010). Given that SQ in universities is vital not only for ensuring economic progress through effective development of human resources but also for the sustenance of each competing university (public or private), management must be aware of any differences in the expectations and perceptions of services provided (Napitupulu et al., 2018).

Previous studies have highlighted the necessity for constant measurement and improvement in SQ owing to the increasingly potent and competitive nature of higher education (Dehghan et al., 2014; Teeroovengadum et al., 2016; Gupta and Kaushik, 2018). Previous researches have adopted the SERVQUAL framework of Parasuraman et al. (1988) (Arambewela and Hall, 2006; Wong et al., 2012), while few studies made an additional effort to identify SQ dimensions and elements as perceived by students (Abdullah, 2006; Lagrosen et al., 2004). However, a limited number of such researches assessed higher education's SQ based on a holistic framework, and the incorporation of the transformative concept, in terms of the outcome in educational quality, has not been much emphasized in the SQ frameworks. A comprehensive framework is guided by the inclusion of quality in terms of both, process and outcome (Kang, 2006). Thus, a suitable and reliable framework for assessing the SQ of universities from different perspectives is crucial.

Given the above background, the current study is driven by various aspects. First is the direct introduction of SQ frameworks from business organizations' context to university context. Second is the dynamic nature of the measures and antecedents of SQ in higher education. Third is the need to focus on differences in the expectations and perceptions of different consumers regarding services provided to uncover potential insights into an improved perceived SQ. Thus, the current study aimed to review critically the research gaps of SQ frameworks used in higher education studies, including universities. In doing so, the relevant literature is reviewed and a process- and outcome-based conceptual framework is formulated, thereby identifying appropriate comprehensive models for evaluating SQ in universities. The following is the organization of the present study. First, the existing relevant literature related to the operationalization of SQ measurement are categorized and measured along with developed scales in university education, followed by antecedents of SQ, and expected and perceived SQ. Second, a comprehensive framework is developed after assessing the research studies related to SQ models in the higher education industry. The paper concludes with the conclusion, limitations, and future research scope.

2. OPERATIONALIZING SQ MEASUREMENT AND MEASURES IN UNIVERSITY EDUCATION

Previous studies have suggested two main issues to be addressed while developing a framework for SQ assessment: defining the SQ measurement and identifying the suitable SQ measures (Brady et al., 2002; Kang and James, 2004).

2.1 Defining SQ measurement

SERVQUAL is the most extensively used scale for assessing SQ in multiple industries like banking, health, education, wholesale and retail (Silva et al., 2017; Calvo-Porral et al., 2013; Wong et al., 2012; Narang, 2012). Tan and Kek (2004) focused on the notion of passing on ideas from customers to management and the readiness to deliberate their opinions for a higher level of SQ in universities. O'Neill and Palmer (2004) described SQ in the context of higher education "as the difference that results from a students' expectation to receive services and perceptions of what has been delivered". This concept has been broadly utilised to evaluate SQ in higher education (Barnes, 2007; Wong et al., 2012). Notwithstanding the wide recognition of this concept of SQ, its operationalization has faced severe criticism (Trivellas and Dargenidou, 2009). An alternative framework with better psychometric elements, namely Service performance (SERVPERF) was proposed which emphasized the performance level of its elements (Brady et al., 2002; Cronin and Taylor, 1992). Moreover, the performance-led approach has also been highlighted as more suitable in the higher education context (Teeroovengadum et al., 2016). This is primarily driven by difficulties relating to capture customers' expectations (Angell et al., 2008). Consequently, a performance-led evaluation of SQ is adopted by the present study as it accords with this belief.

2.2 Measures of SQ and scales developed

One of the vital streams of research in SQ includes SQ measures and scale development (Agarwal and Kumar, 2016). Previous studies suggest SQ in universities as a multidimensional concept (Iacovidou et al., 2009). Concerning the identification of the SQ measures, Owlia and Aspinwall (1996) proposed six perceived measures of SQ in the higher education context. These include tangibility (adequate infrastructure), reliability (problem-solving ability and handling complaints), competence (academic quality), content (application of curriculum and knowledge flexibility), attitude (personal attention to students and willingness to help) and delivery (students' feedback). However, despite the utility of this framework, it does not focus on the external features of universities, especially the communication process and administrative quality (Mishra, 2007). Cook (1997) identified academic staff quality, library and computer facilities, extra-curricular activities, activity factors, overall welfare factors and practice factors as important drivers of SQ. However, this framework lacked the administrative aspect in influencing the service perception of customers. Moreover, Brenders et al. (1999) focused on services, successes and difficulties as perceived by university students but excluded the academic factor. These studies reflect some concurrences of quality factors; however, definition of quality framework is still lacking in higher education.

Several researchers have employed the generic SERVQUAL scale for evaluating SQ in universities. The scale comprises five dimensions, namely, empathy, tangibles, assurance, responsiveness, and reliability. The extensive utilisation of this scale might be attributed to its reliable and valid utility in

various service industries including universities, health, banking and tourism (Bayraktaroglu&Atrek, 2010; Kitapci et al., 2014; Yilmaz et al., 2018). SERVPERF was developed by using the SERVQUAL dimensions (Cronin and Taylor, 1992). SERVQUAL is based on expectations-perceptions of performance theory, while SERVPERF is based only on perception theory (Bayraktaroglu and Atrek, 2010). SERVPERF has been used for SQ assessment in universities (Galeeva, 2016). SERVQUAL and SERVPERF scales have been introduced to universities through the same measures, which indicate inadequate adaptation to the context and nature of universities. Brown and Koenig (1993) underlined the importance of formulating university-specific SQ frameworks. Besides, studies have identified the higher educational SQ (HESQUAL) framework, which proposed seven measures: physical evidence, curriculum, administration, reputation, contact personnel, responsiveness and access to amenities (Lagrosen et al., 2004; Leblanc and Nguyen, 1997). Abdullah (2006) used SQ measures, namely, program issues, reputation, access, and academic and non-academic aspects, to formulate the Higher Education Performance (HEdPERF) scale. This scale had relatively greater relevance, better reliability and validity compared to SERVPERF (Brochado, 2009). Based on HEdPERF, the HiEdQUAL scale was proposed to constitute academic factor, administrative factor, campus infrastructure, support services and academic amenities (Annamdevula and Bellamkonda, 2012). The HEDQUAL scale was proposed and validated by Icli and Anil (2014) with the following measures of SQ: quality of providing career prospects, library services quality, supportive services quality, administrative quality, and academic quality. Teeroovengadum et al. (2016) used HESQUAL to propose and validate a scale for SQ assessment in university with five dimensions, namely, transformative quality, core educational quality, support facilities quality, administrative quality, and physical environment quality. Noticeably, a lack of consensus on SQ measures in higher education is identified. Nevertheless, existing literature evidence that SQ has been substantially researched. An important issue that needs to be considered is that all these previous frameworks, including SERVQUAL, considered only the functional element in terms of process and neglected the objective quality in terms of technical outcome (Kang, 2006), with a few exceptions (Teeroovengadum et al., 2016; Clemes et al., 2013; Chong and Ahmed, 2012).

While revisiting SQ scales, it can be argued that the scale formulated by Teeroovengadum et al. (2016) holds several strengths for SQ assessment in university education. First, the measures that develop this scale constitute the various services that learners are exposed to in a university. Thus, it is university-based and illustrative of received services. Second, this scale showed high reliability with Cronbach alpha above 0.70 threshold mark. Third, the measures in this scale represent functional as well as technical aspects. Such integration allows the evaluation of expected and perceived SQ for every aspect. For instance, perceived and expected SQ of theoretical aspects can be determined and evaluated individually from expected and perceived SQ of administrative or transformative aspects. Fourth, within a university setting, this scale accounts for value creation, like academicians with academic quality, administrators within administrative quality, library and other support facilities within physical environment quality and students as value creators within transformative quality. Thus, the transformative element is proposed to be an integral incorporation for SQ assessment in the context of university education. Thus, this scale can form a basis for different functional and technical areas besides determining perceived strengths and scope of improvisation from both, functional and technical perspectives.

3. SQ ANTECEDENTS IN UNIVERSITY EDUCATION

The customer-based antecedent approach to SQ has not received much attention in the scholarly articles (Gounaris et al., 2003; El Alfy and Abukari, 2019). Also, there is inadequate consensus regarding the antecedents of SQ (Sultan and Wong, 2013; Angell et al., 2008). Dabholkar et al. (2000) described three antecedents of SQ, namely perception-only construct, measured disconfirmation and computed disconfirmation. Considering the difference between expected and perceived SQ, measured disconfirmation is superior to the other two measures. The researchers highlighted the importance of antecedent framework for a better insight into perceived SQ and its evaluations. Furthermore, the perceived SQ is known to be influenced by various factors including external communication, social referrals, management trust and information that the university provides to students (Sultan and Wong, 2013; De Jager and Gbadamosi, 2010; Gounaris et al., 2003). Crosby (1979) opined that processes need to be managed for delivering high-quality service. Gounaris et al. (2003) provided further explanation through word-of-mouth (WOM) as a part of an institutional emphasis on providing high-quality performance and service to customers, which results in an improvisation of their perception of SQ. Given the above perspective, it can be deduced that perceived SQ is an integration of customer and institution-specific antecedents (Voon, 2008). Thus, the antecedent constructs developed by Gounaris et al. (2003) need to be validated through future SQ models in the context of higher education.

4. EXPECTED AND PERCEIVED SQ

The gap between perceived service delivery and expected service delivery affects SQ (Parasuraman et al., 1988). SQ is eventually measured based on whether the services delivered met customers' expectations. Understanding customer expectations is a vital step for the deliverance of high quality service (Zeithaml et al., 1990). This highlights the significance of understanding how expectations of customers develop and their significance when managing service delivery. Perceptions of SQ, which results from the difference between expectations of service delivery and their actual delivery, is viewed as an inclusive decision of the SQ (Zeithaml et al., 1990). Thus, the perceptions of SQ depend on management's service delivery as well as on customers' performance, particularly in the circumstance of university education, where learners are actively involved in the success of service delivery (Chui et al., 2016).

5. CONCEPTUAL APPROACH

The quality of service provided for university education is significant for the development of competent individuals as well as for the market reputation of universities. Thus, it is imperative that policymakers and management authorities of universities should be informed of the consequences due to disparities in the delivery of perceived services and expected services (Napitupulu et al., 2018). The perception of customers indicates the evaluation of the service provided against the expectations, which help in retaining customers and enabling them to invite new students through positive references to other

stakeholders, like parents, faculty and sponsors (Ladhari, 2009). Considering the current competitory arena of public and private universities, the observation and assessment of perceptions and expectations of students and other stakeholders regarding service delivery is imperative to achieve and exceed the demands of the stakeholders (Gupta and Kaushik, 2018). Thus, in the present study, the framework is developed based on Teeroovengadum et al. (2016) to assess SQ of universities by comparing perceptions of the stakeholders against their expectations.

The increasing influence of higher education and the massive intrusion of students have led to an increasing demand for good-quality universities in the past few years (Lim et al., 2011). The public and private universities may share some similar attributes like pedagogical facilities, infrastructural facilities, support facilities, etc. but have different approaches to deliver these attributes which can determine their SQ. In this context, the public and private universities constantly attempt to outperform each other (Shekarchizadeh et al., 2011). Tang (2012) revealed that private universities have progressed more rapidly than public universities in delivering high-quality services to students. Moreover, despite the formulation of various certification bodies at state and national levels to ensure better SQ in universities, the intention is still not fulfilled in India in comparison to the excellence at the global level (Mogre et al., 2018). Thus, the SQ delivered might be the differentiating measure between a public and a private university and would enable students to determine the universities of their choice. This paper, therefore, proposes to suggest the following hypothesis to contribute to the extant literature:

H1$_0$: There is no significant relationship between the parameters of SQ in public and private universities.

Customers' (students and parents) observations regarding services in universities are determined based on their expectations, which arises as a result of the promotional strategies being adopted by universities (Mattah et al., 2018). Customers' service perceptions against service expectations are utilized by universities' management to formulate the service strategies (Hsu and Lin, 2015). The promotional strategies adopted by universities must be based on the gaps that occur as a result of the lack of fulfillment of WOM, lack of external communications and past experiences which influence customers' expectations and the value of service to them (Yosuf et al., 2012). The ability to keep up with customer expectations requires identifying promotional approaches and their progress, which in turn, also leads to outcomes like customer satisfaction. This demands the incorporation of the strategies for retaining a prolonged service provider-taker relationship. Considering these views, the following hypothesis is suggested.

H2$_0$: There is no significant difference in universities' strategies and customer expectations in public and private universities.

Efficient delivery of service in the context of university education is governed by providers' stance on the service provided and customers' outlook of what they expected from the delivered service. Students, as primary stakeholders, possess certain expectations about the services provided by universities (public and private) (Rouf et al., 2016). While recognizing the significance of students' expectations of service, it is also crucial to recognize the service expectations of other stakeholders to provide better insights into delivering high-quality. This is significant from the point of university-led

designing of services which sometimes lacks understanding of the requirements of different groups of stakeholders. Parents, being the main financial source and decision-makers of the students are likely to have education service expectations that could meet their children's satisfaction (Daud and Sapuan, 2011). Thus, considering the highly competitive scenario between public and private universities, assessing customers' expectations of SQ becomes crucial for meeting their requirements and for the survival of these universities (Gupta and Kaushik, 2018). Thus, the first gap of the proposed model is indicated by the following hypothesis

H3$_0$: There is no significant difference in customers' (students and parents) expectations of service delivery and the perceived SQ of public and private universities.

The involvement of different stakeholders in universities has led to different ideas of service delivery leading to a debate regarding the measures of service delivery (Nicholson, 2011). Attempts to assess SQ have emphasized mostly on students' perception based on SERVQUAL, SERVPERF, HEdPERF, Education Service (EDUSERVE), etc. (Ramseook-Munhurrun et al., 2010; Abdullah, 2006; Cronin and Taylor, 1994; Parasuraman et al., 1988). Moreover, service providers' perception about what is expected by customers is necessary to provide service that matches it. Furthermore, a university's success is determined by its managerial capability of meeting or exceeding the customers' expectations on a constant basis. However, the public and private universities are less focused on the effectiveness of the already existing practices to deliver high-quality services and as such the services delivered do not meet the expectation of the customers, thereby producing a gap (Teeroovengadum et al., 2016). In this context, the following hypothesis indicates the second and third gaps of the proposed framework

H4$_0$: There is no significant difference in the customers' (students and parents) expected SQ and management's service delivery of public and private universities.

H5$_0$: There is no significant difference in management's service delivery and customers' (students and parents) perceived SQ of public and private universities.

The present study's conceptual framework is built on the theoretical perspectives of various prototypes and ideas applicable to the elements of SQ in higher education, including universities. The framework illustrates the measures of SQ and the gaps between the different dynamics of SQ in university education. The implications of the measures in the delivery of service are assessed using the propositions, as depicted in Figure 1.
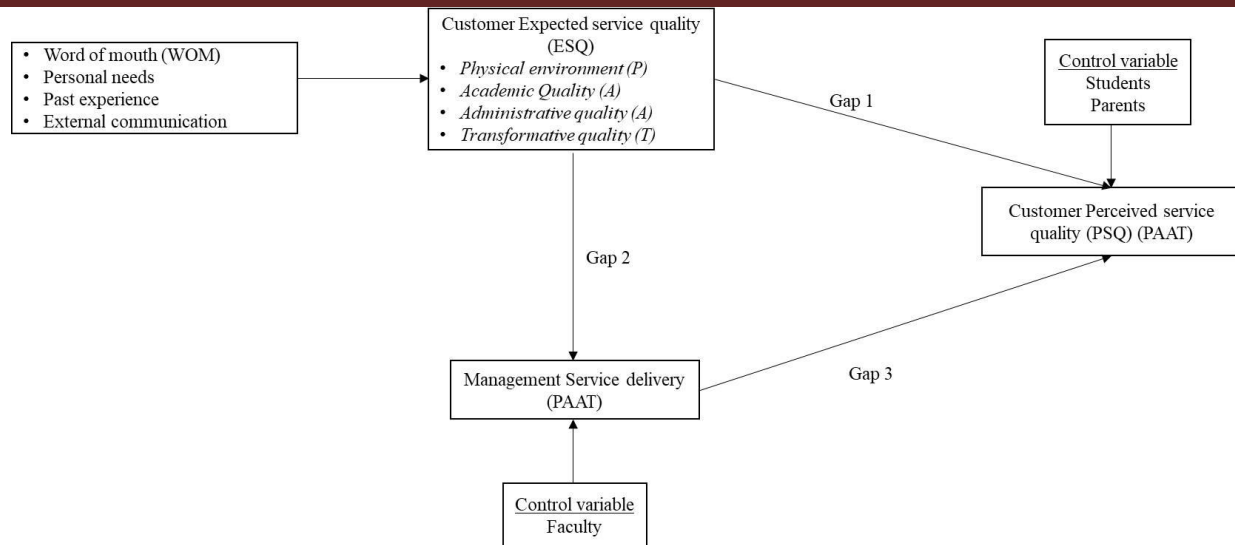
Figure 1: A proposed abstract approach to service quality (SQ) in university education

6. CONCLUSION, LIMITATION AND FUTURE DIRECTIVES

One of the main ideas that have emerged from the theoretical perspectives of the present paper is that SQ-related research in the context of public and private universities need to give primary consideration to improving SQ through both, process-and outcome-based approach, where the outcome aspect in terms of technical output seems to be less emphasized in the existing frameworks, with a few exceptions. The belief behind the alternate conceptual approach in this paper is not that 'more educational services leads to better perceived SQ', which has been emphasized in most studies, but it is that separating different services rather than observing various educational services in an inclusive manner might lead to improved perceived SQ. In the light of the present paper, we hope that future studies will explore the interactions between the service provider and different stakeholders highlighted in this paper, something which SQ-related research in the context of university education has not well explored thus far.

Existing studies on SQ frameworks in universities and higher education were reviewed and the research gaps were highlighted in the present paper. Such research gaps should be bridged through further empirical investigations. The framework developed in this study is based on a theoretical perspective and empirical investigations need to further explore and test the hypotheses proposed in the framework. Since the landscape of university education is dynamic in nature, future studies can focus on other attributes relevant to SQ in university education, and that may affect suggested associations proposed in the framework. Students represent one of the value creators and thus, future research should find ways to effectively manage as well as explore new means for value creation. Thus, future in-depth empirical research should look to contribute additional insights in developing framework for assessing SQ in the circumstance of private and public universities.

REFERENCES:

Abdullah, F. (2006). The development of HEdPERF: a new measuring instrument of service quality for the higher education sector. *International Journal of Consumer Studies*, *30*(6), 569-581.

Abili, K., Thani, F. N., Mokhtarian, F., & Rashidi, M. M. (2011). Assessing quality gap of university services. *Asian Journal on Quality*, *12*(2), 167-175.

Agarwal, A., & Kumar, G. (2016). Identify the need for developing a new service quality model in today's scenario: A review of service quality models. *Arabian Journal of Business and Management Review*, *6*(2), 1000193.

Ahmed, I., Nawaz, M. M., Ahmad, Z., Ahmad, Z., Shaukat, M. Z., Usman, A., & Ahmed, N. (2010). Does service quality affect students' performance? Evidence from institutes of higher learning. *African Journal of Business Management*, *4*(12), 2527-2533.

Alves, H., &Raposo, M. (2010). The influence of university image on student behaviour. *International Journal of Educational Management*, *24*(1), 73-85.

Angell, R. J., Heffernan, T. W., &Megicks, P. (2008). Service quality in postgraduate education. *Quality Assurance in Education*, *16*(3), 236-54.

Annamdevula, S., & Bellamkonda, R. S. (2012). Development of HiEdQUAL for Measuring ServiceQuality in Indian Higher Education Sector. *International Journal of Innovation, Management and Technology*, *3*(4), 412-416.

Arambewela, R., & Hall, J. (2006). A comparative analysis of international education satisfaction using SERVQUAL. *Journal of Services Research*, *6*(Special), 141-163.

Asgari, M., &Borzooei, M. (2014). Effects of service quality and price on satisfaction and the consequent learning outcomes of international students. *Business and Management*, *6*(3), 132.

Barnes, B. R. (2007). Analysing service quality: the case of post-graduate Chinese students. *Total Quality Management & Business Excellence*, *18*(3), 313-331.

Bayraktaroglu, G., &Atrek, B. (2010). Testing the Superiority and Dimensionality of SERVQLAL vs. SERVPERF in Higher Education. *Quality Management Journal*, *17*(1), 47-59.

Becket, N., & Brookes, M. (2006). Evaluating quality management in university departments. *Quality Assurance in Education*, *14*(2), 123-142.

Bhuian, S. N. (2016). Sustainability of Western branch campuses in the Gulf Region: Students' perspectives of service quality. *International Journal of Educational Development*, *49*, 314-323.

Brady, M. K., Cronin Jr, J. J., & Brand, R. R. (2002). Performance-only measurement of service quality: a replication and extension. *Journal of Business Research*, *55*(1), 17-31.

Brenders, D. A., Hope, P., &Ninnan, A. (1999). A systemic, student-centered study of university service. *Research in Higher Education*, *40*(6), 665-685.

Brochado, A. (2009). Comparing alternative instruments to measure service quality in higher education. *Quality Assurance in education*, *17*(2), 174-190.

Brown, D. J., & Koenig, H. F. (1993). Applying total quality management to business education. *Journal of Education for Business*, *68*(6), 325-329.

Calvo-Porral, C., Lévy-Mangin, J. P., & Novo-Corti, I. (2013). Perceived quality in higher education: an empirical study. *Marketing Intelligence & Planning*, *31*(6), 601-619.

Cardona, M. M., & Bravo, J. J. (2012). Service quality perceptions in higher education institutions: the case of a Colombian university. *EstudiosGerenciales*, *28*(125), 23-29.

Chong, Y. S., & Ahmed, P. K. (2012). An empirical investigation of students' motivational impact upon university service quality perception: a self-determination perspective. *Quality in Higher Education*, *18*(1), 35-57.

Chui, T. B., & bin Ahmad, M. S. (2016). Evaluation of service quality of private higher education using service improvement matrix. *Procedia-Social and Behavioral Sciences*, *224*, 132-140.

Clemes, M. D., Cohen, D. A., & Wang, Y. (2013). Understanding Chinese university students' experiences: an empirical analysis. *Asia Pacific Journal of Marketing and Logistics*, *25*(3), 391-427.

Cook, M. J. (1997). A Student's perspective of service quality in education. *Total Quality Management*, *8*(2-3), 120-125.

Cronin Jr, J. J., & Taylor, S. A. (1992). Measuring service quality: a reexamination and extension. *Journal of Marketing*, *56*(3), 55-68.

Crosby, P. B. (1979). *Quality is free: The art of making quality certain*. New American Library, New York.

Dabholkar, P. A., Shepherd, C. D., & Thorpe, D. I. (2000). A comprehensive framework for service quality: an investigation of critical conceptual and measurement issues through a longitudinal study. *Journal of retailing*, *76*(2), 139-173.

Daud, S., &Sapuan, N. M. (2011). Expectation-perception gap in Private Higher Education Institutions in Malaysia. *International Journal of Management in Education*, *6*(1-2), 22-37.

De Jager, J., &Gbadamosi, G. (2010). Specific remedy for specific problem: measuring service quality in South African higher education. *Higher education*, *60*(3), 251-267.

Dehghan, A., Dugger, J., Dobrzykowski, D., &Balazs, A. (2014). The antecedents of student loyalty in online programs. *International Journal of Educational Management*, *28*(1), 15-35.

El Alfy, S., &Abukari, A. (2019). Revisiting perceived service quality in higher education: Uncovering service quality dimensions for postgraduate students. *Journal of Marketing for Higher Education*, *30*(1), 1-25.

Fares, D., Achour, M., &Kachkar, O. (2013). The impact of service quality, student satisfaction, and university reputation on student loyalty: A case study of international students in IIUM, Malaysia. *Information Management and Business Review*, *5*(12), 584-590.

Filip, A. (2012). Marketing theory applicability in higher education. *Procedia-Social and Behavioral Sciences*, *46*, 912-916.

Galeeva, R. B. (2016). SERVQUAL application and adaptation for educational service quality assessments in Russian higher education. *Quality Assurance in Education*, *24*(3), 329-348.

Gounaris, S. P., Stathakopoulos, V., &Athanassopoulos, A. D. (2003). Antecedents to perceived service quality: an exploratory study in the banking industry. *International Journal of Bank Marketing*, *21*(4), 168-90.

Gupta, P., & Kaushik, N. (2018). Dimensions of service quality in higher education–critical review (students' perspective). *International Journal of Educational Management*, 32(4), 580-605.

Halai, N. (2013). Quality of private universities in Pakistan. *International Journal of Educational Management*, *27*(7), 775-786.

Hau, N., Evangelista, F., & Thuy, P. N. (2013). Does it pay for firms in Asia's emerging markets to be market oriented? Evidence from Vietnam. *Journal of Business Research*, *66*(12), 2412-2417.

Hsu, C., & Lin, J. C. (2015). What drives purchase intention for paid mobile apps? An expectation-confirmation model with perceived value. *Electronic Commerce Research and Applications*, *14*, 46-57.

Iacovidou, M., Gibbs, P., &Zopiatis, A. (2009). An exploratory use of the stakeholder approach to defining and measuring quality: The case of a Cypriot higher education institution. *Quality in Higher Education*, *15*(2), 147-165.

Icli, G. E., & Anil, N. K. (2014). The HEDQUAL scale: A new measurement scale of service quality for MBA programs in higher education. *South African Journal of Business Management*, *45*(3), 31-43.

Kang, G. D. (2006). The hierarchical structure of service quality: integration of technical and functional quality. *Managing Service Quality: An International Journal*, *16*(1), 37-50.

Kang, G. D., & James, J. (2004). Service quality dimensions: an examination of Grönroos's service quality model. *Managing Service Quality: An International Journal*, *14*(4), 266-277.

Kitapci, O., Akdogan, C., &Dortyol, İ. T. (2014). The impact of service quality dimensions on patient satisfaction, repurchase intentions and word-of-mouth communication in the public healthcare industry. *Procedia-Social and Behavioral Sciences*, *148*, 161-169.

Ladhari, R. (2009). Assessment of the psychometric properties of SERVQUAL in the Canadian banking industry. *Journal of Financial Services Marketing*, *14*(1), 70-82.

Lagrosen, S., Seyyed-Hashemi, R., & Leitner, M. (2004). Examination of the dimensions of quality in higher education. *Quality Assurance in Education*, *12*(2), 61-69.

Leblanc, G., & Nguyen, N. (1997). Searching for excellence in business education: an exploratory study of customer impressions of service quality. *International Journal of Educational Management*.

Lim, Y., Yap, C., Lee, T., 2011. Destination choice, service quality, satisfaction, and consumerism: International students in Malaysian institutions of higher education. *African Journal of Business Management*, *5*, 1691-1702.

Mattah, P. A. D., Kwarteng, A. J., & Mensah, J. (2018). Indicators of service quality and satisfaction among graduating students of a higher education institution (HEI) in Ghana. *Higher Education Evaluation and Development*, *12*(1), 36-52.

Mishra, S. (2007). *Quality Assurance in Higher Education: an Introduction (first edition)*. National Assessment and Accreditation Council (NAAC), Bangalore.

Mogre, S., Farkiya, R., &Zokarkar, S. (2018). Service Quality in Management Institutions: Perceived and Expected Quality Gaps in Viewpoint of Students. IOSR *Journal of Business and Management*, *20*(4), 19-28.

Nadiri, H., Kandampully, J., & Hussain, K. (2009). Students' perceptions of service quality in higher education. *Total Quality Management*, *20*(5), 523-535.

Napitupulu, D., Rahim, R., Abdullah, D., Setiawan, M. I., Abdillah, L. A., Ahmar, A. S., ... &Pranolo, A. (2018). Analysis of student satisfaction toward quality of service facility. In *Journal of Physics: Conference Series* (Vol. 954, No. 1, p. 012019). IOP Publishing.

Narang, R. (2012). How do management students perceive the quality of education in public institutions?. *Quality Assurance in Education*, *20*(4), 357-371.

O'Neill, M. A., & Palmer, A. (2004). Importance-performance analysis: a useful tool for directing continuous quality improvement in higher education. *Quality assurance in education*, *12*(1), 39-52.

Oldfield, B. M., & Baron, S. (2000). Student perceptions of service quality in a UK university business and management faculty. *Quality Assurance in education*. 8(2), 85-95.

Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research*, *17*(4), 460-469.

Owlia, M. S., & Aspinwall, E. M. (1996). A framework for the dimensions of quality in higher education. *Quality Assurance in Education*, *4*, 12-20.

Parasuraman, A., Zeithaml, V. A., & Berry, L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, *64*(1), 12-40.

Quinn, A., Lemay, G., Larsen, P., & Johnson, D. M. (2009). Service quality in higher education. *Total Quality Management*, *20*(2), 139-152.

Ramseook-Munhurrun, P., Naidoo, P., &Nundlall, P. (2010). A proposed model for measuring service quality in secondary education. *International Journal of Quality and Service Sciences*, *2*(3), 335-351.

Rouf, A., Rahman, M., & Uddin, M. (2016). Students' satisfaction and service quality of HEIs. *International Journal of Academic Research in Business and Social Sciences*, *6*(5), 376-390.

Rozsa, Z. (2010). Adaptation of the SERVQUAL scale in Sempa Bratislava. In *International Scientific Conference Management, Krusevac* (pp. 17-18).

Seth, N., Deshmukh, S. G., &Vrat, P. (2005). Service quality models: a review. *International Journal of Quality & Reliability Management*, *22*(9), 913-949.

Shekarchizadeh, A., Rasli, A., & Tat, H. (2011). Business process management journal emerald article SERVQUAL in Malaysian universities: Perspectives of international students, *Business Process Management Journal*, *17*, 67-81.

Silva, D. S., de Moraes, G. H. S. M., Makiya, I. K., & Cesar, F. I. G. (2017). Measurement of perceived service quality in higher education institutions: A review of HEdPERF scale use. *Quality Assurance in Education*, 25(4), 415-439.

Sultan, P., & Wong, H. Y. (2010). Performance-based service quality model: an empirical study on Japanese universities. *Quality Assurance in Education*, *18*(2), 126-143.

Sultan, P., & Wong, H. Y. (2012). Service quality in a higher education context: an integrated model. *Asia Pacific Journal of Marketing and Logistics*, *24*(5), 755-784.

Sultan, P., & Wong, H. Y. (2013). Antecedents and consequences of service quality in a higher education context. *Quality assurance in education*, *21*(1), 70-95.

Tan, K. C., & Kek, S. W. (2004). Service quality in higher education using an enhanced SERVQUAL approach. *Quality in Higher Education*, *10*(1), 17-24.

Tang, S. F. (2012). Academic quality characteristics and satisfaction: An empirical survey among the students of two Malaysian private universities. *Academic Research International*, *2*(1), 213-228.

Teeroovengadum, V., Kamalanabhan, T. J., &Seebaluck, A. K. (2016). Measuring service quality in higher education. *Quality Assurance in Education*, *24*(2), 244-258.

Trivellas, P., &Dargenidou, D. (2008). Organisational culture, job satisfaction and higher education service quality: The case of Technological Educational Institute of Larissa. *The TQM Journal*, *21*(4), 382-399.

Van der Bij, T., Geijsel, F. P., & Ten Dam, G. T. M. (2016). Improving the quality of education through self-evaluation in Dutch secondary schools. *Studies in Educational Evaluation*, *49*, 42-50.

Voon, B. H. (2008). SERVMO: A measure for service-driven market orientation in higher education. *Journal of Marketing for Higher Education*, *17*(2), 216-237.

Voss, R., Gruber, T., &Szmigin, I. (2007). Service quality in higher education: The role of student expectations. *Journal of Business Research*, *60*(9), 949-959.

Wicks, A. M., &Roethlein, C. J. (2009). A satisfaction-based definition of quality. *The Journal of Business and Economic Studies*, *15*(1), 82.

Wong, K., Tunku, U. & Rahman, A. (2012). Constructing a survey questionnaire to collect data on service quality of business academics. *European Journal of Social Sciences*, *29*(2), 209-221.

Yeo, R. K. (2009). Service quality ideals in a competitive tertiary environment. *International Journal of Educational Research*, *48*(1), 62-76.

Yilmaz, V., Ari, E., &Gurbuz, H. (2018). Investigating the relationship between service quality dimensions, customer satisfaction and loyalty in Turkish banking sector: An application of structural equation model. *International Journal of Bank Marketing*, *36*(3), 423-440.

Yusof, A., Hassan, Z. F., Rahman, S., &Ghouri, A. M. (2012). Educational service quality at public higher educational institutions: A proposed framework and importance of the sub-dimensions. *International Journal of Economics Business and Management Studies*, *1*(2), 36-49.

Zeithaml, V. A., Parasuraman, A., Berry, L. L., & Berry, L. L. (1990). *Delivering quality service: Balancing customer perceptions and expectations*. Free Press, New York.

ROLE OF DATA MINING TECHNIQUES IN THE HEALTH SECTORS

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Nowadays, data analysis almost used in every fields like retail, e-business, marketing, healthcare industry etc. It is provides a better prospective in the direction of the future decision taken with respect to available information. Health care sectors has massive amount of data, with the cooperation of data analysis concept it provide a great vision over various health conditions such as censer, diabetes, covid-19 etc. This paper studied the data mining concepts used for early prediction of health problems such as diabetes, cancer etc. Diabetes is a heterogeneous group of disease and lots of people suffering from diabetes. Diabetes affects the harmonic insulin and increases levels of sugar in the blood. High blood sugar has an impact on various organs of the human body and sometimes creates complication in their functionalities such as heart disease, kidney disease, eye problem, nerve damage, stroke etc.

Keywords: Data mining, Healthcare application, Diabetes Mellitus, Machine Learning Algorithm

1. INTRODUCTION

Data analysis holds great potential on the health care industry to enable healthcare system for systematically use the available data to diagnosis the various types of health issues. Healthcare professionals use statistical models to predict risk factors in a patient for different health condition. Nowadays, Diabetes Mellitus, generally known as diabetes is a critical disease and lots of people suffering from this. Diabetes affects the harmonic insulin and increases levels of sugar in the blood. This high blood sugar has an impact on various organs of the human body and sometimes creates complication in their functionalities such as heart disease, kidney disease, eye problem, nerve damage, stroke etc. Therefore machine learning and data mining concepts play a vital role in this scenario. There is various data analysis approaches used such as regression, classification, clustering, deep learning etc.(Kavitha R.K. et al., 2020)(Kishore N.G.,. et. al, 2020) (Allam T.M, et al., 2019)

2. DATA MINING

Data mining is a process which is used to extract usable data from a larger data set. It implies analysis of larger data to discover meaningful hidden patterns, rules etc. Data mining is a process by which hidden knowledge discover from large amount of data. The paper discusses some of the data mining techniques, algorithms and who were adopted data mining technology to improve businesses. The useful patterns discover by the data analysis are further be used to make some decisions for expansion

of their businesses, precaution in health problem etc. (Sneha N., et al., 2019)(Aravindan J. et al., 2019) (Nazim R.. et al. , 2019)

Data Mining Techniques

One of the most important tasks in Data Mining is to select the correct data mining technique. Data Mining technique has to be chosen based on the type of business and the type of problem your business faces. A generalized approach has to be used to improve the accuracy and cost-effectiveness of using data mining techniques. There are basically seven main Data Mining techniques which are discussed in this article. There are also a lot of other data mining techniques but these are considered more frequently used in data analysis and processing such asClustering, Visualization, Decision Tree, Regression, Association Rules, Classification etc. (Sisodia D. et al., 2018) (Ramachandro M. et al., 2018) (M.S. Kadam et al., 2018)

3. DIABETES MELLITUS

Diabetes mellitus, commonly known as diabetes, is a metabolic   disease that causes high blood sugar. The hormone insulin moves sugar from the blood into your cells to be stored or used for energy. With **diabetes**, our body either doesn't make enough insulin or can't effectively use the insulin it does make. (Wu H. et al. 2017)

Diabetes is a disease that occurs when our blood gl(Nazim R.. et al. , 2019) (Pattekari S.A. et al., 2018)ucose, also called blood sugar, is too high. Blood glucose is our main source of energy and comes from the food you eat. Insulin, a hormone made by the pancreas, helps glucose from food get into our cells to be used for energy.

SYMPTOMS OF DIABETES- The general symptoms of diabetes include:
- Increased hunger
- Increased thrust
- Weight loss
- Frequent Urination
- Blurry vision
- Extreme Fatigue

TYPES OF DIABETES-There are a few different types of diabetes:

1.TYPE 1-Type1diabetes is an autoimmune disease. The immune system attacks and destroys cells in the pancreas, where insulin is made. It's unclear what causes this attack. About 10 percent of people with diabetes have this type.

2. TYPE 2-Type 2 diabetes occurs when your body becomes resistant to insulin, and sugar builds up in your blood.

3. GESTATIONAL DIABETES-Gestational diabetes is a condition in which your blood sugar levels become high during pregnancy (Q. Zou et al., 2018) (Azrar A. et al.,2018) (Shetty D. et al. ,2017).
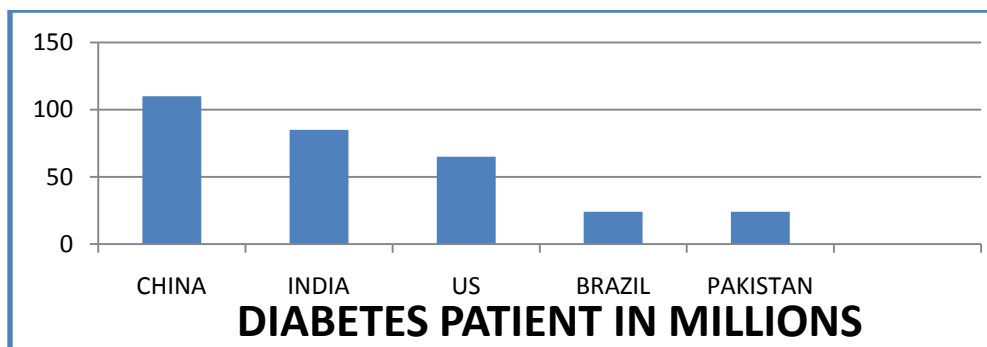
Fig 1- Adult diabetes patient in millions (India has the second highest number of diabetes patient)

4. LITERATUREREVIEW

As the life style of present generation is intend to epic center of various health problem, therefore study of health sector is amplify day by day to provide better prediction before the condition became worst. Hence data analysis of health sector data is frequently increased and predictive data mining is used for diagnosis of disease at an early stage helps the physicians to cure the patient from disease. The available literature reveals greater part of the work that has been carried out on diabetes has focused mainly on developing the methods for diagnosis accuracy. At the present time various researchers used various concept to provide better accuracy as possible on the sequence of that various algorithm and techniques must be used for data analysis such as Decision tree, SVM , KNN , classification etc. in the below table some them are summarized (A. Singh et al. , 2017) (Pattekari S.A. et al., 2012) (Zhe W. et al., 2015)

S.No	AUTHOR NAME	PROBLEM	ALGORITHM USED	TOOL USED	CONCLUSION
Table 1: Summery of Research Work in the field of Data analysis for diabetes patient.					
1	R.K. Kavitha and W. Jai Singh (Kavitha R.K. et al., 2020)	Their aim is to construct a model which will be able to foresee the chances of occurrence of with greatest precision with the help of various machine learning algorithms	Decision tree, naïve bayes algorithm, multi layer perception	NA	They proposed a model helps to detect early diabetes among patients with high accuracy.

2	Naveen Kishore G, V.Rajesh, A.Vamsi Akki Reddy, K.Sumedh, T.Rajesh Sai Reddy)(Kishore N.G.,. et. al, 2020)	Five machine learning algorithms has used measured different parameters within the dataset and came through better accuracy rate	SVM, KNN, logistic regression, KNN, random forest	NA	This work can be extended by adding any other algorithm which can give better accuracy than random forest algorithm.
3	T.M. Allam, M. A. Iqbal, A.Yasir, A. Wahab,S. Ijaz, T.I. Baig (Allam T.M, et al., 2019)	A few existing classification methods for medical diagnosis of diabetes patients have been discussed on the basis of accuracy	Association rule mining, artificial neural network (ANN), Data mining, classification, Diabetes, K-means clustering	NA	A classification problem has been detected in the expressions of accuracy.
4	N.Sneha, T.Gangil (Sneha N., et al., 2019)	The objective of this research is to make use of significant features, design a prediction algorithm using Machine learning and find the optimal classifier to give the closest result comparing to clinical outcomes..	Data Mining, Big Data, and Support Vector Machine (SVM)	NA	The proposed method aims to focus on selecting the attributes that all in early detection of Diabetes
5	J. Aravindan (Aravindan J. et al., 2019)	Data regarding various aetiological determinants and risk factors Genetic risk factor and few	Diabetess mellitus; Young onset diabetes,	NA	Risk factors such as obesity and FH (maternal history of type 2 diabetes) and consanguinity may play an important role in

		modifiable risk factors were collected. Chi-squared test was used for statistical analysis.	chi-square test.		screening of family members of type 2 diabetes patients which may lead to early intervention and reduced risk of subsequent complications
6	Deepti sisodia, dilip singh sisodiya (Sisodia D. et al., 2018)	This study is to design a model which can prognosticate the likelihood of diabetes in patients with maximum accuracy.	Decision tree , SVM, Naïve bayes algorithm	weka	Naive Bayes outperforms with the highest accuracy of 76.30% comparatively other algorithms.
7	Nazim Razali ,Aida Mustapha , Syed Zulkarnain Syed Idrus , Mohd Helmy Abd Wahab , Siti Aida Fatimah Madon (Nazim R.. et al. , 2019)	This paper aims to use several data mining techniques for classifying whether positive or negative result of diabetes diagnostic. Then, the results will be measured using confusion matrix in term of accuracy, precision and recall as evaluation metric for measuring the classification performance.	Naive Bayes, Sequential Minimal Optimizati on (SMO), Decision Tree and Simple Logistic Regressio n		The evaluation metric such as accuracy, precision and recall are measured for the given dataset to estimate the performance of each classification techniques.
8	Ramachandr a majji, Bhramaram baravi (Ramachand ro M. et al., 2018)	To create a risk prediction website for diabetes using collected the survey data	FP tree classifier algorithm	Weka	This project is aimed to validate and compare existing in prediction model for type 2 diabetes in the world variability is assessed in prediction performance between countries and by sex, age etc.
9	M.S. Kadam,	K-nearest neighbor algorithm for	KNN,class ification		A proposed classification approach based on

	I.W.Ghinda wi, D.E. Mhawai (M.S. Kadam et al., 2018)	eliminating the undesired data, reducing the processing time	techniques ,Decission Tree.		Decision Tree (DT) to assign each data sample to its appropriate class. By experiments, the proposed system achieved high classification result.
10	Han wu shengiyang, z hangin huang (Wu H. et al. 2017)	The main problem solved are comparing accuracy of prediction model and making the model to adapt different data set	Logistic Regressio n, K-means cluster algorithm	weka	The conclusion shows that the model attained a 3.04% higher accuracy of prediction than those of other researchers.
11	Quqn Zou, Kaiyang Qu, Yameilua (Q. Zou et al., 2018)	In this study, five-fold cross validation was used to examine the models we chose some methods that have the better performance to conductindependent test experiments.	Random forest, decision tree, neural network		comparing the results of three classifications methods random forest, decision tree and neural network, random forests are better than the another classifiers methods
12	Amina Azrar,Yasir Ali, Muhammad Awais (Azrar A. et al.,2018)	Data mining got a lot of attention for extracting information from large datasets to find patterns and to establish relationships to solve problems	Data mining algorithms include classificati on, associatio n, Naïve Bayes, clustering and decision tree		Data mining algorithms include classification, association, Naïve Bayes, clustering and decision tree by using the PID dataset for early prediction of diabetes.
13	Deeraj shetty, Kishor Rit, Sohail Shaikh, Nikita Patel	KNN and the Naïve Bays technique has been used for the prediction of diabetes	KNN and Naïve Bayes Algorithm		Their technique was implemented as an expert software program, where users provide input in terms of patient records and the finding that either

	(Shetty D. et al. ,2017).				the patient is diabetic or not.
14	Asmita singh,Malha .N. Halgamuge, Rajaseharam Lakshmigan than (A. Singh et al. , 2017)	The aims to evaluate different algorithms on datasets of different types. The Classification problems in this study are explored in terms of mean accuracy.	Big data ,Random Forest,K-nearest Neighbour Algorithm		They used the KNN, random forest and Naïve Bayesian algorithms. The K-fold cross-validation technique was used for evaluation
15	Shadab adam Pattekari,As ma Parveen (Pattekari S.A. et al., 2012) (Zhe W. et al., 2015)	The main aim to analysis is to develop a prototype Health Care Prediction System using, Naive Bayes.	Naïve Bayes algorithm		The System will discover and extract hidden data related to diseases (heart attack, cancer heart disease database. And developed a web-based application for prediction of myocardial infarction using Naive Bayes.
16	Wei Zhe, Ye Guangjian (Zhe W. et al., 2015)	Improve the low efficiency in analyzing risk factors of type 2 Diabetes Mellitus by Apriori Algorithm	Apriori Algorithm, FP-tree Algorithm	C# progra m	The improved FP-tree Algorithm can be used to analyze the risk factors of Diabetes Mellitus and holds a higher efficiency.
17	Azra ramrzankha ni,OmidRou rnik,Jamal shahrabi.et.a l (Ramezankh ani A., et al., 2015)	The aim of this study was to identify risk patterns for type 2 diabetes incidence using association rule mining (ARM).	Diabetes Mellitus, Type 2; Data Mining; Body Mass Index		The ARM focuses on joint exposure to different combinations of risk factors, and not the predictors alone.
18	V.Anuja kumara,R.ch itra (Kumari	The proposed method uses Support Vector Machine (SVM), a machine learning	Support vector machine		The experimental results obtained show that support vector machine can be successfully used for

V.A. et al., 2015)	method as the classifier for diagnosis of diabetes.			diagnosing diabetes disease.
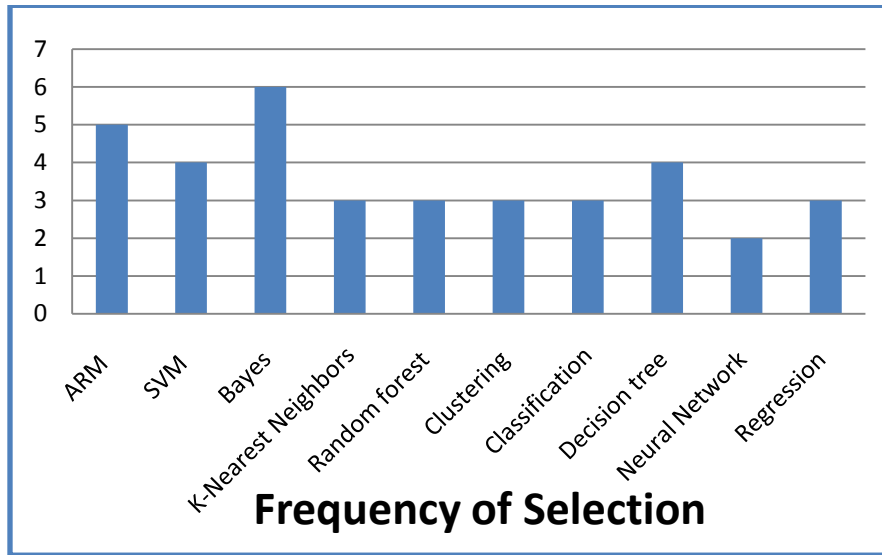
Fig 2- Frequency of selection of DM techniques.

5. CONCLUSION

From past few decades machine learning plays a vital role in the health sector for prediction and diagnosis of various health issues. This could become a valuable tool that aids in medical decision-making. This work focus on the better prediction of future health issue arises in diabetes patients through machine learning. Nowadays, numbers of diabetic patient's increase, due to diabetes some other health issues are appear in the patient. Hence that it is necessary to calculate the risk factor in diabetic patients due to their life style and their diabetes condition. Machine learning is widely used to calculate this type of risk factor.

REFERENCES

Kavitha RK. , Singh WJ (2020). "A Study on the Effectiveness of Machine Learning Algorithms in Early Prediction of Diabetics among Patients", Biosc.Biotech.Res.Comm, 13(11), 99-104.

Kishore N.G., Rajesh V., Vamsi A., Reddy A, Sumedh K., Reddy TRS, (2020). "Prediction Of Diabetes Using Machine Learning Classification Algorithms", INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH 9(1), 1805-1808.

Allam T.M, Iqbal M. A., Yasir A., Wahab A.,S. Ijaz, T.I. Baig, Hussian A., Mallik M.A, Raza M.M., Ibrar S, Abbas Z., (2019). "A model for early prediction of diabetes", Informatics in medicine unlocked, 16(1), 1-6.

Sneha N., Gangil T.(2019). "Analysis of diabetes mellitus for early prediction using optimal features selection", Journal of big data, .2-19.

Aravindan J., (2019). "Risk Factor in patients with Type 2 diabetes in Bengaluru", World Journal of Diabetes, 10(4), 241-248.

Sisodia D. & Sisodia D.S., (2018). "Prediction of Diabetes using Classification Algorithms", International Conference on Computational Intelligence and Data Science (ICCIDS 2018), The NorthCap University, Gurugram.

Nazim R. , Mustapha A. , Syed I., Syed Z., Abd W. & Helmy M. S, (2019). "Analyzing Diabetic Data using Classification" ,Journal of Physics: Conference Series. 1529. 022105. 10.1088/1742-6596/1529/2/022105, 1-7.

Ramachandro M. & Bhramaramba R, (2018). "Type 2 Diabetes Classification and Prediction Using Risk Score", International Journal of Pure and Applied Mathematics, volume 119, issue 15, 1099-1111. (2018).

M.S. Kadam, I.W.Ghindawi, D.E. Mhawai, (2018). "An Accurate Diabetes Prediction System Based on K-means Clustering and Proposed Classification Approach", International Journal of Applied Engineering Research,vol.13,no.6, (2018), pp-4038-4041.

Wu H., Yang S., Huang Z., He J., Wan X., (2017). "Type 2 diabetes mellitus prediction model based on data mining" , Informatics in Medicine Unlocked, 10(2), 100-107.

Q. Zou, K. Qu, Y. Luo, D. Yin, Y. Ju, (2018). "Predicting Diabetes Mellitus with Machine Learning Techniques", Frontiers in Genetics.

Azrar A., Ali Y., Md. Awais,(2018) "Data Mining Models Comparison for Diabetes Prediction", International Journal of Advanced Computer Science and Applications(IJACSA), 9(8), 320-323.

Shetty D., Rit K., Shaikh S., Patil N.,(2017). "Diabetes disease prediction using data mining", International conference on Innovation in information, embedded and communication systems.

A. Singh, A. Singh, M.N. Halgamuge, R. Lakshmikanthan, (2017). " Impact of different data types on classifier performance of random forest, naive Bayes, and K-nearest neighbor's algorithms" , International Journal of Advanced Computer Scienceand Application, 8(12), 13-18.

Pattekari S.A., Parveen A., (2012). "Prediction system for heart disease using Naïve Bayes", International Journal of Advanced Computer Math Science, 3(3), 290-294.

Zhe W. and Guangjian Y, (2015) "The Research on Analyzing Risk Factors of Type 2 Diabetes Mellitus Based on Improved Frequent Pattern Tree Algorithm", International Conference on Materials Engineering and Information Technology Applications.

Ramezankhani A., Pournik O., Shahrabi J., Azizi F., & Hadaegh F., (2015), "An application of association rule mining to extract risk pattern for type 2 diabetes using tehran lipid and glucose study database", International journal of endocrinology and metabolism, 13(2), 32-39.

Kumari V.A., Chitra R., (2013). "Classification of diabetes disease using support vector machine", International JournalEngineering Research and Application, 3(2), 1797-1801.

Zhe Wei & Guangjian Ye, (2015), "The Research on Analyzing Risk Factors of Type 2 Diabetes Mellitus Based on Improved Frequent Pattern Tree Algorithm" , Proceedings of the 2015 International Conference on Materials Engineering and Information Technology Applications.

OPTIMIZATION OF EVAPORATION PROCESS IN SUGAR INDUSTRIES IN A SIMULATED ENVIRONMENT

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Evaporators employed in sugar industries are usually multiple effect in nature. In fact, modelling and control of such complex systems have been very much challenging for quite some time. The conventional methods for modelling and control do not yield good results due to the complex and highly non-linear nature of evaporation process. Out of the different unit operations in a sugar industry, evaporation process is the most energy consuming one and its optimization has a direct impact on both the sugar quality and steam fuel economy. An evaporator raises the concentration of sugar cane juice (brix) from a low value around 15% to a high value of nearly 70%.In this paper, an attempt has been made to model the operation of a quadruple effect evaporator in a simulated environment using MATLAB. The model has been developed through mass and energy balance equations at different effects of the evaporator. Based on the data obtained from sugar industry, a Simulink model has been prepared. Taguchi trials have been conducted on this model for the optimization of the same. These trials are based on L9 Orthogonal Arrays. For finding out how the evaporator parameters viz. Flow rate of steam, Flow rate of feed and Feed temperature influence the sugar cane juice concentration and steam economy, ANOVA (Analysis of Variance) results are employed. The level of influence of each parameter is determined with the help of ANOVA. For making this analysis simple, Minitab 17 software has been employed.

Keywords: ANOVA, Brix, Quadruple Effect Evaporator, Optimization, Steam Economy, Taguchi Trials

1. INTRODUCTION

In India, the technology of production of sugar from raw sugar cane has been stabilized for a long time. There are number of steps in the process of manufacturing sugar right from sugar cane collection and its weighing till the bagging of white sugar in jute bags. Cane preparation, juice extraction, juice weighing, juice treatment/sulphitation, evaporation and massecuite boiling are other processes involved in the production of sugar. Massecuite is a mixture of semi- solid obtained from the sugarcane juice after several rounds of concentration by boiling. Massecuite is separated by centrifugation into molasses and pure sugar. Molasses which emerges as a byproduct during the manufacturing process may be sent to subsidiary units like distilleries.

In the present era, sugar industries arebound to adopt reduction in energy consumption, material recycling and optimization of unit operations because of environmental protection demands and extreme competition (**Sebastian et al., 2012**). Systems are available for Plant automation like Juice

flow stabilization system, Lime sulphitation pH control system, Steam flow stabilization system, Pan automation package, Inbibition water control system, Evaporator control system etc. Such systems are designed with an intention of improving both sugar quality and steam fuel economy.

2. LITERATURE REVIEW

2.1 Evaporation Process

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Evaporation process is found to be the most energy consuming one among various unit operations in a sugar plant.The economy of sugar manufacturing is very much dependent on this process as the amount of steam required during evaporation is very large(**Elhaq et al., 1997**). As such, the concentration of sugarcane juice (brix) is raised from a nominal value say, 15wt% to a high value of 72wt%, in the evaporator station.

For ensuring smooth operation of the evaporator and accurate control of brix value, appropriate control mechanisms are required (**Smith et al., 2000**). A meaningful interpretation of the same is in terms of the economy of evaporator operation. In fact, maximum amount of high-quality product is expected to be delivered to the downstream factory and brix is the proper parameter to determine this quality.Also, there are constraints on the amount of syrup to be delivered which is related to the rate at which the juice arrives at the station. Too much high value ofsyrup concentration is also not recommendedas it may lead to spontaneous nucleation or excessive deposition.

2.2 Multiple Effect Evaporators

In sugar factories,evaporator effects are usually placed in series effects facilitating Multiple Effect Evaporation (MEE)process (**Hugot, 1986**). As a result, only certain amount of water is removed in each effect. With the juice passing through each effect progressively, the brix value increases Despite its extensive use, the Multiple Effect Evaporator is a very difficult system for modelling and control. Conventional control techniques like single loop PID controller will not yield good results owing to the complexity and number of interactions between evaporator variables(**Elhaq et al., 1997**). Hence, for many years, optimization and control of MEE have become an active area of interest for researchers.

An attempt has been made by some researchers to design and implement control scheme for a multiple effect evaporator having five effects. This work has been carried out in a real time simulation environment. The control system designed was on the idiomatic concept. After successfully testing the concept on real time simulator, it was implemented in a Danish sugar plant with minor modification (**Nielsen et al., 1996**). Three different linear control schemes viz. Generalized Predictive Control (GPC), Linear Quadratic Gaussian (LQG) and Internal Model Control (IMC) for a five-effect evaporator have also been proposed (**Elhaq et al., 1997**). A model predictive control scheme has been proposed for brix control (**Smith et al., 2000**). Modeling and optimization of a five-effect evaporator using genetic algorithm has also been attempted by some researchers(**Pitteca et al., 2004**). The same authors designed a Fuzzy control scheme for the control of MEE (**Pitteca et al., 2004**). The work was carried out in simulation using MATLAB. Model identification and study of the behaviour of multiple

effect evaporator under PID control, auto-tuned PID control and Fuzzy control have also been carried out (**Raghul et al., 2012**).

3. EXPERIENTIAL WORK

3.1 Multiple Effect Evaporator Dynamics

As indicated in Figure 1, the evaporator considered here has four effects.
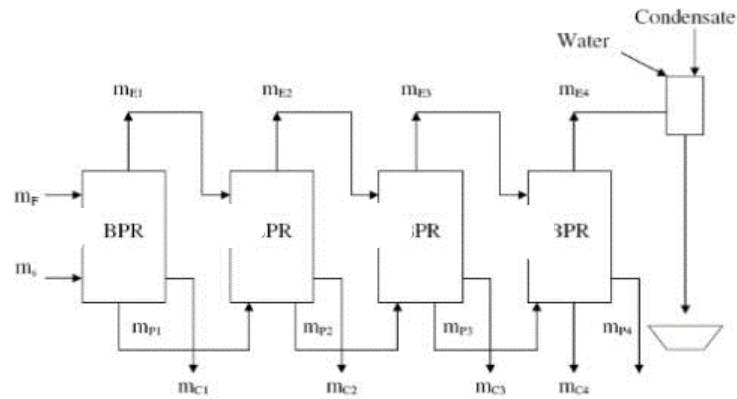
Figure 1: Quadruple Effect Evaporator

For representation of evaporator dynamics, there are number of variables at each effect like:

m_F – Mass flow rate of feed, kg/hr
x – Initial concentration
y – Final concentration
m_P-Product flow rate , kg/hr
m_E – Total water evaporated, kg/hr   SE – Steam economy
m_S – Steam flow rate, kg/hr
m_{E1}, m_{E2}, m_{E3}, m_{E4} –Water removed in effects 1 – 4,kg/hr
m_{P1}, m_{P2}, m_{P3}, m_{p4} – Flow rate of product obtained in effects 1 – 4, kg/hr
m_{C1}, m_{C2}, m_{C3}, m_{C4} – Flow rate of condensate obtained in effects 1 – 4, kg/hr
 These variables are correlated by the mass and energy balance of feed flow rate, vapour flow rate and product flow rate in the forward feed. Solving the basic equations describing the balance of mass and energy at each effect will yield the values of m_P and m_E (**Shah et al., 2012**).For calculation of sugar cane juice concentration and steam economy, the steps followed are:

1. Calculate the amount of product obtained by

$$m_P = (m_F * x) / y \qquad (1)$$

2. Evaporation taken place will be

$$m_F = m_P + m_E \qquad (2)$$

3. Amount of steam required to achieve desired evaporation can be calculated by

$$m_S = m_E / \text{steam economy} \qquad (3)$$

Assume suitable value of steam economy here

4. Brix per each effect is calculated by

$$x_{new} = (\text{feed flow for that effect} * x_{old})/(\text{product flow from that effect}). \qquad (4)$$

This process is repeated till the desired brix value is attained. An initial concentration value of 20% is assumed for this calculation.

3.2 Modelling

As mentioned in the earlier works of the author, a Simulink model has been developed for a quadruple effect evaporator based on the data collected from sugar industry (**Sebastian et al., 2016)** The model developed is shown in Figure 2. For the purpose of model validation, the values predicted by the model are compared with actual values. It is observed that the model predicted values differ from the actual
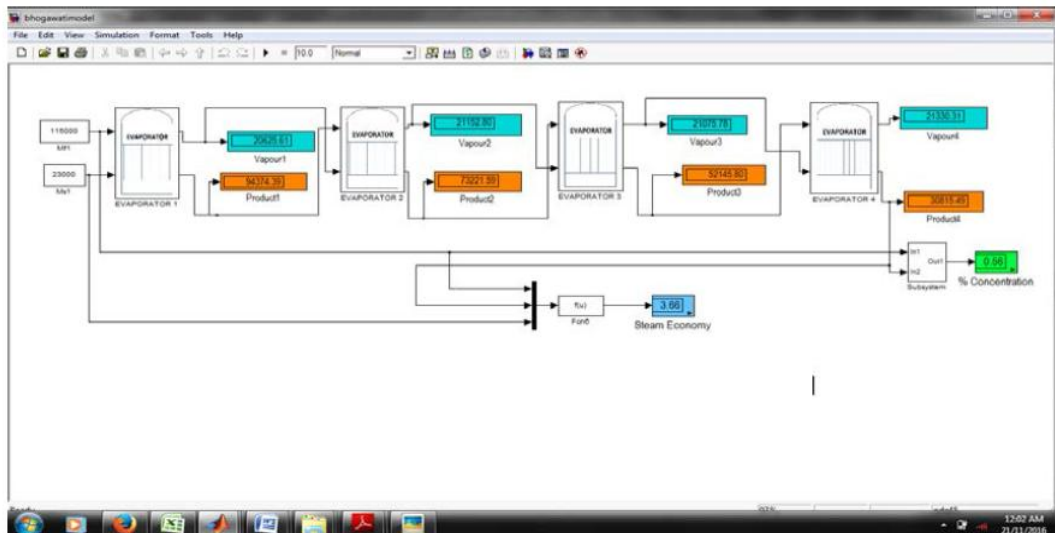
Figure 2: Model in Simulink

values. To be particular, for a feed flow rate of 115000 kg/hr and steam flow rate of 23000 kg/hr with 120^0C steam temperature, the product flow rate will be 55000 kg/hr. But the model predicted value is only 30185 kg/hr. This error has occurred because of the fact that the model has been prepared based only on the mass and energy balance equations written at the four effects of the evaporator. In fact, the steam coming out from different effects will be used not only for the evaporation of the feed at the subsequent effect, but also for various other purposes like juice heating, pan washing, vent and radiation losses and unforeseen usage margin. A Simulink model taking into account of additional steam utilization has been developed as shown in Figure 3.
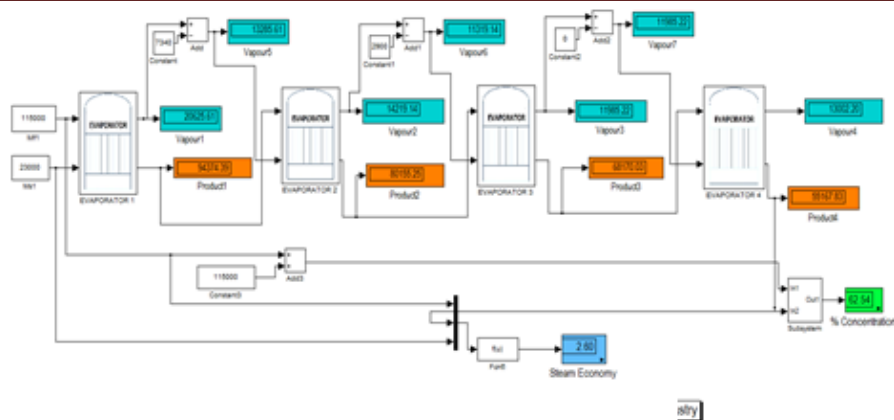
Figure 3: Final Simulink Model

3.3 Optimization

There may be disagreement between the evaporator parameter values at steady state obtained from the model and those measured on the actual plant. This demands proper tuning of the model parameters to get reasonable steady state values (**Pitteca et al., 2004**). The model tuning becomes very difficult due to severe mass and energy interaction among the effects of the evaporator station.In such a case, some technique has to be identified for extracting plant parameters to optimize the model.

While conducting a run on any process plant, the matter of preliminary interest is determination of process variables affecting the response. This is followed by determination of the optimum combination of process variables leading to the best possible response (**Montgomery, 2006**). For example, if the response is surface roughness of lathe facing operation, one should look for a region of minimum roughness(**Athreya et al.,2012**), whereas, if the response is steam economy in an evaporator, it should be a region of maximum economy. The Taguchi method is a very powerful statistical tool in such situations for determining the optimum parameter combinations and their relative contributions.

Taguchi Technique

Taguchi suggested Design of Experiments (DOE) using Orthogonal Arrays and other statistical techniques to determine levels of process variables that force the mean to a desired value with reduced variability around the same.This method recommends for loss function, the value of which is further transformed into Signal-to-Noise (S/N) ratio. There basic categories are there for analysis of S/N ratio.: Nominal-the best, Larger-the better and Smaller-the better. Steam economy and concentration (brix) of sugarcane juice are the two responses considered here. The application of Taguchi technique has been demonstrated in improving boththese parameters.

Taguchi Trials

On the developed Simulink model, Taguchi trials are conducted based on the L9 Orthogonal Arrays which are summarized in Table 1. Results obtained from these Experimental runs are indicated in Table2.

Table 1: Taguchi L9 Orthogonal Array			
	Feed Temperature(^{0}C)	m_S (kg/hr)	m_F (kg/hr)
Trial No. 1	75	22500	100000
Trial No. 2	75	23000	115000
Trial No. 3	75	23500	130000
Trial No. 4	90	22500	115000
Trial No. 5	90	23000	130000
Trial No. 6	90	23500	100000
Trial No. 7	100	22500	130000
Trial No. 8	100	23000	100000
Trial No. 9	100	23500	115000

Table 2:Experimental Runs and Results				
Input parameters			Output parameters	
Feed Temperature (^{0}C)	m_S	m_F	% Brix	Steam Economy
75	22500	100000	51.27	1.65
75	23000	115000	44.12	1.60
75	23500	130000	39.31	1.55
90	22500	115000	52.25	2.18
90	23000	130000	46.22	2.19
90	23500	100000	67.78	2.23
100	22500	130000	51.94	2.63
100	23000	100000	78.22	2.56
100	23500	115000	64.47	2.67

Analysis of Variance

ANOVA evaluates the percentage response magnitude of each parameter in the trials. The results thus obtained after Taguchi trials for brix and steam economy are given in Table 3 and Table 4 respectively.

Table 3: ANOVA for Brix

```
Analysis of Variance for S/N ratios

Source          DOF  Seq SS   Adj SS   Adj MS     F       P
Feed Temp(°C)    2   14.7573  14.7573  7.37867  445.98  0.002
mS (kg/hr)       2    0.5747   0.5747  0.28733   17.37  0.054
mF (kg/hr)       2   14.1666  14.1666  7.08329  428.13  0.002
Residual Error   2    0.0331   0.0331  0.01654
Total            8   29.5317

Response Table for Signal to Noise Ratios
Larger is better

              Feed
Level    Temp(°C)   mS (kg/hr)   mF(kg/hr)

1          32.99      34.29       36.23
2          34.76      34.69       34.48
3          36.12      34.90       33.17
Delta       3.13       0.61        3.06
Rank           1          3           2
```

Table 4: ANOVA for SE

```
Analysis of Variance for S/N ratios

Source          DOF   Seq SS   Adj SS   Adj MS     F       P
Feed Temp(°C)    2   28.3272  28.3272  14.1636  174.95  0.006
mS (kg/hr)       2    0.0356   0.0356   0.0178    0.22   0.820
mF (kg/hr)       2    0.0402   0.0402   0.0201    0.25   0.801
Residual Error   2    0.1619   0.1619   0.0810
Total            8   28.5649


Response Table for Signal to Noise Ratios
Larger is better

             Feed       mS        mF
Level    Temp(°C)   (kg/hr)   (kg/hr)
1          4.080     6.506     6.594
2          6.848     6.352     6.461
3          8.365     6.434     6.338
Delta      4.285     0.154     0.155
Rank           1         3         2
```

In both the cases, the criterion selected is larger thebetter. It can be understood from the Tables that both for steam economy and brix, the most predominant parameter is feed. temperature, which is followed by flow rate of the feed. Steam flow rate has the least level of predominance. Unlike other optimization problems, for the MEE optimization, confirmation tests cannot be done in real time. For this, the optimized parameter settings and their level of predominance have been discussed with the experts in the sugar factory. Whatever knowledge and experience such experts have shared, confirms the results obtained from these trials and further analysis.

4. CONCLUSION

A mathematical model of Quadruple effect evaporator is developed in Simulink and it has been optimized using Taguchi method. Though Taguchi technique is very powerful in optimization of real time systems, its application is more or less restricted to optimization of single performance characteristic. But in applications like MEE, handling of multi-response characteristics need to be addressed. For this purpose, Taguchi technique has to be integrated with techniques like Fuzzy logic, Grey relational analysis etc. (**Rajyalakshmi et al., 2012**). Authors in their earlier works have used the Fuzzy logic integration with Taguchi for optimization of MEE (**Sebastian et al., 2016**). But in that work, the evaporator model used was a generalized one and has not taken into account the additional utilization of steam at different effects. Hence the model will not give accurate results and the optimum settings obtained will not agree with the actual parameter values of the MEE on which the observations are carried out**.**

REFERENCES:

Srinivas Athreya, Ventatesh Y. D. (2012). Application of Taguchi Method for Optimization of Process Parameters in Improving the Surface Roughness of Lathe Facing Operation. *International Refereed Journal of Engineering and Science*, Vol. 1, Issue 3, 13-19

S. LissaneElhaq, F. Giri and H. Unbehauen (1997). The Development of Controllers for a Multiple-Effect Evaporator in sugar industry. https://ieeexplore.ieee.org/document/7082624

E. Hugot (1986). Handbook of Cane Sugar Engineering (pp 504-506). Elsevier Science Publishing Company Inc.

Laxmi Narayan, Rao K. S. N., Kota S., Acharya G. N (1986). pH Control System for Juice Clarification. *Proceedings of Workshop on Modernization of Sugar Industry using Electronic Systems, CEERI Pilani*, 101-123

K. M. Nielsen, J.F.D. Nielsen and T.S. Pederson (1996). Simulation and control of a Multiple Effect Evaporator. https://ieeexplore.ieee.org/abstract/document/656202

Douglas. C. Montgomery (2006). Design and Analysis of Experiments (pp. 1-20). Singapore: John Wiley & Sons (Asia) Pte. Ltd

Arvin V. Pitteca, Robert T. F., Ah King and Harry C. Rughooputh (2004). Parameter Estimation of a Multiple-Effect Evaporator by Genetic Algorithms. *Proc. Joint 2nd International Symposium on Advanced Intelligent Systems*, *Yokohama, Japan*

Arvin V. Pitteca, Robert T. F., Ah King and Harry C. Rughooputh (2004). Intelligent Controller for Multiple Evaporator in Sugar Industry. *Proceedings of IEEE International Conference on 'Industrial Technology',* 1177-1182

Rajyalakshmi G., Venkata Ramaiah P. (2012). Optimization of Process Parameters of Wired Electrical Discharge Machining using Fuzzy Logic Integrated with Taguchi Method. *International Journal of Scientific Engineering and Technology.* Vol. 2, Issue 6, 600-606

Raghul R., Syed MohaideenShahidh. H, Luca Nelson. S, Ajith. B. Singh (2012). Model Identification and Fuzzy Controller Implementation for the Evaporator Process in Sugar Industry. *Proceedings of International Conference on Electrical Engineering and Computer Science (ICEECS – 2012)*, 27-32

Sebastian George, Kyatanavar D. N. (2012). Applications of Fuzzy Logic in Sugar Industries: A Review. *International Journal of Engineering and Innovative Technology*, Vol 1, Issue 6, 226-231

Sebastian George, Kyatanavar D. N. (2016). Optimization of Multiple Effect Evaporator using Fuzzy Logic Integrated with Taguchi Technique", International Conference on 'Electrical, Electronics and Optimization Techniques' (ICEEOT) - 2016, DMI College of Engineering, Chennai http://ieeexplore.ieee.org/document/7754917/?reload=true

Dhara J. Shah, Bhagchandani C. G (2012). Design, Modeling and Simulation of Multiple Effect Evaporators. *International Journal of Scientific Engineering and Technology*, Vol. 1, Issue 3, 01-05

P. D. Smith, Cleswartz,Harrison S. T. L (2000). Control and Optimization of a multiple effect evaporator. *Proceedings of S AfrSug Technol Ass.,*74, 274-279

ROLE OF SOFT COMPUTING MODELS IN ORTHOPEDIC DISEASE PREDICTION USING INTERNET OF THINGS

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The objective of using the model as soft computing is to provide precise approximation for complex real-life problem and when it is very difficult to get straight forward solutions. Approximate solutions are available through the usage of Soft computing models.The   internet of things is a network of dedicated devices deployed and used to gather and exchange the information / data across the internet or other networks. In this paper an effort has been made to predict the orthopaedic disease using the technique of Internet of things. And thereafter the method of multivariate statistical tool and soft computing models have been used.

Under soft computing model, fuzzy logic, neural network,evolutionary algorithm, particle swarm optimization, harmony search algorithm have to be used. The selection of particular soft computing model has to be decided based on average error, Atkinson's Information Criterion(AIC), and Bayesian's Information Criterion(BIC). K-means clustering algorithm has to be applied on the estimated data based on selected soft computing model to form a number of clusters. The value of each cluster centre indicates type of orthopedic disorder of the person. The performance of proposed model has to be examined by the formation of confusion matrix.

Keywords: Multivariate statistical tool, fuzzy logic, neural network, evolutionary algorithm, clustering.

1. INTRODUCTION.

In the field of orthopaedics, due to the advancement in the treatment and surgery, the gathering of information and education, advanced research and development has become possible with the Internet of Things. After orthopaedics surgery, it is necessary to do effective communication between doctors and patient and with that, there are better chances of recovery of the patient. The main benefits of this technology are to decrease operational cost and errors during surgery. It appropriately manages all drugs to improve patient outcome through this virtual infrastructure. Internet of Things connects all physical orthopaedics devices with internet to quickly receive or sent information.

2. LITERATURE REVIEW.
Farahnaz Sadoughiet al (2020) have made an effort to make a study with an objective to identify and map the current IOTdevelopments in medicine with the help of graphical/tabular classifications on the

current experimental and practical IOT information in medicine.It has been found that India, China and the United States are found to be the most involved countries in the field of medical IOT research.

Bikash Pradhan et al(2021) have opined that the Internet of things (IOT) has shown potential application in connecting various medical devices, sensors, and healthcare professionals to provide quality medical services in a remote location. It has improved patient safety, reduced healthcare costs, enhanced the accessibility of healthcare services, and increased operational efficiency in the healthcare industry.

Amani Aldahiri et al(2021) have used Machine Learning techniques in Health Prediction system.The authors have made an effort to analyse the most well-known Machine Learning(ML) algorithms for the classification and prediction of IOT data in the healthcare sector in order to select appropriate algorithms for building an efficient prediction model.

AbidHaleem et al(2019) have discussed the role of internet of things in orthopaedics. There are different technologies used in IOT, which are helpful in orthopaedics to provide proper information. These include big data, cloud computing, smart sensors, artificial intelligence, actuators and virtual reality/augmented reality.It can detect mistakes during orthopaedics surgery.

Deepak Chahal et al(2019) have tried to analyse how IOT is used in Computer aided diagnostic systems using dataset of orthopedic patients and in order with an objective to make a decisionregarding the health of a patient. They have tried to get a solution in the treatment of vertebral column disorders of a patient.

Vatan, et al(2020)have made an effort to make a systematic analysis of the clustering protocols based on soft computing approaches in the agricultural domain in order to increase the life time of Wireless Sensor Network.

Nicola Maffulli et al(2020), have tried to evaluate the applications of AI(Artificial Intelligence) and ML(Machine Learning) in providing a clinical diagnosis andpredicting post-operative outcomes and complications in orthopedic surgery.

3. CONTENTAND PROBLEMSTATEMENT.

From literature review it is evident that the authors have shown importance of models of internet of things in clinical and surgical fields (FarahnazSadoughi et al(2020) , Bikash Pradhan et al(2021), AbidHaleem et al(2019), Vatan, et al(2020), Nicola Maffulli et al(2020))   Discussion on machine learning algorithms in surgical fields have been made in(Amani Aldahiri et al(2021). The supremacy of machine learning models and artificial intelligent has been discussed in (Nicola Maffulli et al(2020)). From the literature review it has been found that a lot of authors have expressed their views that the models of internet of things should be used in clinical and surgical fields. But they have not worked on any data of the surgical field where the models of internet of things can be applied. The importance of machine learning algorithms have been discussed in Amani Aldahiri et al(2021). But they have not worked on any surgical data. For this purpose, here an effort is being made to work on vertebral data which is available from UCI Machine Repository[8].

In this paper an effort has been made to apply multivariate statistical tools on the available data items for eliminating redundant items and to form a cumulative data item. The particular multivariate

statistical tool has to be chosen based on the minimum value of standard deviation and coefficient of variation using the estimated data based on both methods. Thereafter the available data has to be fuzzified and neural network has to be applied on these fuzzy data. The output data from neural network has to be defuzzified and operators of evolutionary algorithm, particle swarm optimization and harmony search algorithm have to be applied. The performance of these models has to be compared based on the value of average error, Atkinson's Information Criterion(AIC) and Bayesian's Information Criterion(BIC). K-means clustering algorithm has to be applied on the estimated data based, on selected modelto get optimum number of clusters. Based on the clusters as formed and available orthopaedic disorder data, confidence matrix has to be formed which can indicate the accuracy of the proposed system.

4.METHODOLOGY.

4.1.Multivariate Statistical Tool.

Multivariate statistical analysis is considered a useful tool for evaluating the significance of anomalies in relation to both any individual variable and the mutual influence of variables on each other.

4.1.1. Factor Analysis.

Step 1: To calculate the correlation matrix for the features in the dataset.
Step 2: To calculate the eigenvalues and eigenvectors for the correlation matrix.
Step 3: to consider those eigenvalues whose contribution is more than 2.5%.
Step 4: To pick the eigenvectors corresponding to the selected eigenvalues and to form cumulative tem set for a particular data set.

4.1.2.. Principal Component Analysis(PCA)

Principal component analysis (PCA) is a statistical procedure that is used to reduce the dimensionality. To calculate the covariance matrix for the features in the dataset. The steps as narrated in section 4.1.1 have to be applied.

4.2. Fuzzy Logic.

Fuzzy logic is an approach to a variable that allows to process multiple truth values using the same variable. Fuzzy logic attempts to solve problems with an open, imprecise spectrum of data and apply the law of heuristics to obtain an array of accurate solutions. Fuzzy logic works on membership functions. These are Gaussian, triangular, trapezoidal, generalized bell, sigmoid, etc.

4.3. Neural Network.

A neural network is a series of algorithms that makes an effort to recognize the predefined relationships in a set of data through a process that behaves the way the human brain operates. In this sense, neural networks refer to systems of neurons, artificial in nature. There are three main components: an input later, a processing layer, and an output layer. The inputs may be weighted based on certain criteria. The processing layer, is kept as hidden from view, which consists of nodes and connections between these nodes, which are analogous to the neurons and synapses of an animal brain.

4.4. Evolutionary Algorithm.

An evolutionary algorithm (EA) is an algorithm that uses mechanisms inspired by nature and solves problems through processes that emulate the behaviour of living organisms(reproduction, mutation, recombination, and selection.). Fitness function determines the

quality of the solutions. EA is a component of both evolutionary computing and bio-inspired computing.EAs are inspired by the concepts in Darwinian Evolution. In EAs, the solutions play the role of individual organisms in a population.

4.5. Particle Swarm Optimization.

In computational science, particle swarm optimization (PSO) is a computational method that can optimize a problem iteratively in order to improve a candidate solution with respect to a given target which has been decided early. It solves a problem by moving these particles around the search-space according to simple mathematical formula over the particle's position and velocity. Each particle's movement is controlled by its local best known position, and also by the global best solution in the search-space. Swarm is also following the same process.

4.6. Harmony search Algorithm(HS).

The HS algorithm follows the behaviour of music player where each player produces a pitch based on one of three operations (random selection, memory consideration, and pitch adjustment) in order to find a better state of harmony which can be translated into a solution vector in the optimization process.

5. IMPLEMENTATION.

The vertebral dataset have been taken from UCI machine repository [8] which have been used as input data set.Methods of factor analysis and principal component analysis has to be applied on the available data items to get cumulative data item.

5.1. Comparison on the performance of factor analysis and principal component analysis.

A comparative study has been made between estimated data based on factor analysis and on principal component analysis using the value of standard deviation and coefficient of determination. Lesser value of standard deviation and coefficient of variation indicates the superiority of the model. The value of coefficient of variation becomes almost same for both cases.However the value of standard deviation is less in factor analysis than principal component analysis. Therefore factor analysis is preferable as compared to principal component analysis as selected multivariate statistical tool..

Table 1		
Comparative study of Factor Analysis and Principal Component Analysis		
Model	**Factor Analysis**	**Principal Component Analysis**
Mean	271.063	564830
Standard Deviation	64.969	139590
Coefficient of variation	0.239	0.24

5.2. Ap plication of Neural network, Evolutionary algorithm, Particle Swarm Optimization, Harmony search Algorithm(HS).

The estimated data based on selected multivariate statistical tool(factor analysis) has been fuzzified based on Gaussian membership function. Gaussian membership function has been used because the

performance of that Gaussian membership function is better than other membership functions(triangular, trapezoidal, etc.).

The estimated data based on fuzzy logic has been applied to feed forward back propagation neural network(BPNN). The output data from BPNN is fuzzy and it has to be defuzzified to get the real numbers.

Evolutionary algorithm operators have been applied on the estimated data based on neural network.

Thereafter particle swarm optimization algorithm has been applied to the estimated data based on evolutionary algorithm.

Harmony search algorithm has been applied on the estimated data based on particle swarm optimization. The application of Evolutionary algorithm, particle swarm optimization algorithm, The proposed models have been made in order to improve the performance of the proposed system.

Now error analysis(computation of average error) and computation of AIC(Atkinson's information criterion) coefficient and BIC(Bayesian Information criterion) coefficient has been made. The result has been furnished in table 2.

Table 2				
Comparative study of the performance of Neural Network, Evolutionary Algorithm, Particle swarm Optimization and Harmony Search				
Model	Neural Network	Evolutionary Algorithm	Particle Swarm Optimization	Harmony Search
Average Error	2.919 %	0.9195 %	0.2534%	0.179%
Atkinson's Information Criterion(AIC)	-5.932	-2.944	1.009	3.768
Bayesian's Information Criterion(BIC)	-3.574	-0.5856	3.367	6.1259

5.3. Application of Clustering algorithm.

From table 2, it has been observed that lesser value of average error, greater value of Atkinson's Information Criterion(AIC) and Bayesian's Information Criterion(BIC) gives more preference of the model. Therefore the estimated data based on harmony search algorithm has to be used for next processing. K-means clustering algorithm has been used on the estimated data value based on harmony search algorithm as narrated in previous section.

Step-1.

K-means clustering algorithm has been used on the estimated data value based on harmony search algorithm as narrated in section of 3.6.

Step-2.

It has been observed that the number of clusters as 3 gives minimum intra cluster distance. Therefore the said number of clusters as 3 has been used for further processing. Here it is to note that Euclidean distance has been used as intra cluster distance

Step-3.

Based on the maximum number of elements in cluster allocation, the selected cluster number has been mapped with the orthopedic disorder level data types. Therefore it can be mentioned that cluster 1 is meant for 'disk hernia' disorder level, cluster 2 for 'spondylylothesis' disorder level, cluster 3 for 'normal' order level.

6. RESULT.

Based on mapping of orthopaedic data items along with cluster number, confusion matrix has been formed based on certain parameters. The parameters used are as follows:-

Accuracy = (TP + TN)/(TP + FP + TN + FN), Recall = TP/(TP + FN), Precision = TP/(TP + FP), Specificity = TN/(FP + TN), F-Measure = (2 * precision * recall)/(precision + recall)

Where TP stands for True Positive, TN stands for True Negative, FP stands for False Positive and FN stands for False Negative respectively.

Table 3					
Confusion Matrix					
Orthopedic data level	Accuracy	Recall	Precision	Specificity	F-measure
Disk Hernia	0.6051	0.983	0.279	0.8296	0.3427
Spondylylothesis	0.6497	0.433	0.48	1	0.6486
Normal	0.4796	0.24	0.6875	0.9338	0.529

7. CONCLUSION.

Vertebral data set have been taken from UCI machine repository data[8]. Here in this data set, type of orthopaedic disorder with respect to orthopaedic parameters have been furnished. It is to note that if there is no orthopaedic disorder, type of orthopaedic is assigned as normal. Here three types of orthopaedic disorder data are available, based on the orthopaedic parameter values, any orthopaedic disorder of the patient can be ascertained.

8. THEORETICAL/MANAGERIAL IMPLICATIONS.

The orthopedic disorder of any person can be detected by taking Image of defected organ of the person and accordingly the value of orthopedic parameters can be found out and the said values can be processed for detection of orthopedic disorder using the proposed methodology. The data can be

collected from persons in a camp located at distance from processing laboratory, send vide internet to the processing laboratory for examination and decision..

REFERENCES.

Farahnaz Sadoughia , Ali Behmaneshb, NasrinSayfouric (2020). Internet of things in medicine: A systematic mapping study, *Journal of Biomedical Informatics*, www.elsevier.com/locate/yjbin

Bikash Pradhan ,Saugat Bhattacharyya , and Kunal Pal (2021). IoT-Based Applications in Healthcare Devices, *Hindawi Journal of Healthcare Engineering*, Volume 2021, Article ID 6632599, 18 pages, https://doi.org/10.1155/2021/6632599.

Amani Aldahiri ,BashairAlrashed and WalayatHussain, (2021). Trends in Using IoT with Machine Learning   in   Health   Prediction   System,   *Forecasting   2021*,   3,   181   206. https://doi.org/10.3390/forecast3010012

https://www.mdpi.com/journal/forecasting.
AbidHaleem, MohdJavaid, Ibrahim HaleemKhan   (2019).Internet of Things (IoT) applications in orthopaedics   ,*Journal of Clinical Orthopaedics and Trauma* , doi: https://doi.org/10.1016/ j.jcot.2019.07.003.

 Deepak Chahal, LatikaKharb, (2019)Smart Diagnosis of Orthopaedic Disorders using Internet of Things (IoT), *International Journal of Engineering and Advanced Technology (IJEAT)* ISSN: 2249 – 8958, Volume-8 Issue-6, August 2019, DOI: 10.35940/ijeat.7191.088619

Vatan, Sandip Kumar Goyal, (2021). Soft Computing based Clustering Protocols in IoT for Precision and Smart Agriculture: A Survey, *Proceedings of ISIC''21: International Semantic Intelligence Conference,* February(2021), New Delhi, India.

Nicola Maffulli, Hugo C. Rodriguez, Ian W. Stone , Andrew Nam , Albert Song , Manu Gupta , Rebecca Alvarado , David Ramon and Ashim Gupta(2020). Artificial intelligence and machine learning in orthopedic surgery: a systematic review protocol, *Journal of Orthopaedic Surgery and Research(2020)* 15:478, https://doi.org/10.1186/s13018-020-02002-z

Vertebral data set http://archive.ics.uci.edu/ml/datasets/vertebral+column
Dharmpal Singh, J. Paul Choudhury, Mallika De (2020).A Comparative Study of Meta Heuristic model to assess the type of Breast Cancer disease, *IETE Journal of Research,* June 2020, https://doi.org/10.1080/03772063-2020.1775139, Taylor & Francis Online.

ManishaBurman, J. Paul Choudhury, SusantaBiswas (2019). Automated Skin disease detection using multiclass PNN, *International Journal of Innovations in Engineering &Technology*(ISSN 2319-1058),http://dx.doi.org/10.21172/ijet 144.03, vol 14, issue 4, November 2019, 19-24.

Md. Iqbal Quraishi,AbulHasnat, J. Paul Choudhury (2017). Selection of Optimal Pixel resolution for Landslide Susceptibility analysis within Bukit Antarabangsa, Kuala Lampur, by using Image Processing and Multivariate Statistical tools, *EURASIP Journal on Image & Video Processing,* Springer Open(2017) 2017-2, DOI 10,1186/S1 3640-01S-0169-2, 1-12. Thompson Reuter.

Shrayasi Dutta, J. Paul Choudhury (2015) A Framework for the selection of Neural Network Training Functions towards the classification of Yeast data , *JCSE International of Computer Science & Engineering* E-ISSN: 2347-2693), vol 3 special Issue 1, February 2015, 23-29, Thompson Reuter listed.

Shrayasi Dutta, J. Paul Choudhury (2015) A Comparative Study on the Performance of Fuzzy Rule Based and Artificial Neural Network towards classification of Yeast Data, *I.J. Information Technology and Computer Science,*(*ISSN:* 2074-9007 (Print),*ISSN:* 2074-9015(Online)) 2015, 05, 40-47. Google Scholar Citation

Dharmpal Singh, J. Paul Choudhury, Mallika De (2015)   An Effort to select a preferable Metaheuristic model for Knowledge Discovery in Data Mining, *International Journal of Metaheuristics,*(ISSN:1755-2176 *EISSN:*1755-2184) ACM Digital Library, Vol 4, no 1, 2015, 57-90.

EXPLORING THE RELATIONSHIP OF SUPPLY CHAIN MANAGEMENT PRACTICES WITH FINANCIAL PERFORMANCE- A BIBLIOMETRIC APPROACH.

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Recently, there has been a tremendous increase in research on different dimensions of supply chain management, let it be; green supply chain, sustainable supply chain, lean supply chain, agile supply chain, etc. The emergence of Industry 5.0 has today shifted the interest of the corporate world towards structuring and restructuring the supply chain. However, this shift of interest is not only for the reason of smooth functioning of the supply chain, but rather to improve their financial performance. It's no longer a hidden secret that the supply chain management practices do impact the financial performance of a firm. Previous literature has empirically shown the impact of different dimensions of supply chain management practices on financial performance. Although popular among researchers, there has not been any bibliometric study focussing on the association between the two.

This review paper presents a comprehensive overview of research on the relationship of supply chain management practice with the financial performance from the year 1996 to 2022 by reviewing trends across authors, sources, documents, keywords, countries etc utilizing various bibliometric tools. The paper analyzes around 679 Scopus database papers on the theme. The graphical analysis uses citation analysis of authors, documents, sources, and countries along with co-occurrence analysis of keywords. To the best of our knowledge, this is the first paper reviewing the relationship between supply chain management practices and financial performance using bibliometric tools. Managerial implications and future research directions are also discussed towards the end.

Keywords: Supply chain practices, financial performance, bibliometric analysis

1. INTRODUCTION

Today, supply chain management practice is one of the most explored research areas; let it be sustainable supply chain, green supply chain, lean supply chain, or its association with different dimensions. Researchers have explored numerous dimensions of the topic. Though researchers have previously associated supply chain practices with the financial dimension yet there is no literature contributing to bibliometric analysis on their relationship. There are papers on bibliometric analysis of supply chain management, sustainable supply chain, green supply chain management, etc. however no research paper has been found conducting bibliometric analysis on the relationship between financial performance and supply chain management practices.

Lately, there has been tremendous research supporting the relationship of supply chain management with financial performance. A recent study involving a survey of skilled employees of the production and finance department verified the presence of a significant impact of GSCMPs and the company's core competency on the firm's financial performance *(Hilal, 2022)*. Another study evaluated information-sharing capabilities for GSCMPs and found out that it does improve the environmental collaboration which in turn reduced their green cost *(Woo et al., 2016)*. Researchers in one of their study observed the vital impact of GSCM on environmental performance, social performance, and financial performance *(Bag et al., 2020)*. The combined effect of social control and GSCM was analyzed in a study where green purchasing was found to have a positive impact on a firm's financial performance *(Zhang et al., 2019)*. A survey data of 289 shipping firms observed the relationship between GSCM practices and the firm's financial performance *(Alexandrou et al., 2021)*. Discussing supply chain management practices (SCMP), researchers in a study argued the presence of an association between the level of SCMPs and organizational performance which also includes the financial performance of the firm *(Li et al., 2006)*. Unfortunately, there is no literature supporting the bibliometric analysis of their association. This study believes to fill this gap. The next section discusses the research methodology employed, followed by a bibliometric analysis and a discussion at the end.

2. RESEARCH METHODOLOGY

Bibliometric analysis is today one of the most popular cross-disciplinary methodologies, capable of describing patterns of publications utilizing a large volume of data within a given body of literature using quantitative analysis and statistics. For this study, we utilized the Scopus database and searched ("supply chain management" OR "supply chain" OR "supply chain practices" OR "supply chain management practices" OR "SCM" OR "SCP" OR "SCMP") AND ("financial performance" or "Return on investment" or "ROI") in "title, abstract, keyword" search bar. This gave us 805 Scopus research papers as a result. We further narrowed down our results using a filter of language and restricting all the documents to the English language only. Not willing to include books, book chapters, or conference proceedings, we limit source types to only journals, document types to article or review papers, and subject areas to the 'business management and accounting, social science, economics, econometrics and finance, and multidisciplinary'. This identified 679 unique Scopus research papers on our theme. The entire search results including all the essential information of papers such as title, author names, affiliations, abstracts, keywords, etc were carefully downloaded in CSV excel format for further analysis in VOSviewer software *(van Eck & Waltman, 2010)*.

A total of 679 unique Scopus research papers published between the year 1996 to 2022 were obtained as our final search result. Fig 1. highlights the annual publication trend of research papers it can be observed that the first paper on the topic was published in 1996 and for the next five years the total number of annual publications on the topic was two or even less than two papers a year. It was only after 2006 that we witnessed a significant increase in the publication in comparison to the previous year. Maximum papers were published in the year 2021. The citation growth pattern is presented in a tabular adapted obtained from the literature *(Amirbagheri et al., 2019)*. Table 1 depicts year-wise total publications and total citations bifurcated based on more than or equal to 100 citations, 50 citations, 20 citations, 10 citations, 5 citations, and 1 citation. It can be observed that the maximum number of citations are achieved in the year 2016. Also, a total of 55 papers on the theme have been cited more than 100 times. 18.5% of total papers are cited more than 50 times. To gain deeper insights on

publication patterns in journals, countries, keywords, etc we induced bibliometric tools. The next section discusses the in-depth bibliometric analysis.
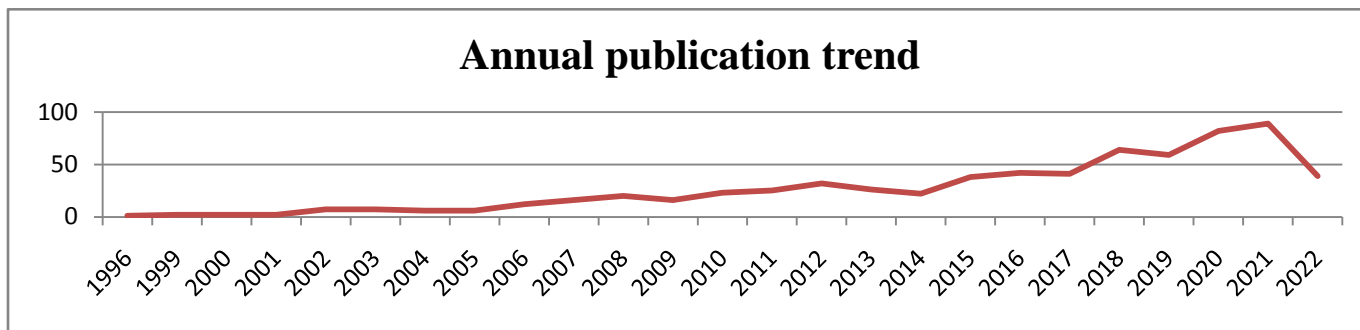
Fig. 1. Annual publication trend

Table 1: Yearly citation growth; TP refers to the total number of publications and TC: total number of citations.

Year	TP	TC	≥ 100	≥ 50	≥ 20	≥ 10	≥ 5	≥ 1
2022	39	16	0	0	0	0	1	2
2021	89	349	0	0	1	10	26	50
2020	82	680	0	0	9	25	42	57
2019	59	901	0	4	18	28	34	44
2018	64	1171	2	7	20	28	38	49
2017	41	1138	3	5	21	29	35	40
2016	42	1971	7	16	23	31	34	37
2015	38	1514	4	11	17	22	29	36
2014	22	846	2	5	13	17	20	21
2013	26	1397	5	10	15	20	21	23
2012	32	1483	5	9	17	24	30	31
2011	25	583	0	3	11	17	19	23
2010	23	1441	4	10	17	19	21	22
2009	16	859	3	6	10	14	15	16
2008	20	1366	4	11	16	16	17	19
2007	16	1171	3	6	10	13	13	16
2006	12	898	3	7	11	11	11	11
2005	6	514	2	3	5	6	6	6
2004	6	827	2	3	4	4	4	5
2003	7	1175	2	2	4	6	6	6
2002	7	383	1	2	3	4	6	6
2001	2	72	0	1	1	1	1	1
2000	2	522	2	2	2	2	2	2
1999	2	195	1	2	2	2	2	2
1996	1	9	0	0	0	0	1	1

Total	679	21481	55	125	250	349	434	526

3.   BIBLIOMETRIC ANALYSIS

Several software packages, including Publish or Perish, HistCite, BibExcel, and VOSviewer, have been used in the past for bibliometric analysis by various researchers *(Bhatt et al., 2020; Maditati et al., 2018; Ren et al., 2020)*. However, only a few software packages support Scopus imported data and provide detailed network analysis data. We chose VOSviewer for this paper primarily because of its compatibility with imported databases from Web of Science, Scopus, etc. Also because of its user-friendly interface, which includes features such as screenshots, overlay visualization, network clustering, data cleaning, and so on. The data source used as input into VOSviewer is in CSV format (Scopus output) and contains the article's bibliographic information. The following categories are the primary focus of our analysis: citation analysis of documents, sources, authors, and countries along with co-occurrence of keywords.

3.1 Citation Analysis

Citation analysis is a tool to determine an author's, article's, or publication's relative significance or impact by carefully measuring or counting the number of times that author, article, or publication has been quoted by other works. Larger the number of citations, the higher the impact or relative significance. In this study, we have performed citation analysis of documents, sources, authors, and countries. Citation analysis of documents focuses on the number of citations a particular paper have received or the number of times a document is cited by any other paper. Figure 2 depicts overlay visualization of document citations taking links as weights and citations as scores. We put a threshold of a minimum of 50 citations in a document. Higher link strength is represented by the larger size of the circle encircling the document name. A study conducted in 2003 investigating the effectiveness of the integrated supply chain approach utilizing customer service quality and financial performance *(Vickery et al., 2003)* is observed to have the highest link strength in comparison to others. The number of citations is represented by scores or color. Blue symbolizes less than 50 citations, green represents midway, and yellow colors highlight documents having more than 250 citations in number. Table 2 in the annexure reports the top 20 publications along with their total citations. Citation analysis of sources represents the number of citations a particular journal receives. Figure 3 depicts overlay visualization of journal citations taking total link strength as weights and citations as scores. We put a threshold of a minimum of 5 citations per journal. Higher link strength is represented by the larger size of the circle encircling the journal name. "Journal of operations management" having the strongest total link strength can be observed in a larger circle in comparison to others. The number of citations is represented by scores or color. Blue symbolizes less than 0-20 citations, green represents midway, and yellow colors highlight journals having more than 80 citations. Table 3 in the annexure reports the top 20 journals, their respective total link strength along with their 5-year phase-wise publication distribution.

Citation analysis of authors represents the number of times a particular author is cited. Figure 4 depicts overlay visualization of author citations taking total link strength as weights and citations as scores. Higher link strength is represented by the larger size of the circle encircling the author's name. It's rather interesting to observe that 'Baofeng Huo' has the strongest total link strength though 'Roger J Calantone' has the highest number of citations. The number of citations is represented by scores or

color. Blue symbolizes less than 0-20 citations, green represents midway, and yellow colors highlight authors having more than 90 citations. Table 4 in the annexure represents the top 20 authors, respective total link strength, and citations. Citation analysis of countries represents the number of times a document from a particular country is cited. Figure 5 depicts an overlay visualization of country citations taking total link strength as weights and citations as scores. We fixed a threshold of a minimum of 5 documents from a particular country. Higher link strength is represented by the larger size of the circle encircling the country's name. It's noteworthy that the United States has published the maximum number of documents on this theme, has the highest number of cited documents, and has the strongest total link strength. The number of citations is represented by scores or color. Blue symbolizes less than 0-10 citations, green represents midway, and yellow colors highlight countries having more than 35 citations. Table 4 in the annexure represents the top 20 countries, their publications, total link strength along with their citations. Post-citation analysis we conducted a co-occurrence analysis of keywords.
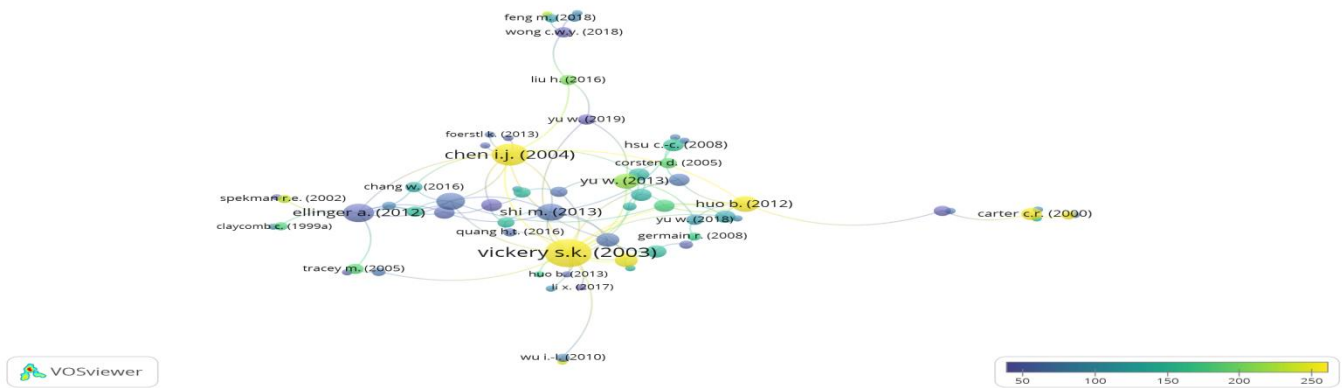
Fig. 2 *Citation analysis of Documents (Overlay visualization)*
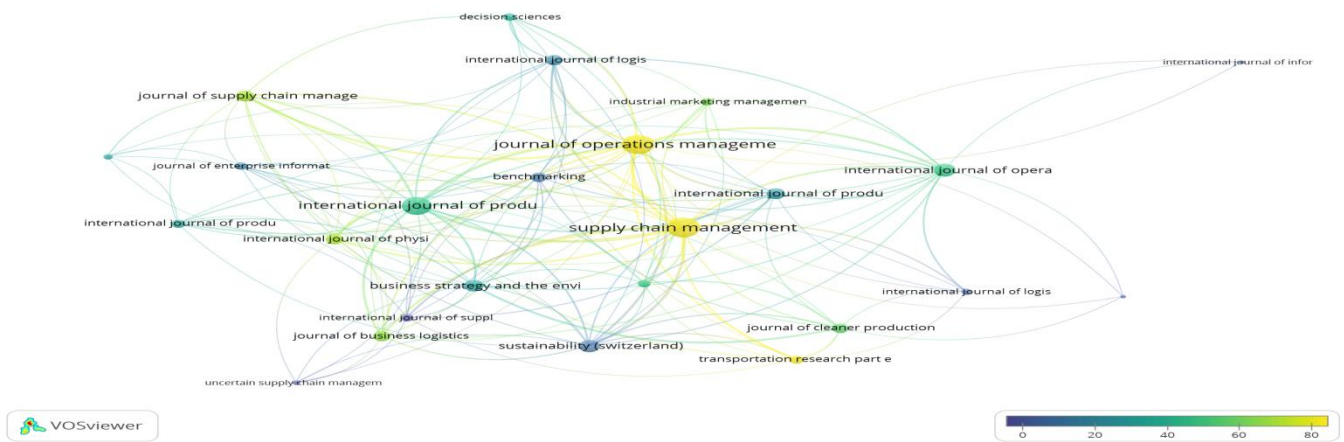
Fig. 3 *Citation analysis of Sources (Overlay visualization)*
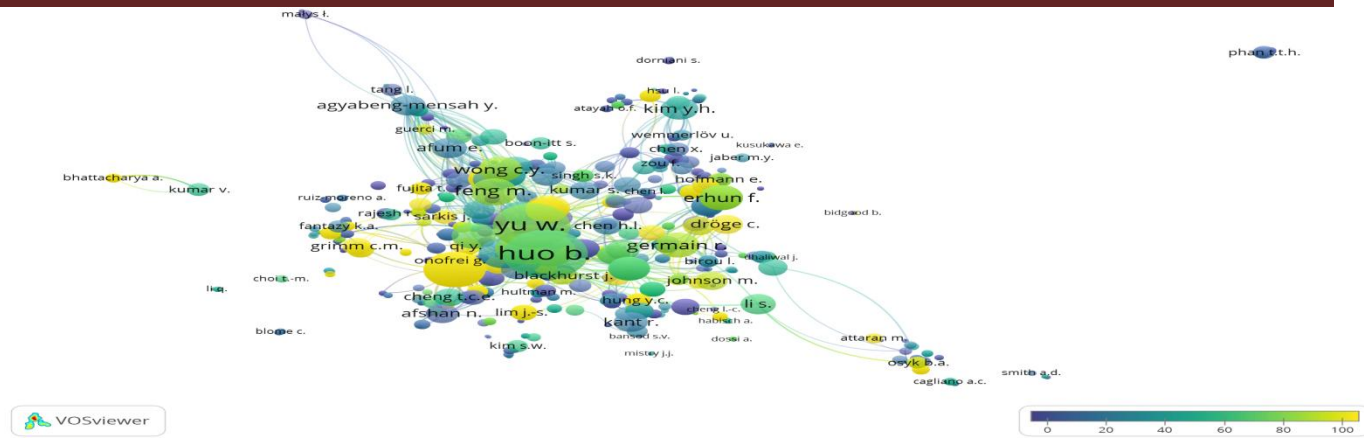
Fig. 4 Citation analysis of authors (Overlay visualization)
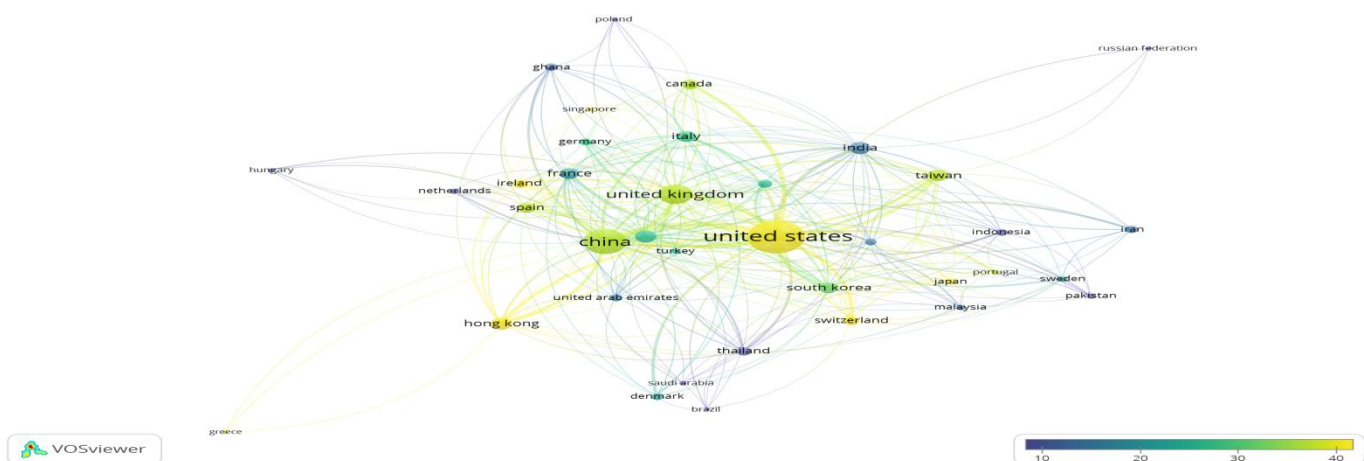
Fig. 5 Citation analysis of countries (Overlay visualization)

(Table 4)

3.2 Co-occurrence of keywords

The co-occurrence of keywords keeps a note of the frequency of occurrence of a particular keyword and thus reveals the most popular search terms and keywords used and mentioned by various publications. Figure 6 depicts an overlay visualization of keyword co-occurrence taking the total number of occurrences as weights and publication year as scores. We fixed a threshold of a minimum of 15 times the occurrence of a particular keyword. A higher number of occurrences is represented by the larger size of the circle encircling the keyword. The publishing year is represented by scores or color. Blue symbolizes the publishing year 2012- 2014, green represents midway, and yellow colors highlight documents that are published from 2017 onwards. It can be seen in Figure 6 that the keywords 'supply chain management and 'financial performance' have the highest number of occurrences. This also highlights that occurrence of the 'supply chain management' keyword was more in publications published during 2015 as compared to 'financial management which was more popular in the year 2017. The publication timeline and relationship among the keywords represent the publication pattern in this area.
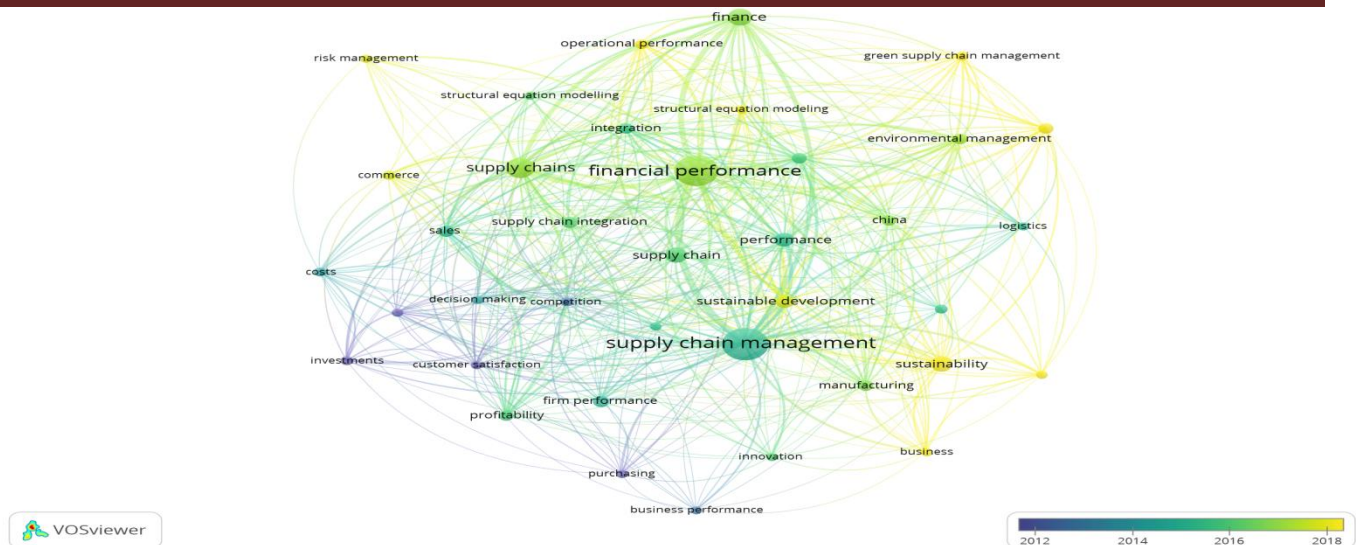
Fig. 6 *Co-occurrence of Keywords (Overlay visualization)*

4. CONCLUSION AND DISCUSSION

This paper conducted a bibliometric analysis of the relationship between supply chain management practices and financial performance. Though there is a rich significant literature supporting the relationship of supply chain management with financial performance, no previous study has conducted a bibliometric study on their association. In the present paper, we utilized VOSviews software to conduct citation analysis of documents, sources, authors, and countries along with co-occurrence of keywords. The results highlight that a study conducted in 2003 investigating the effectiveness of the integrated supply chain approach utilizing customer service quality and financial performance *(Vickery et al., 2003)* having more than 800 citations in number is observed to have the highest link strength in comparison to other studies. Observing the bibliometric map *(fig. 2)* it is evident that a small number of publications have more than 250 citations *(Table 2)* in number. Observing the citation analysis of the journal "Journal of operations management" having 2671 citations in number from only 13 documents *(table 3)*, is found to have the strongest total link strength *(fig. 3)*. This also highlights the significance of quality research documents. It's rather interesting to observe the citation analysis map of authors *(fig. 4)*, that 'Baofeng Huo' has a total of 786 citations in number *(Table 4)* has the strongest total link strength though 'Roger J Calantone' has the highest number of citations i.e. 837. Citation analysis of the country reveals that "The United States" has published the maximum number of documents on this theme, has the highest number of cited documents, and has the strongest total link strength *(fig. 5)* *(table 4)*. Co-occurrence of keywords identified keywords 'supply chain management and 'financial performance' to have the highest number of occurrences *(fig. 6)*. This also highlights that occurrence of the 'supply chain management' keyword was more in publications published during 2015 as compared to 'financial management which was more popular in the year 2017. Observing Figure 1 it can be concluded that the association of supply chain management with financial performance is a recent research hotspot as the maximum number of papers on this association are published in the year 2021.

By observing the pattern, academician can explore various other dimensions of the supply chain and their respective impact on financial performance. Due to time consistency this paper only conducted citation analysis, future researchers taking this as base research can also conduct co-citation analysis,

co-authorship analysis, and bibliographic coupling on the association. Here, we have taken the Scopus database, researchers can consider the Web of Science database for their study. This paper is also a shred of evidence that the literature supports the relationship between supply chain management and financial performance. Corporate management can indulge in various discussed theories and practically apply them to strengthen financial performance.

REFERENCES

Alexandrou, S. E., Panayides, P. M., Tsouknidis, D. A., & Alexandrou, A. E. (2021). Green supply chain management strategy and financial performance in the shipping industry. *Maritime Policy and Management*, *00*(00), 1–20. https://doi.org/10.1080/03088839.2021.1883141

Amirbagheri, K., Núñez-Carballosa, A., Guitart-Tarrés, L., & Merigó, J. M. (2019). Research on green supply chain: a bibliometric analysis. *Clean Technologies and Environmental Policy*, *21*(1), 3–22. https://doi.org/10.1007/s10098-018-1624-1

Bag, S., Gupta, S., Kumar, S., & Sivarajah, U. (2020). Role of technological dimensions of green supply chain management practices on firm performance. *Journal of Enterprise Information Management*, *34*(1), 1–27. https://doi.org/10.1108/JEIM-10-2019-0324

Bhatt, Y., Ghuman, K., & Dhir, A. (2020). Sustainable manufacturing . Bibliometrics and content analysis. *Journal of Cleaner Production*, *260*, 120988. https://doi.org/10.1016/j.jclepro.2020.120988

Hilal, F. (2022). The Effect of Green Supply Chain Management Practices and Competitive Advantage on Financial Performance The Effect of Green Supply Chain Management Practices and Competitive Advantage on Financial Performance Fadhel Hilal. *International Journal of Business*, *January*.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Subba Rao, S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, *34*(2), 107–124. https://doi.org/10.1016/j.omega.2004.08.002

Maditati, D. R., Munim, Z. H., Schramm, H. J., & Kummer, S. (2018). A review of green supply chain management: From bibliometric analysis to a conceptual framework and future research directions. *Resources, Conservation and Recycling*, *139*(July), 150–162. https://doi.org/10.1016/j.resconrec.2018.08.004

Ren, R., Hu, W., Dong, J., Sun, B., Chen, Y., & Chen, Z. (2020). A systematic literature review of green and sustainable logistics: Bibliometric analysis, research trend and knowledge taxonomy. *International Journal of Environmental Research and Public Health*, *17*(1). https://doi.org/10.3390/ijerph17010261

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Vickery, S. K., Jayaram, J., Droge, C., & Calantone, R. (2003). The effects of an integrative supply chain strategy on customer service and financial performance: An analysis of direct versus indirect relationships. *Journal of Operations Management*, *21*(5), 523–539. https://doi.org/10.1016/j.jom.2003.02.002

Woo, C., Kim, M. G., Chung, Y., & Rho, J. J. (2016). Suppliers' communication capability and

external green integration for green and financial performance in Korean construction industry. *Journal of Cleaner Production*, *112*, 483–493. https://doi.org/10.1016/j.jclepro.2015.05.119

Zhang, M., Tse, Y. K., Dai, J., & Chan, H. K. (2019). Examining Green Supply Chain Management and Financial Performance: Roles of Social Control and Environmental Dynamism. *IEEE Transactions on Engineering Management*, *66*(1), 20–34. https://doi.org/10.1109/TEM.2017.2752006

ANNEXURE

R	Authors	Title	Year	Journal	Cited by	C/Y
1	Vickery S.K., Jayaram J., Droge C., Calantone R.	The effects of an integrative supply chain strategy on customer service and financial performance: An analysis of direct versus indirect relationships	2003	JOM	837	44
2	Chen I.J., Paulraj A., Lado A.A.	Strategic purchasing, supply management, and firm performance	2004	JOM	550	31
3	Carter C.R., Kale R., Grimm C.M.	Environmental purchasing and firm performance: An empirical investigation	2000	TR	381	17
4	Huo B.	The impact of supply chain integration on company performance: An organizational capability perspective	2012	SCM	276	28
5	Lee C.W., Kwon I.-W.G., Severance D.	Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer	2007	SCM	265	18
6	Cappelli P.	Talent management for the twenty-first century	2008	HBR	262	19
7	Gligor D.M., Esmark C.L., Holcomb M.C.	Performance outcomes of supply chain agility: When should you be agile?	2015	JOM	248	35
8	Dehning B., Richardson V.J., Zmud R.W.	The financial performance effects of IT-based supply chain management systems in manufacturing firms	2007	JOM	244	16
9	Patterson K.A., Grimm C.M., Corsi T.M.	Adopting new technologies for supply chain management	2003	TR	244	13
10	Spekman R.E., Spear J., Kamauff J.	Supply chain competency: Learning as a key component	2002	SCM	226	11
11	Zhu Q., Geng Y., Fujita T., Hashimoto S.	Green supply chain management in leading manufacturers: Case studies in Japanese large companies	2010	Management Researc	220	18

				h Review		
12	Attaran M.	RFID: An enabler of supply chain operations	2007	SCM	214	14
13	Yu W., Jacobs M.A., Salisbury W.D., Enns H.	The effects of supply chain integration on customer satisfaction and financial performance: An organizational learning perspective	2013	IJPE	208	23
14	Liu H., Wei S., Ke W., Wei K.K., Hua Z.	The configuration between supply chain integration and information technology competency: A resource orchestration perspective	2016	JOM	198	33
15	Sharma A., Iyer G.R., Mehrotra A., Krishnan R.	Sustainability and business-to-business marketing: A framework and implications	2010	IMM	198	17
16	Nikolaou I.E., Evangelinos K.I., Allan S.	A reverse logistics social responsibility evaluation framework based on the triple bottom line approach	2013	Journal of Cleaner Production	186	21
17	Corsten D., Felde J.	Exploring the performance effects of key-supplier collaboration: An empirical investigation into Swiss buyer-supplier relationships	2005	IJPDLM	185	11
18	Tracey M., Lim J.-S., Vonderembse M.A.	The impact of supply-chain management capabilities on business performance	2005	SCM	181	11
19	Green Jr. K.W., Whitten D., Inman R.A.	The impact of logistics performance on organizational performance in a supply chain context	2008	SCM	176	13
20	Bhattacharya A., Mohapatra P., Kumar V., Dey P.K., Brady M., Tiwari M.K., Nudurupati S.S.	Green supply chain performance measurement using fuzzy ANP-based balanced scorecard: A collaborative decision-making approach	2014	Production Planning and Control	175	22

Table 2: list of top 20 documents published on this theme. R refers to rank; C/Y refers to citation per year;   abbreviations for journals are as follows: Journal of Operations Management: JOM;

Transportation Research Part E: Logistics and Transportation Review: TR; Supply Chain Management: SCM; Harvard Business Review: HBR; International Journal of Physical Distribution and Logistics Management: IJPDLM; International Journal of Production Economics: IJPE; Industrial Marketing Management: IMM

Source	Citations	Total link strength	1996-2002	2003-2007	2008-2012	2013-2017	2018-2022	Documents
Benchmarking	164	24			1	2	11	14
British food journal	66	0		1		3	2	6
Business strategy and the environment	406	38				2	11	13
Decision sciences	377	15	1			5	4	10
Industrial marketing management	361	16		1	2	1	2	6
International journal of business performance and supply chain modelling	14	4			1	2	2	5
International journal of information systems and supply chain management	54	3			3	3	2	8
International journal of logistics management	355	29			2	7	10	19
International journal of logistics systems and management	73	11			2	4	4	10
International journal of operations and production management	978	45		1	6	5	9	21
International journal of physical distribution and logistics management	1007	29	1	2	3	4	5	15
International journal of production economics	1880	79	1	2	7	10	22	42
International journal of production research	533	29		3	2	6	11	22
International journal of productivity and performance management	159	19				2	3	5
International journal of supply chain management	102	17				6	32	38
Journal of business logistics	443	30		1	3	3		7
Journal of cleaner production	1146	25				9	12	21
Journal of enterprise information management	120	16		1	1	1	4	7
Journal of operations management	2671	99		4	3	4	2	13
Journal of supply chain management	661	34		1	2	5	2	10
Operations management research	206	8			2	1	4	7
Production planning and control	338	16				4	3	7

Supply chain management	2218	106	1	6	6	4	9	26
Sustainability (switzerland)	290	43				5	21	26
Transportation research part e: logistics and transportation review	732	18	1	1			3	5
Uncertain supply chain management	33	7					13	13

Table 3: 5-year document count of top 20 journal citations

Author	C	TLS	Country	Documents	C	TLS	Keyword	Occurrence	TLS
Calantone r.	837	176	United states	234	11724	697	Supply chain management	240	502
Droge c.	837	176	China	85	3021	395	Financial performance	212	517
Jayaram j.	837	176	United kingdom	77	2763	245	Supply chains	99	344
Vickery s.k.	837	176	Hong kong	20	1089	97	Finance	65	237
Huo b.	786	336	Canada	28	1004	60	Supply chain	54	100
Paulraj a.	689	95	Italy	31	851	79	Sustainability	53	131
Grimm c.m.	625	40	India	48	733	97	Performance	47	123
Yu w.	620	282	South korea	22	690	78	Sustainable development	39	142
Chen i.j.	606	83	Taiwan	19	690	85	Sales	32	140
Lado a.a.	606	83	Switzerland	11	622	54	Firm performance	29	57
Germain r.	595	92	Germany	22	595	31	Supply chain integration	29	74
Dröge c.	515	51	Australia	23	585	96	China	28	114
Jacobs m.a.	388	140	Spain	15	545	67	Environmental management	27	113
Carter c.r.	381	34	France	20	406	81	Environmental performance	27	104
Kale r.	381	34	Finland	15	373	42	Profitability	27	93
Claycomb c.	374	48	Singapore	7	360	7	Manufacture	26	124
Gligor d.m.	368	35	Greece	9	343	3	Manufacturing	26	92
Zhu q.	328	25	Malaysia	21	281	23	Integration	25	109
Ellinger a.e.	322	138	Japan	6	262	21	Operational performance	23	82
Wang z.	288	94	Ireland	6	256	43	Competition	20	93

Table 4: Top 20 authors, countries, and Keywords along with their respective citations(C), and total link strength (TLS)

DETECTION OF TOMATO LEAF AILMENT USING CONVOLUTION NEURAL NETWORK TECHNIQUE

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Tomatoes are very essential staple crop that is consumed by millions of people from all corner of the world. But, unfortunately a huge part of the total tomato crop production is lost annually due to various plant ailments and manual identification of this diseases is tedious and may need the assistance of trained expert. To overcome these issues, we have concentrated in relation to the usage of a deep learning algorithm according to a convolutional neural network to build a classification system to accurately classify leaf images and identify the disease. The tomato leaf ailment pictures in this paper is obtained from Kaggle database. Each plant in the picture is either healthy or unhealthy. If the plant is infected with a disease, the disease name is mentioned in the dataset. The dataset contains around 7928 images which are categorized into 10 different classes. The dataset was divided into train, test and validation sets in ratio 8:1:1. The first instance the dataset is iterated over, its elements are cached in memory. Subsequent iterations use the cached data. During a particular iteration, the dataset for the next iteration is also prefetched. The neural network is built by adding the rescaling and data augmentation layers first. Six convolutional and pooling layers were alternatively later applied for feature extraction. Dense layers were used for classification of the data from convolutional layers to the correct class-name. The model gave an accuracy of 96.26% over the dataset which is much better than the traditional model.
Keywords: Deep learning, Convolutional neural network, Pooling layer, Feature extraction, Classification

1. INTRODUCTION

Tomatoes are a very essential staple crop that is enjoyed by millions of people all over the world. Tomatoes include the three most significant antioxidants that are vitamin E, vitamin C, and beta-carotene. They're also high in potassium, a mineral that's essential for overall health. It has a high

market value and is mass-produced in massive quantities. But, unfortunately, a huge part of the total tomato crop production faces loss annually because of various plant ailments. Late and inaccurate detection of plant ailments increases the losing percentage for the crop production. It is critical as to monitor the farmed crop's growth early on in order to ensure minimal losses. The disease causes color changes in tomato leaves, as well as spots, and damage. Some diseases have symptoms that are not visible to the naked eye, while others have signs that are evident but difficult to interpret. Many farmers make incorrect conclusions about the disease because visually discernible patterns in the leaf are difficult to classify at a glance. As a result, farmers' preventative measures may be ineffectual and, in some cases, detrimental. They don't have any expert recommendations on how to cope with their harvest infection. Over-dosing or under-dosing pesticide has reflected in crop damage, resulting in increased output loss, in some cases due to a lack of understanding or misperception about the severity of the disease. Because manual disease monitoring is laborious, automatic disease detection in tomato plants will aid farmers in disease identification and decrease costs. Disease identification will aid in the prevention of losses and the creation of a high yield. As a result, a good method for detecting tomato disease promptly is essential. Plant disease detection has always relied on human interpretation via visual scrutiny. To identify pathogen-specific antigens or oligonucleotides, it is now coupled or replaced with various applied sciences. Furthermore, recent technological advancements and huge price savings in the digital imaging area collection have enabled practical implementation of a variety of diagnosis based on images. However, because the captured image contains compressed data that is tough for a machine to understand, it necessitates a preliminary processing phase to bring out specific characteristic (for example, colour and shape) that is manually prearranged by specialists.Deep learning is often used in these scenarios because it allows the computer to train the most appropriate functions without the need for human intervention. Deep CNN became trainable in large scale in 2010s thanks to rapid technological development and improved learning methods. The method proposed in the study applies to some of the most frequent tomato plant diseases which are Bacterial spots, Curl virus and septoria spots and other illnesses. The image of each leaf can be assigned to one of the ailments classifications or determined as healthy. The dataset was taken from Plant Village, a collection of 7,928 photos. Broadly speaking, the proposed method contains three main steps: data acquisition, preprocessing, and classification. As mentioned earlier, pictures used to track the proposed approach were taken from a public dataset called Plant Village. The next step was to scale the image before inputting it into the classification model. The classification of the input in the final step was done using a so-called convolutional neural network model, which comprises of layers of convolution, pooling, and fully connected. The first layer of the convolutional network is the convolutional layer. The rest of the paper is designed as: Literature review is explained in section 2, experimental work has been put in the section 3. Section 4 represents the result and discussion and conclude the paper in section 5 with some future aspects.

2. LITERATURE REVIEW

To follow the right path, we need to identify previous research in this area. Image processing and deep learning techniques have long been in use for the reliable categorization of plant leaf ailments, which is

a crucial research subject. This article describes the most commonly used techniques in the relevant field. This section describes the most widely used techniques in each field.

In (N. Durga et al., 2019), the author used the Histogram of Oriented Gradient (HOG) method to predict features and feed them into a classification model. Finally, they evaluated the leaves, diagnosed the disease, and sent the information to the farmers by text message. Next, the tomato leaves were taken and the disease was identified using SVM and ANN algorithms. Data acquisition, preprocessing, feature extraction, image segmentation, and classification phases were all part of those methodologies. The dataset contained 200 images of tomato and corn leaves. Fifty images were images of healthy tomato and corn leaves, and 110 images were images of tomato and corn leaves in the coaching and testing section. Similarly, 40 sheet images were used in the test phase. The arrow represents connection from output of one node with a standard ANN to the output of another node. The batch size was set at 20 for each batch. The learning rate was initially set at 0.01 and gradually reduced to 1 / 0.3 until the plateau where the loss did not decrease was reached. Early stopping was also used to track loss of validation and stop the training process when the validation process increased. We examined tomato and corn crops using SVM and ANN classifiers. The tomato harvest result with SVM and with ANN8085 accuracy was 6070%. SVM provided 7075 percent accuracy for maize, while ANN provided 5565 percent accuracy. This model consumes more time and is slow. The highest accuracy achieved is 85%. The goal of (Kai et al., 2019) was to create two models for identifying diseased tomatoes using deep CNNs and object detection architectures. Pictures from internet were taken and carefully inspected to ensure that the visuals and disease types corresponded. The training set photos needed to be annotated in two different ways for two different object recognition architectures. A training set was used to train the model. Validation set was accustomed to provide feedback on progress of the training and whether training was completed. Finally, a trained model was used to evaluate performance on the test set. In this study, tomato plant diseases were detected at the fruiting stage. Detection of plant diseases at the fruit stage leads to detection of diseases at later stages, which are more difficult to treat. (Qimei et al., 2019) segmented images of tomato leaves using adaptive clustering numbers from the K-means algorithm. The first clustering center was specified through a series of preprocessing tests to avoid the clustering calculation in falling into local optimization, and the clustering number value for the approach was obtained by computing Davies-Bouldin index. It required a certain value of cluster K. Finding the right number of clusters can be difficult, but this is important for getting the best image segmentation results. This approach has not been able to achieve high accuracy in disease detection. The goal of their study at (Xian et al., 2021) is Extreme, a machine learning categorization technique with a one-layer feedforward network for classifying plant diseases by analyzing leaf photographs. It was to use Learning Machine (ELM). In this study, the image was preprocessed in HSV color space and features were extracted using Haralic textures. We then used these features to train and evaluate the model using the ELM classifier. After the test was completed, the accuracy of the ELM was calculated. As compared to other models, ELM results show 84.94 percent higher accuracy. However, training and processing the model is time consuming. (U. Shruthi et al., 2020) conducted a comparative study of five machine learning methods for plant ailment recognition. The results of this work show that the CNN classifier can detect more diseases with high

accuracy. According to this work, in the future, other machine learning techniques like decision trees will be used to detect plant diseases using a naive Bayes classifier, and all kinds of plant diseases detected by farmers. Can be automatically detected. The classification was accurate only to distinguish between healthy and unhealthy leaves. Another classification of unhealthy leaves was inaccurate.

(Deepa et al., 2021) used the KFHTRL PBC method, which included three steps: pretreatment, feature extraction, and classification. Input leaf photo noise was taken out using a Kuan filter during preprocessing to enhance picture quality and disease diagnosis accuracy. They then used the Hough transform. The results of the experiments demonstrate that the KFHTRLPBC technique has improved the peak signal-to-noise ratio while reducing time complexity. However, accuracy achieved was only 88%. They used a random forest to distinguish between healthy and unhealthy leaves from the datasets obtained in (S. Ramesh et al., 2018). The research they proposed included several implementation phases such as dataset creation, feature extraction, classifier training, and classification. To classify infected and healthy photos, we combined the generated diseased and healthy leaf datasets and trained under a random forest. They used a oriented gradient histogram to extract image features (HOG). Only 70% accuracy was achieved in Random Forest. (S. Chouhan et al., 2018) used a soft computing approach to automatically segment the disease from plant leaf photographs. They used BFO to optimally weight the RBFNN. This has improved the speed and accuracy of the network in identifying and classifying areas affected by various diseases of plant leaves. By finding and grouping seed points that have a common quality in the feature extraction process, the region expansion algorithm has improved the efficiency of the network. The proposed method advanced disorder identity and type accuracy. But the noisy pixels have been now no longer eliminated the use of the filtering method. To classify the 1.2 million excessive-decision pictures, they educated a huge, deep convolutional neural community (Krizhevsky et al., 2017). The neural community consisted of 5 convolutional layers. They didn`t use any unsupervised pre-education of their research to maintain matters simple. Due to the excessive quantity of layers withinside the neural community, a considerable quantity of processing time became required. It became now no longer prepared to categorize various agricultural sicknesses. The studies in (Vijai et al., 2016), proposed a way for photo segmentation method that became used to locate and classify plant leaf sicknesses automatically. Image segmentation, that is a key a part of disorder analysis in plant leaf disorder, became achieved the use of the genetic algorithm. Image segmentation, in keeping with this paper, is the technique of dividing or grouping a photo into diverse additives. These additives are commonly related to something that people can without problems separate and consider as unbiased matters. But there has been no type method used withinside the segmentation technique for enhancing the popularity rate.

3. EXPERIENTIAL WORK

3.1 Data Collection

The tomato leaf ailment images adopted in this paper are obtained out of Kaggle.com. It consists of a labeled dataset of various images of tomato leaves. Each plant in the image is either healthy or unhealthy. If the plant is infected with a disease, the disease name is mentioned in the dataset. Around 7928 photos from ten different classifications make up the collection. Images are of high-resolution

quality in RGB format. The dataset contains a higher number of images of unhealthy plants as compared to healthy plants since during prediction most of the images will be of unhealthy class type.

3.2 Data pre-processing

The dataset was divided into 8:1:1 train, test, and validation sets. The neural network will be trained using the training dataset. The validation dataset is used to offer a rough indication of model skill while adjusting the hyperparameters. The test dataset is used for computing the final precision and prediction of the model after the training is completed. The items of the dataset will be cached in memory the first time it is iterated over. Subsequent iterations will use the cached data. During a particular iteration, the dataset for the next iteration is prefetched. Doing so reduces the step time to the maximum of the training and its time to extract the data. This enables faster computational speeds and higher efficiency of the model. The figure 1 and figure 2. represents Naïve implementation vs Prefetch.
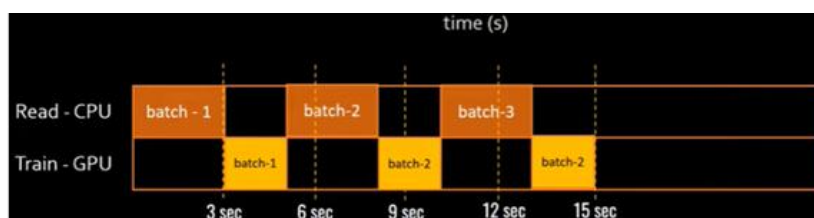
Figure 1: Naïve implementation
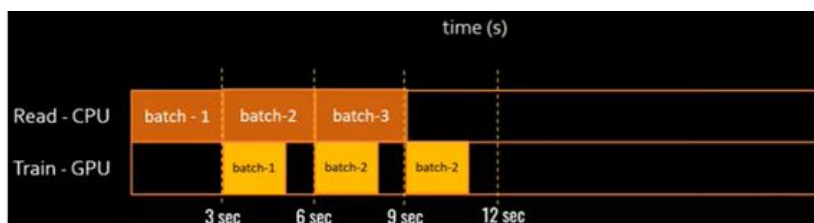
Figure 2: Implementation using Prefetch

The RGB values of the image [0, 255] are rescaled to be in the [0,1] range. Images are also resized to fixed dimensions (256 x 256). This ensures uniformity in data so higher accuracy can be achieved without overfitting. Data Augmentation strategy is used for increasing diversity of training set by applying random (but realistic) modifications to images, such as random rotations and flipping, image contrast, image hue, and so on. This increases the model's robustness when it comes to making predictions on a wide range of photos.

3.3 Classification

Wehave used CNN to create a computer model that takes unstructured images as input and turns them into classification labels. They fall into the class of artificial neural network that could be taught to learn functions needed for classification. Performance is improved because it requires less preprocessing and can perform autonomous feature extraction compared to traditional methods. The

CNN architecture is similar to organization of the visual cortex. Each block has three levels named as convolution, activation, and maximum pooling. This design uses two fully combined layers with a SoftMax activation layer on the output label, followed by six such blocks. For feature extraction, convolutional and pooling layers are used and for classification, fully connected layers are used. Since the classification problem is non-linear in nature, the non-linearity is introduced into the network via the activation function. The convolution layer consists of alternating convolution and pooling operations that help in feature extraction. The complexity of the retrieved features grows as the depth is increased in the network. Throughout, a 3 x 3 filter is utilized. In the first convolutional layer, we employed 32 output filters. This number is increased to 64 for all further convolutional layers. To compensate for the smaller feature map, the number of filters must be increased. Zero padding was used to retain the image size after the convolution operation. Non-linearity is incorporated using the ReLU activation function. After every convolution operation, a max-pooling operation is performed to speed up training and to make the model lesser susceptible to slight input changes. For max-pooling, the kernel size is 2x2 with a stride of 1 in all directions. The final 2 layers are responsible for the classification of input. It is made up of two layers of neural networks that are fully coupled. To compute the probability scores for 10 different classes, The first layer is made up of 64 neurons, whereas the second layer is made up of ten neurons with softmax activation function which is represented in figure 3.
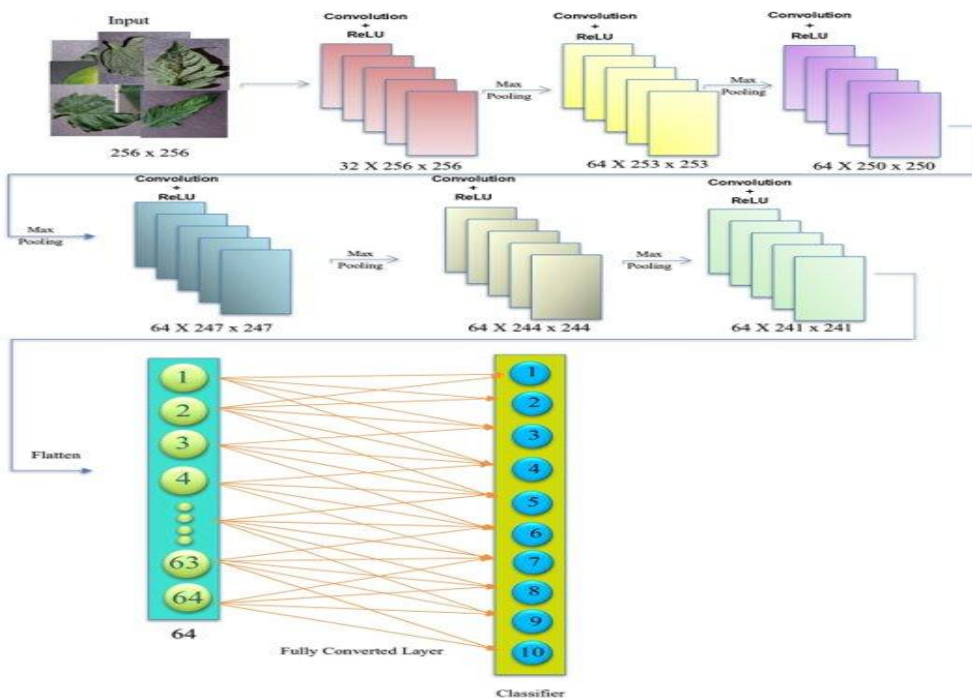

Figure 3: Model Diagram

3.4 Experimental settings

The dataset used in this paper is gathered from Kaggle.com. It consists of around 7928 images of tomato leaves each belonging to one of 10 different classes of tomato plant diseases. Images are of high-resolution quality in RGB format. TensorFlow is used to implement the model. The dataset is splitttedin an 8:1:1 ratio into training, testing, and validation datasets respectively. Data augmentation has been used to boost the efficiency of the model on pictures that are distorted or misaligned. Random rotation of 72 degrees, horizontal and vertical flipping of images is performed to augment the dataset. The loss function is categorical cross-entropy, and the Adam optimizer is used for optimization. For a total of 20 epochs, the model is trained and a batch size of 32 is employed for every iteration. The experiment is run on an Intel Core i5-10210U CPU running at 1.60 GHz.

4. Results and analysis

The performance of the model has been assessed using accuracy. The training accuracy and loss graphs with respect to the number of epochs show convergence of the model. After 20 epochs of training, an accuracy of 96.26% has been obtained over the validation dataset. This figure of accuracy suggests that the model works well on the dataset and can be used to classify the 10 tomato leaf diseases with a minimal amount of resources. Optimizations like data caching and prefetch enable the neural network to be quickly trained on a computer with minimum hardware requirements without any specialized hardware such as a Graphics Processing Unit(GPU). The model, therefore,
gives a straightforward and practical solution of handling the problem of plant disease identification with accurate results.
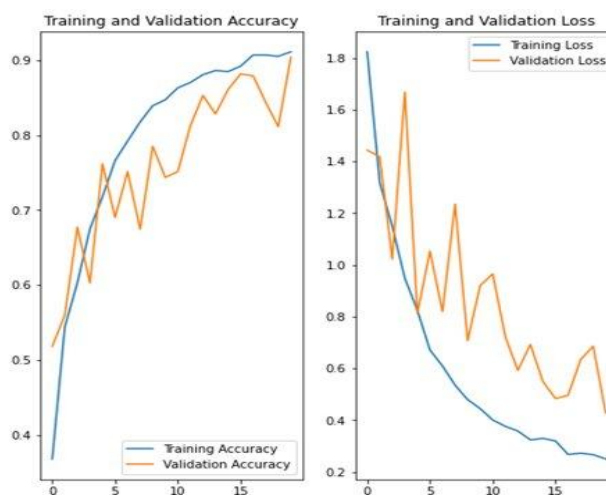

Figure 4: Training Vs Validation Graphs

In Figure 4, the first image is the Training vs Validation accuracy graph, and the second image is the loss graph. The number of epochs is represented on the X-axis, while on the Y-axis we have accuracy measure in the first image and loss measure in the second image. So, we can see from the Figure 4 that

initially we had an accuracy of nearly 0.5, which increased up to nearly 0.9 after 20 epochs. Whereas, in the loss chart we can see that error keeps reducing in backpropagation as we proceed forward with epochs.

5. CONCLUSION

Agriculture is one of the most important sector with the bulk of the population relying on it. Therefore, identification of diseases in these crops is very important for economic growth. Tomatoes are a staple food that is cultivated in large quantities. Therefore, the purpose of this paper is to detect and identify 10 different diseases of tomato crops. To classify tomato leaf diseases into 10 classes, the suggested methodology employs a convolutional neural network model, achieving 96.26% accuracy. As part of future work, we can experiment with the proposed model utilizing a variety of learning rates and optimizers. It may also include experimenting with new architectures to increase the model's performance. Research can be extended to detect multiple diseases of multiple plants. We can also develop IoT-based real-time monitoring systems, websites, and mobile applications for this purpose.

REFERENCES

Chouhan, S. S. , Kaul, A. , SinghU. P. , &Jain, S. (2018) Bacterial Foraging Optimization Based Radial Basis Function Neural Network (BRBFNN) for Identification and Classification of Plant Leaf Diseases: An Automatic Approach Towards Plant Pathology,in IEEE Access, vol. 6, pp. 8852- 8863, DOI: 10.1109/ACCESS.2018.2800685.

Deepa, N.R., Nagarajan, N. Kuan noise filter with Hough transformation based reweighted linear program boost classification for plant leaf disease detection. J Ambient Intell Human Comput 12, 5979–5992 (2021).

N. Kanaka Durga and Ghanta Anuradha, "Plant Disease Identification Using SVM and ANN Algorithms," 2019 International Journal of Recent Technology and Engineering (IJRTE).

Kai, Tian & Li, Jiuhao& Zeng, Jiefeng&Asenso, Evans & Zhang, Lina. (2019). Segmentation of tomato leaf images based on adaptive clustering number of K-means algorithm. Computers and Electronics in Agriculture. 165. 10.1016/j.compag.2019.104962.

Alex Krizhevsky, Ilya Sutskever, and Geoffrey E. Hinton. 2017. ImageNet classification with deep convolutional neural networks. Commun. ACM 60, 6 (June 2017), 84–90. DOI:https://doi.org/10.1145/3065386

SRamesh. (2018), Plant Disease Detection Using Machine Learning,International Conference on Design Innovations for 3Cs Compute Communicate Control (ICDI3C), pp. 41-45, DOI: 10.1109/ICDI3C.2018.00017.

U. Shruthi, V. Nagaveni and B. K. Raghavendra, "A Review on Machine Learning Classification Techniques for Plant Disease Detection," 2020 5th International Conference on Advanced Computing & Communication Systems (ICACCS), 2020, pp. 281-284, doi: 10.1109/ICACCS.2019.8728415.

Singh, Vijai&Misra, A.K.. (2016). Detection of Plant Leaf Diseases Using Image Segmentation and Soft Computing Techniques. Information Processing in Agriculture. 4. 10.1016/j.inpa.2016.10.005.

Qimei W, Feng Q ,Minghe S, Jianhua Q, Jie X [2019]. Identification of Tomato Disease Types and Detection of Infected Areas Based on Object Detection Techniques, Article ID 9142753.

Xian, Tan &Ngadiran, Ruzelita. (2021). Plant Diseases Classification using Machine Learning. Journal of Physics: Conference Series. 1962. 012024. 10.1088/1742-6596/1962/1/012024.

RESEARCH ENVIRONMENT FOR GEOSPATIAL COMPUTING

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This paper describes ongoing efforts to create an environment for undergraduate research projects in geospatial computing. Our goal is to provide tools and procedures to help accelerate and make more meaningful student experiments. This environment supports teamwork and allows for efficient supervision. Students learn skills related to geospatial computing based on real-world large data sets. The student experiences are consistent with industry requirements and make them employable in the job market, experiencing growing demand for geospatial applications. The initial direction of the undergraduate research supported by this environment is related to GPS data for object position and movementclassification. The central theme of the research is discovering all critical aspects of data science as applied to geospatial computing, i.e., integration of data, data cleaning, data processing, including machine learning and visualization.

Keywords: Geospatial computing, Visualization, Big Data, Data Profiling, Undergraduate Research

1. INTRODUCTION

Advances in geospatial computingare rich in real-world applications that attract student attention through visual aspects, e.g., mapping interesting objects, GPS tracking, and understanding individual or group behavior(Yu et al.2008;Yu et al. 2009;Dodge et al. 2008). Geospatial computing is undergoing significant changes by using Machine Learning (ML) tools(Schmidhuber 2015). The rapid increase in demand for geospatial applications is being brought about by big data and a better understanding of existing approaches taking advantage of powerful software libraries.

Due to the advanced nature of the work, it is challenging, in general,to include research inundergraduate programs in a meaningful way(Lopatto 2003) and,in particular, forthe computing discipline (Erkan 2008et al.;Fincher et al. 2001;McConnell 1996; Russell et al. 2012). This paper describes an extensive support environment for student researchdeveloped to serve as a scaffolding system. It consists of a well-structured set of programming templates to supportall phases of geospatial processing. The software templates are provided to students to assist them in their learning, proceed with research experiments in a timely fashion, and avoid unnecessary impediments like developing the numerous software components from scratch.

2. ARCHITECTURE OF STUDENT RESEARCH ENVIRONMENT

Our research environment needs to satisfy the requirements for efficient student researchthrough software components that can be modified individually or integrated to create advanced computational models. The software components are referred to here as templates since they can be easily tailored to perform specific tasks. The templates can be used in the order shown in Figure 1 for typical applications exposing students to the entire process. For more specialized research, we can ask students to emphasize one of the phases shown in Figure 1, e.g., Data Visualization assuming that the appropriate data sets are already prepared. The environment includesthe example data sets and templates for combining data sets, cleaning and profiling, visualization,processing, and ML templates, as shown in Figure 1.

A data set needs to be selected based on the application description, as shown in Figure 1. Then the general requirements table template should be completed based on the application description and the selected data set. The general requirements table should contain the data schema for the selected data set. It should also specify therequired number of data records, type of treatment of null values, and allowed data ranges. The general requirements table is related to data profiling and cleaning. The specific requirements table describes the design for a solution to the problem specified by the application. Hence, the requirements table is related to the choice of processing templates.
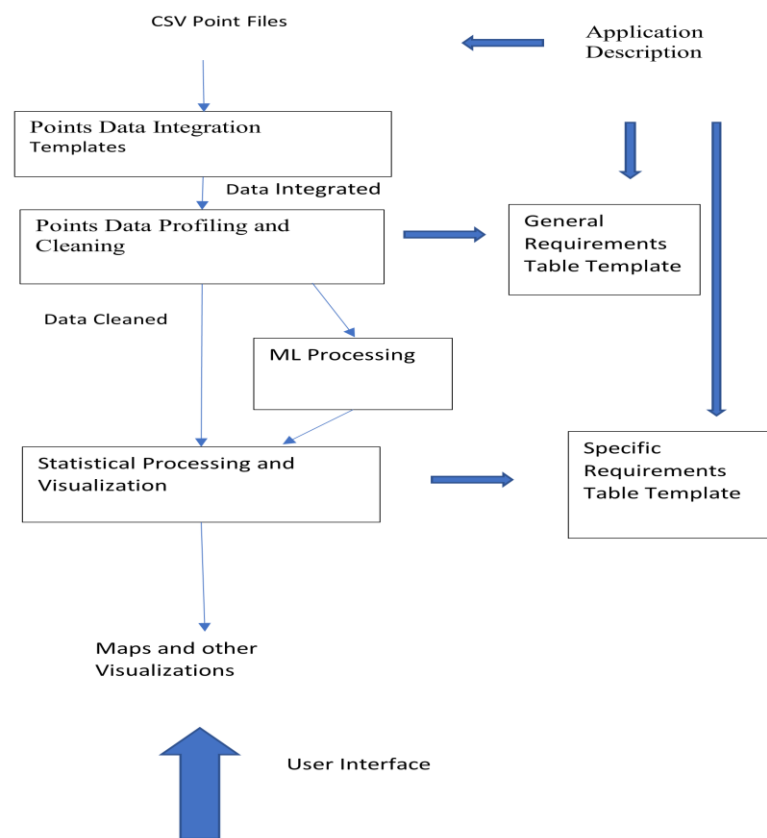

Figure 1: Research Environment Architecture for Geospatial Data

The geospatial data sets can have various data schemas. Let us discuss a general structure of schema supported by our research environment. It can be described by a template schema shown in Figure 2.

ObjectId	Longitude	Latitude	Altitude	ObjectType	Time

Figure 2. Template Geospatial Schema

The schema has three geospatial attributes, Longitude,   Latitude,   andAltitude,   quantitative properties, and   ObjectId,ObjectType, andTimeproperties that can be quantitative or categorical. This template can generate many specific schemas by removing or expanding the existing attributes. However, the two essential schema types can be identified: static point objects schema (SPO) and moving point objects (MPO) schema. The point objects schema might have the Time attribute removed. If the Time attribute is still present, the key for both schemas is composite [ObjectID, Time]. If the Time attribute is removed from SPO, the key can be the simple attribute ObjectID. We can have an attribute ObjectType point expanded into separate attributes or various attributes such as ObjectType and Altitude removed for some specific schemas.

3. GEOLIFE DATA AND SUSPECTS OF TERROR IDENTIFICATION - CASE STUDY

Our research environment supports the analysis and visualizations of two types of geospatial data: static point data and dynamic segment (vector) data. Discussion in this paper focuses on static point data analysis using a dataset collected in (Microsoft Research Asia) Geolife project by 178 users over four years (Yu et al. 2008; Yu et al. 2009). The GPS Geolife dataset for each user is represented as multiple files. This data was recorded by different GPS devices with various sampling rates. This datasetrepresents by the time-stamped points containing information about the user's latitude, longitude, and altitude. This dataset recorded a broad range of users' locations, including outdoor, home, work, sports events, shopping, sightseeing, and dining. This GPS or similar datasets can be used in many research fields, such as social networks, crowd density, and location recommendation. As a sample application for our case study, we will use the following situation: *An act of terror was triggered by a cell phone connection initiated from the identified area at a given hour. We need to find suspects from our GPS users' recordings.*

4. POINTS DATA INTEGRATION AND SINGLE TABLE CREATION

The typical geo-computing research is based on a single data table. Sometimes data table is provided as a single table, but in many cases, including our case, data is distributed over multiple files and needs to be integrated first. We have developed several templates to support students' efforts for reading data with various levels of file hierarchy complexity. The simplest is the template for data reading from one file. Another more advanced option is reading and combining multiple files from a single directory. An extension of this template is the code to combine multiple files from the various directories. Here students can appreciate templates that integrate files and use directory names as new attribute values in

the merged file with the minimum effort from the student. The current version of our templates helps in integrating homogenous files. Students can extend them as a part of additional research; however, to provide better assistance for future students, we are working on new templates to combine heterogeneous files.

As a result of the integration step, we have obtained a single table with rows storing uniquely identified point data. The key attributes of the table are a user identifier and the recording time—the Initial Geolife Data Schema, as shown in Figure 3.

User	Latitude	Longitude	Altitude	Days	Date	Time

Figure 3: The Initial Geolife Data Schema.

5. DATA PROFILING AND CLEANING

Let us discuss the software templates for geospatial data profiling and cleaning. The templates are organized according to the general rules for profiling. There are fourgroups of templates for profiling and cleaning individual attributes, profiling and cleaning multiple attributes, schema changes, and removal of observations.

The students would typically start experimenting with templates for profiling individual attributes. The application's general requirements must be considered in all experiments, e.g., the required number of data samples, absence of null values, and data ranges. These requirements are usually explicitly given. It requires some problem-solving skills to create conditions for multiple attributesfrom the application. For geospatial data,we should pay special attention toprofile pairs of Longitude and Latitude in relationship with other attributes, i.e., identifying aggregate values for various attributeswhile grouping byLongitude and Latitude pairs.

Let us consider single attribute cleaning and profiling. Different templates were used for cleaning quantitative and categorical attributes. First, let us focus on quantitative attributes and check for errors. This task can be done by a template that checks both: if no value exists in the cell and if there are nonumbers present in the data. It is critical since Null or Non-Number values can result in processing result errors or, even worse, can cause execution errors in other programs. Another template can perform repairing actions such as removing the observations for this problemor generating and inserting some values. Our template allows for replacing the missing values by the meanfor the entire column or based on the values of immediately adjacent observations. In the case of our application, we used the latter option for cleaning Latitude, Longitude, Altitude, and Days based on the semantics of the data. Yet another template can also return the basic statistics of the single attribute values and identify any out-of-range values.

Let us now discuss cleaning the categorical or combined attributes. The appropriate template can be used to ensure the correct categorical values, e.g., of the User attribute. The User attribute stores the identification number in a 3-character string. If there were Null values or any that did not follow this

format, they would be reported. The correction methods are slightly different than for quantitative attributes. Instead of mean, we use a value of one of the adjacent observations.Similarly, any out-of-range values are determined and correctedusing specific string methods. For example,Date values were assumed to have the string format of Year-Month-Day and that all observations spanned seven months from 2008 to 2009. Any aberrations were discovered and corrected. The Time attribute was similarly cleaned. All the time values were set to a string format of Hours:Minutes:Seconds to ensure uniformity. The special templates to check component values were used to verify if any are out of range, i.e., hours set in range 0 to 23.

This phase can also include some pre-processing, i.e.; some initial attribute values can be converted to be more convenient for later processing. The attribute Daysholds the value of the number of days since January 1st, 1900. It was first cleaned similarly to other quantitative attributes. However, the values counted since 1900 are not convenient because all our data is from the 21st century. Therefore, it has been converted to days since January 1st, 2000. The profiling after conversion is also usually recommended to verify the correctness of the conversion.

Now let us consider cleaning and profiling multiple attributes. Once each individual attribute is analyzed and cleaned, we can clean the relationships between attribute values and their aggregations for various attributes. For instance, while there can be repetitions of values for some non-key attributes, there cannot be repetitions of the same observations. These duplicate observations were searched and removed to eliminate redundancy.

In the case of our data set, we have the constraint that we cannot have two observationsfor the same user at the same time. However, we cannot simply remove one observation because we might have valuable information about the different locations. That posed the practical challenge of choosing the recording. For our case, the average method was used to correct this discrepancy. We can profile multiple attributes using other aggregations, as shown in Figure4. It shows the basic statistics listing min, max, and mean of Days for each User.

	Days		
	min	max	mean
User			
000	3220.404456	3475.323090	3399.755681
036	3329.382697	3405.440046	3368.117342
037	3343.108206	3400.154826	3377.803220

Figure 4: Profiling through aggregationsmin, max, and mean of Days for each User.

As a part of pre-processing, the existing columns can be removed or new columns added. We removed the Unused attribute in the original data set with no values. A new column for Hours was added that refers to the hour of the day in which the data was collected, and a column SecSinceNight which is the number of seconds from midnight to when the data was collected. These two new columns provide

	SecSinceNight			Hours		
	min	max	mean	min	max	mean
User						
000	0	86398	34660.959595	0	23	9.139361
036	2458	45237	29932.693368	0	12	7.887011
037	419	82600	27294.878766	0	22	7.116410

additional simplification for our processing in the following phases. The basic statistics for the relationships between SecSinceNight and Hours, grouped by User values, is shown in Figure 5 and obtained using the template for profiling multiple attributes.

Figure 5: Profiling the relationship between User and SecSinceNight and Hours.

Pre-processing can also involve observation removal. The main reasonis to remove observations that will not be needed now or in the future. The removal should be carefully considered and not related to the application's specifics. It is generally not recommended to do it in this phase,making the data set more application independent.The resulting data table of 82,238 observations contains the cleaned data, is ready for further analysis, and can be processed by algorithms.

6. GEOSPATIAL DATA PROCESSING AND VISUALIZATIONS

Depending on the application, a subset of data of interest can be identified, and various statistical or ML operations,possibly on different data aggregations, can be required. Comparing the specific application requirements with the results of statistical experiments can identify theneeded solutions.

Some solutions might require experimentations with machine learning (ML). We created templates to use Linear Regression, SVM, Decision Trees, and ANN. Geospatial data can classify the object positionsorobjectposition clustersandfind higher-level information such as goals, intention, etc. Algorithms such as Support Vector Machines and Decision Tree can be trained with feature vectors that determine howUsers' positions concerning a landmark determine, e.g., intentions. Our feature vector can incorporate a variety of geometric and temporal measurements, such as thedistances of the users to different points on the landmark and angles that it forms concerning the landmark. Our templates are based on the Sci-kit Learn library that comprehensively implements standard ML algorithms for classification, clustering, neural networks, etc.

We also usetemplates for the user interface to visualize the solutions. Generally, geospatial data visualization displays data on a map,in a table form, or on a chart to convey specific information. The

map is the first choice, especially to get a general point of view, as shown in Figure 6. This heat map indicates the presence of some users close to the airports that could be of interest in our investigation.
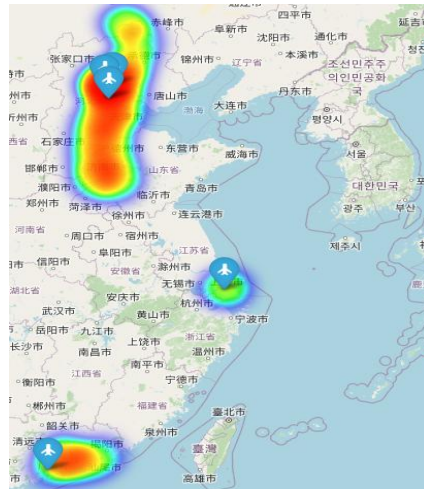
Figure 6: Heat map visualization of our data

The map visualizations have many advantages, and they can be used interactively using our templates. The interaction can include various actions, including changing map type, moving the map, zoom-in, zoom-out, and counting the distance. However, typically various charts also need to be used to find the solution for an application. The most straightforwardnon-map visualization is for a single attribute to show the distribution of its values. Let's use apie chart to view the number of observations for the different users, as shown in Figure 7.
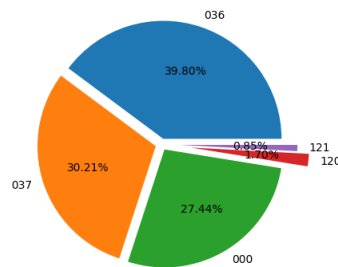
Figure 7: The pie chartshowsthe number of observations for the different users.

There is considerable variability in the number of observations per user. Typically, visualizations show relationships between one attribute value and the aggregations for other attribute values.Since the solution for the application is User related, it is more interesting for usthe count observations for each value of an Hour but separately for each User, as shown in Figure 8. For a smaller number of values for the grouping attribute, in our case, Hours, we combine the charts into one.
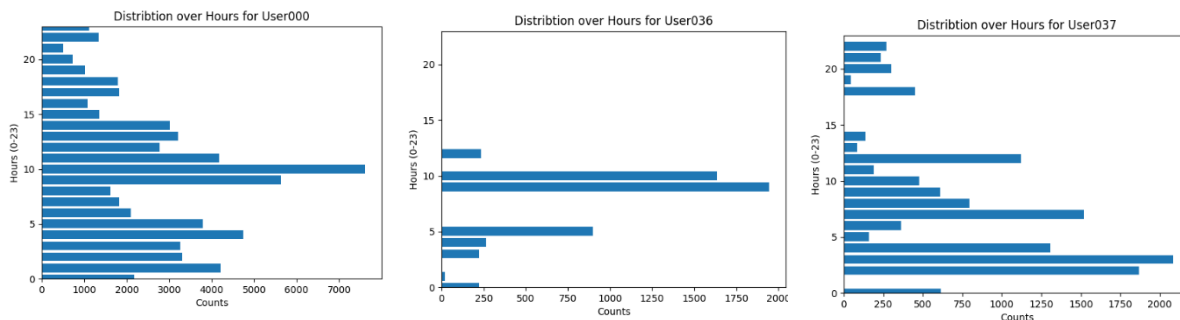
Figure 8: Bar graphs showingrelationships between Hour and the number of observations separately for each User

Let us assume that in the specification of our application, the hour of a terrorist attack was provided as between 16:00 and 17:00. Based on our visualization, we can conclude that the suspect is User 000.

7. CONCLUSION

We have observed many benefits of our research environment forundergraduate researchers: learning to analyze geospatial data and transform it into various representations, developing advanced computation models,appreciating scientific experiments, and learning what scientific research entails. We achieved that by emphasizing the use of appropriate research methodology, formulationhypothesis, and specifying methods for its verification. Wewere able to accomplish that byproviding a set of templates that could accelerate often unnecessary tedious programming tasks.

REFERENCES

Dodge S., Robert Weibel R., and Lautenschütz A. 2008. Towards a taxonomy of movement patterns. Information Visualization 7, 3 (June 2008), 240-252.

Erkan, A.; Newmark, S.; and Ommen, N. 2009. Exposure to research through replication of research: a case in complex networks. In Proceedings of the 14th annual ACM SIGCSE conference on Innovation and technology in computer science education (ITiCSE '09). ACM, New York, NY, USA, 114-118.

Fincher, Sally, Marian Petre, and Martyn Clark. 2001. Computer science project work: principles and pragmatics. Springer Science & Business Media, 2001.

Lopatto, D. 2003. The essential features of undergraduate research. Council on Undergraduate Research Quarterly, 23, 139–142.

McConnell J. 1996. Active learning and its use in computer science. In ITiCSE: Proceedings of the 1st conference on Integrating technology into computer science education, pages 52–54.

Russell, I., Coleman, S., & Markov, Z. (2012, September). A contextualized project-based approach for improving student engagement and learning in AI courses. In Proceedings of Second Computer Science Education Research Conference (pp. 9-15). ACM.

Schmidhuber, J. (2015). Deep learning in neural networks: An overview. Neural Networks, 61, 85-117.

Yu Zheng, Quannan Li, Yukun Chen, Xing Xie. Understanding Mobility Based on GPS Data. In Proceedings of ACM Conference on Ubiquitous Computing (UbiComp 2008), Seoul, Korea. ACM Press: 312-321.

Yu Zheng, Lizhu Zhang, Xing Xie, Wei-Ying Ma. Mining interesting locations and travel sequences from GPS trajectories. In Proceedings of International conference on World Wild Web (WWW 2009), Madrid Spain. ACM Press: 791-800. Article. Accessed Jan 2022.

EFFECTIVENESS OF KAIZEN APPROACH FOR CONTINUOUS IMPROVEMENT IN EMPLOYEE'S PERFORMANCE: A META-ANALYSIS

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The purpose of this paper is to explore the effectiveness of Kaizen and few more management tools & techniques come under the umbrella of kaizen, which helps in increasing the efficiency and effectiveness of employees as being a powerful motivational tool for HR experts. Kaizen implementation framework is practicable and can be implemented in the organizations without too much expenditure. How it can be helpful in the human resource policies and activities in different sectors.

A Meta-analysis was done in order to determine the overall trends to effectiveness of kaizen approach and critically explores there potential advantages of it in enhancing employee's performance.

After doing holistic study the finding of the paper is that Kaizen as a continuous improvement approach and other management techniques which come under the umbrella of Kaizen may effectively help in increasing the performance of employees. HR experts are appropriate candidates for Kaizen training, as they may then be capable of disseminating their knowledge to the wider workplace, ensuring the high-quality practices are adopted and continual improvement becomes a business enterprise-wide mantra. Kaizen may help HR managers in motivating and increasing the satisfaction level of employees in various ways.

Kaizen approach may be implemented in the right manner in the form of kaizen events after providing training to employees and increasing their engagement to get effective results in the form of better productivity, satisfaction, reduction of cost etc. Proper implementation may give many benefits to the business enterprise without too much of expenditure and without going into innovation in technology or bring major changes in the infrastructure of the organization.

KEYWORDS: Continuous improvement, Kaizen, Human Resource, Employees Performance, Kaizen events, Hoshin kanri, PDCA.

1. INTRODUCTION

Workforce is an important part of an organization and every successful organization requires efficient, hardworking and satisfied workforce which will work for the betterment of the organization. Therefore, HR management is an important function of any organization of any size and objectives. Every organization wants to adopt such ways which can help them to motivate and satisfy the workforce in an effective manner to give better results. It is a global tendency to follow the working techniques of the Japanese Management as these techniques provided a huge success for the Japanese organizations (Mitra Debnath, 2019). Kaizen technique is the one of an effective way to find the ways to motivate and satisfy the workforce in an effective manner to get better results. After the Second world war in

1986, Masaaki Imai Father of Kaizen introduced the concept of kaizen in his book, "Kaizen: The Key to Japan's Competitive Success" (Mukhopadhyay, 2022; Nguyen, 2019; Rosak-szyrocka, 2019) . Kaizen is a management tool to make improvement through elimination of waste and taking small steps for improvement. Since this Japanese approach 'Kaizen' is used and implemented by human so it can be used to all the sectors to make improvement in its process to get effective results. It can even be used in our personal life (Rosak-szyrocka, 2019). In Japanese, Kaizen means continual improvement that involves everyone - both managers and workers and entails relatively little expense. According to White and Trevor in 1983 that the Japanese management techniques such as Kaizen is set for Japanese culture only and is difficult to be implemented effectively in other countries of the world. While some other believed that some of the rational features of Japanese management philosophy may be used outside Japan. Kaizen can be implemented effectively with the locally practiced management techniques for the sustainable competitive advantages and organizational excellence (Macpherson et al., 2018). Kaizen methodology will help the employees to increase their effectiveness in making their workplace a better and organised place of work which will lead to improvement in the overall performance of the organization.

Kaizen: Everyone in an organization is encouraged to give ideas for improvement and to take small steps for improvement. Since middle management and workers are more close to the root cause of the problem so they may give better solution to the problem. It requires many people with conventional knowledge. **Innovation:** Innovation asks to make drastic changes so it cannot be practiced by middle and lower management. Also it requires heavy investments for which only top management can take decisions. It requires few champions with the knowledge of technology of equipments.

2. LITERATURE REVIEW

Masaki Imai defined kaizen as- "Kaizen means improvement. Moreover, it means continuing improvement in personal life, home life, social life, and working life. When applied to the workplace Kaizen means continuing improvement involving everyone- managers and workers alike." Kaizen is set for Japanese culture only and is difficult to be implemented effectively in other countries of the world. While some other believed that some of the rational features of Japanese management philosophy may be used outside Japan. Kaizen can be implemented effectively with the locally practiced management techniques for the sustainable competitive advantages and organizational excellence (Macpherson et al., 2018). It will help organizations to achieve better results with optimum utilization of resources and workforce. Kaizen process includes many small improvements and is a continuous improvement process and require regular attention (Kumar, 2015). Kaizen practices also may be efficaciously applied in small manufacturing business enterprise as a productivity improvement tool. A successful implementation of Kaizen and 5S approach helps in small organisation to improve performance (Shubhangi & Gurway, 2016). Kaizen events can be an effective tool to be used to improve the process of back office such as frontline supervisor to cooperate in recruiting and retention (Montabon, 2005). Kaizen has a direct and positive impact on economic benefits and for human resources. The application of kaizen are sustained, eliminating waste and support of workforce may help in improvement within the organization (Vento et al., 2016). Kaizen as a management philosophy

is fit for everyday management practices in an organization for the same it is important to make change in management attitude. A manager needs to share power with his lower level also (Smadi, 2009). Workforce is an important part of any organization whereas Kaizen is an idea generation and problem solving activity which is to be performed by human resource therefore coordination and cooperation of human resource is fundamental to any improvement in any organization system. That is the reason the success of business is positively related to the way human resource are involved in the activities of the organization (Bhuiyan & Baghel, 2005). Continuous Improvement and employee participation has a positive impact on the operational performance of an organization (Galeazzo et al., 2021). Continuous improvement process may be used in human resource management processes to get better results for an organization and to produce goods and services that meet the needs of customers by a higher work performance and increased workforce productivity (Gemar et al., 2019). There is a positive relationship between continuous improvement methods and engagement. This engagement can be increased by providing training for continuous improvement to the employees an effective training program increase the productivity of employees and their involvement (van Assen, 2021) and will reduce the pipeline time of a work and also increase the profit margin and provide better financial forecasting for an organization (Khan et al., 2019). Kaizen plays an essential role in improvement in terms of quality, overall performance in the use of all assets, better enterprise, and work safety and working situations through continuous improvement with kaizen. 20% of employees working inside the organization's HR department take part active within the employee suggestion program and regularly submit their suggestions, out of which with 80% reporting of getting heard and implemented too in the functioning of organization (Ostrowski, 2017). Kaizen has been successfully implemented across different industries in many countries worldwide and brought significant benefits towards relevant organizations, including SMEs. Supports from senior management, training, working environment, assessment, motivation, mindset and engagement of all members in the enterprises. These factors help in successful implementation of kaizen and improving performance for sustainable growth of the organization (Nguyen, 2019). Kaizen creates an environment conducive to problem-solving through collaboration. Kaizen additionally offers medical institution an opportunity for making continuous improvement without big expenditure (Rosak-szyrocka, 2017). Kaizen approach is helpful in healthcare institutes in personnel management, proper management of record and satisfaction of patients (Rosak-szyrocka, 2017). There are many other techniques with kaizen which helps in continuous improvement. The introduction of Kaizen and 5S rules helps in increase the effectiveness and efficiency in the processes, improved visibility of the process, improved morale and safety of the employees, reduced delays, searching time and dangerous conditions (Gupta & Jain, 2014). Along with kaizen PDCA is also a quality management system that is used as a continuous improvement tool. PDCA is a continuous improvement tool that is widely used in the services and manufacturing sector (Isniah et al., 2020). It also bring productivity improvement and quality improvement for the organization at bigger level (Patel & Deshpande, 2017). The implementation of the lean-Kaizen method helped the human resource department to reduce the cycle time of its human resource selection and hiring process, retaining its overall performance, (Suárez-Barraza & Ramis-Pujol, 2010) and also increase job satisfaction (Nahmens et al., 2012). Hoshin Karni is another important management tool which used with kaizen for getting better results and to achieve the highest goal supporting and linking the potential of

organization (Messaouda & Maazouzi, 2017). 'Kaizen' and '5 Why' technique can be used together to find the root cause of the problem. For example, if you are late for some meeting or appointment the first question that will be asked is 'WHY', why you are late

3. OBJECTIVES

1. To identify key factors, outcome factors of kaizen from literature review.
2. To identify the relationship between Kaizen implementation and employee's performance
3. To identify how effective implementation of kaizen helps in practicing human resource policies.

4. RESEARCH METHODOLOGY

A Meta-analysis was done in order to determine the overall trends to effectiveness of kaizen approach and critically explores there potential advantages of it in enhancing employee's performance. Meta-analysis refers to the statistical of the data from independent primary studies focused of the same subject, which aims to generate a quantitative estimate of the studied phenomenon in order to determine overall trends.

5. FINDINGS AND CONCLUSION

Workforce is an important part of an organization. In order to get continuous improvement in any organization it is important to train employees to find out root cause of any problem and to develop the skill to problem solving approach. Problem solving activity is to be performed by human resource therefore coordination and corporation of human resource is required for the success of any organization. It can be concluded that the success of any business is positively related to its human resource and their involvement in the activities of the organization.

There are many factors which are directly related to the successful implementation of kaizen and continuous improvement. For the effective kaizen implementation top management commitment, organizational kaizen culture, personal initiative, recognition, training to workers, human resource development is required to get better employee and organization performance. These factors have direct relationship for the effective implementation of kaizen (Saleem, 2015). Kaizen approach may be used in all the sectors as it is implemented by human resource of any organization it may give effective outcomes for an organization and also increase the efficiency and productivity of the employees of an organization. Better training and employee engagement is very essential to implement Kaizen as a continuous improvement tool to get better results in the form of better productivity, reduce waste, improves process and product quality, better employee and customer satisfaction, high job satisfaction and low workforce absenteeism. Kaizen is an approach which requires very less investment as compared to innovation. Because innovation ask to make radical changes while kaizen ask to take small steps for improvement.

Finally it can be conclude that Kaizen approach may be implemented in the right manner in the form of kaizen events after providing training to employees and increasing their engagement to get effective results in the form of better productivity, satisfaction, reduction of cost etc. Proper implementation may

give many benefits to the business enterprise without too much of expenditure and without going into innovation in technology or bring major changes in the infrastructure of the organization

REFERENCES

Bhuiyan, N., & Baghel, A. (2005). An overview of continuous improvement: From the past to the present. Management Decision, 43(5), 761–771. https://doi.org/10.1108/00251740510597761

Galeazzo, A., Furlan, A., & Vinelli, A. (2021). The role of employees' participation and managers' authority on continuous improvement and performance. In International Journal of Operations and Production Management (Vol. 41, Issue 13). https://doi.org/10.1108/IJOPM-07-2020-0482

Gemar, G., Negrón-González, A. M., Lozano-Piedrahita, C. J., Guzmán-Parra, V. F., & Rosado, N. (2019). Procedure for the continuous improvement of human resource management. Ingenieria e Investigacion, 39(1), 53–62. https://doi.org/10.15446/ing.investig.v39n1.72402

Gupta, S., & Jain, S. K. (2014). The 5S and kaizen concept for overall improvement of the organisation: a case study. International Journal of Lean Enterprise Research, 1(1), 22. https://doi.org/10.1504/ijler.2014.062280

Isniah, S., Hardi Purba, H., & Debora, F. (2020). Plan do check action (PDCA) method: literature review and research issues. Jurnal Sistem Dan Manajemen Industri, 4(1), 72–81. https://doi.org/10.30656/jsmi.v4i1.2186

Khan, S. A., Kaviani, M. A., J. Galli, B., & Ishtiaq, P. (2019). Application of continuous improvement techniques to improve organization performance: A case study. International Journal of Lean Six Sigma, 10(2), 542–565. https://doi.org/10.1108/IJLSS-05-2017-0048

Kumar, N. (2015). Kaizen implementation in visi cooler industry : a case study. International journal for research & development in technology, 4(1).

Macpherson, W. G., Lockhart, J. C., Kavan, H., & Iaquinto, A. L. (2018). Kaizen in Japan: transferring knowledge in the workplace. Journal of Business Strategy, 39(3), 40–45. https://doi.org/10.1108/JBS-04-2017-0048

Maurer, R. (2013). The Spirit of Kaizen (2013th ed.). McGraw-Hill.

Messaouda, C., & Maazouzi, K. (2017). Planning using Hoshin Kanri. 6(4), 1–13. https://doi.org/10.6007/IJAREMS/v6-i4/3175

Mitra Debnath, R. (2019). Enhancing customer satisfaction using Kaizen: a case study of Imperial Tobacco Company (ITC). Journal of Advances in Management Research, 16(3), 277–293. https://doi.org/10.1108/JAMR-01-2018-0009

Montabon, F. (2005). Using kaizen events for back office processes: The recruitment of frontline

supervisor co-ops. Total Quality Management and Business Excellence, 16(10), 1139–1147. https://doi.org/10.1080/14783360500235876

Mukhopadhyay, B. R. (2022). Do Less . Do Better . Be More : Efficiency gains through ' Kaizen '. February.

Nahmens, I., Ikuma, L. H., & Khot, D. (2012). Kaizen and Job satisfaction - A case study in industrialized homebuilding. Lean Construction Journal, 2012, 91–104.

Nguyen, T. (2019). STEAM-ME : A Novel Model for Successful Kaizen Implementation and Sustainable Performance of SMEs in Vietnam. Wiley, Hindawi, 2019.

Ostrowski, D. (2017). Assessment of Employee Engagement in the Implementation of an Employee Suggestion Program in Company X – Research Results. 17(4), 985–1002.

Patel, P. M., & Deshpande, V. A. (2017). Application Of Plan-Do-Check-Act Cycle For Quality And Productivity Improvement - A Review. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 5(1), 197–201.

Rosak-szyrocka, J. (2017). HUMAN RESOURCES MANAGEMENT IN KAIZEN ASPECT. Human Resources Management & Ergonomics, XI(Figure 1), 80–92.

Rosak-szyrocka, J. (2019). Quality of life improvement in kaizen aspect. Quality Production Impovement, 1(1), 528–536.

Saleem, M. (2015). Analysis of Key Factors Affecting Kaizen and Development of a Framework for its Effective Implementation in Automobile Sector of Pakistan By The Dissertation Submitted to National University of Science and Technology Islamabad , Pakistan In Partial Fulfil.

Shubhangi, & Gurway, P. (2016). Implementation of Kaizen as a Productivity Improvement Rool in Small Manufacturing Company. Journal of Information, Knowledge and Research in Mechanical Engineering, 4(1), 760–771.

Smadi, S. Al. (2009). Kaizen strategy and the drive for competitiveness: Challenges and opportunities. Competitiveness Review, 19(3), 203–211. https://doi.org/10.1108/10595420910962070

Suárez-Barraza, M. F., & Ramis-Pujol, J. (2010). Implementation of Lean-Kaizen in the human resource service process: A case study in a Mexican public service organisation. Journal of Manufacturing Technology Management, 21(3), 388–410. https://doi.org/10.1108/17410381011024359

van Assen, M. F. (2021). Training, employee involvement and continuous improvement–the moderating effect of a common improvement method. Production Planning and Control, 32(2), 132–144. https://doi.org/10.1080/09537287.2020.1716405

Vento, M., Alcaraz, J., Macías, A., & Loya, V. (2016). The impact of managerial commitment and kaizen benefits on companies. Journal of Manufacturing Technology Management, 27(5). https://doi.org/10.1108/JMTM-02-2016-0021

A STUDY OF WORK FROM HOME IMPACT ON EMPLOYEES: DIGITAL HR REVOLUTION

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We look at how the pandemic's quick and broad move to working from home affected how knowledge workers allocated their time throughout the day and the work cultures Itchanged the way people work, and most employees and Companies are doing Work from home (WFH). This WFH culture is pushing the boundaries of Conventional HR and creatinga revolution Toward digitalHR.

The purpose of this study is to identify unknown challenges, Strategies,policies, new tools, psychological stress relief, etc. It also brings many challenges for the employees thus creating a revolution in Digital HR so that HR People can cope with the demand and challenges accordingto of new work culture.

The study applied a secondary approach. The study conducted published literatureresearch through the electronic databases at Web of Science, Websites, Scopus, Articles, and Research papers. The COVID-19 pandemic posed numerous challenges faced like the Hybrid approach, new workstyle methods, IT Sector booming, High Productivity, Motivation, and Flexible work style but still some complexities in HRM Work culture, some strategies and policies not supporting WFH Culture in HRM.

Keywords: HR Digitalization, HR Revolution, COVID-19 pandemic, Job satisfaction, Remote work,Working from home.

1. INTRODUCTION

Digital Revolution

Organizations are seeking new, effective, and productive methods to address the growing needs ofconducting business, and the HR technological evolution is here and advancing at a quick pace (Kalogiannidis & Chatzitheodoridis, 2021). Agility, global access 24 hours a day, 7 days a week,speed, and accuracy Leading companies know that they must innovate or be disrupted, therefore they've started to construct totally new work environments, which we've dubbed the "digital workplace revolution." It is going to change the way we thought about and approach our daily tasks (Shetty, 2021).

As per the study (Al Harthy&Wigley: 2020), 88% of HR managers believe that digital tools boostemployee engagement, (Nutsubidze and Schmidt, 2021). The digital revolution is transforming theway we cooperate in businesses. "It's clear that digital technology is promoting longitudinal management, collaborative effort, agility, and autonomy by leveling out hierarchies." Tools like workplace social networking sites, which have become the major information source for many employees, have made it easier for any employee to obtain information (Dockery and Bawa, 2020).If an HR department is not prepared to acceptdigital tools, others will, whether they like it or not!"

Digital transformation expenses are expected to rise by 25% in the coming year, according to a (Savi, 2020) With the introduction of artificial intelligence (AI), blockchain, machine learning, automated software management, and much more, HR departments that still collect and analyze data using Excel sheets must make the switch to automation as soon as possible (Sandeep:2020). HR Digitalization & People Analytics have become a hot topic in all Digitalize new era series organizations. "The transformations brought about by the use of digital technology in all facets of human civilization" (*Halid, Hafinas & Mohd Yusoff, Yusmani & Somu, Hemalatha. (2020).* Today, the world is growing with social revolution. HR Digital tools & Techniques help companies acquire new and easy work environments and maintain existing business. In the trending world, it is more important than ever to use digitalization in the form of a new era. HR changes are one such industry that needs to be prioritized. Not because of development and consistent work, but beyond that, because of our commitment to modern society, the youngest workers drive the development story of multinational corporations around the world. As paperless workplaces become more commonplace, it is just as essential to create and update HR fonts for a modern society's bespoke approach. Technology can bring tremendous benefits to HR capabilities. Save time by streamlining the process, increase engagement by enabling analysis of employee data, or enable employees to access the content they need, whenever they need it, across the platforms they need (Drewniak, Zbigniew & Posadzinska, Iwona. (2020).

2. LITERATURE REVIEW

This section provides a summary of previous material on the HR Tech Revolution, work remotely, and Pandemic (Covid-19) collected from several peer-reviewed research papers. The literature evaluation focuses primarily on the many HRM issues and opportunities related to the COVID19 era. a). Working from home's Digital: Positive experiences In this section many studies showings the role of working from home is very effective and efficient. The best example of WFH is pandemic time 2019 (Shetty, 2021). The ability to perform some of the maintenance and care that was made essential due to the lockdown, due to school and childcare facility closures and the lack of options to outsource chores such as cooking and cleaning have been some of the primary benefits of working from home (Gigauri, 2020; Lewis, 2020). Because of COVID-19, numerous people will be working from home for the first time. Others have more experience working from home. However, in your situation, working from home is more likely than ever to play a larger role in your life, or the lives of

others you live with. 1. Working Safely at Home You're in charge of designing your own working environment at home, which is typically quite different from an office. You must also take care of your mental and physical well-being. 2. Creating a Work Environment If you would like to stay consistent and get things done, you'll need to set up an effective work environment. Have all the tools you'll need on hand, and make sure you have enough space to work comfortably (Mohsen et al.: 2004, pp.226-233; Al-Madi et al.: 2017, pp.134). One of the best decisions you can make is in a high-quality office chair. If you don't have the capacity or the budget for one, make sure you can comfortably fit. If you don't, you'll most likely come up with a variety of reasons to get up or go somewhere else! Furthermore, a faraway corporation can maintain a physical presence using an office (Behrens et al., 2021). One of the advantages of remote working is that employees spend a few days in the office and the rest of the time at home, ensuring that everyone stays in touch face-to-face. Some key pointers are presenting like. 3.Flexibility and freedom Remote workers value their independence. They can schedule their days to fit both their job and personal lives as far as they do the required tasks on time (Jenkins and Smith, 2021). Having the freedom to attend medical appointments, watch your children's basketball game, or take your elderly parents shopping can help to reduce the load. When an employer provides employees this level of independence, it develops trust and increases job happiness (Hamouche, 2021). 4. Price- Cutting It might be costly to drive to work. Travel expenses, accommodation, lunch, coffee and snacks, birthday cakes, buddy gifts, work apparel (Shepherd- Banigan et al., 2016). The list goes on and on. Some firms even provide an allowance for refreshments or clothing as a perk. Working from home saves money on these costs, which could also add up quickly. This means you'll have more money to spend on things, that's always a positive idea (Borkovich and Skovira, 2020; Singh and Kumar, 2020). 5. Location and Save time A remote work allows employees to manage their own agendas in addition to saving time on commuting (OWIWI: 2016). Remote working also saves time getting to and attending meetings because modern technology allows teams to video contact each other over the intranet. People are not required to live in a city that does not meet their standards or preferences, you can work from anywhere in the global as far as you have a good internet connection (Lott and Abendroth, 2019). b). Working from home's Digital: Negative experiences There are some limitations to working from home, most of them apply to all those who work at home full-time rather than part-time: 1. Working from home isn't ideal for everyone: Working from home isn't for everyone's personality or skill set (Shetty, 2021). 2. Staff feeling isolated: Individuals who work from home may experience true detachment from their coworkers and the organization that an office atmosphere provides. People that work from home may not feel as separated from their colleagues and the organization as those who work in an office do.3. Home distractions: Although working from home removes workplace distractions, if a worker does not have a sufficiently quiet dedicated working space at home, they may be distracted by domestic noises or other members of their community. Issues with employee development You might find that not maintaining your employees at a near distance makes it harder to keep them developing and improving their abilities (Perrigino and Raveendhran, 2020). You might, however, encourage employees to participate in online events and programs to gain new skills. To get started, use our Events Finder. Harmful to one's mental health, Broadband speeds are slow, not

all jobs are suitable for working, and Morale among employees has dropped (Colville and Murphy, 2006)

3. RESEARCH METHODOLOGY

This study was focused on secondary data with support from reviewed papers, articles, blogs, websites, journals, textbooks, and government documents that contained information about the impact of the pandemic on HRM and WFH activities in various firms around the world the data was gathered utilizing a well-designed survey questionnaire that was put online for various HRM experts and work professionals to submit their thoughts on the influence of a pandemic on the work culture and the adoption of WFH policies. The web users who agreed to participate in the study were chosen based on their willingness to answer several questions about the study's topic. data were obtained from secondary sources such as journals, textbooks, and government documents that contained information about the impact of the pandemic on HRM and WFH activities in various firms around the world.

4. CONCLUSION

COVID-19 has affected the lives of many people, in a technologically gifted era such as this, working from home (WFH) is now a reality. The primary findings have shown that most of them are reasonably satisfied with their present working from home (WFH) arrangement. Additionally, challenges such as general anxiety about the COVID-19 pandemic and social isolation from fellow employees have also been highlighted.

REFERENCES

AL HARTHY, R &WIGLEY, T (2020). Covid-19: Employment update – Issues to consider in Oman.

Birkinshaw, J., Cohen, J., & Stach, P. (2020, August). Knowledge Workers Are More Productivefrom Home. Harvard Business Review.

Choudhury, P., Foroughi, C., & Larson, B. (2020). Work-from-anywhere: The Productivity effects of geographic flexibility. Strategic Management Journal, online.

Dockery, M., and Bawa, S. (2020). Working from home in the COVID-19 lockdown. NCVER'sInternational Tertiary Education Research Database.

Gajendran, R. S., and D. A. Harrison. 2007. "The Good, the Bad, and the Unknown About Telecommuting: Meta-Analysis of Psychological Mediators and Individual Consequences." The Journal of Applied Psychology 92 (6): 1524–

1541.doi:10.1037/0021- 9010.92.6.1524. [Crossref], [Web of Science ®], [Google Scholar]

Gigauri, I. (2020). Effects of Covid-19 on Human Resource Management from the Perspective of Digitalization and Work-Life-Balance. International Journal of Innovative Technologies in Economy, 4(31). https://doi.org/10.31435/rsglobal_ijite/30092020/7148

Kalogiannidis, S., & Chatzitheodoridis, F. (2021). Impact of Covid-19 in the European Start-ups Business and the Idea to Re-energise the Economy. International Journal of Financial Research, 12(2), 55. https://doi.org/10.5430/ijfr.v12n2p55

Mello, J. A. 2007. "Managing Telework Programs Effectively." Employee Responsibilities and Rights Journal 19 (4): 247–261. doi:10.1007/s10672-007-9051-1. [Crossref], [Google Scholar]

Messenger, J. C., and L. Gschwind. 2016. "Three Generations of Telework: New ICTs and the (r)Evolution from Home Office to Virtual Office." New Technology, Work and Employment 31 (3): 195–208. doi:10.1111/ntwe.12073. [Crossref], [Web of Science ®], [Google Scholar]

Nutsubidze, N., and Schmidt, D. A. (2021). Rethinking the role of HRM during COVID-19 pandemic era: case of Kuwait. RSEP 6, 1–12.

Robertson, M. M., W. S. Maynard, and J. R. McDevitt. 2003. "Telecommuting: Managing the Safety of Workers in Home Office Environments." Professional Safety 48 (4): 30–36. [Google Scholar]

SANDEEP, S (2020), Job cuts on anvil: small, medium retailers may layoff this many employeesas Covid-19 kills liquidity, Financial Express.

Savi, D. (2020). COVID-19 and work from home: digital transformation of the workforce. GreyJ. 16, 101–104.

Shetty, P. (2021). The Impact of COVID-19 in the Indian Tourism and Hospitality Industry: BriefReport. Journal of Tourism & Hospitality, 10(456), 1–7.

DEVELOPMENT OF FLOOR RESPONSE SPECTRA FOR RC BUILDINGS WITH DIFFERENT PLAN SHAPES

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Previous earthquakes have clearly demonstrated that there is considerable failure ofoperational and functional equipments in buildings. This paper deals with the effect of planshapes on Peak Floor accelerations(PFA) of buildings. The accelerations data is important forthe seismic safety of non-structural elements (NSEs) as these are the input at the base of NSEsjust like the ground accelerations are input at the base of buildings. Three seven story RCbuildings having T and L shaped plans were subjected to fourteen recorded earthquakeground motion for performing Time history analysis. Floor response spectra and mode shapeshave been compared for all the buildings. It was observed that there is considerable amount ofacceleration in the higher modes especially in the lower stories. From this study it can beidentified that NSEs need to be protected not only in strong earthquakes but also in the case oflow moderate earthquakes.

1. INTRODUCTION

Buildings' structural configuration is critical for their seismic performance. The overall geometry, structural systems, and load routes are all essential factors that influence the seismic configuration of buildings. During earthquake shaking, buildings oscillate and inertia forces are mobilized. These forces then travel through several courses, known as load paths, through various structural parts before being delivered to the soil via the foundation. The overall geometry of the building, which includes (a) plan form, (b) plan aspect ratio, and (c) slenderness ratio, has a significant impact on the generation of forces based on basic oscillatory motion and the final transfer of force through the foundation.To satisfy the architectural demand of the buildings they are more often designed irregular. The response of any building depends on the arrangement and type of structural elements in it. The major things affecting the response as a whole is the configuration of the structure. In this review we focus only on the acceleration response of a building due to variation in the configuration of a structure. When a building is subjected to ground motion the resultant acceleration is different at its various floor levels and the acceleration at a particular floor is the input at the base of non-structural elements (NSEs) mounted on that floor just like the earthquake ground acceleration is input at the base of the building. Thus, by this we can conclude that identical NSEs kept on different floor levels experience different acceleration at their base, so the study of output acceleration at various floor levels is very important for the safe design of NSEs. NSEs are basically classified into three types, namely 1) Acceleration sensitive, 2) Displacement sensitive 3) Acceleration and displacement sensitive.Acceleration sensitive NSEs oscillate during earthquake shaking and if they are not properly localized in a building, then it

could lead to its damage which in turn would risk the life of the occupants in the building. Thus, its necessary to study the acceleration response of the buildings.

2. LITERATURE REVIEW

Previous earthquakes have shown that there is significant damage to the operational equipments of the structure. There are several cases when there is minimum loss to the structure but the critical equipments have undergone irreparable damage. In USA, the economic loss due to the earthquake failure of non-structuralcomponents(NSEs) is alone US$2-0-4.5 billions per year over the last three decades[ATC 69,2008;Kircher ,2003]. Equipment failure especially in critical lifeline structures such as hospitals, fire stations can critically affect the performance and also put the life of patients in severe danger in the hospitals. During 1994 Northridge earthquake in California, several major hospitals had to be evacuated, not only because of structural damage, but due to the failure of emergency power systems, air control units, false ceilings and light fixtures. In Canada, the 1988 Saguenay earthquake, strongest event in eastern North America recorded within the last 50 years, caused very little structural damage. It has been a proven fact that majority of injuries, damage of properties and the economic losses were caused by the failure of operational and functional components (OFC) in the buildings. Recently it was the SIKKIM earthquake which exposed the seismic vulnerability of NSCs mounted on hill side buildings and this event led to significant damage of equipments of hospital buildings, thus disrupting medical services. In some cases, the economic losses due to the failure of NSCs has even exceed the total replacement cost of the building, given that the losses connected to the damaged inventory and business interruption (downtime loss) are accounted for.

Structural system and the height of a building critically govern a floor acceleration response under earthquake shaking. In general, proximity of fundamental natural period of a building (governed by the magnitude and distribution of mass and stiffness in the building) to the dominant frequencies carried by the earthquake ground motion largely govern the acceleration response at any floor level in the building. For a total of 6 buildings, consisting of 5, 10 and 15-story frame buildings floor response spectra was established. Fifteen artificial recorded earthquake ground motion are used for analysis of all the above buildings. The amplification of floor spectral acceleration is maximum at the roof level. The amplification decreases gradually going from the roof level to the first storey level. Floor to floor amplification of spectral accelerations are more pronounced in low-rise buildings. The spectra for different floors tend to approach each other as buildings become taller. Therefore, Height plays an important role in controlling fundamental natural period and fundamental natural mode shape of buildings. (M.Saaticoglu,2005).For key buildings and vital systems, earthquake design of non-structural elements is critical. Seismic design used to be primarily concerned with the design of structural elements. Seismic codes incorporated design provisions for non-structural elements when progress was made in seismic safety of primary structures and failures of non-structural parts were documented in previous earthquakes. This research looked at the evolution of codal provisions. Different seismic codes' design philosophy and provisions were examined, as well as the design lateral force recommended in these codes. Most of these codes include a simplified approach for calculating design seismic force, which is based on the reaction of the supporting building, the size and weight of

the element, the element's relative location in the building, and the component's flexibility.Non-structural items should be constructed for far greater seismic coefficient values than the supporting building, according to most codes. Displacement-sensitive non-structural items are likewise covered under the International Building Code. For critical and harmful non-structural elements, most codes also propose using the floor response spectrum. The requirements recommended here need to be changed in the Indian standard because they do not consider aspects that influence the behaviour of non-structural elements. (Sudhir Jain,2005).

3. RESEARCH METHODOLOGY

In the present study a set of moment resisting frame building with different plan forms i.e. L-shaped and T-shaped is studied as shown in the (fig 1-fig 2). The effect of near field earthquakes on the peak floor accelerationis studied on the above buildings.

The story height is set to 3.2m for all the story. Three-dimensional structural models of the considered buildings are created in a finite element software package ETABS 2017. Beams, columns are modelled using frame elements while the slab is modelled as flexible diaphragms. The cracked section properties of the beams and columns are taken according to Indian standardsIS1893(Part1):2016. For beams and columns, the effective section rigidity is taken as 35% and 70% of the gross section rigidity respectively. Buildings are analyzed and designed as special moment resisting frame with Response Reduction factor (R=5) for Seismic Zone V on soil type II (medium stiff) according to IS1893 part 1. Importance factor is taken as 1.5 for all the considered buildings. Rayleigh Damping is taken to be 5%.Dead Loads and Live loads are considered according to IS 875 Part1 and IS 875 Part 2 respectively. Dead Load consists of slab weight and the floor finish load of $1.5Kn/m^2$. Live load is taken to be $3Kn/m^2$. To investigate floor response of the considered structural models, bi-directional linear Time history analysis has been performed by using suite of 14 near field ground motion records as identified by FEMA P695.
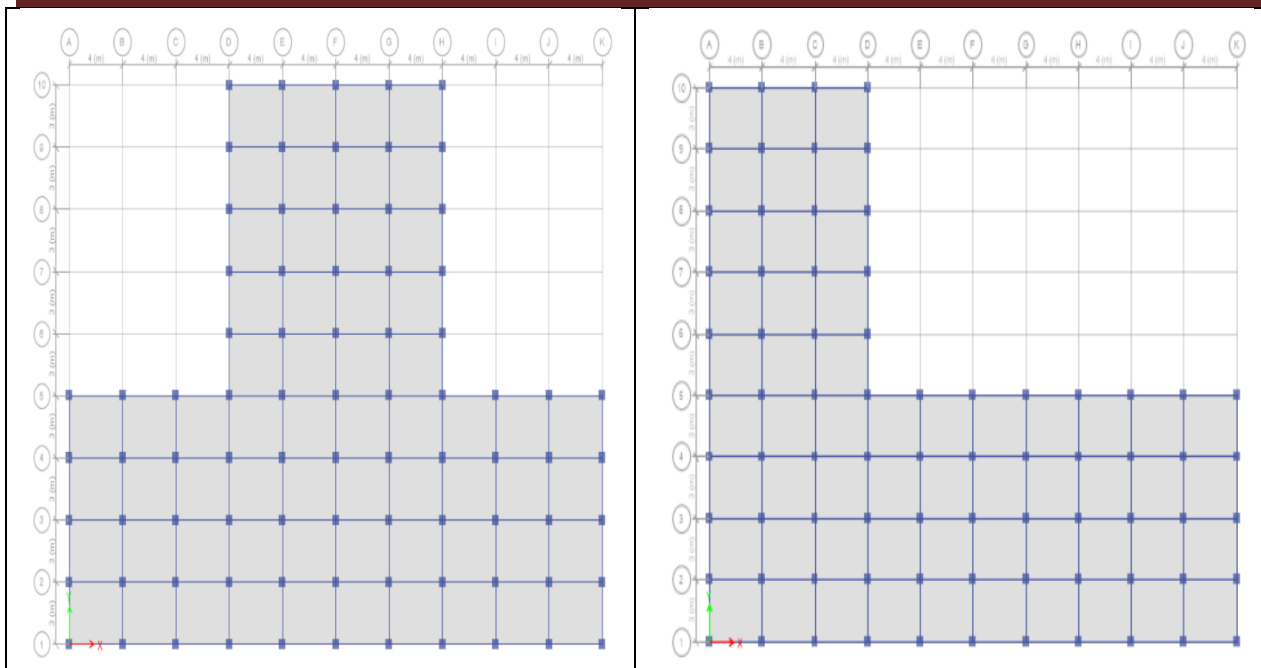
Figure1:- Plan of T and L-Shaped building

The peak floor accelerations obtained after performing time history analysis is shown in the table below:-

Storey No	PFA(X-Direction) T shaped(m/sec²)	PFA(Y-Direction) T shaped(m/sec²)	PFA(X-Direction) L shaped(m/sec²)	PFA(Y-Direction) L shaped(m/sec²)
	Table 1:-Peak floor accelerations (PFA) in X and Y directions for T and L shaped buildings			
7	7.92	9.43	10.33	13.42
6	7.41	7.99	6.63	12.04
5	7.54	7.51	6.69	9.99
4	5.58	7.47	8.42	10.34
3	6.36	6.6	12.88	10.99
2	6.63	6.26	7.62	9.52
1	4.69	5.64	3.84	5.98

Figure 2:-PFA vs Storey Number for T-shaped building

Figure 3:-PFA vs Storey Number for L-shaped building

4. CONCLUSIONS

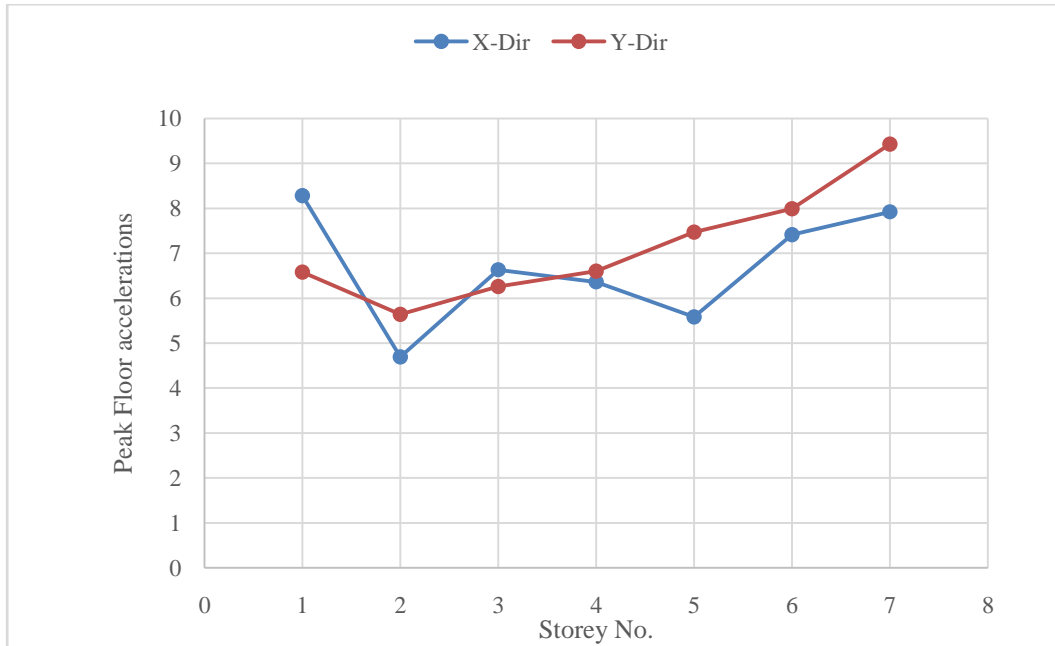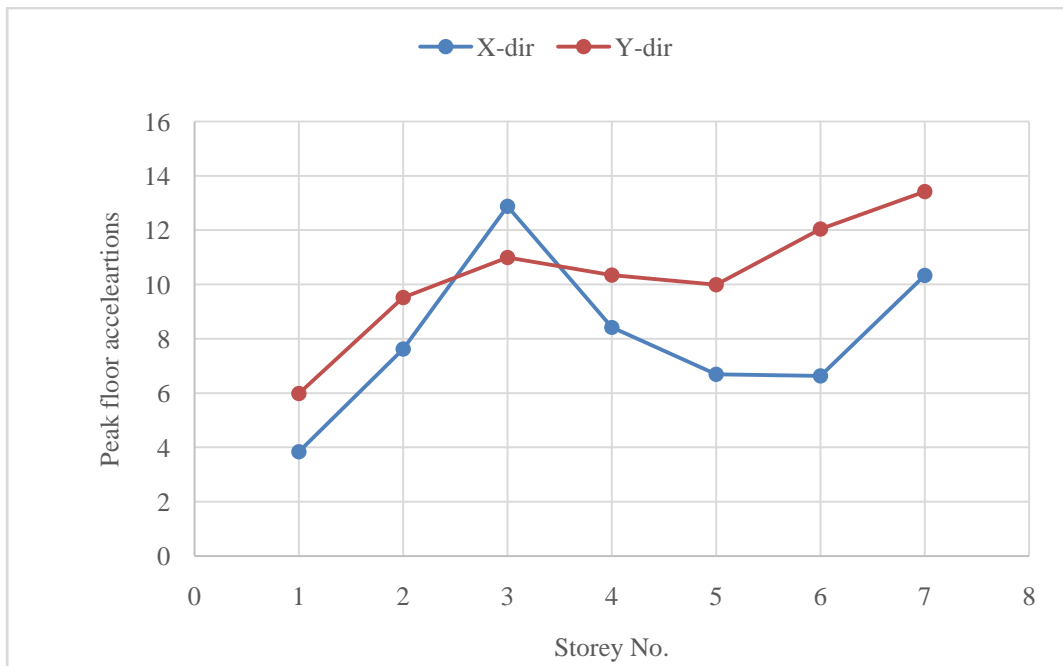In the present paper the attention is paid to the seismic assessment of the non-structural elements in a building. In particular Floor response spectra approach is used to assess the seismic demand of NSEs.Indeed having the knowledge of floor accelerations can help us in best localization of our non-structural elements.The results of Time history analysis on two different buildings namely T and L-shaped buildings is presented. It was worth noting that the first few modes of oscillation in T-shaped building was torsion along with translation in both x and y- directions whereas in L-shaped building the first two modes were pure translational and the third mode observed was the torsional mode. One of the main outcomes of this study is the vulnerability of the NSEs with the short vibration periods (close to the higher modes of the structure) especially when they are located at the lower floors. This contribution of higher modes in the lower floors is more prominent in the L-shaped building rather than the T-shaped building.

The study of PFA becomes important in case of free standing objects to prevent them from overturning or rocking conditions. On the basis of these results, charts are proposed in thispaper as the operational and effective tools for the large-scale seismic vulnerabilityassessment of simply supported objects located inside a building.These charts would allow the designer to evaluate the stability conditions against rockingand overturning, using very limited number of information about the geometryof the object, its placement inside the building and the seismicityof the site. These charts can be used for example to obtain the minimadimensions of the support base of an object, as well as to identify thebest location inside the building to increase its safety, with respect toboth rocking and overturning conditions. The particular features of the valuable NSEs imply that even a small damage may cause significative losses, so making often the rocking occurrence the mostcritical phenomenon.

REFERENCES

Foo,Naumoski,Saatcioglua andShooshtari.(2008) *'' Development of floor design spectra for operational and functional components of concrete buildings in Canada''*, *The 14thWorld Conference on Earthquake Engineering October 12-17, 2008, Beijing, China*

Jain K,Mondal. (2005) "Design of non-structural elements for buildings: A review of codal provisions", *The Indian Concrete Journal August 2005.*

Goswami,Kumar,Murty, Vijayanarayanan,, V. Mehta, "Introduction *to* Earthquake Protection of Non-Structural Elements in Buildings" *Gujarat State Disaster Management Authority, September 2012.*

IS 1893 (Part 1), 2016, Criteria for earthquake resistant design of buildings, Bureau of Indian standards,New Delhi

CAN TECHNOLOGICAL INTERVENTIONS LIKE INSTRUCTOR-CREATED VIDEOS HELP STUDENTS SUCCEED IN MATH?

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In this yearlongexperiment, two groups of minority students were randomly selected from the overall population of more than 300 students enrolled in a gateway course called "College Algebra." The selected groups (labeled C for Control, $n = 53$ and E for Experimental, $n = 37$) had the same instructor, lectures, web-based assignments, curriculum-linked videos, study sessions, and assessments. However, the E Groupwas required to take notes on three *instructor-created videos*, each of which focused on difficult problem typesthat would appear on three subsequent tests.

Analysis showed that overall success increased in mathematics when students were supported by the technology of *instructor-created videos*. Although students in both groupsviewed common*WebAssign*®curriculum-imbedded videos while working on their homework, the *instructor-createdvideos* resulted in a significant difference between the E and C groups' achievement.

Evidence-based data and analysis in this report includes:

- Descriptive measures (mean, median, mode, interquartile range, standard deviations), and Boxplotsof both group's scores on all three tests
- *p*-values using the *t*-distributions to see if a video made a significant difference in E group's test scores on all three exams
- The Pearsoncoefficient *r* and correlation coefficient r^2 for the three E group tests, followed by scatter plots with regression models to identify relationships between videosand the associated subsequent tests
- To examine self-confidence, the number of questions attempted vs. unanswered on C and E final exams
- E group's written responses to a survey tool, classified into four positive and one negative category

Analysis supported the conclusion thatinstructor-created videos* empowered students to understand mathematical content and improved their self-confidence, which resulted in higher student achievement.

Keywords: Instructor-created videos, Mathematics curriculum, self-confidence, minority education

1. INTRODUCTION AND LITERATURE REVIEW

Students at historically black colleges and universities (HBCUs) tend to arrive on campus with significant skill deficits in mathematics and usually need remedial work. Aside from taking one mandatory prerequisite course when they first enroll in classes, students are expected afterwards to close any remaining skill gaps on their own. Low self-confidence due to past failures in math and the cultural pressure to appear self-sufficient often inhibit this expectation and instead cause many students to believe they are incapable of succeeding in math. Rather than trying toachieve, they fall into a cycle of continued failure by exhibiting behaviors that guarantee they will fail. Educators have identified several factors contributing to this unproductiveprogression. As early as 1997, Steele found "minorities tend to develop a perception of their ability, intellectual performance, and identity of self based on stereotypes."According to Johnson (2000), that stereotypeis that they will perform poorly in math. African American males, in particular, present well documented self-defeating behaviors such as "showing off what they were expected to learn and be like – i.e. talking and 'holding the floor'- rather than trying to develop the quality, deeper conceptualized understandings of mathematics" that their teachers were trying to foster during the class (Martin, 2000; Murrell, 1995).

The result of these external and self-inflicted expectations is that minority students are often subjected to basic skills instruction in math, and because memorization of shallow, unconnected steps is unsustainable, they end up lacking confidence in their own ability to thinkmathematically (Ridlon, 2009, 2013). However, working with minorities, Mulat and Arcavi (2009) report that success in mathematics learning can shift by exposure to new ways of thinking about math … low-achieving minorities can see their success and failure as attributable to self-controllable (e.g. fostered self-regulation) rather than uncontrollable external factors (e.g. their instructor). This realization helped students take responsibility for their own learning and invest in their studies.

The implications for classroom practice at the university level are significant. In their research, Swigart and Murrell (2001) found that minority students in community college were encouraged to exert greater quality of effort when instructors used computer technology to establish communication and interaction between faculty members and students. Technology that promotes "active learning" (such as when students watch videos and are required to respond by taking notes or doing problems on their own) is not just the latest academic fad – on the contrary, active learning is a well-tested approach (Mills, 2012). Swigart and Murrell found such instructional strategies resulted in greater gains in learning. They point out that these strategies are especially important for first-generation college students in the absence of role models who can help these students understand their own responsibility for learning and development – a situation typical for the minority student body at an HBCU.

In this investigation, the impact of using *instructor-created videos* was examined. This technological intervention is supported by the work of Abbasian and Sieben (2016), who focused on the merits and shortcomings of using instructional videos in mathematics teaching, especially in light of the recent endorsement of flipped learning classroom models. They found videos had many positive impacts on student achievement. In addition, in a study of Irish classrooms by Ahmad and his colleagues (2013) discovered that students felt instructor-made mathematics videos were an advantage in their learning

experience. "Ten primary benefits of videos emerged, namely allowing flexible and personalized learning, supplementing lectures and enhancing understanding of key skills, facilitating exam revision and material review, providing multimodal support for learning, providing a tighter match with course content, delivering a vicarious learning experience, self-efficacy, serving as a memory aid, filling gaps in class notes, and making math more enjoyable. The findings support the use of videos in facilitating and enhancing students' learning of mathematics in higher education."

2. EXPERIMENTAL DESIGN

In this yearlong experiment, two groups of minority students a historically black college (HBCU) were randomly selected from the overall population of more than 300 students enrolled in a gateway course called "College Algebra." Students randomly self-enrolled in sections of this course offered over in a variety of times of day. Two sections of the course were chosen each semester and students became the Control (C, $n = 53$) or Experimental (E, $n = 37$) group. Both groups of students attended a typical 3-day-a-week 50-minute lecture with the same instructor, studied the same curriculum, had common online assignmentswith access to videos (on *WebAssign*®), and were required to attend a Math Lab staffed with peer tutorsfor two hours per week. Student achievement was measured by identical assessments (quizzes and tests). However, the E Group was required to take notes on the technological intervention of three *instructor-created videos*, each of which focused on difficult problem types that would appear on three subsequent tests. The C group had no access to these videos.

The three instructor-created videos were on the topics of:(1) interest earned at maturity on two deposit accounts having different rates,(2) solving non-linear functions, and (3) graphing piecewise functions. Students in both groups were initially introduced to each of these problem scenarios during routine lectures, and were subsequently required to solve multiple versions of each type on homework assignments. They also had questions on each topic on low-stakes formative quizzes. Yet, in spite of repeated chances to practice, these three kinds of "application word problems" were frequently solved incorrectly or left unanswered on summative chapter tests.

To make a video, a carefully designed PowerPoint presentation of $7 - 8$ slides was prepared. The slides began with clear instructions about the problem type, including reading the question aloud to identify what was given and what was unknown, followed bya short discussion about how to select the appropriate formula or strategy for solving that particular type of problem. Then the given problem was worked step-by-step (with each step animated to "fly in" after an explanation), until the final solution was reached. After completing the problem, students were shown a second challenge question to solve on their own, with the answer provided.

The slide presentationswere converted to video on Screencast-o-matic, a free website that allows recordings of up to 15 minutes. However, the videos were more than a static display. Each slidewas accompanied by audio, and students were consistently asked to pause the program and complete a step before pressing "play" to watch the animation thatrevealed the answer. This process encouraged them

to see if they could do the math independently and correctly (rather than copying the instructor) in a non-threatening and private environment. Screencast-o-matic allowed the judicious addition of calming (not distracting) background music. The result was an mp4 file of a size that was easily compatible with most platforms and machines.

The videos were uploaded onto the university course LMS site (*Canvas*®) a week before that question-type would be assessed on a test. Students were required to take notes and turn them in for a homework grade the day before the test. As with any mp4 file, students could pause, stop, rewind, or fast-forward at their own discretion as they took notes. A scoring guide was created to grade video notes, and this guide was sharedwith students prior to the onset of the first video.When students'graded video notes were returned to them, the scoring guide was stapled to their paper.

3. RESULTS, ANALYSIS, AND DISCUSSION

Descriptive measures (mean, median, mode, interquartile range, standard deviations) from numerical data on thethree exams of both groups are shown in the following Table:

Table 1: Descriptive Measures										
		Mean	Med	Range	SD		Mean	Med	Range	SD
Test 1	**C**	31.8	21.5	96.5	27.1	**E**	34.2	31.0	87.5	24.0
Test 2	**C**	37.7	30.8	105	31.8	**E**	40.2	47.0	88.5	27.6
Test 3	**C**	49.4	52.9	100	32.7	**E**	55.2	60.0	93.5	27.7

Analysis of these measures yields several observations. First, the mean and median score on the tests increased with each sequential exam. This increase might be attributed to the fact that failing students tended to withdraw from the course as time progressed. Therefore, during each successive test only the more successful students remained, leading to higher overall scores (sadly, the mean still lingered at "failing"). Second, measures of dispersion (range and standard deviation) are very large for all three tests. These results illustrated the great diversity of student skill levels in College Algebra. As discussed in the introductory background section of this paper, many minority students arrive at HBCUsill prepared in mathematics, whereas a small proportionwere ready to begin at the college level.

Boxplots representing the C and E group scores for all three tests are shown in Figure 1. Theseplotsdemonstrate that scores in the E group had less dispersion (clustered closer together) than scores in the C group. On all three tests, there was a minimum score near zero and high scores at 100 for both groups. However, 50% of E scores – the IQR box of the plot – were not only more closely cropped, but alsogathered at higher levels than C scores. It is meaningful to note that the only difference in the curriculum to prepare for these three tests was the E group's requirement to take notes on the instructor-created video forone problem-type that would be on the subsequent test. (Each test contained 11 -12 different kinds of problems.)
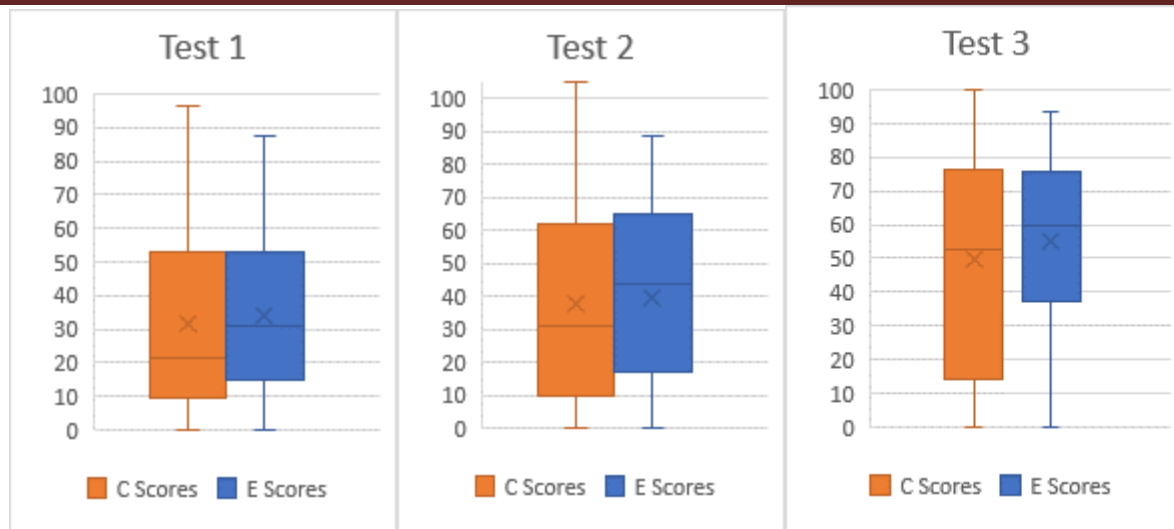
Figure 1: Boxplots of Tests

It is safe to assume the whole population taking College Algebra has a normal distribution of exam scores, and that population variances for exam scores are equal for all students enrolled in the course. As the samples of students were randomly selected (students randomly enrolled into any section of College Algebra), it is possible to use Central Limit Theorem. The two samples are independent. The student *t*-distribution *p*-value and other measures are shownin Table 2. A significancelevel of 0.10 (10%) was used, with μ_1 = C mean and μ_2 = E mean.

	p-value for $\mu_1 \neq \mu_2$	Pearson coefficient *r*	Correlation coefficient r^2	Regression Model
Test 1	0.671	0.2894	0.0837	$y = 0.5314x + 29.118$
Test 2	0.356	0.5659	0.3202	$y = 1.8531x + 16.277$
Test 3	0.228	0.5440	0.2959	$y = 1.6712x + 37.578$

Table 2: Statistical Measures

The analysis found *p*-values for Test 1, Test 2, and Test 3 were larger than the 0.10 significance level, meaning that there was not sufficient evidence to state that the mean test scores of the C and E were different. However, the *p*-value got smaller with each successive test, showing that the difference in mean test scores was becoming more significant as the semester progressed.

Further analysis examined the relationship (correlation) between the two variables *x*, the video score (the independent or explanatory variable) and *y,* the test score (the dependent or response variable). The Pearson coefficient *r* determines the strength of a linear relationship with a value of $-1 \leq r \leq 1$ (-1 signifying the strongest negative relationship with one variable going up as the other goes down, and +1 the strongest positive relationship with both variables going up or down). The correlation coefficient r^2 is the measure of the proportion of variation in the response variable that can be <u>associated</u> with the variation in the explanatory variable. All test *r*-values were positive, meaning that as homework scores for watching videos increased, a student's overall test grade also increased. This relationship became

stronger with time. The positive r^2obtained for each testshowed that after Test 1, associations became stronger (near 30%) as remaining students were committed to passing the course. For each of the three tests, r was sufficiently significant to justify creating scatter plots with regression models (see Figure 2).

Graph 2: Video and Test 1 Scores

$y = 0.5314x + 29.118$

Graph 3: Video and Test 2 Scores

$y = 1.8531x + 16.277$

Graph 4: Video and Test 3 Scores
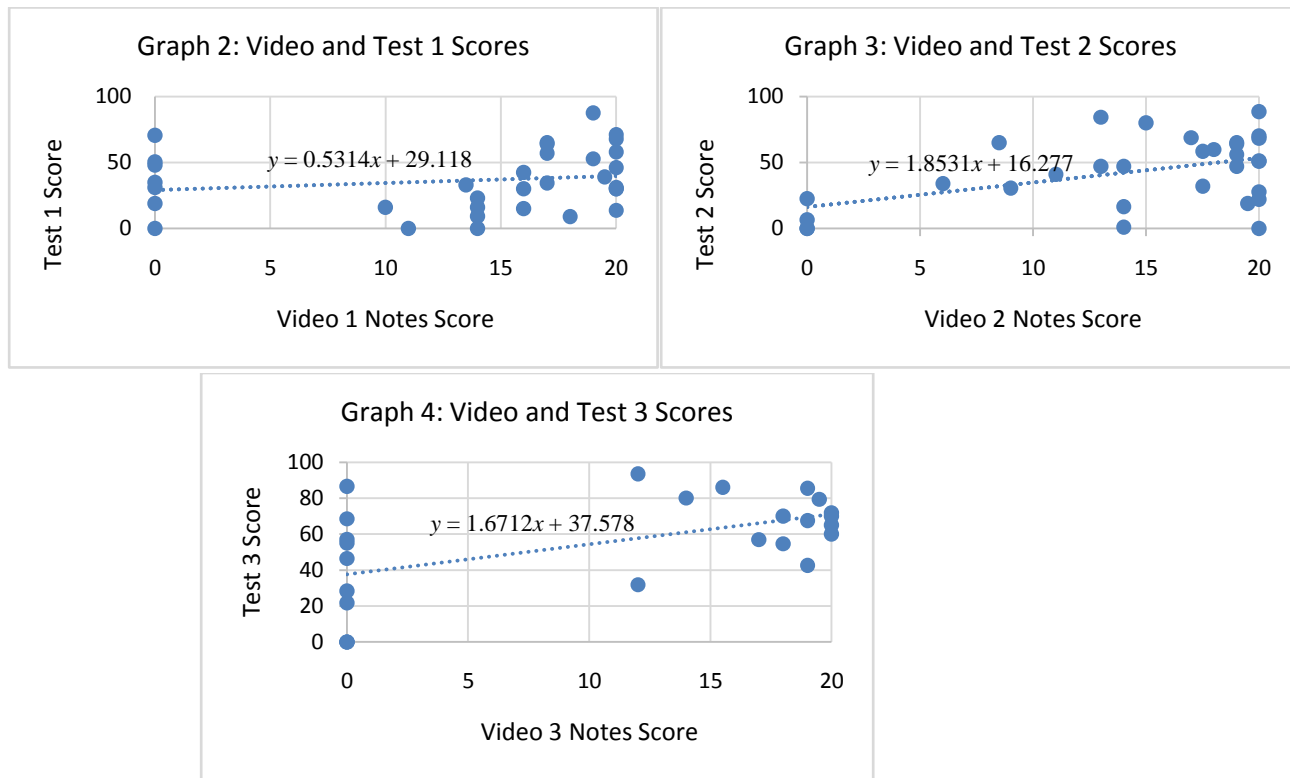
$y = 1.6712x + 37.578$

Figure 2: Scatter Plots with Linear Regression Models

Graphs 2, 3, and 4(see Figure 2) showed a positive relationship (positive slope) existed: in other words, getting a higher score on the instructor-created video notes meant students got a higher score on the test associated with that video. This positive effect occurred in spite of the fact only one problem type out of $11 - 12$ questions on a test was related to that video. Other advantages must have led to students' overall testing success, so a measure of self-confidence was explored to search for possibleexplanations of this positive outcome.

Research by Ahmad (2013) found that students felt instructor-made mathematics videos had a positive effect on self-efficacy. Thus, to examine the impact on self-confidence for the minority students at this HBCU, the number of test questions attempted vs. no answer (left blank or unanswered) for the C and E groups'final exams were analyzed.(See Table 3). The Final Exam was comprehensive and contained 25 questions. By the end of the course, if a student felt they "knew anything," they tended to exhibit thatconfidence by attempting a solution, even if they just identified a formula or cited relevant information given in the problem scenario. However, when a student lacked self-confidence, they were inclined to skip the problem and leave it blank. Only completely blank questions were categorized as "Unanswered" in computing the results in Table 3. Note that the size of the samples, n, decreased because 43% of students had "withdrawn" from College Algebra by the date of the Final Exam and were

no longer enrolled in the course. That percentage is typical and ranges from 35% – 65% when all sections of College Algebra from the past decade from this HBCU are included.

Table 3: Unanswered Questions on the Final Exam			
Group	**Mean # Unanswered**	**Range**	**Sample Std. Deviation**
C (n = 23)	μ_1 = 3.434783	0 – 13	3.702899
E (n = 16)	μ_2 = 2.066667	0 – 7	2.379601
Total (n = 39)	For $\mu_1 > \mu_2$: 2-Sample t-test: p = 0.0844		

As described previously, it is possible to use Central Limit Theorem and the student's t-distribution to determineif there was a significant difference in the mean number of unanswered questions on the groups' Final Exams. At a significance level α of 10%, $p \leq \alpha$. Thus, the number of unanswered questions on the C final examsis significantly higher than the number of unanswered questions on the E group's final exams.

Written student comments in response to an open-ended survey tool yielded feedback that showed hearing their own teacher in a video helped students understand more material than was possible from viewing the standardcurriculum-based (*WebAssign*®) video. The E Group volunteered comparisons of the two video types. Excerpts of students' responses to a survey toolare grouped into five categories (four positive and one negative).

Table 4: Group E Student Feedback on Videos			
Category	**Example 1**	**Example 2**	**Example 3**
<u>Positive</u>: Enhanced Understanding of Content	Every video I watched has helped me on the test.	The videos were definitely a help when it came to taking exams and the final. I feel that it was broken down nicely and concisely so that someone can follow along without getting confused.	Unlike the videos on webassign, the videos [my instructor] made were very clear and direct, and it helped me on my exams.
<u>Positive</u>: Matched Teaching Style	Helped because of [my instructor's] explaining and teaching… videos on web assign have a different teaching style.	The videos have a big difference - sometimes the Webassign videos skip explaining in-between steps (they think we automatically know how to do it), when sometimes we don't. [My instructor] makes sure she goes through everything step	The videos gave me a detailed explanation of <u>why</u> we were doing what we were doing in class so it matched the paper and the test.

			by step as if she was teaching us.	
Positive: Matched Learning Style	I am a visual learner so I like to see the problems being worked out in front of me in a video.	The videos helped me to feel more confident on answering that specific type of question.	Being able to record the steps taken on paper and write them out or explain them while you watch a video shows that you've learned and understand what you're doing.
Positive: Like to Use Technology	I prefer the technology way when I need extra help rather than paper and pencil.	Technology (watching videos and taking notes) should be required in a math course because you are able to rewatch videos if you are having a hard time understanding, as well as pausing it.	I enjoy watching the video after doing it in class.
Negative: Suggestions for Change	I would change the video by giving more practice examples at the end, a minimum of two, just to be sure that the problem type is well understood.	I know it may be a lot of work to make, but I do believe that it helped a lot of students, and having 2 videos per exam would be wonderful.	Something that should happen with the videos is more than one example to make sure that the student can do the question independently.

4. CONCLUSIONS

One important result of this study was that E group earned higher test scores than the C group. This inference was supported bydescriptive measures and boxplots. Statistical analysis yielded a relationship between watching a video and scores on a subsequent test. In fact, the three regression models and scatter plotsshowed that the higher a student scored on video notes, the higher they would achieve on the test associated with that video. This positive effect occurred in spite of the fact only one problem type out of 11 – 12 questions on a test was examined on a video. Because the only difference in the instruction between the C and E groups was the requirement to take notes on the instructor-created video to prepare the subsequent test, these findings imply that the videos had a significant positive effect on overall student success, not just on the one problem-type.

Furthermore, the number of unanswered questions on the C group's final exams was significantly higher than the number of unanswered questions on the E group's final exams. This observation points to the conclusion that students who watched the instructor-created videos felt more confident in

attempting *any* kind of problem by the end of the course. It appears E group had developed sufficient self-efficacy to believe in themselves and their ability to think mathematically.

Student feedback in response to the open-ended survey tool yielded comments that triangulated the results of measurable data. Instructor-created videos in mathematics were seen as helpful. In fact, the only negative comments were that students wanted <u>more</u>… more challenge problems on each video, and more videos altogether.

This study supports the hypothesis that *instructor-created videos* helped minority students at an HBCU close mathematical skill gaps on their own and improved their self-confidence, resulting in higher student achievement. Providing technology in in a non-threatening and private environment (and in a way that felt familiar) encouraged students to learn math independently and correctly.

REFERENCES

Abbasian, R. O., & Sieben, J. T. (2016). Creating math videos: Comparing platforms and software. *Primus, 26*(2), 168-177. doi:https://doi.org/10.1080/10511970.2015.1047916

Ahmad, T. B. T., Doheny, F., Faherty, S., & Harding, N. (2013). How instructor-developed screencasts benefit college students' learning of maths: Insights from an Irish case study. *Malaysian Online Journal of Educational Technology, 1*(4), 12-25. Retrieved from https://www.proquest.com/scholarly-journals/how-instructor-developed-screencasts-benefit/docview/1773226675/se-2?accountid=14579

Johnson, D., Johnson, R., Stanne, M. (2000). *Cooperative learning methods: A meta analysis.* Minneapolis, Minn.: University of Minnesota. July 2005: http://www.clcrc.com/pages/cl-methods.html.2000

Martin, D. B. (2000). Mathematics success and failure among African-American youth: *The roles of sociohistorical context, community forces, school influence, and individual agency*. Mahwah, NJ: Erlbaum.

Mills, B. J. (2012). Active learning strategies in face-to-face courses. Manhattan, KS: The Idea Center. Mulat, Tiruwork, and Abraham Arcavi (2009). Success in Mathematics within a Challenged Minority: The case of the students of Ethiopian origin in Israel (SEO). *Educational Studies in Mathematics.*

Murrell, P. C. (1995). In search of responsive teaching for African-American Males: An investigation of students' experiences of middle school mathematics curriculum. *Journal of Negro Education, 63(4),* 556 – 569.

Ridlon, Candice L. (2009). Learning mathematics via a problem-centered approach: A two-year study. *Mathematical Thinking And Learning* 11(44), 188-225.

Ridlon, Candice L. (2013).   Can active instructional strategies help college-age minority students succeed in math? *Annual Meeting of the Modern Technology and Management Institute*; September 20-21, 2013: Virginia Beach, VA.Screencast-o-matic. Retrieved on May 19. 2022: https://screencast-o-matic.com/screen-recorder

Steele, C. (1997). A threat in the air: How stereotypes shape the intellectual identities and performance of women and African-Americans. *The American Psychologist, 52*, 613-629.

Swigart, T. E., & Murrell, P. H. (2001). Factors influencing estimates of gains made among African-American and Caucasian Community College students. *Community College Journal of Research and Practice, 25*, 297-312.

ADVANCE E-COMMERCE FARMER APMC PORTAL WITH CROP PREDICTION USING MACHINE LEARNING AND IBM WATSON CHATBOT

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Agriculture plays a major role in economics and survival of people in India. Adoption of internet technologies help in cost reduction and demand enhancement via e-commerce for food supply. It is important and a necessity for a farmer to get complete benefit from what he gives to the world for livelihood. The purpose of this system is to overcome what is lacking in the existing systems. Looking forward to, how farmers can earn the profit that agent does and on other hand how APMC can buy produce at fair price. This e-commerce portal (website) is integrated with IBM Watson chatbot and machine learning crop prediction features which will help farmer know what type of crop will be more suitable on basis of the weather condition, NPK values, temperature, humidity, rainfall, pH level. Random Forest, a supervised learning algorithm is used to achieve it.

Keywords: Agriculture, Crop prediction, E-commerce website, IBM Watson Chatbot, Machine learning, Random Forest, Supervised Learning.

1. INTRODUCTION

Agriculture is an important sector for Indian economy and also for human future (Kumar et al.,2020).. It is also considered a primary occupation and also one of the India's major industrial sectors (Kalimuthu et al.,2020). E-commerce can bring advancement in India's traditional method. It offers and alternative venue for promoting and marketing agricultural products that can help Indian products reach more of geographical areas and increase the business (Balkrishnan et al.,2018).In today's century everyone is familiar with e-commerce trading and also making it a part of life by using it. Electronic commerce known as e-commerce consists of buying, selling and exchanging of products, service and information via a computer network in a large geographical area. There are various reasons that helps e-commerce stand in India. As now-a-days every other person has busy schedule because of which shopping offline becomes challenging, here in they take help of e-commerce that helps them save time and shop their need. E-commerce being online it is 24x7 in use (Kalimuthu et al.,2020)..

When it comes to selling and buying of agriculture produce; food items then it becomes challenging to make it online because people believe in buying the best by market visit, so if the same fresh market is up online and with quick delivery then people might start trusting and using e-commerce for food items too. Not only successful implementation of e-commerce in the field of agricultural products can change the economic status of farmers, but common people and APMC's also will buy their essential commodities at a fair price-rate (Kalimuthu et al.,2020)..

The government has launched a website "Farmer's Portal" in two language English and Hindi. With respect to make available relevant information and services to the farming community regarding fertilizers, seeds, pesticides, etc. Government also distributes high quality seeds, pesticides, to produce high quality crops. But the main problem of poverty is still there in the Indian farming community. Because of selling their produce through intermediate distributors, they are not getting sufficient profit from their total produce, maximum profit goes to the middleman. Indian farmers who are staying in different parts of country doesn't know or doesn't have the contacts to APMC of different place, here they need to take help of agent that keeps a track of buying and selling the produce from farmer to APMC. Indian farmers face a lot of challenges in making decisions about which farming technique to opt for, and which crop should be selected for which climate. The agriculture sector directly affects the overall economic development of the country.

Looking after this, we have come up with an idea of e-commerce website that will allow farmers to sell their products directly to the APMC's instead of having a middleman. Agricultural Produce Market Committee (APMC) Yard / Regulated Market Committees (RMC) Yard is any place in the market area managed by a Market Committee, for the purpose of regulation of marketing of notified agricultural produce and livestock in physical, electronic, or other such mode. The website will also recommend the best crop for farmer's farm, will also provide information about the latest benefits by Government for famers, a guide for soil, crops will also be provided. With the help of online selling, farmers will be able to get the complete profit that is taken by middleman.

2. LITERATURE REVIEW

The authors have implemented a system to predict crop production from the collection of past data. Out of different machine learning techniques, they found Random Forest with best accuracy (Kumar et al.,2020).

Now-a-days, food production and prediction is getting depleted due to unnatural climatic changes, which will adversely affect the economy of farmers by getting a poor yield. So, the proposed system using Naïve Bayes Gaussian classifier with boosting algorithm is developed to predict the crop at high accuracy. Thus, the seed is predicted as an output for the given input parameter (Kalimuthu et al.,2020).

Proposed a crop recommendation system using Tkinter and after applying three different algorithms i.e., logistic regression, SVM and Random Forest Classifier, they found out that Random Forest

Classifier gave the best results and so the model has been made using the same. The model has then been incorporated with Tkinter which makes it a complete application which can directly be put to use without further updates required (Parikh et al.,2021).

E-commerce will be able to eliminate the role of the middleman for trading agri-production of farmers. They will be able to reach the customer directly and total profit will be obtained. Not only successful implementation of e-commerce in the field of agricultural products can change the economic status of farmers, but common people also will buy their essential commodities at a fair price-rate (Banerjee et al.,2018).

The authors proposed an effective recommendation system for fertilizers and crops based on NPK values and the region. The data sets include specific soil features that are collected for Warangal test area in the soil test laboratory, Warangal, Telangana State India. In addition, similar online general crop data sources were also used (Manjula et al.,2019).

The authors have proposed an innovative approach for smart agriculture using machine learning technique. The result shows that best accuracy for crop yield prediction is using the Random Forest algorithm. It is suitable for massive crop yield prediction in agricultural planning. This makes the farmers to take the right decision for right (SivaRao et al.,2021).

The authors state that e-commerce offers an alternative venue of promoting and marketing agricultural products that has a benefit of reaching extensive geographical populations and providing detailed product information at a relatively low cost. Markets may become more transparent. This paper concludes that transformation is about change and change creates winners and losers (Balkrishnan et al.,2018).

Table 1:Paper Comparison				
Attributes	**Datasets**	**Methodology**	**Accuracy**	**References**
Temperature,rainfall, humidity, PH	Kaggle website 3101 instance	RF, DF, NB	Random Forest algorithm	(Kumar et al.,2020)
Months, moisture, temperature,rainfall, humidity, PH	Different source	NB	Naïve Bayes classifier	(Kalimuth u et al.,2020)
NPK, temperature,rainfall, humidity, PH	Kaggle	Logistic Regression, SVM, RF,	Random Forest Classifier gave the best results	(Parikh et al.,2021)
Year, Crop, Area andProduction	Kaggle	(WEKA) J48, LAD Tree, LWL	IBK achieves highest accuracy	(Mishra et al.,2018).

		and IBK		

There are a few similar existing systems which we have surveyed, they are as follows:

Farmer Portal : Home Page (2015)

It is a government website that provides information and farming products. The government has launched a website "Farmer's Portal" in two language English and Hindi. With respect to make available relevant information and services to the farming community regarding fertilizers, seeds, pesticides, etc. Government also distributes high quality seeds, pesticides, to produce high quality crops.

Kisan Mandi- Online Agri Market India (2016)

It is an online veggie selling website where the things are sold directly to the Mandis according to the fixed kgs posted by farmer or the KisanMandi website. They also have fees for suppliers for registration. The booking of goods is done by calling the farmer so there is no online mode to do so.

eNam | Home (2016)

e-NAM facilitates better prices for a seller through transparent bidding, increased number of buyers from different markets , hence greater negotiation power. Via assaying, price commensurate to the quality of produce is obtained by the seller. They also have Traders here in.

farmersMandi | Digitising Indian Agriculture Supply Chain (Bengaluru)

They get the produce from farmers in bulk (stored in warehouse) and then sell it to customers.

famers - Google Play

Provides information about agri science, horticulture practices, fertilizer use to market rates. Progressive farmers check live mandi bhav on Krishi app to sell their produce; Weather forecast in this Indian agriculture apps helps farmer to plan after checking Mausam Poorvanuman on this khetikisani app. Krushi app is a community of active agri experts from Indian states like Uttar Pradesh, Madhya Pradesh, Rajasthan & Haryana agriculture departments.

3. PROPOSED SYSTEM

Every existing system has pros and cons. After going through papers and existing systems, we came through need of a website which is easy to use for famers as well as customer. By an e-commerce website we will be able to bridge the gap between farmers and the APMC's that means there will be no role of middleman (agent) which will help reduce the produce rates for customer and will let farmer earn the profit that agent does.

The objective of our proposed system is to provide complete benefit to farmer which is taken by agent, an e-commerce website with all needed benefits and services will be provided to farmers as well as the APMC and the system will be easy to use and also convenient for both the parties

3.1 Data Collection

For classification purpose many datasets are available, few can be found out on kaggle, data world, data gov, fao org. Kaggle is a subsidiary of Google which gives users a platform to get and publish data sets. Apart from this, it also allows the users to build models in an environment that is generally web-based and data-science oriented. Basically, it is a community for machine learning and data science. SVM, Random Forest, Logistic Regression, Linear Regression, XG boost, Decision Tree following supervised machine learning techniques can be used for building the model.

Figure 1: Analysis of dataset

3.2 Pre-processing Step

Pre-processing the data is an important and crucial step in machine learning, with this the data which is about to use gets clean and organized and becomes ready for building and training machine learning models.

3.3 Feature Extraction

The pre-processed data has been used. In this step, required feature (input) are being extracted. Features like weather details, nitrogen (N), phosphorus (P) and potassium (K), rainfall, pH are being extracted and used for model training.

3.4 Data Preparation and Building Models

For this, the data has been split into train and test dataset.We have applied different algorithms to the dataset and selected the best one as follows:

Machine learning is a method of analyzing data to automate the building of an analytical model. It is in fact a branch of AI as it is based on the concept of systems learning from data and identifying some

patterns to make decisions without much human intercession. We will be using machine learning to make our model capable of suggesting the optimum crop which can be sown by a farmer according to various input factors.

Supervised Learning:

Supervised learning (SL) is the machine learning task of learning a function that maps an input to an output based on example input-output pairs.

i. Decision Tree

Decision Trees (DTs) are a non-parametric supervised learning method used for classification and regression. The goal is to create a model that predicts the value of a target variable by learning simple decision rules inferred from the data features. A tree can be seen as a piecewise constant approximation.

ii. Random Forest

Random forest algorithm is one of the most famous and a widely used supervised learning technique. It contains a number of decision trees for different subsets of the data instead of working on the whole data as a single subset. This improves the accuracy of prediction of the model by several folds as it takes the average of predictions of all the trees and decides the final output on the basis of majority votes of the predictions. This makes it suitable even for the large and varied datasets as it can deliver results with high accuracy in very less amount of time.

iii. Naïve Bayes

Naive Bayes classifiers are a collection of classification algorithms based on Bayes' Theorem. It is not a single algorithm but a family of algorithms where all of them share a common principle, i.e. every pair of features being classified is independent of each other.

iv. XGBoost

XGBoost is a decision-tree-based ensemble Machine Learning algorithm that uses a gradient boosting framework. In prediction problems involving unstructured data (images, text, etc.) artificial neural networks tend to outperform all other algorithms or frameworks.
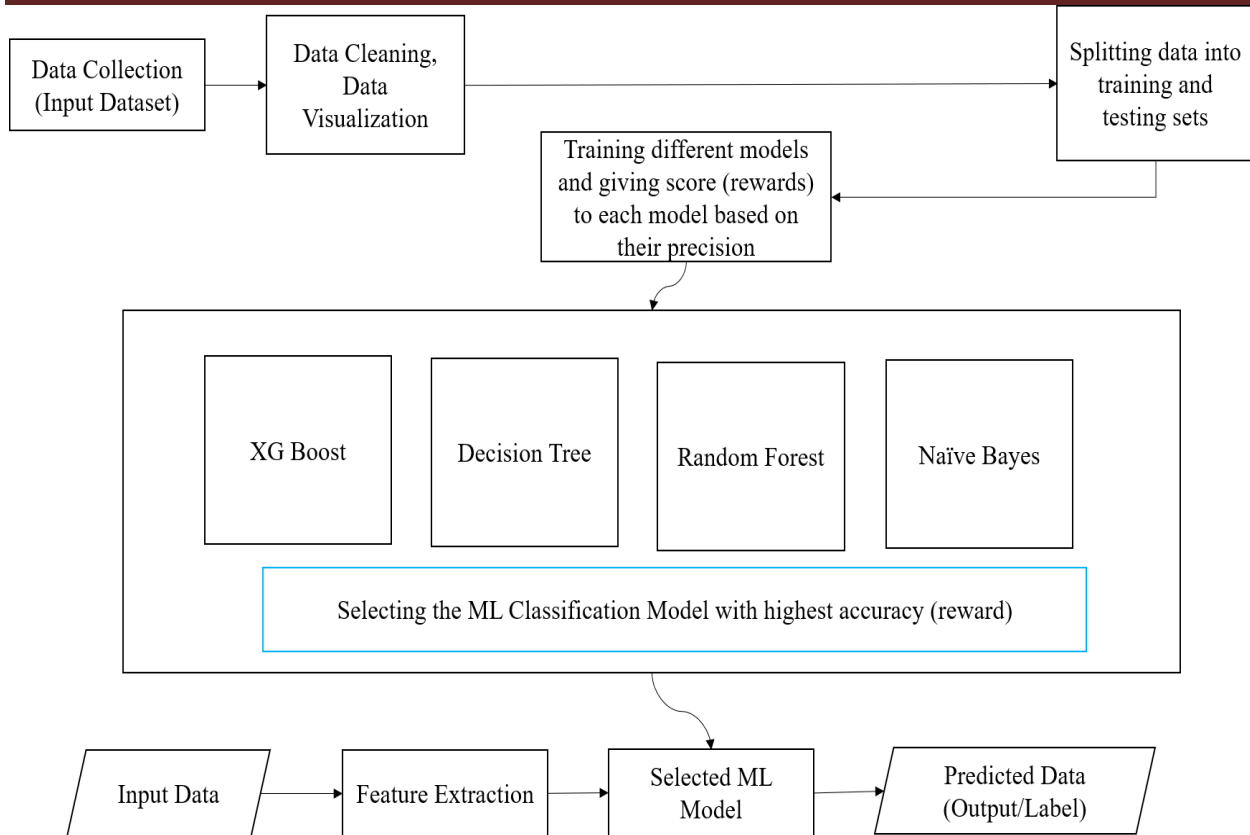
Figure 2: Building and training of Model

The Figure2 explains the basic data flow of the selection of best model and how the result is generated. The different components are data collection, data cleaning, data visualization, splitting into training and testing set, selecting the model with highest accuracy, input as crop dataset, feature extraction - giving features to selected machine learning model and predicting the best crop for farm.

The main idea of the model is to provide the farmers with an ideal recommendation for growing crops taking into consideration different feature which are extracted composition of soil i.e., the NPK values (Nitrogen, Phosphorous, Potassium), the environmental factors like temperature, humidity, rainfall, and the geographical influence.

4. HARDWARE SOFTWARE REQUIREMENTS AND SYSTEM WORKING

4.1 Hardware and Software Requirements

For hardware there is a need of Desktop/Laptop – operating system: Windows 10, 4 GB / 8 GB RAM
For software the list goes like:

i. Python 3:
Python is a programming language that lets you work more quickly and integrate your systems more effectively.

ii. Google Colab
Colab notebooks are Jupyter notebooks that are hosted by Colab. Colab notebooks allow you to combine executable code and rich text in a single document, along with images, HTML, LaTeX and more.

iii. Front-End Technologies (HTML, Bootstrap, CSS, PHP)
HTML, Bootstrap, CSS – are the basic front end technologies that a can be used to execute a real time design of website.

iv. IBM Watson
Watson is a question-answering computer system capable of answering questions posed in natural language

v. PHP and Database (MySQL)
PHP is a fast and feature-rich open-source scripting language used to develop Web Applications or Internet / Intranet Applications. MySQL is a powerfulopen source database server built based on a relational database management system (RDBMS) and is capable of handling a large concurrent database connection.

4.2 Algorithm and Process Design

i. Algorithm
The algorithm which we went through are XGBoost, Decision Tree, Random Forest, Naïve Bayes, out of which have selected that algorithm which has highest accuracy to predict the crop i.e., Random Forest. We have worked on a sample dataset from Kaggle which is taken into consideration records obtained from a broad agricultural demography.
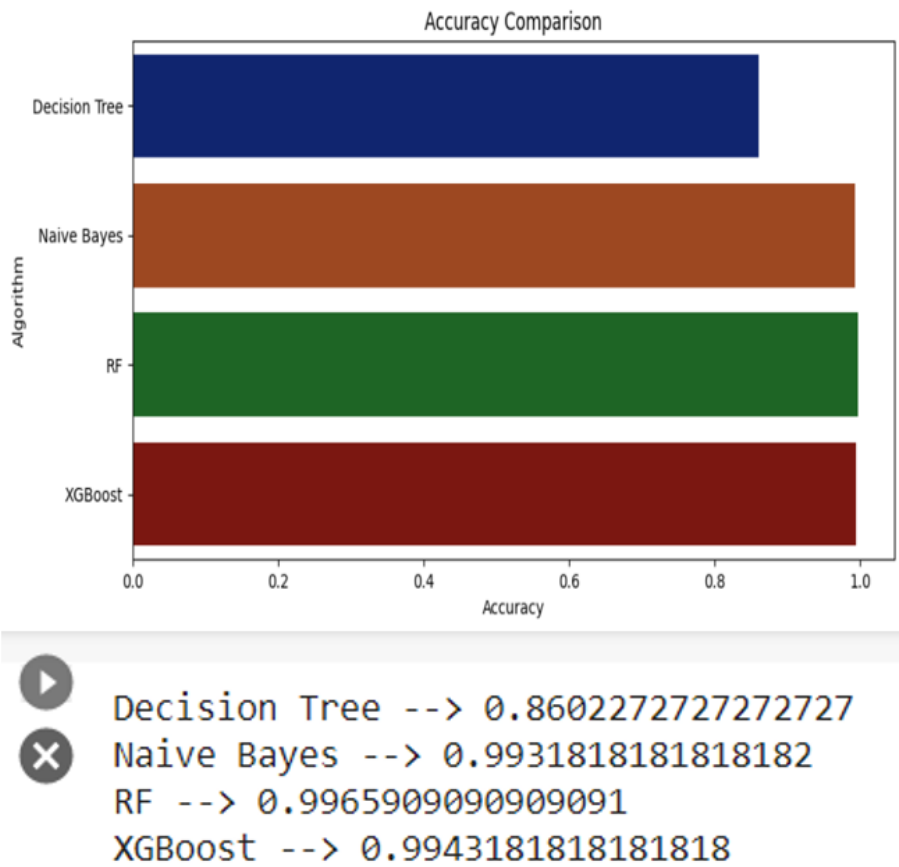
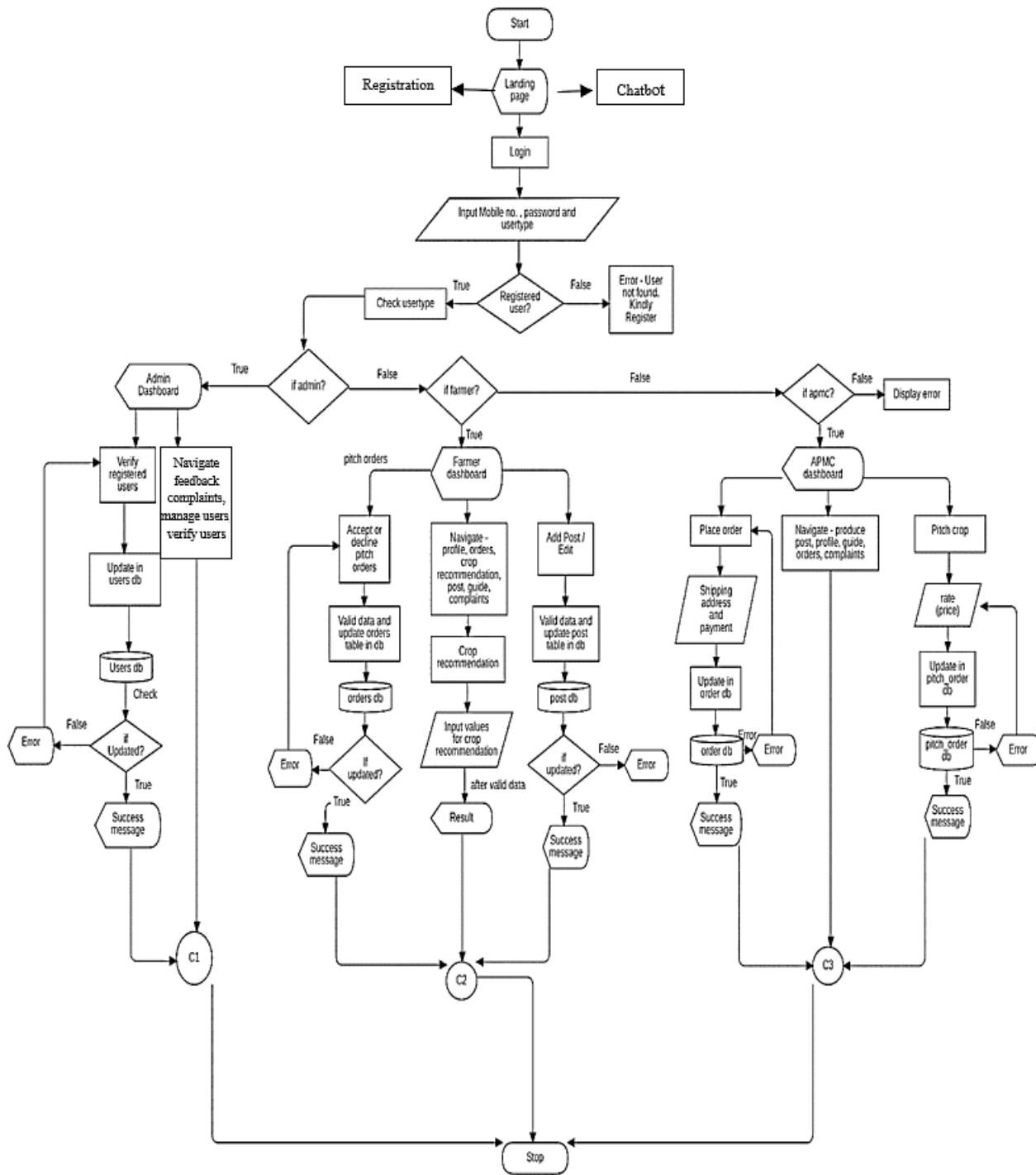**Figure 3:**Accuracy of Different Models

ii. Process Design

Figure 4: Flowchart of Website using Star UML

The flowchart – Figure4depicts the flow of website. There are typically 3 main users, the admin, the farmer and the APMC. The admin can verify the newly registered user, handle the feedbacks and complaints. The farmer can sell online by uploading a post for the produce to be sold, can have analysis

of daily activity and can also make use of crop prediction ML system to see what crop he can grow on his farmer. The APMC can buy farmer produce by the uploaded post and can also pitch for the same. There is an IBM Watson chatbot available for the non-registered users, with the help of chatbot they can come to know about the services provided on the farmer APMC portal.
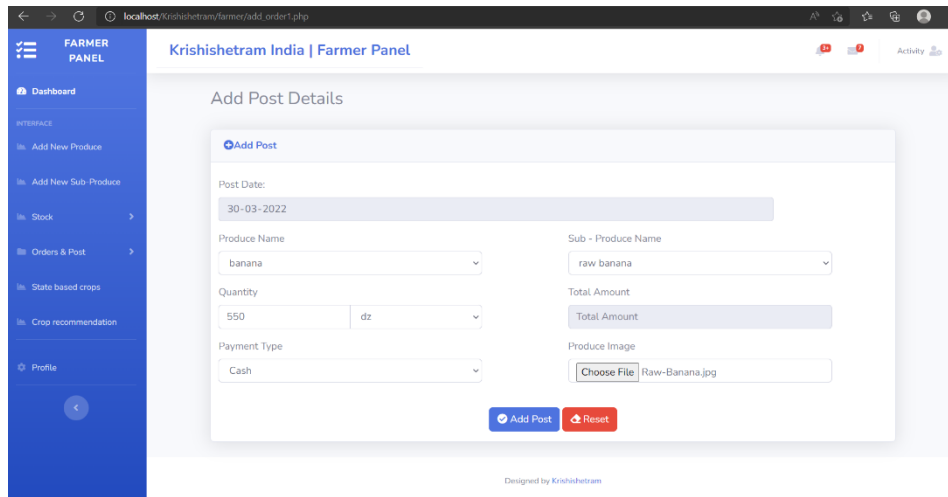
5. RESULTS

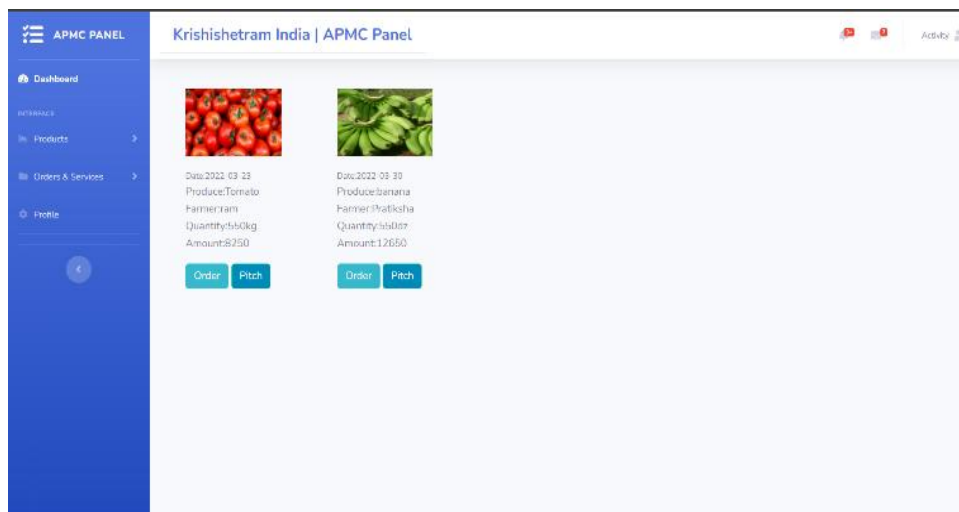**Figure5:** Post Produce -Farmer

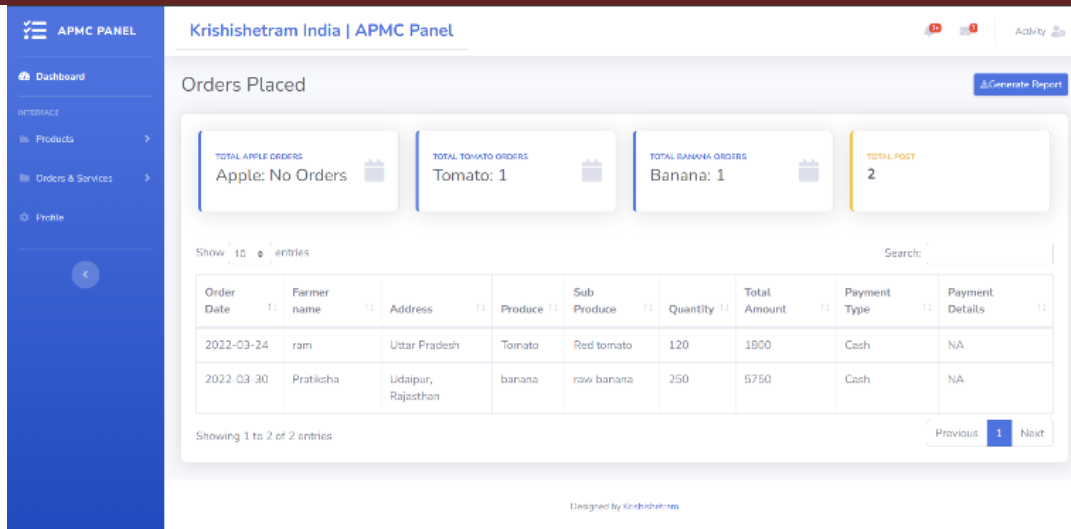**Figure6:** Posted Produce – APMC

Figure7: Orders - APMC

After collecting, cleaning and organizing the data, it got used for building models in Google Colab using machine learning algorithms. Using Random Forest as the best model we integrated it in the farmer APMC web portal.

Figure8: Prediction on Google Colab
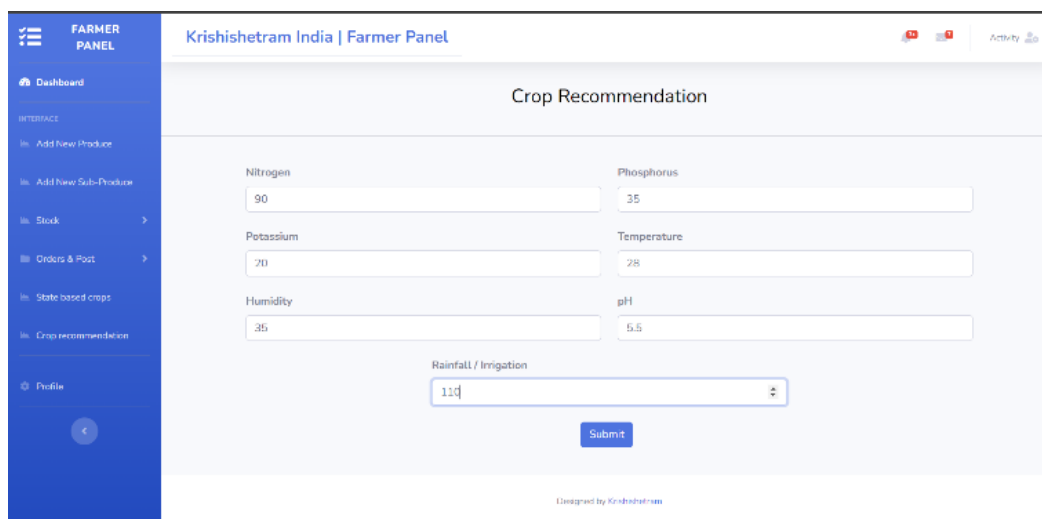
Figure9: Crop Prediction on Website
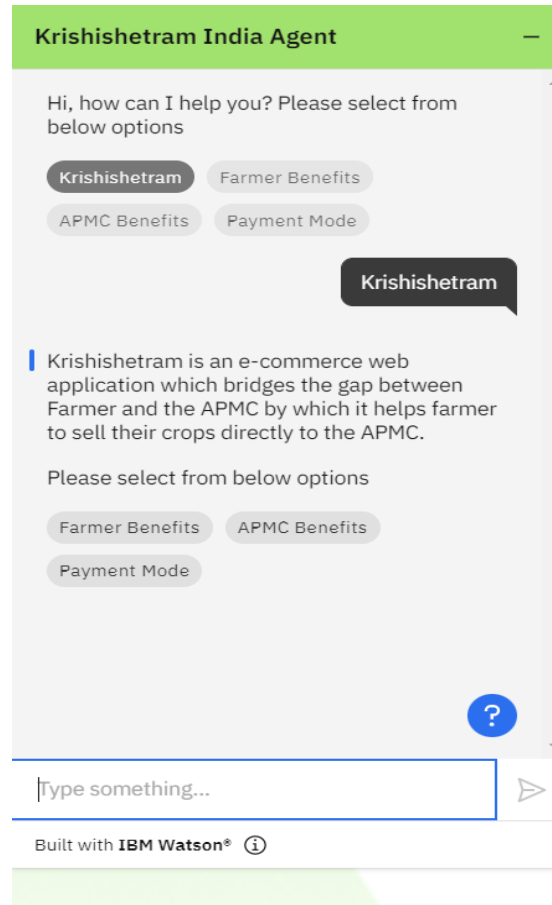
Figure10: Prediction Result

Figure 11: IBM Watson Chatbot

6. CONCLUSION AND FUTURE SCOPE

India is a nation where agriculture plays a major role. So, our work will help farmers come in direct contact of customer (APMC) and earn profit and also sow the right seeds based on soil requirements to increase productivity and gain profit from crop recommendation technique. Thus, the farmer planting the right crop increases its yield as well the overall productivity of the nation. Our future work is aimed at an improved data set of large number of features and volume. For real time values of soil and weather, hardware implementation can be too done as looking forward to future. This paper proposes an effective e-commerce website with sell and buy and crop recommendation or prediction system based on NPK values, PH and the region. If widely used, it will benefit farmers in terms of crop production and earn maximum profit. With the help of all this information, a trusted and a secured website can be deployed with a greater number of service or facility which will in return help the

farmer to not only understand how the technology works but will also understand to use technology for profit.

REFERENCES

Balakrishnan, M., B. Ganesh Kumar, Ch. Srinivasa Rao and S.K. Soam (2018) - "Status and Scope of E-Commerce In Agribusiness In India". International Research Journal of Management and Commerce, Volume 5, Issue 1, January 2018.

Banerjee,Tumpa (2018) – "Enrichment of Indian Farmers' Economic Status: Trading of Agricultural Produces Through E-commerce". International Journal of Latest Trends in Engineering and Technology Vol.(11)Issue(1).

Kalimuthu, M., P.Vaishnavi, M.Kishore (2020),– "Crop Prediction using Machine Learning". 2020 IEEE. Kumar, Dr. Y. Jeevan Nagendra, V. Spandana, V.S. Vaishnavi, K. Neha, V.G.R.R. Devi (2020) - "Supervised Machine learning Approach for Crop Yield Prediction in Agriculture Sector". 2020 IEEE, IEEE Xplore ISBN: 978-1-7281-5371-1

Manjula,Aakunuri, Dr. G.Narsimha – "Crop Recommendation and Yield Prediction for Agriculture using Data Mining Techniques". 2019 JETIR March 2019, Volume 6, Issue 3, ISSN-2349-5162).

Mishra, Shruti, Priyanka Paygude, Snehal Chaudhary, Sonali Idate- " Use of data mining in crop yield prediction", IEEE Conference Publication | IEEE Xplore, 2018 IEEE

Parikh, Dhruv Piyush, Jugal Jain ,Tanishq Gupta and Rishit Hemant Dabhade – "Machine Learning Based Crop Recommendation System". International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 6, Issue 1, June 2021.

SivaRao, M.Samba, K.Jyothi , K.Giridhar , P.BabyAnitha , M.Abdul Rahim – "Crop Prediction System Using Machine Learning". Journal of Advanced Research in Technology and Management Sciences (JARTMS) Volume: 03 Issue: 04 ISSN: 2582-3078 July 2021.

Farmers Portal (2015)https://farmer.gov.in/FarmerHome.aspx

Kisan Mandi- Online Agri Market (2016) India https://kisanmandi.com

eNam | Home (2016)https://www.enam.gov.in/

farmersMandi | Digitising Indian Agriculture Supply Chain

Krishi Network Agriculture App - Apps on Google Play

Farmers, Middlemen and the Way Out - Spontaneous Order.

AN ANALYTICAL STUDY AND A CRITICAL REVIEW OF EMPLOYABLITY SKILL GAP AMONG MBA GRADUATES ACROSS INDIAN STATES

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Advancement has pushed experts to reevaluate their enterprises on and on because of major financial emergencies, new innovation, and consistently expanding business needs. In the Asia Pacific region, the labour force is being given more abilities by bosses, and the pattern is by all accounts going worldwide. Each representative should be conscious of the associations drawn out targets. It was important to further develop specialist abilities to satisfy the organization & objectives. Colleges should prepare understudies to be employable if they have any desire to remain applicable to the functioning scene. It is once in a while as huge as the degree & specialized abilities and information because of the significance of enthusiasticcapacities. Abilities and capacities are hence fundamental in everybody & life. Theexamination tries to find out about the employability expertise gap degree of precision. Thecurrent article concentrates on the explanations for the occupation gap for expertiseadvancement. Moreover, the review features techniques on the best way to determine the gapin employability. This article endeavors to give an outline of Employability expertise gapamong the executive's understudies across India, by connecting substance from distributedresearch papers, papers, and the network. The current article uncovers a significant differencein delicate abilities, for example, critical thinking, authority, and independent direction,among senior-level specialists contrasted with computerized capacities. The articlerecommends that the candidates need to get delicate abilities preparing before they join thecalling and instructive establishments need to give guidance to further developing the delicateabilities program. Subsequently the current article means to assess the work ability gapfactors which give an issue to Business students and furthermore talks about and investigatesthe numerous significant distributions connected to tending to the business break. The articlerecommends a few procedures for adapting up to employability issues.

Keywords: Skills gap, Senior-Level Employees, Employability skill gap, Highereducation, Employers.

1. INTRODUCTION

An associationlaborersor planned workerspresent abilities and the abilities that theassociation or business requires are both estimated by means of a gap investigation thatshows where there is a distinction in capacities. At the singular level, it will be well versed inindividual patrons and the people who have an aggregate range of abilities of a noisy groupon the other hand, at the hierarchical level and related sub-divisions where they have focused on and are great at distinct capabilities. Understanding the distinctions in capacity in your HRdivision can take into account more prominent authoritative

execution since you can dealwith any gaps in abilities that might be significant to hierarchical achievement. As of late, there has been an expansion in acknowledgment of the need to further develop understudies work abilities. Whatmore, understudies and organizations can both depend on better administration schools than get their needs and necessities. Better alumni concentrates ongive all various types of individuals a spot to look further into their work and assist them withturning out to be more useful laborers. Most speculations attest the need of putting resourcesinto human resources advancement, and these strategies are frequently expressed in an openway. The Expert in Business Organization (MBA) course is for those individuals who wish toexpand their abilities and capacities in subjects like promoting, business regulation, moneyand human asset the board. This course assists individuals with getting sorted out themselvesand their abilities in the space of money, business regulation, promoting, and human asset theboard, for instance. In the Capabilities gapbosses and occupation searchers wind up atchances since businesses guarantee that it is elusive somebody with the right range of abilitiesfor their organization, which persuades work searchers to think that steady employments arescant. Interestingly, entrepreneurs are hoping to lease while work searchers are searching forpositions. It is felt that the abilities gap and unfortunate employability proportion result fromdeficient language courses, obsolete schedules, insufficient functional preparation, and anabsence of vocation direction. Worker capacity is typically assigned due to the procurementof traits that assistance to help one expert life and prevail in their preferred profession(Yorke et al. 2004). Human Asset Office, Monetary, as well as other corporate positions willgenerally be contracted out to an outsider association; the most well-known avocation for thisbeing the need to set aside cash, effectively use workers, exploit outside specialists, andutilize fundamental industry methodology. This permits the organizations to involve theirlabor forces in their center regions, which thus works on in general hierarchical efficiency.Towns, provinces, regions, and entire nations all experience monstrous misfortunes whenthey canfurnish understudies with the right skills for specific occupations. Later on, therewill be a general absence of talented work of around 30 million by 2020 (from where thisinformation is taken) and a shortage of 15 million untalented workers. Representatives withlittle capacities will be under 10% requests, meaning a shortage of 90 to 95 millionindividuals. This is regularly agitating for an organization, and itthe explanation anorganization can prosper or remain cutthroat since it can track down qualified specialists toperform key positions. Open positions are turning out to be progressively challenging to fill,with more organizations finding themselves unfit to recruit an adequate number of

individuals. A greater part (45%) of those studied case they can find the ability they have,and the numbers are a lot higher among those in bigger organizations, with close to 66% ofrespondents detailing ability deficiencies in 2018. The business would be impacted in eacharea. Bosses experience difficulty observing laborers who can accomplish specialized workand have the relational characteristics they need. To be pertinent in this capacities change, up- Skilling and work force advancement must be progressively quick and productive than ever.To address the immense ability lack, it is fundamental to go past regular arrangements andtake on new systems like structure, getting, loaning, and acquiring so that individuals willhave the gifts that are required now and later on. One of the biggest staffing firms on theplanet, Labor works in 80 nations and many zones consistently, helping large number of organizations with their enlistment, appraisal, advancement, and maintenance of very

capablerepresentatives. This study coordinates their exploration on the worldwide labor forceemergency, the 12-extended discoveries from the main faculty capital examination of its sort.Associations might utilize this asset to all the more likely get their labor force abilities, aswell as find the least difficult potential outcomes and how to enlist the most encouraging Individuals for the advanced domain.

2. OBJECTIVES OF THE CURRENT WORK
 To assess the work ability key factors which create an issue to Business students.
 To investigate and review the numerous significant factors coupled with businessarea.

3. LITERATURE REVIEW

Previous investigations and research conducted before have influenced the notion of the framework being suggested.Global talent shortages have at their highest levels in 12 years due to businesses being more hopeful and having better hiring demand, as well as because the global economy has improved over the last decade. In a time of rapidly shifting skill requirements and personnel shortages, it was noticed that 2018 has been the worst year for recruiters.

Figure:1 Foundation: Manpower Counselor Collection website

Only three countries, Ireland, China, and the UK, have trouble filling jobs in 2018, but they differ drastically in how much trouble they have finding qualified applicants. A popular trend among Japanese companies is to keep everything in-house (i.e., on-shore) to ensure quality control. But now, as a consequence of ageing demographics and tighter immigration policies, some firms are moving more production to nearby countries (i.e., near-shoring) and to foreign countries (i.e., off-shoring). And employers are stuck with empty locations, and that is harmful to operational efficiency and growth. (Talent shortage findings, according to Manpower Group (2018)Employers think that the reason they cannot fill vacant positions is because there are too few candidates, and have told the Times of London about their conclusions.
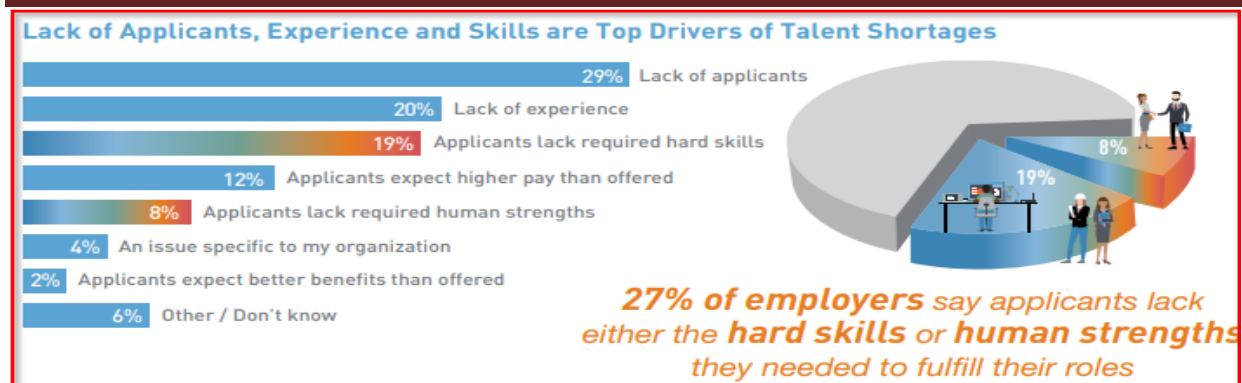
Figure-2 Basis: Manpower Counsellor Collection website

What's more, 20% accept candidates essentially needed skill. Finding individuals with theright blend of specialized capacities and human characteristics is significantly morefundamental than beforehand and the organizations digitalize, robotize, and revaluate,however 27% of scouts guarantee jobseekers are missing whether specialized mastery orrelationship building abilities. Among businesses, conveying great (verbally and recorded asa hard copy) is valued more than some other quality. In pretty much every business,consumer loyalty and walk execution rely upon getting the right gifts balance. Since theyneed to use advanced stock and investigation instruments, salesmen need brilliant iteminformation, impacting, and relationship the executives, and IT offices require capacities aswell as great individual's administrative staff and powerful imparting capacities. Countlessyouths are joining the work pool in South Asia consistently, yet a considerable lot of them areunfit to perform work obligations. Henrietta Front, UNICEF leader chief, conversed withDW about the numerous deterrents defying the region.Almost 50% of South Asia populace, roughly 1.8 billion individuals, are younger than 24, making the districts young labour force very huge. Many miss the mark on essentialpreparation and information to track down better-paying business. UNICEF viewed that as54% of understudies in the space do not have what it takes they should be useful citizenry.UNICEF Chief Henrietta Front gave an admonition to DW in a meeting; let the media knowwhat is going on will probably disastrously affect the area & monetary framework. As perUNICEF, 100,000 South Asians join the labour force consistently, yet close to half of themcome up short on abilities to get business. It's totally overpowering. South Asia is beinggrasped by a labour force issue. We have viewed that as 54% of teenagers in the space havework abilities that are not appropriate for the work market. In South Asian countries, we will seeabatement in the pace of Gross domestic product improvement, which will probably promptbunch of ladies and men not getting an opportunity to monetarily take part. We are expectingto work together with legislative and private associations to build how much preparation andinstruction that the young people get.

The locales chiefsprimary goal is to give generously compensated work to the ruined. Theperson in question should zero in on transforming the schooling system by focusing onschools. Schools are neglecting to show youngsters large numbers of the abilities they willrequire for their forthcoming. We are discarding this age coming on the off chance that wedone chip away at fixing this issue. you might want to have both an astounding oral andcomposed presence in the business world Accreditations and formal capabilities areimperative, yet making an adaptable labour force that will keep on being

significant isdependent on causing employable capacities that to accentuate communal ended focused capabilitiesMyers presumed that relational abilities are expected to improve the humanperson in business settings. Project arranging, critical thinking, timekeeping, and imparting,innovation and scientific and even adaptability are for the most part corporate abilities. Tostand apart from the group while searching for a raise, you should be a viable speaker withastounding eye to eye connection and a solid jargon. These are the abilities that businessesconsider a need to flourish in the present economy. The reason for the examination is tosupport organization explicit capacities, which assists with fortifying connections to theorganization while likewise ending up fruitful. It is to observe the gaps among what corporatebosses need and what business understudies realize. In their paper, Aaron W. Calhoun, et al.(2009), feature the basic importance that relational abilities have in proficient turn of events.The multilayer relational abilities test with gap investigation filled some needs, includingassisting us with perceiving our solid and feeble regions, our over-and under-examinations,and where we want to give designated analysis. Students might be assisted with inputassuming their advancing necessities were tended to by means of recreation based trainingthat utilized a multilayer appraisal with gap examination.Kanesan Canister Abdullah (2013) shared their considerations on Malaysia& financial state.This is often a significant objective for the economy of the country. The Malaysian government & transient dynamic market arrangements that are centered on use appear to havemade little difference. The exploration, therefore, will find this deficiency of experts outfitted with sufficient pressure the executive's capabilities by the expansion.

VikheGautam and PreetiAgrawal (2014) explain that we all exist. The purpose ofmanagement education should be to create "marketable products" in the form of managementstudents to meet the business world& needs. So, management schools have to develop andprovide completed skills for instant use. Employers want certain talents supplied at a timewhen they need them, and are willing to pay. Prospects that employers are drawn to include ways to go up the ladder and control over their careers. This study examined the talent gapbetween academics and industry to find out the reason behind the difference. Also, it focuseson differences in skill understanding among Human Resource Managers, along with Training and Placement Officers & perceptions of job market suitability. This investigation demonstratesthat there exists a notable difference in the amount of emphasis given to employable skills byboth the verticals. This study will most certainly offer academics and business with theinformation necessary to simplify cooperation, which will be useful to both parties. The studywas performed to get a better understanding of the diversity of abilities in India and the skilland talent landscape, according to Dr. PallaviKapooria and SatishSumbria. This articleoutlines how important it is to help students and graduates choose their best career paths bycompiling and reviewing previous work on the topic and explaining what factors may impede the supply and demand of career talent. The main goal of this study is accomplished if itsdiscoveries are frequently implemented by talent available business operators to need positivemoves for skill improvement and use.

L. Kalaivani and R.V. Maheswari (2015) portray the manners by which Public DesigningSchool has upgraded the work capacities of graduates by utilizing specific techniques. Theglobalization and modernization of ongoing years have brought about a more changed andinterlinked worldwide society. Changes in innovation significantly affect the workingenvironment, changing how individuals work, the work they do, and their profession ways. Amore prominent requirement for employability abilities

emerges from emotional changes inthe financial interaction. Engineers are exceptionally famous as workers, and organizationsshould rival each other to get them. Stock that comes from schools in the field of designing issignificant, and it ought to have conspicuous highlights and qualities that can be dependedupon. There is a need to change and adjust a few pieces of the specialized school system.

This exploration endeavors to look at the uniqueness between industry assumptions forgraduates and their quality. The exploration means to give proposals to defeating thedisconnectivity between what organizations hold to be true with respect to employingarchitects and what they understand to be true regarding their capacities. The article additionally covers estimates that have been set up in Public Designing School forimprovement of the profession abilities of graduates. In their investigation of the perspectiveson Indian businesses on turn out fit for ongoing alumni, Mary Metilda and Neena P.C. (2016)explore how graduates see work fit. The responses of organizations were appeared differentlyin relation to the range of abilities of ongoing MBAs being ingested from the College or higher instructive foundations to observe an association between what they expect and whatthey get. It was likewise in this exploration that how essential gifts are to the business in anassortment of enterprises was analyzed. There is a ability gapbetween the genuine and theexpected, which was found through these outcomes, and it will be enlightening for businesstraining developers. This was frequently a review in which business ability characterizationswere upheld by Holland Occupation fit theory. A new examination uncovered a gigantic number of graduates who were completely unsatisfied with the level of expert skill ofbusiness college graduates. The investigation discovered that 86% of managers concurredthat MBA-employs for the most part did not offer huge benefit to their organizations for a longtime of their professions. This end that new administrators&ranges of abilities are insufficientbackings the past outcome. The ranges of abilities expected by workers might change regularly, given the emotional changes prone to happen in the gig market. The discoveries ofthis exploration help understudies of business studies, corporate spotters, higher scholasticassociations, and profession advising specialists. Len Büth (2017) observed that a huge extent of India&designing alumni don't get prepared all around ok for the working environment.This going with article presents an idea known as Learning Industrial facilities that might fillthe gap among scholastics and industry. Subsequent to directing meetings with specialists anddoing an intensive assessment of important materials, we have reasoned that the mastery of newdesigning alumni will decidedly affect the capacities of India & business local area. The skillstandards have been displayed to coordinate, but there&a deficiency in regards to strategicability. You should be prepared as an alumni engineer toward the beginning of your work.Extra preparation, which is additionally very costly, would be squandered in the event that itisn't fruitful. A drive called a Learning Processing plant has been sent off at a top Indianfoundation to attempt to close the gap. One supposition that will be that the new LearningProcessing plant will be equipped for making Indian college level alumni prepared forbusiness, dispensing with the requirement for additional college level alumni engineer preparing. Learning Production lines (an Indian instructive association) guidance incorporatesa layout of how to work it as a critical part of the countryscholarly construction. KhushbuKhurana and Rajnish Kumar Misra (2017) featured the meaning of graduate understudies work. Graduates are progressively incapable to secure fair positions, and this predicament ispresently not one that can be ignored in the globalized exchange. One should get theappropriate employability abilities to succeed. This article endeavors to recognize thesignificant abilities graduates

and laborers in the IT business need to gain to support theirwork possibilities. To research the gaps between scholarly learning and capacities as well asthe experience and ability important to businesses when they are selecting, the articleanalyzes hypothetical thoughts and models of serviceable. A significant part of this report contains portrayals of capacities fundamental for IT laborers to have to be employable in theIT business. Our examinations for the most part inspected six capacities: specialized capacity,more noteworthy thinking, individual ability, relational insight, general ability, and businesspossibilities. Industry specialists have offered their go-ahead to a bunch of center skills,which is currently being utilized in different spots to prepare individuals. The consequencesof this examination will help the private and public areas in working on word related abilityin the labor force. KhaledAlshare et al. (2018) examined the foundation of their examinationand the normal contrast between the instruction of new business understudies and thebusiness prerequisites, as their work features an unmistakable connection between the thingschool organizations are giving in the method of abilities and what the work market requires.The examination explores twenty years of urgent abilities expected for future workers and the overall exchange, assessing the perspectives on the two associations and the board educators.Experts utilized literary works to recognize the 20 most fundamental capacities, andafterward they gave a survey to test to these gifts. It was found that there is an opening in thebusiness understudiesrange of abilities, thusly showing that there is an ability gap in thework market. At long last, business teachers and managers have it are more essential tocontrast suppositions on which abilities. Business colleges advance hard abilities whileorganizations put a ton of accentuation on milder gifts. This review& discoveries arefundamental for both business colleges and bosses to overcome any issues in ability andconsequently advance the business.Another report (2018) delivered by AshitaBagra and Dr. Dinesh Kumar Sharma examineshow 21st-century mastery areas of the economy are enhancing as well as concocting newbusiness models that truly are influencing task conveyance, client commitment, andsubsequently the ability important to find true success in the overall business. Companiesbelieve individuals should work for them straight away, who come from organizations withthe executives preparing. The review targets skills which are characterized as data, gifts,capacities, and capability by the business local area. Employability implies a singularabilityto get and keep up with business. The review adopts a double strategy to feature the meaningof employability-connected capacities. Able business understudies are tried on their fitnessfor performing different undertakings by using the Free Example t-test with a test not set instone by a trial of Cohn. In view of the review results, an inlet exists between thecapacities organizations expect the executive's graduates to have and the capacities held bygraduating business understudies. This record& supports address the things understudies needto be aware of to work on their possibilities for business. Nikita SarthakPatil (2019) observedthat there is currently a critical difference among what the business expects with regards toinformation and what work searchers presently have. It's for sure pivotal that now theelaborate partners centre around abilities headway to diminish the divergence, thus cultivategeneral financial development. Employability capacities might be utilized to occupations and circumstances in existencewith different settings. To gain a nice work in India, the board abilities resembleidentification. Administrative preparation at Indian business foundations is perceived as apractical choice and is presently seen as a calculated strategy for business preparing. Theascent in employable creating abilities among Indian business students is attached to thisitem. Assisting

understudies with planning for the labour force is a genuine battle for theboard schools. Directors should go up against a few industry-explicit issues when they are in school. Companies are struggling with remembering administrative alumni for the businesson account of a deficiency in work abilities today. Employability among understudies inadministration schooling in India has declined during the past quite a while. An understudycapacity to get ready for or tackle significant industry challenges is to a great extent foundedon their Data Innovation (IT) capacities. Contemporary society couldn'tt make due without theutilization of data and interchanges advancements. Superb understudies should be deliveredby the focal point of a hierarchical goal, which centers on the preparation in data innovation.The capacity to impede information for local area students is basic in keeping this capacityfrom having an effect. While e-learning is disregarded, low PC education will deter utilizinge-learning in diminishing the mechanical gap(Mohpatra et al. 2020).The meaning of employability is an assortment of capacities, gifts, and characteristics thatwill incline a person toward secure work and succeed in their profession. It benefits people,the specialists, the general public, as well as the financial framework. A person who hasgifts, characteristics, and abilities to get a new line of work and furthermore be useful in thatbusiness is supposed to be employable. Representatives are expected to have every one of theimportant abilities of their particular industry. Thought having a superior degree will promptbetter and particular positions. (Mohpatra 2020). Students can upgrade their employabilitywhile getting a college degree. An understudy must have both the ability and delicateabilities. Classes are impacted by the gifts utilized by the understudies, who could procurethem in various ways. A few components that might affect the home room, incorporate thingslike study hall size, course load, personnel assets, the program chief ability to assistunderstudies with developing illustration plans, and time spent outside of class with differenteducators. There are various fundamental boundaries, like showing experience, affirmations,and informative strategies that can assist understudies with landing positions after graduation(T, 2006, Mohpatra 2020). Indeed, even as number of school graduates jobless ascents, someare pointing fingers at the unfortunate type of understudies being created. Associations havethe test of tracking down the perfect people to stay with their cutthroat and beneficial. Twoscholars talked about this issue in a 2014 paper by Velasco 2014; and a 2010 report byNilson. To ensure that imminent understudies are satisfying the needs of the gig market, it isurgent to zero in on improving alumni's skill to have graduates ready to satisfactorily matchmarket interest from here on out. So the review intends to uncover new techniques forhelping the ability of graduates to all the more likely serve the business. While as yet overseeing individual life needs, a few alumni centre on skills in development of theirorganization. The current article centres on the accompanying causes which are liable foremployability ability.
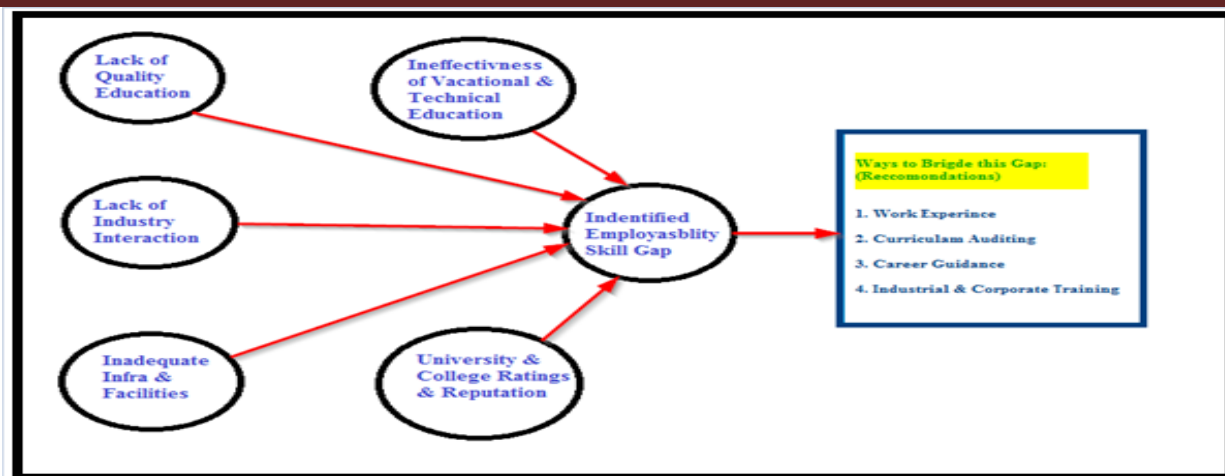
Figure-3 Shows methods to bond the skill Gap

Value-Based Quality Deficit Because of insufficient investigation and innovation efforts, colleges are unable to properly educate the next generations and keep up with current knowledge creation. The investigation, conducted by Sheikh Tariq Mahmood (2011), has been aimed at investigating the things that immediately and unintentionally influence the researching effectiveness in education. The investigation was completed using an interpretive paradigm in cross-sectional investigation. The specimens for the research were obtained through International Islamic University, Islamabad, where 90 students had their Masters and Doctorate degrees. The Likert scale was used to collect the information. The investigation concluded that the participants remained disappointed with their classes and curriculum materials. Value-based training was determined to be essential to increasing teaching efficacy.

An absence of periodic business-to-business interaction:

To guarantee that the training is tailored to requirements and expectations, it is critical to ensure that the curriculum and skills are consistently being matched. Ensuring that employee training is consistent is important to ensuring a solid career, as well as to guarantee employment. The article examines academic–industrial cooperation in India by M.M. Gandhi (2014). Because of many unappreciated differences, beliefs, attitudes, skills, and requirements, and the lack of financial clout, it is hypothesised that the partnership between academics and industry has remained restricted in the prior and therefore will probably keep being restricted in the future. The upper-level undergrads are not receiving the appropriate professional and technical knowledge.

Insufficient infrastructure and resources (Teaching Learning Aids)

Students' progress at every level of education depends on the Teaching Learning ecosystem's involvement in their growth. The shoddy infrastructures and learning facilities that exist in many of India's institutions have a detrimental effect on the students' learning ability. Banyte (2008) looked at how the set-up and infrastructure are essential in making sure that the world takes the proper steps toward social change.

The lack of vocational and technical and retraining has resulted in a failure to adequately prepare students (TVET)

Education and training focuses on the hands-on skills needed to perform a certain occupation. Developed countries' productivity and economy will suffer because of its effects. Quality of education and learning in India, as well as advancement beyond basic school, is a big problem. Due to a skill development strategy introduced by the Indian government, the current TVET (technical and vocational education and training) scenario appears optimistic, as described by AakashKamble and NaynaAbhang (2017). Central level regulation is better due to the establishment of such organizations as the Directorate General of Training and the National Skills Development Corporation, which allows the crafting of strong policies and regulatory outlines. Even if complete enrollment in technological and occupational instruction and training in India is very far off (TVET). The research is really just giving information, since all of the data comes from other sources.

The reputation of the institution

The ability to meet employers' requirements is part of the organizational capability, which is defined by university repute. According to AmaiaLafuente-Ruiz-de-Sabandoet. al. (2017), University reputation is a complicated problem and this isn't necessarily the same as their second preference, which is to portray a certain image. The article aims to examine and clarify the issues with the image and prestige of colleges and universities and to investigate any knowledge gaps. The research developed a data collecting form after a series of successive tests and edits. The article uses a structure developed by three writers and set out in a methodical way.

Strategies for reducing the employment skill gap (proposed skill alignment recommendation)
Employment history:

To be employable, it's important to have a history of working. It could also have a significant impact on employment if the graduate recruiting procedure includes corporate placements as a critical component. Investigation by Ruth Helyer and Dionne Lee shows that work experience acts as a method to enhance employability via current research and policies about this technique. In the context of today's competitive business environment and civilization, the topic of employability must continue to develop, since it is an ever-evolving, continuous phenomenon.

Reviewing curriculum

As reported by MantzYarke, and Peter T Knight, curriculum auditing uses exams and other measurements to assess what is missing in a student's education and pinpoint possible career training opportunities. Education, training, and evaluation should promote a job-related learning environment where employers want to hire students who are actively engaged in their learning.

Assistance in planning a career

The primary criticism of higher education is that students have no assurance of being able to find a job after graduating. In order to combat the mismatch between higher education and the workplace, it is necessary to provide quality career advice. Students and graduates' professional and interpersonal growth relies heavily on the advice they get about their careers.

Retraining in a factory setting

To fill the gap among academic and industry, retraining for industries is the most effective method. It is a skill set that aids the development of practical knowledge in the field. A study conducted by Lai Fong Woonet.al. (2007) evaluated the effectiveness of training for workers at University Teknologi

PETRONAS (UTP) with the aim of enhancing skills in the technology and engineering fields. In a research involving three major stakeholders, the interested parties views were taken into account (students, universities and host companies). The survey was used to collect information from the two different responder groups. More than 400 students and mentors each filled out a questionnaire. The scale collected data in the 5-point range. The report found that when a good business or industry internship programme is added to an academic curriculum, it provides additional value. For students participating in an internship program me, there are learning objectives that will enhance their employability. This will reinforce their academic cognitive development.

Records of accomplishments

Abilities, understanding and individual ascribes are the arrangement of accomplishment that makes graduate to acquire their business and to find actual success in their profession which gives advantages to themselves, to their local area, to their working environment and public economy.

4. Results and Conversations:

The review found that the most serious issue in advanced education is the alumni business. The ability to prevail in the labor force is involved numerous components including fundamental schooling, cognizance, and character attributes. Understudies who have basic employability abilities, like collaboration and arranging, could be missing urgent capacities to prevail in the work force. This issue is tended to by Mpho M. Pheko and KaeloMolefhe (2017). To all the more likely comprehend how students at Botswana College comprehend about employability, the article has utilized elucidating concentrate on that spotlights on getting a handle on new things. The article proposes the utilization of an employability abilities worldview that sees work as an aggregate obligation. This worldview perceives four partners, specifically, current laborers, preparing focuses, planned bosses, and entrepreneurs, as taking responsibility in its accomplishment. A last survey took a gander at writing on the employability gap, and this exploration incorporated an investigation of it. The's review will probably comprehend how understudies should be prepared for the working environment today. To evaluate the information, the examination used a scope of procedures, like the mean and standard deviation.

The article finishes up and suggested that organizations should zero in on giving very compelling guidance, make solid relational abilities, and join forces with specialists in creating proficient abilities. This is significant in light of the fact that understudies should have strength in themselves, feel associated with the labor force, and expertise to work on their abilities assuming they desire to prevail in their profession. The associations should likewise arrange preparing projects to assist understudies with acquiring their very own superior comprehension character and construct skill.

Ideas to adapt up to employability issues:

The current article under light of leaving writing proposes that Administrative educational program acknowledges people from an assortment of foundations and openings. It is, unquestionably, an easily proven wrong issue. The insightful attitude is basic since it helps with getting an incredible work at the finish of the course. It is seen that most of the class comprises of the two newbies and experienced experts. It has a twofold advantage. Students with sufficient encounters have quite recently a superior cognizance of the educational program as well as occupation possibilities. This should be considered to

be a benefit for people who need adequate work skill. The point is to lay out a companion bunch in which a fitting harmony between rookies and experienced individuals exists. This companion gathering will help you in acquiring a comprehension of value developments and vocation movement strategies. Training will happen outside of the study halls, and it will actually want to encourage a dynamic instructive air on grounds (Mohpatra 2020).

It tends to be extraordinary assuming that the states having the higher extent of understudies from provincial foundations can be given exceptional significance. Notwithstanding, with progression of advanced advances, openness to study is at this point not a critical issue. The issue is the means by which to lay out a conductive learning air. Also, the e-content and electronic literary push help in the further developing information for monetarily denied people. The foundation might take part in special endeavors to tempt people out from encompassing country region to seek after advanced education. The significant issue is the rising level of dropouts from fundamental through halfway to customary college. Various understudies are associated with different useful pursuits to build the family's wages. The second basic variable is moderateness. A particular exertion should be created in which online instruction stages, for example, NPTEL and SWAYAM help understudies in learning courses all the more without any problem. Help with labor as teachers and framework might give valuable in learning the organization. As opposed to standard administration studies, wide open initiative, agro-based administration, enterprising, collaborate design and the board, and others will help them in their learning. Since these projects straightforwardly sway their live (Mohpatra 2020). Incredible academic execution is a basic component in expanding work. Simply class guidance and preparing probably won't be satisfactory to secure information in a subject like administration. There is far extra work to be done to fathom the issue. It is as often as possible accepted that exorbitant the utilizing Innovation instruments will cause a break among teachers and understudies, and that learning a subject without an instructor will be hard. In any case, in most of circumstances, the opposite is valid. Also, the utilization of advances which helps as well as keeps understudies current, as well as adds to the improvement of the study hall air as meetings progressively more participatory. Proactive usage assets will help understudies in gaining a full comprehension of the subject. Participation among instruction and industry is essential. Business associations have the vital experience and are in a more grounded spot to appreciate the exact necessity. An agreeable cycle would without a doubt add to a students' word related prosperity. The endeavor will contribute state of the art advances, while the organization will help with advancing instruction. The undertaking ought to be engaged with educational program arranging. Furthermore, ICT apparatuses are expected to upgrade teachers' capability. Consistent use of ICT-empowered applications benefits the homeroom, yet rather the more extensive world. Just limited handful scholarly organizations are equipped for executing something similar. Also, changing advances to the association isn't plausible; this implies that a helpful technique will help understudies improve their mental limit.

5. Conclusion

This article has mainly focused on management graduate job searcher's inadequate degree of expertiseleads in their insufficiency to achieve ajob regardless of whether they fulfil the job's guidelines. A huge piece of this issue originates from postsecondary the scholarly community's absence of consciousness of business assumptions and how to meet them. Also, the paper underlined the absence of college resources and infrastructure, which add to work difficulties. To close the skill gap in management graduates' employability abilities, the article proposes numerous ways for improving understudies' employability limits.

References:

Abdul Ghani Kanesan Bin Abdullah (2013): Bridging the Gap BetweenIndustry and Higher Education Demands on Electronic Graduates'Competencies, IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 8, Issue 1 (Nov. - Dec.2013), PP 63-68 www.iosrjournals.org

Aris, N. A., Baharum, Z., Sanusi, Z. M., Abdul-Rahman, I. K., & Lee, T. H. (2013). Assessment of critical success factors for accounting graduates employability. IEEE Business Engineering and Industrial Applications Colloquium, 526-531.

AshitaBagra and Dr.Dinesh Kumar Sharma (2018) "Changing CompetencyRequirement of ManagementGraduates in the 21st Century Business Environment" International Journal of Management Studies ISSN (Print) 2249-0302 ISSN (Online)2231-2528, http://www.researchersworld.com/ijms, DOI:10.18843/items/v5i2 (4)/11 DOIURL:http://dx.doi.org/10.18843/ijms/v5i2 (4)/11

Aaron W. Calhoun, et al. (2009) "Assessment of Communication Skills andSelf-Appraisal in the Simulated Environment: Feasibility of Multi-raterFeedback with Gap Analysis", © 2009 Society for Simulation in Healthcare, Vol. 4, No. 1, Spring 2009

Brown et al. (2003) "Providing Social Support May Be More Beneficial ThanReceiving It: Results from A Prospective Study Of Mortality" AmericanPsychological Society VOL. 14, NO. 4, JULY 2003.

Crotty, M. (1998). The Foundations of Social Research: Meaning andPerspective in the Research Process. London: SAGE Publications Inc.,Scientific Research

Creswell, J. W. (2009). Research Design: Qualitative, Quantitative, and MixedMethods Approaches (3rd ed.). Thousand Oaks, CA: Sage Publications.

Dr.Pallavi Kapooria and Satish Sumbria (2015) "Employabilityand SkillsGap Analysis: An Overview of Literature Review" International Journal OfMarketing, Financial Services & Management Research, Vol.4 (2),FEBRUARY (2015), pp. 1-6

A study on the employability gap of graduates referring to Tamilnadu andKarnataka http://hdl.handle.net/10603/254811

Hanapi, Z., Nordin, M. S., &Che-Rus, R. (2014). Unemployment problem among graduates of technical field: Competencies of the graduates and quality of the education. SainsHumanika, 2(2), 53-57.

Janer, Deri, Dio, Marbella & Ricafort, (2015) "Employability and Skills ofMBA Graduates from Literature Review as Input to Student Development Program" Quest Journals Journal of Research in Business and ManagementVolume 4 ~ Issue 5(2016) pp: 16-21 ISSN(Online): 2347-3002www.questjournals.org

Khaled Alshare et al.(2018): A Gap Analysis Of Business Students' Skills InThe 21st Century: A Case Study of Qatar, Academy of Educational Leadership Journal, ISSN: 1528-2643, Volume 22, Issue 1, 2018.

Lennart Büth et al. (2017): Bridging the qualification gap between academiaand industry in India ISSN: 2351-9789 © 2017, DOI:10.1016/j.promfg.2017.04.009

L. Kalaivani and R.V. Maheswari (2015) "Gap Analysis and Implications toDevelop Employability Skills: A Case Study of NEC, Department of EEE,National Engineering College, Kovilpatti, Tamil Nadu.

Mohpatra, M.; Das, S. C.; Satpathy, I.; Patnaik, B. C., 2020, Exploring employability of management students through information and communication technology, Journal of critical reviews, 11, 7.

Manpower consultant: https://www.manpower.co.in/ManpowerIndia/home

Nilsson, S. (2010). Enhancing individual employability: The perspective of engineering graduates. Education & Training, 52(6/7) 540-551

Nikita Sarthak Patil (2019) "Corporate Expectations and Students Skills–Gap Analysis in Career Carver Group –Baramati" International Journal ofTrend in Scientific Research and Development (IJTSRD), www.ijtsrd.com e-ISSN: 2456 – 6470, March 2019

Perera, S., Babatunde, S. O., Pearson, J., & Ekundayo, D. (2017). Professional competency based analysis of continuing tensions between education and training in higher education. Higher Education, Skills and Work-based Learning, 7(1), 1-20.

Pereira, E., T., Vilas-Boas, M., & Rebelo, C., F. (2020). University curricula and employability: The stakeholders' views for a future agenda. Industry & Higher Education, 1-9. https://doi.org/10.1177/0950422220901676

Rajnish Kumar Misra, Khushbu Khurana (2017) "Employability Skills among Information Technology Professionals: A Literature Review" ScienceDirect,Information Technology and Quantitative Management (ITQM 2017)

Saleh, N. S., & Rosli, M. S. (2019). Kepentinganpembelajaranabadke 21 terhadappotensikebolehpasaran modalinsan. Innovative Teaching and Learning Journal, 2(2), 71–81.

R. Mary Metilda and Neena P.C.(2016) "Gap Analysis Of Employability SkillsOf Entry Level Business Graduates Based On Job-Fit Theory" R. M. Metildaand N. P.C. (2016) Int. J. Soc. Sc. Manage. Vol. 3, Issue-4: 294-299, DOI:10.3126/ijssm.v3i4.15973, 2016

National Employers Skills Survey 2005: Main Report, Learning and SkillsCouncil website: www.lsc.gov.uk, Publication reference: LSC-P-NAT-060304.

Velasco, M. S. (2014). Do higher education institutions make a difference in competence development? A model of competence production at university. Higher Education, 1-21.

VikheGautam and PreetiAgrawal (2014): Industry-Institute EmployabilitySkill Gap Analysis, ISSN: 2319–5479, Volume-3, Issue–4, 2014

Yorke et al. (2004) https://www.ed.ac.uk/files/atoms/files/hea-learning-employability_series_one.pdf

A ROBUST TRUST ESTABLISHMENT MECHANISM IN A CROSS-DOMAIN CLOUD ENVIRONMENT

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Establishing a secure trust mechanism for a distributed cloud environment is always a challenging task. Here we are proposing a model for establishing authorization combined with a two-way trust model in the sense it takes into account the individual opinion of both provider and user. In the proposed model trust is measured from the user side as well as the provider side also and the transaction is allowed only if both the trust values exceed a predefined threshold value. We cannot completely depend on the recommender's feedback in the calculation of trust for a particular node or entity. The model includes a new expression for measuring such type of false or biased reporting. Further by eliminating biased feedback from both user and provider groups, the resultant transactions become more reliable and secure. Not only that we are also providing a rule by which trust values can be updated dynamically and active nodes are given more weightage in trust calculation.

Keywords: Cloud computing, virtual organization, trust, reputation.

1. INTRODUCTION

The always evolving, multi-dimensional nature of cloud computing technology generates massive amount of risks and threats to the end-users of the environment. Research works has been carried out to enforce some sort of standardized authorization mechanisms based on trust values of individual nodes but unfortunately consistency is yet to be achieved. Cloud access control policies may allocate varying amount of permissions to different global users at the various local domains as proposed by Pandey &Goswami (2017) and Bhilare&Uikey (2018). Users will be assigned role rankings based on their jobs or functions. The user's needs to be restricted by proper authorization mechanisms and a trustworthy environment must be set up. No standard solutions exist for cross-domain authorization establishment based on trust in a VO based multi-institutional cloud environments. In this paper, in the following sections a model is being described whereby attempt has been made to create a trustworthy cloud environment.

The main contributions of this paper can be summarized as:

> ➢ Proposing a novel access control mechanism for a virtual organization based cross-domain cloud environment combined with a dynamic trust updating mechanism.

➢ A two-way trust model is being defined which takes into account the reputation of both the service provider and the client devoid of any biasness.

The rest of the paper is organised as follows. Section 2 describes some related studies. Section 3 describes the cross-domain architecture model and mechanism. Section 4 illustrates the two way trust model. Section 5 shows the performance analysis. Section 6 concludes the paper.

2. LITERATURE REVIEW

Ahmed andHussain (2019) have highlighted on the issues of trust establishment in a cross-cloud federated environment. Novel mechanisms have been proposed for composite and mutual trust evaluation within the cloud network. Unilateral trust delegation and resource awareness are the major issues in such an environment. The federation's nature and the characteristics of the trust management system are to be in sync for an efficient and trustworthy environment.

Kurdi and Ahmed (2018) have proposed a lightweight trust management algorithm, which is dependent on subjective logic for interconnected cloud computing environment. Using subjective logic which is a type of probabilistic logic, uncertainty and incomplete knowledge can be modelled and analysed. It can be used to define the trust value of a participant with respect to another participant. They have also proposed an Inter-trust algorithm, consisting of two levels, global as well as local, thereby giving a cumulative value of trust.

Latif et al. (2021) have proposed a federated cloud trust management framework which consists of three different mechanisms for calculation of trust – SLA parameters for trust, feedback from customers and feedback of users. The concept of trust engine which they have proposed in their architecture is sure to increase the complexity of processing. Moreover SLA can be used to measure the level of performance but it is not dependable to measure the trustworthiness of individual nodes in a cloud environment.

Mehraj and Tariq (2020) have proposed a zero trust strategy in cloud environment. The theme of zero trust approach is "never trust, always verify". All the traffic is considered as untrusted in zero trust approach. It is helpful in avoiding data breaches caused due to exploitation of privileges assigned to individual nodes.

Sun (2019) have proposed an access control mechanism based on trust evaluation. A multi-attribute trust model is described based on direct trust, evaluation of trust risk, feedback trust, reward penalty and obligation trust, thereby highlighting the complexity of trust relationship.

3. CROSS DOMAIN ACCESS MECHANISM

Cross-domain authorization is a crucial factor where multiple domains are involved. Complexity may arise while formulating access control policies as advocated by Mahmood et al. (2019). Different domains may be employing their own customized rules and regulations for granting resource access. Role of a node may also vary extensively across domains. A genuine need exists for establishing some sort of equality among the roles. Here the approach which has been highlighted is a trust based solution.

3.1 Working principle

- Initially computational complexity of each node in a domain is calculated as the summation of the total turn around time of all the jobs by the total number of jobs in job set which is being defined as under :

$$C_t(N) = \frac{\sum_{i=1}^{m} TAT(J_i)}{m} \tag{1}$$

where N denotes a node and m= total number of jobs at time instant t, and
J = (J1,J2….Jm) in unit interval of time.

- Storage complexity of each node is calculated as :

In unit interval time , if ' f ' no of file request comes for storage , then a file set can be described as F = (f1,f2,….fm).
Storage complexity can be described as

$$S_t(N) = \frac{\sum_{i=1}^{m}(\alpha i + (\text{mode of operation})* \text{no of instances affected})}{m} \tag{2}$$

at time instant t, where mode of operation can be addition (= 1), deletion (= -1) or modification (= 0) and α is the file size.

- Also data transfer complexity of a node is calculated as the ratio of number of successful data transfer operations by total number of data transfer operations.

$$Dt(N) = \frac{\text{No of successful data transfer opeartions}}{Total\ no\ of\ data\ transfer\ operations} \tag{3}$$

- Based upon these formulations and applying fuzzy logic principle nodes are being classified as computation specific, storage specific or data – transfer specific i.e based on their roles which they can perform with greater precision they are being classified.

- Appropriate queue are to be maintained for separate type of activities.

- As a service request may span several domains, the credentials of the entities needs to be calculated which are passed through tokens.

- We now propose a two way trust model which is to be implemented for final access purpose.

4. TWO-WAY TRUST MODEL

In the proposed mechanism, reputation of nodes is being calculated. Feedbacks are taken and rank correlation methods are used to remove biased feedbacks. Two types of trust – direct trust & indirect trust are calculated. Direct trust is of greater significance. Direct trust is calculated based on transactions which originates from the initiator or requestor. Indirect trust is measured based on feedback values obtained from neighbour entities of same domain or other domain. Some specific parameters in the form of similarity, activity, specificity, idleness are put to practise to determine the trustworthiness of the recommender's opinion.

4.1 Trust calculation

Considering A to be the user and B to be the provider, the following mechanism is to be adopted here: First A will be taking the decision whether to accept services from B or not. The total trust is estimated here by combining the following expressions :

$$Direct\ Trust = \frac{Total\ no\ of\ successful\ transactions\ within\ a\ time\ period\ T}{No\ of\ submitted\ jobs\ within\ the\ time\ period\ T} \tag{4}$$

$$Indirect\ Trust = \frac{(1-CR)*average\ feedback\ received\ from\ the\ same\ domain}{Credit\ factor} \tag{5}$$

where Credit factor = 0.50 and CR is the value of the credibility

Direct trust value is assumed to be of more significance and is obtained by the user's own past interactions. Indirect trust is calculated by taking the recommenders' feed backs. Spearman rank order correlation method with some modifications are implemented here to ascertain the similarity of the feedback values for a certain node obtained from its neighbours. If the correlation is greater than zero then only feedback is taken, thus avoiding any sort of biasness. The following formulations are also to be calculated in implementing the proposed mechanism.

$$similarity = 1 - \frac{6\sum d_i^2}{n(n^2-1)} \tag{6}$$

where d is the difference in ranks and n is the total number of entities.

$$activity = \frac{Number\ of\ interactions\ by\ recommendor}{Total\ number\ of\ interactions\ by\ all\ recommendors} \tag{7}$$

$$specificity = \frac{Number\ of\ interactions\ with\ initator}{Total\ number\ of\ interactions\ with\ all\ other\ hosts} \tag{8}$$

$$idleness = 1 - \frac{Total\ number\ of\ successful\ transactions\ within\ time\ period\ T}{Number\ of\ submitted\ jobs\ within\ time\ period\ T} \tag{9}$$

$$Credibility = m * similarity + n * activity + o * specificity + p * idleness \qquad (10)$$
where m>n>o>p and m+n+o+p=1

The recommendation values from the neighbours are collected, rank correlation is being estimated and a decision is taken whether to accept the feedback or not. If the rank correlation is positive, then only feedback is to be taken seriously, otherwise it is rejected.

Host Y is new to the system: Let us consider host y to be a new host that has just joined the system and consequently, has not yet interacted with any other hosts.x interacts with y according to a predefined first impression value that x uses which may be a minimum value. y will be assigned with non-harmful resources for the initial period. After the transaction is over the reputation table will be updated as per the recommendation of the client. The decaying factor is to be calculated for modifying the reputation of each entity with time. When a host z receives a request (from host x) for reputation information about host y, it modifies its reputation information relative to yby considering the decaying factor and then sends the updated result to the requesting host .

$$rep\ y/z\ =\ final\ value + (final\ value - initial\ value\ ) * decay\ factor \qquad (11)$$

where decay factor depends on time . If t is the current time and t0 is the time at which the last transaction taken place then the calculation of decay factor is as follows.

decay factor= 1 if t- t0 < 1 month
(12)
decay factor= 0.75 if 1< t- t0 < 2 month
(13)
decay factor= 0.5 if 2< t- t0 < 3 month
(14)
decay factor= 0 if t- t0 > 3 month and, final value is the past value
(15)

initial value = u*direct trust + v * indirect trust $\qquad\qquad$ (16)

whereu,v are constants, u+v=1 and u>v
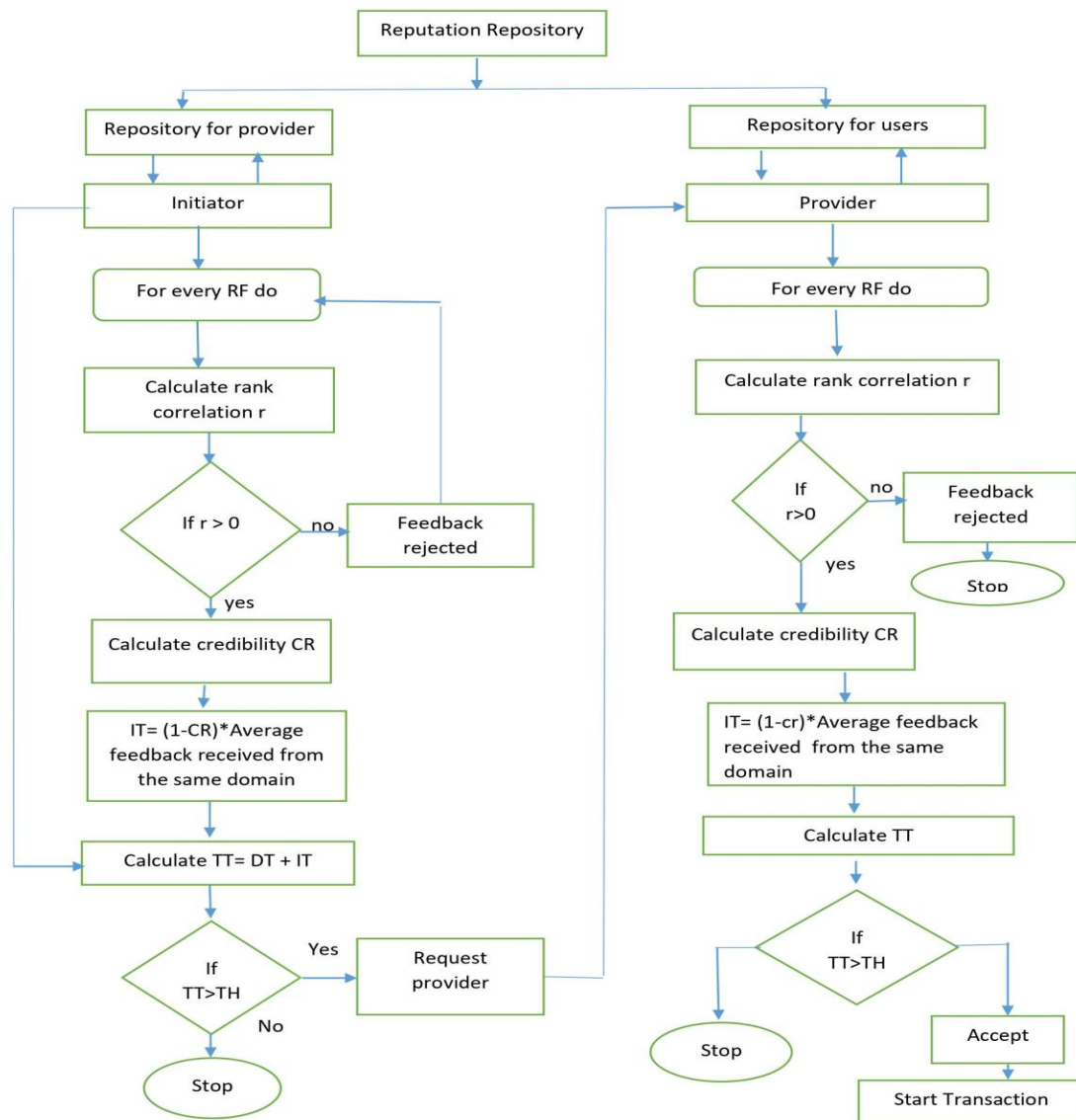
4.2 Flow diagram

Fig. 1. Flow diagram

The flow diagram of the proposed model is illustrated above. User A may opt for services from entity B. The user or initiator then goes for calculation of the trust value of the provider by collecting feedbacks about its services from the neighbours. Credibility of those feedback values are examined by rank correlation methods. Then the total trust values are calculated and if it is more than some pre-defined threshold value, the resource provider is being requested to provide services. Then it is the turn of the provider to go through all the steps as illustrated in the model from its end to ascertain the trustworthiness of the user or requestor. If both the user and the provider are satisfied with the trust values of each other, then the transaction may start.

5. PERFORMANCE ANALYSIS

For analysis purposes, we have taken a sample set of three no of requestors and ten number of recommenders who will be giving their valuable feedbacks about the requestors. At time instant t1 we have obtained some hypothetical values in the form of recommendation scores (from 1 to 10) of the three entities as per the following table 1.

Table 1: Feedback scores at time instant t1										
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Entity 1	1	2	3	2	0	1	1	1	1	2
Entity 2	0	1	1	1	2	3	1	2	1	1
Entity 3	4	4	2	1	0	1	0	1	2	1

At time instant t2, the recommendation scores are as per the following table 2.

Table 2: Feedback scores at time instant t2										
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Entity 1	4	3	5	3	2	0	1	3	4	2
Entity 2	4	3	2	4	1	0	2	0	1	3
Entity 3	6	7	5	4	0	1	2	3	2	3

The results that we have got after plotting the rank co-relations by applying modified Spearman's formula clearly suggests that if the variance of feedbacks about a particular entity is considerable, then there is immense chance of rank co-efficient value being rejected and consequently the corresponding feedback will not be taken into consideration.
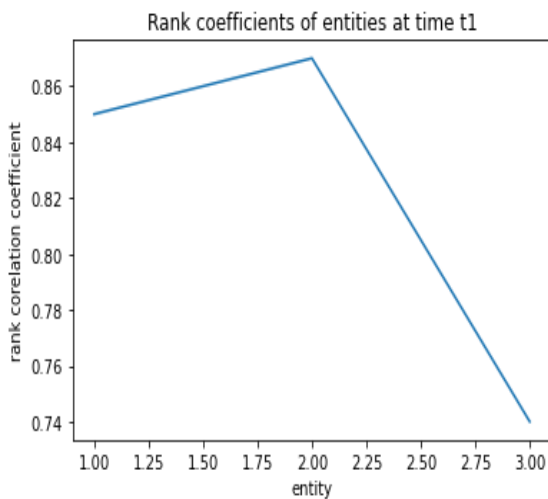

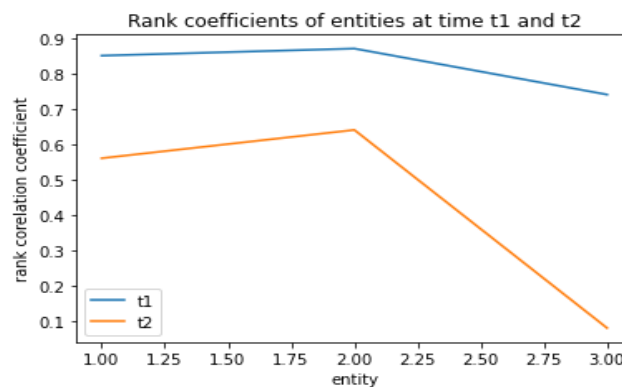**Fig 2** : Depiction of rank coefficients   **Fig 3** : Variance of rank co-efficients

In the above fig 2, the rank co-efficients are being depicted at a particular time instant t1. The closer the value of co-relation is to 0, weaker is the association and it is likely to be discarded. The closer is the value to 1, more is the association and trustworthiness of the node.

In figure3, the rank coefficients are being plotted with reference to two different time instances t1 and t2. The rank coefficients may vary sharply over time and if there are considerable differences among the recommender's feedback about a particular node, then it will be certainly having less amount of trustworthiness.

6. CONCLUSION

The proposed model presents a new mechanism for establishing authorization combined with a two-way trust model. Trust is being considered not only from the provider's end but from the user's end as well. Only upon exceeding a pre-defined threshold limit, the transaction is executed. Reputation calculation is also not solely dependent on the feedback values but credibility is also being estimated to prevent biased feedbacks. Some malicious nodes may exist in the system and they may produce biased results but that can be prevented by the measurement of rank correlation method. Existence of malicious nodes may hamper the smooth operation of the system and their ill-effects should be neutralized. Rank correlation performs that role in the proposed model. By the removal of the biased feedbacks, the system may perform efficiently, thereby aiding in the development of a stable and secure cloud environment.

REFERENCES

Ahmed, U.,&Hussain, S.A.(2019). Trust Evaluation in Cross-Cloud Federation: Survey and Requirement Analysis. *ACM Comput. Surv.* 52(1), 1-37,https://doi.org/10.1145/3292499

Bhilare, D.S., &Uikey, C. (2018). RBACA: role-based access control architecture for multi-domain cloud environment.*International Journal of Business Information Systems*, 28(1), 1–17.

Fangbo, C.,Nafei, Z., Jingsha, H. ,Pengyu, M. ,Wenxin, Li. , & Yi, Y. (2018). Survey of access control models and technologies for cloud computing.*Springer Nature*.

Kaushik, S., &Gandhi, C. (2020). Capability based outsourced data access control with assured file deletion and efficient revocation with trust factor in cloud computing.*International journal of cloud applications and computing*, 10(1), 64-84.

Kurdi, H., &Ahmed, S.H. (2018). A lightweight trust management algorithm based on subjective logic for interconnected cloud computing environment. *The Journal of Supercomputing*, 75, 3534-3554,https://doi.org/10.1007/s11227-018-2669-y

Latif, R., Afzaal, S.H, &Latif, S. (2021). A novel cloud management framework for trust establishment and evaluation in a federated cloud environment. *The Journal of Supercomputing*,77, 12537-12560,https://doi.org/10.1007/s11227-021-03775-8

Mahmood, G.S., Huang, D.J. ,&Jaleel, B.A. (2019). A Secure Cloud Computing System by Using Encryption and Access Control Model. *Journal of Information Processing System*, 15(3), 538 - 549.

Mehraj, S., & Tariq, M. (2020). Establishing a zero trust strategy in cloud computing environment. *International Conference on Computer Communication and Informatics (ICCCI -2020)*, 1-6, doi:10.1109/iccci48352.2020.9104214

Pandey, V., &Goswami , M. (2017). Various challenges and trust issues in cloud computing for improvement of quality and services. *International journal on emerging technologies* (Special issue NCETST-2017), 8(1), 324-329.

Sun, P., (2019). Research on cloud computing service based on trust access control.*International Journal of Engineering Business Management*, 12, 1-13, doi: 10.1177/1847979019897444.

THE ENERGY OF GRAPH – "A NEW PERSPECTIVE"

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The ordinary energy of graph is defined as the sum of the absolute values of Eigen values obtained from the adjacency matrix of the molecular graph for a given chemical compound. There has always been a limitation that the adjacency matrix obtained from the molecular graph has no information about the bonds and the atoms connected. Hence to overcome this limitation, we are considering the atom connectivity and connectivity matrix which gives more information about the types of bonds and atom connectivity of a chemical compound in the molecular graph and the matrix calculations. In this paper we define atom connectivity energy and connectivity energy also find energy of few hydrocarbons and their comparison with the ordinary energy.

1. INTRODUCTION

The concept of graph energy arose in theoretical chemistry where certain numerical quantities, as the heat of formation of a hydrocarbon are related to total π electron energy that can be calculated as the energy of corresponding molecular graph. The molecular graph is representation of molecular structure of a hydrocarbon whose vertices are the position of carbon atoms and two vertices are adjacent, if there is a bond connecting them.
Eigenvalues and eigenvectors provide insight into the geometry of the associated linear transformation. The energy of a graph is the sum of the absolute values of the eigenvalues of its adjacency matrix. From the pioneering work of C. A. Coulson (1940)there exists a continuous interest towards the general mathematical properties of the total π electron energy ε as calculated within the framework of

the Huckel Molecular Orbital (HMO) model. These efforts enabled one to get an insight into the dependence of ε on molecular structure. The properties of $\varepsilon(G)$ are discussed in detail in Basak. S. C& V.R. Magnuson V. R (1988), B. Zhou(2007) andDanail Bonchev & Douglas J. Klein(2002).

The energy so obtained represents the physical and chemical properties of the molecules. The above concept energy of graph has few limitations. In energy of graph various types of bonds are represented in the form a single edge, more over different atoms are also represented as nodes and the corresponding adjacency matrix too have neither information of the various types of atoms nor the types of the bonds in the molecule hence the significant of double bond, triple bond or atoms cannot be interpreted in energy of graph. Hence, we are overcoming the above limitations by introducing the various energy of graph through atom connectivity matrix (ACM) and in general connectivity matrix (CM) discussed inD.M.Cvetkovic, M.Doob, & H. Sachs(1980), E. Sampath Kumar(2010), Frank. Harary (1975) and Gutman & Boris Furtula(2017).

The purpose of this study is to investigate the various energy of graph through the new perspective of atom connectivity matrix and in general connectivity matrix. The current study is innovative as the connectivity matrix approach has not yet been studied. Moreover, the new study will explore the various possible applications in the field of applied sciences.

2. Atom connectivity energy and Connectivity energy

The energy calculates with respect to the atom connectivity matrix and connectivity matrix is called atom connectivity energy and connectivity energy respectively. Illustrations are given below:
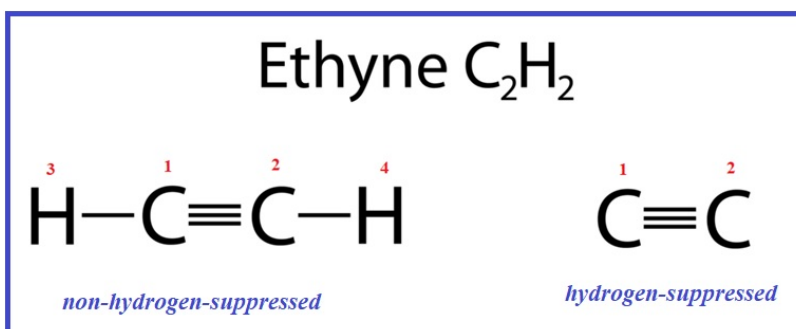

Figure 1**: Ethyne**

<table>
<tr><td colspan="13" align="center">Table 1: Initial Matrices</td></tr>
</table>

Table 1: Initial Matrices												
non-hydrogen-suppressed matrix												
Adjacency Matrix					Atom Connectivity Matrix					Connectivity Matrix			
	1	**2**	**3**	**4**		**1**	**2**	**3**	**4**		**1**	**2**	**3**	**4**
1	0	1	1	0	**1**	0	3	1	0	**1**	6	3	1	0
2	1	0	0	1	**2**	3	0	0	1	**2**	3	6	0	1
3	1	0	0	0	**3**	1	0	0	0	**3**	1	0	1	0
4	0	1	0	0	**4**	0	1	0	0	**4**	0	1	0	1

hydrogen-suppressed matrix								
	1	**2**		**1**	**2**		**1**	**2**
1	0	1	**1**	0	3	**1**	6	3
2	1	0	**2**	3	0	**2**	3	6

2.1 Calculations of characteristic polynomial and Eigen values of hydrogen-suppressed matrix and non-hydrogen-suppressed matrix

Hydrogen-suppressed matrix considers only the molecular skeleton without hydrogen atoms. Whereas non hydrogen suppressed matrix is the molecular structure considering all the compounds in the structure. The characteristic polynomial, Eigen values and the calculations of various energies defined in sections 3.1 and 3.2 from the datasetsare calculated by using some simple MATLAB codes given in reference as Dataset and code files.

3. Preliminary results

Table 13: The characteristic polynomial, Eigen values and Various Energies of Ethyne - C2H2 – With Hydrogen
1) Graph Energy

From Adjacency Matrix	From Atom Connectivity Matrix	From Connectivity Matrix
$\lambda^4 - 3\lambda^2 + 1 = 0$ $\lambda = -\dfrac{1}{2} - \dfrac{\sqrt{5}}{2}, \dfrac{1}{2} - \dfrac{\sqrt{5}}{2}$ $-\dfrac{1}{2} + \dfrac{\sqrt{5}}{2}, \dfrac{1}{2} + \dfrac{\sqrt{5}}{2}$ $E = 4.472135954995$	$\lambda_A^4 - 11\lambda_A^2 + 1 = 0$ $\lambda_A = -\dfrac{3}{2} - \dfrac{\sqrt{13}}{2}, \dfrac{3}{2} - \dfrac{\sqrt{13}}{2}$ $-\dfrac{3}{2} + \dfrac{\sqrt{13}}{2}, \dfrac{3}{2} + \dfrac{\sqrt{13}}{2}$ $(E)_A = 7.21110255$	$\lambda_C^4 - 14\lambda_C^3 + 50\lambda_C^2 - 52\lambda_C + 16 = 0$ $\lambda_C = 2 - \sqrt{2}, 2 + \sqrt{2}$ $5 - \sqrt{17}, 5 + \sqrt{17}$ $(E)_C = 14$

4. Open problem

- Study of atom connectivity and connectivity energy for other compounds.
- Find the significance of these energies with respect to the physical properties of the compound.
- Compare energies and atom connectivity and connectivity energies of different compounds and characterize them.
- Finding the relationship between the structure of a compound and the energy of the compound.

5. CONCLUSION

The purpose of this study is to investigate the various energy of graph through the new perspective of atom connectivity matrix and connectivity matrix. The current study is innovative, andthis approach has not yet been studied. Moreover, the new study will explore the various possible applications in the field of applied sciences.

In this paper we introduced the various energy of graph through atom connectivity matrix (ACM) and in general connectivity matrix (CM). In the previous studies the significance of double bond, triple bond or atoms are not properly interpreted in energy of graph. Here we are defined the various energies by considering the types of the bonds in the molecule and the significant of double bond, triple bond or atomic number are interpreted in energy of graph. Calculations of characteristic polynomial and Eigen values, various energies from the hydrogen-suppressed matrix and non-hydrogen-suppressed matrixare calculated in the compound Ethyne - C2H2.

In future works, the significance of these energies with respect to the physical properties of the compounds need to be developed. The various results, theorem related to the atom connectivity and connectivity energies in new perspective are to include in future works.

References:

Basak. S. C& V.R. Magnuson V. R (1988). Determining Structural Similarity of Chemicals Using Graph-Theoretic Indices, *Discrete Applied Mathematics 19, 17-44.*

B. Zhou(2007).The largest eigenvalues of the distance matrix of a tree.*MATCH Commun. Math. Comput. Chem. 58, 657-662.*

C. A. Coulson(1940). On the calculation of the energy in unsaturated hydrocarbon molecules.*Proc. Cambridge Phil. Soc., 36, 201 – 203.*

Danail Bonchev & Douglas J. Klein(2002). On the Wiener Number of Thorn Trees, Stars, Rings, and Rods.*CROATICA CHEMICA ACTA, CCACAA 75 (2) 613-620 .*

D.M.Cvetkovic, M.Doob, & H. Sachs(1980). Spectra of graphs theory and applications.*Academic press, New York.*

E. Sampath Kumar(2010). Graphs and Matrices.*Proceedings of National Workshop on Graph theory Applied to chemistry, chapter-2, Centre for Mathematical Sciences, Pala Campus , Kerala, 1-3.*

Frank. Harary (1975). Graph theory.*Addison Wiley, Reading Mass.*

Gutman & Boris Furtula(2017). Survey of Graph Energies.*Mathematics Interdisciplinary Research 2 , 85 – 129.*

Gutman(1978). The energy of a graph.*Ber. Math. Statist. Sekt. Forschungszenturm Graz., 103, 1-22.*

Gutman, O. E. Polansky(1986). Mathematical Concepts in Organic Chemistry.*Springer.*

Gutman (2000). The energy of a graph: old and new results.*Algebraic Combinatorics and Applications, Springer, 196-211.*

Gutman(2005). Topology and stability of conjugated hydrocarbons, The dependence of total ¼-electron energy on molecular topology.*J. Serb. Chem. Soc., 70 441-456.*

G.Indulal, I.Gutman, A.Vijaya Kumar(2008). Distance Energy of a graph. *MATCH Commun. Math. Comput. Chem. 60 , 461-472.*

Gutman, Sekt. Forchungsz, J.A. de la Pena and J. Rada(2007).The energy of regular graphs.*MATCH Commun. Math. Comput. Chem., 57, 351-361.*

H.B. Walikar(2007). The energy of a graph: Bounds, Graph theory Lecture notes.*Department of Computer Science, Karnatak University, Dharwad.*

H.S. Ramane, D.S. Revankar, Ivan Gutman, Siddani Bhaskara rao, B.D. Acharya, H.B. Walikar(2008). Estimating the distance energy of graphs.*Graph theory notes of New York LV.*

H.S. Ramane, H.B. Walikar, S.B rao, B.D. Acharya, P.R. Hampiholi, S.R. Jog and Gutman(2005).Spectra and energies of iterated line graphs of regular graphs.*Appl. Math. Lett., 18, 679-682.*

H.Hua and M.Wang(2007). Unicyclic with given number of vertices and minimal energy.*Lin. Algebra Appl., 426, 478-489.*

Kamal Kumar. M(2012). Domination energy of graphs.*IJAM, Vol. 3, No. 1, 417-424.*

Kamal Kumar. M (2011). Relation between domination number, energy of graph and rank. *International Journal of Mathematics and Scientific Computing, 1(1), 58-61.*

Kamal Kumar. M (2014). Characteristic polynomial and domination energy of some special class of graphs. *International Journal of Mathematical and Combinatorics, 1(1), 37-48.*

Kamal Kumar. M, Johnson J..J, Winson. R (2018). Different Domination energies in graphs.*International Journal of Mathematical and Combinatorics, Vol.4, 103-145.*

Koolen. J. H, Moulton. V (2001). Maximal energy graph.*Adv. Appl. Math. 26,47-52.*

Koolen. J. H, Moulton. V (2003). Maximal energy of bipartite graph.*Graphs Combin. 19, 131-35.*

L.Ye and X. Yuan(2007). The minimal energies of trees with a given number of pendent vertices.*MATCH Commun. Math. Comput. Chem., 57, 197-201*