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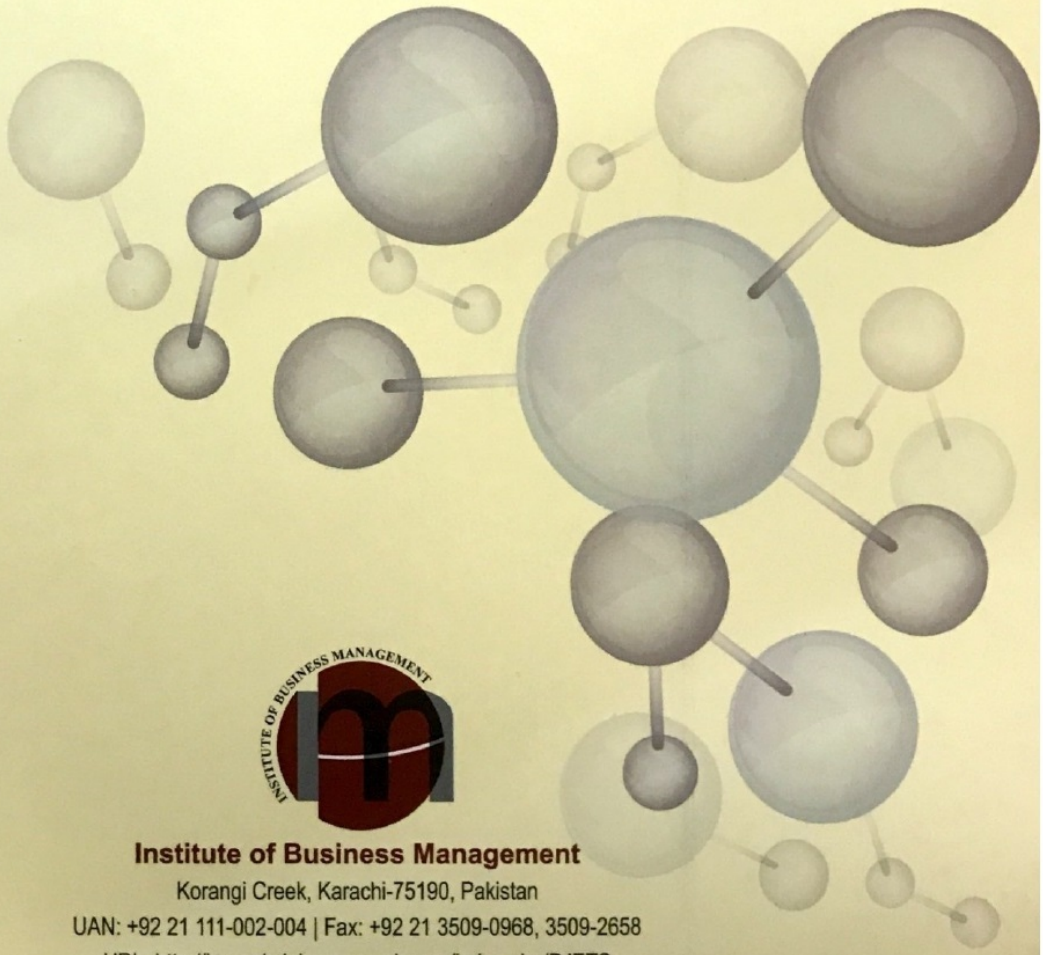

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Editors' Note

I am very much pleased to introduce new editorial team who took the charge from Vol. 7, Issue No. 2, December 2017 and onwards. This change marks the beginning of new era. PJETS has changes its review process, by introducing single non-blind internal review and double-blind external reviews. This means that initially after successful internal review, papers sent for double-blind external reviews having both the reviewers and author(s) identities kept confidential. We have completed six years of successful publications. The scope of PJETS is publishing and promoting innovative ideas and original research in the field of Science, Technology, Engineering and Statistical Science since 2011, twice a year. This journal aims at publishing authentic research papers with less than 19% of plagiarism to create a culture of innovation and scientific development. The focus of the journal is limited to "Computer Sciences", "Engineering", relevant "Emerging Technologies", along with "Mathematics" and "Statistics".

The mission of PJETS is to provide a platform to the researchers, faculty and students to spread their findings. The main goal is to link authors from different professions, for example academia and non-academia in particular and encourage them to share their research. We fortunately succeeded in developing a new editorial review board comprising of reputed scholars and researchers at national and international level, from academia and non-academia.

I hope the new editorial team will be great boon to give new energy to the journal and will impart their knowledge and experience to improve the quality of publications.

Note: Conference papers included in the issue are not subject to the standard of PJETS.

Prof. S.M. Aqil Burney
Editor

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Member Editorial Review Board (National – Academia)

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Contents

Simulation of Complex Heat Transfer Phenomenon across the Composite Wall by Using COMSOL Multiphysics

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***Abstract*- Steady state complex heat transfer phenomenon across a cold storage composite wall has been studied by using COMSOL 5.0 Multiphysics simulation software. The layers of composite wall are built with three different materials, pine, cork board and concrete. Inside and outside surface temperatures of composite wall are T1 = 255K and T4 = 298 K respectively. Without including convective resistance heat flux value is 17.15 W/m2 and with convective resistance it is reduced to 12.12 W/m2. The temperature profiles in each composite layer are linear at constant thermal conductivities. But it has been observed that this trend is changed when thermal conductivities are the function of temperature. COMSOL Multiphysics simulator results are compared with analytical results.**

Keywords: Composite Wall, COMSOL, Heat Flux, Temperature Profile.

I. INTRODUCTION

Rate of heat loss through composite wall have attracted significant attention in various field such as multiwall thermal projection system, unit operation, cold storage rooms, and furnaces. Operating and capital cost have resilient relation with rate of heat loss. Greater the heat loss larger will the operating cost. It can be reduced by increasing the thickness of wall but this will increase the capital cost. Therefore, to optimize the operating and capital cost it is important to analyze the thermal behavior across composite wall. It is very difficult to precisely analyze the thermal behavior of composite wall because it contains more than one constitute with different thermal properties.

Whenever there is a temperature difference occur heat transfer will take place. The amount of heat transfer depends upon deriving force (temperature difference) and thermal resistances. There are three modes of heat transfer, conduction, convection, and radiation. The conduction heat transfer

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phenomenon take place by vibration of molecules within the object and convection heat transfer phenomenon appears due to movement of molecules from one position to another. In case of radiation heat transfer take place by electromagnetic radiations [1].

Wei Chen analyzed the heat transfer rate through composite solar wall with porous medium and observed that porous medium behaves like as thermal insulator when no solar shining [2]. Abdulaziz Almujahid, explained the heat loss across building wall and extensive consequences on energy consumption and energy conservation in buildings [1, 4]. J. Raymond, studied heat transfer behavior in composite walls and evaluated the effect of wall channel width and surface emissivities at heat transfer rate [7].

In this paper complex heat transfer phenomenon has been studied through composite wall of cold storage room. It was constructed by three different materials pine, cork board, and concrete. Heat loss was analyzed by COMSOL Multiphysics and results were compared with analytical results.

II. Problem Statement

Cold storage room wall was constructed with layers of pine, cork board and concrete. Inside surface temperature was less than the outside surface temperature. Hence, heat transfer was took place across the wall due to temperature gradient. Properties of wall materials are summarizing in the Table I.

TABLE I
PROPERTIES OF MATERIALS

Layer	Material	Thickness of Layer (L = mm)	Thermal Conductivity (k = W/m.K)
A	Pine	15	0.151
B	Cork board	100	0.0433
C	Concrete	75	0.762

Figure 1 Show the systematic diagram of cold storage wall. Heat will flow from outside surface to inside surface. Temperatures at each boundary layer were T1, T2, T3, and T4. The outside air temperature was T5. The interior and exterior surface temperatures were 255 K and 298 K respectively. Heat transfer has occurred due to temperature gradient. It was required to reduce the heat flux up to 50% by increasing the corkboard thickness or with some other material. The temperature profile was also studied by changes the corkboard with new material having thermal

conductivity K = 2.5exp (-1225/T). Heat flux and temperature profiles were also examined with natural convection heat transfer coefficient ($h = 1.37\lceil(T_5 - T_4)/6\rceil^{1/4}$) at the outside of the wall.

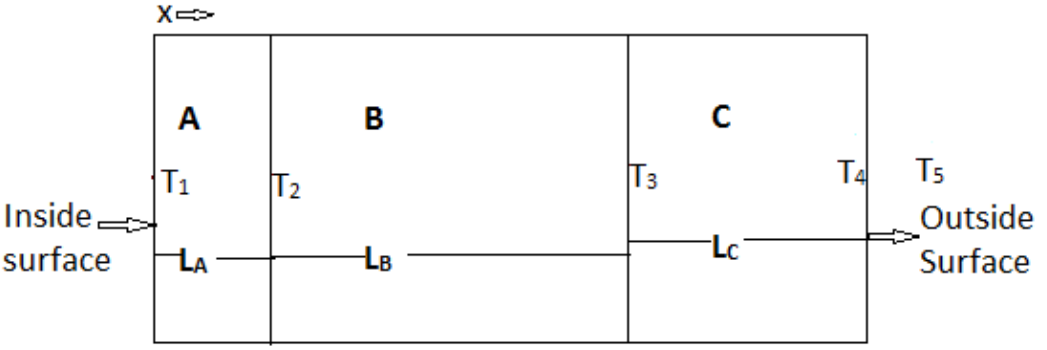

Figure 1. Heat transfer through cold storage wall.

III. Mathematical Model

The heat transfer was occurred by conduction mode across the solid wall. Furrier law will be applicable:

$$\text{Heat flux} = q_x = \frac{\text{Deriving force}}{\text{Resistance}} ----- 1$$

$$\text{Deriving force} = \text{Temperature change} = \Delta T ---- 2$$

$$\text{Thermal resistance} = \frac{\text{Thickness of material}}{\text{Thermal conductivity}} = \frac{L}{K} ---- 3$$

Thermal resistance = R = Resistance of Pine + Resistance of cork board + Resistance of concrete

Convective resistance will also encounter in case of convective heat transfer.

$$R = R_A + R_B + R_C = \frac{L_A}{K_A} + \frac{L_B}{K_B} + \frac{L_C}{K_C} ---- 4$$

Heat flux through layer A, Layer B, and Layer C will be

$$q = \frac{\Delta T}{\frac{L}{K}} ---- 5$$

$$T_1 - T_2 = -\frac{L_A}{K_A} q_A ---- 6$$

$$T_2 - T_3 = -\frac{L_B}{K_B} q_B ---- 7$$

$$T_3 - T_4 = -\frac{L_C}{K_C} q_C ---- 8$$

Total temperature difference

$$\Delta T = T_1 - T_2 + T_2 - T_3 + T_3 - T_4 = T_1 - T_4 - - - - 9$$

Total heat flux through composite wall is

$$q_x = \frac{\Delta T}{R_A + R_B + R_C} = \frac{T_1 - T_4}{\frac{L_A}{K_A} + \frac{L_B}{K_B} + \frac{L_C}{K_C}} - - - - - \ 10$$

In case of convection

$$q_x = \frac{\Delta T}{R_A + R_B + R_C} = \frac{T_1 - T_4}{\frac{L_A}{K_A} + \frac{L_B}{K_B} + \frac{L_C}{K_C} + \frac{1}{h}} - - - - \ 11$$

IV. METHODOLOGY

COMSOL 5 multiphysics software was used to study the heat transfer phenomenon. 2 D heat transfer module has been selected for this particular case. Composite wall geometry has been sketched first with the help of data. To analyze the problem material data from table 1 and Furrier law equation has been selected. Boundary conditions were defined from problem statement. The required parameters for simulation were used from the table 1. Run the simulator after completion of all simulation requirements. The obtained results were compared with mathematical method.

V. RESULTS AND DISCUSSION

The temperature profile was linear in each layer of composite wall at constant thermal conductivities. At steady state condition temperature was raised from 255 K to 256.7 K at interface of pine and cork board. Temperature profile trend was linear in pine layer. It was increased from 256.7 K to 296.3 K in cork board layer. The temperature at interface of corkboard and concrete was 296.3 K. The outside surface temperature was found 298 K. From these results it can be concluded that heat was transferred from outside surface to inside surface. The heat flux value was found 17.150389 W/m2. In case 2, when the cork board was changed with other material which thermal conductivity is function of temperature. It has been analyzed that the temperature profile with in layer of that martial was not linear. It was changed along the temperature change within that layer. When convective heat transfer (h) was considered heat flux and temperature at interfaces were also changed. The heat flux value was reduced to 12.12 W/m2. Pine and corkboard interface temperature was remained unchanged. The corkboard and concrete interface temperature was 289.68 K and the concrete and air interface temperature was 290.88 K. It has been observed that the heat flux value was decreased with increased in thermal resistances. It is required to decrease the value of heat flux

up to 50%. It was achieved by increasing the thickness of corkboard from 0.1 m to 0.2 m. This increase in thickness will increase the thermal resistance and hence reduce heat loss up to 50%.

Simulated temperature profiles were shown in Fig. 2 and fig. 3. In Fig.1 graph (A) and Fig.2 (C) it has been observed that when the thermal conductivity of corkboard was function of temperature then the temperature profile has little curve. The temperature profile was linear in pine (0-0.015 m) and concrete (0.1-0.75 m) layers but little curved can be seen in middle layer (0.015-0.1 m). This trend shows that temperature profile in composite material depend upon thermal conductivity and consequently thermal resistance of the material.

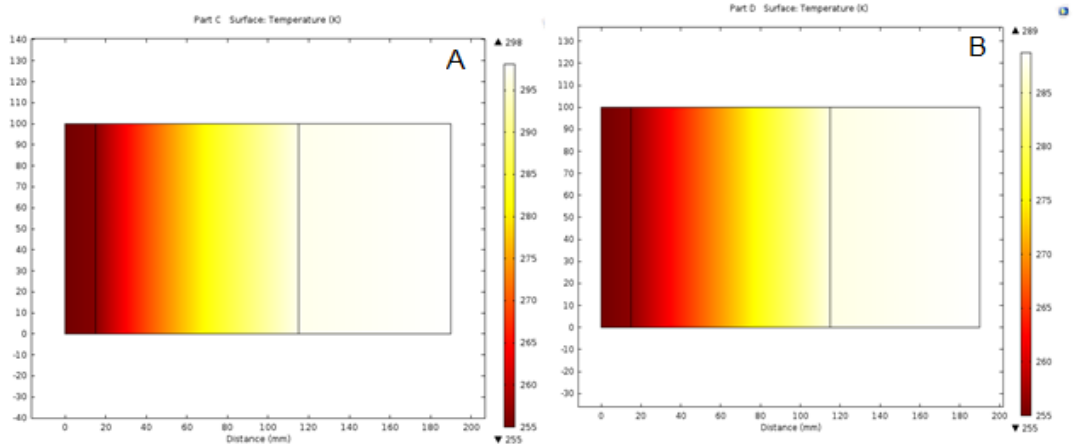

Figure 2. COMSOL Multiphysics 5 simulation results: (A) Temperature variations within composit layers when material thermal conductivity (K = 2.5exp (-1225/T).) was the function of temperature. (B) Temperature profile with convective resistance.

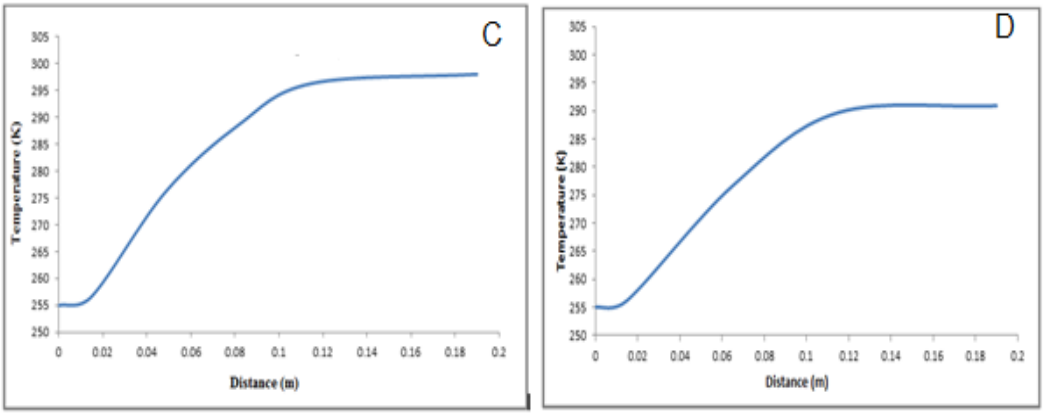

Figure 3. Temperature profiles within composite layer layers when material thermal conductivity (K= 2.5exp (-1225/T).) was the function of temperature (C); Temperature profile with convective resistance (D)

VI. CONCLUSIONS

Complex steady state heat transfer phenomenon across a cold storage composite wall has been studied with the help of COMSOL 5.0 Multiphysics. In this article it has been observed that temperature profiles within the composite wall are linear but temperatures value at the interface depend upon the thermal resistances of composite materials. Heat loss through the wall can be reduced by increasing the thermal resistance of composite materials used to construct wall. It is concluded that heat loss across the wall is depend on the thickness of composite material layers and temperature gradient across the composite layers.

ACKNOWLEDGMENT

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Competency Assurance Management System: Enhancement of Assessment and Verification Process

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Abstract: **The paper addresses Competency Assurance Management Systems (CAMS): design, developing and implementing of learning programs. Competency Development Framework (DFW) skills profile of a specific job consists of set of components: competencies, levels of proficiency, and Performance Criteria -Behavior Indicators. To implement CAMS DFWs successfully, the learning development programs need to meet the SMART principles. One of which is to be measurable through mapping real work tasks to a specific Key performance Indicator(s) and achievable through mapping them to a specific competence(s). Competencies achievement may be ensured though conducting assessments. The paper explores the quality of assessment and verification (A&V) process that make CAMS DFW implementation more effective and reliable. It focuses on technical coaching as a main stage of the A&V process and how to enhance its quality and the outcome of the CAMS system accordingly.**

Keywords: CAMS, DFW, Learning and Development, and Quality Assessment and Verification.

I. Introduction: Competency-Based Education Systems (CABES) and Assessments

A. Learning and training through Competence

Nowadays, there is a need for professional competence improvement [1]. This put demands on higher education and training institutions, to bring academia and industry together and establish a closer relationship between them. Competency Based Education (CBE) common model includes two main items: (1) a competency DFW and (2) a competency assessment. The competency DFW which determines the awareness, the knowledge and skills required to perform a specific job task, activity, and assignment. While the assessments of competency are used to describe mastery. The importance of CBES credentials depends on the reliability and quality of those assessments.

Assessment reliability and quality is a very important topic for CBE learning development programs [1]. The major development focus in CBE should lie in the design of appropriate performance assessments besides the availability of the instructional materials. On the top of that, institutions should not commit themselves to CBE programs before having clear methods, tools and means to directly assess students' progress or Entry Point Employees' (EPE) performance [2].

B. CBES Accreditation Requirements

For an organization to implement competency-based education/training system, and to be accredited, the following criteria must be considered and reviewed by an accreditation body [3][4][5]:

I) Manual/Document of training statement, policies and procedures.

II) Description of job positions to be considered competent through the program.

III) Process for specifying competencies.

IV) Methods and Learning Resources to support the process of learning and development.

V) Evaluation (Assessment) System – a means to evaluate an EPE's competence.

VI) Documentation System – a means of recording satisfactory accomplishment of learning and evaluation (assessments).

VII) Quality Assurance – a means of ensuring commitment to the approved and documented policies, procedures, documents and manuals, and periodical reports.

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C. Competency Assurance Management System

It is important for implementing EPEs' performance assessment and verification process effectively and for a successful development of CAMS system for various industrial organizations that it is supported by the top management of the organizations/institutions.

The corporate management of an institution must specify a mission and objectives of their competency assurance management system.

Competency assurance management system is used for developing, implementing, and managing the core/business, technical, support, and personal/behavioral competence framework of minimum standards for employees under development (Entry Point Employee -EPE). Such DFW will ensure that all new employees are developed to meet and perform the required critical skills of the target position and other HSE tasks in a competent way.

For this purpose, it is important to establish a corresponding Corporate Standard Policy to ensure its implementation. The Corporate Standard Policy requires the following:

I) Work activities are performed competently by EPE.

II) Job progression is competency-based. It is not time-based progression.

III) Assessment & Verification Standard Processes is developed. EPEs are assessed against agreed competence standards for the given job and a clear verification system is approved.

IV) D. Development of the professional staff is to a high level of competence in their job areas and their standards are continuously updated through continuing training and learning.

V) E. Core critical tasks are performed by EPEs competently to meet the organization's business objectives.

VII) F. Health, Safety, and Environment critical tasks are performed by EPEs effectively to meet HSE organization's Policies.

VIII) All relevant entities are contractually required to be committed to the above principles.

D. What is a competency-based assessment?

Assessment process is making judgments on whether competency has been achieved. The aim of assessment process is to ensure that an EPE can perform the standard expected, as expressed in the relevant endorsed competency standards.

II. CASE STUDY: LEARNING & DEVELOPMENT – ZADCO CAMS AND ASSESSMENT & VERIFICATION PROCESS

A. ZADCO LMS and Unified DFW Structure

Manpower Development Department provides the best learning services and support to meet the learning, training, development of all ZADCO employees' needs, and ensures ZADCO's success as a world class learning and performance driven organization. Figure. 1 illustrates ZADCO DFWs' program types: CAMS, Z CAMS, Z PDP, & CAS

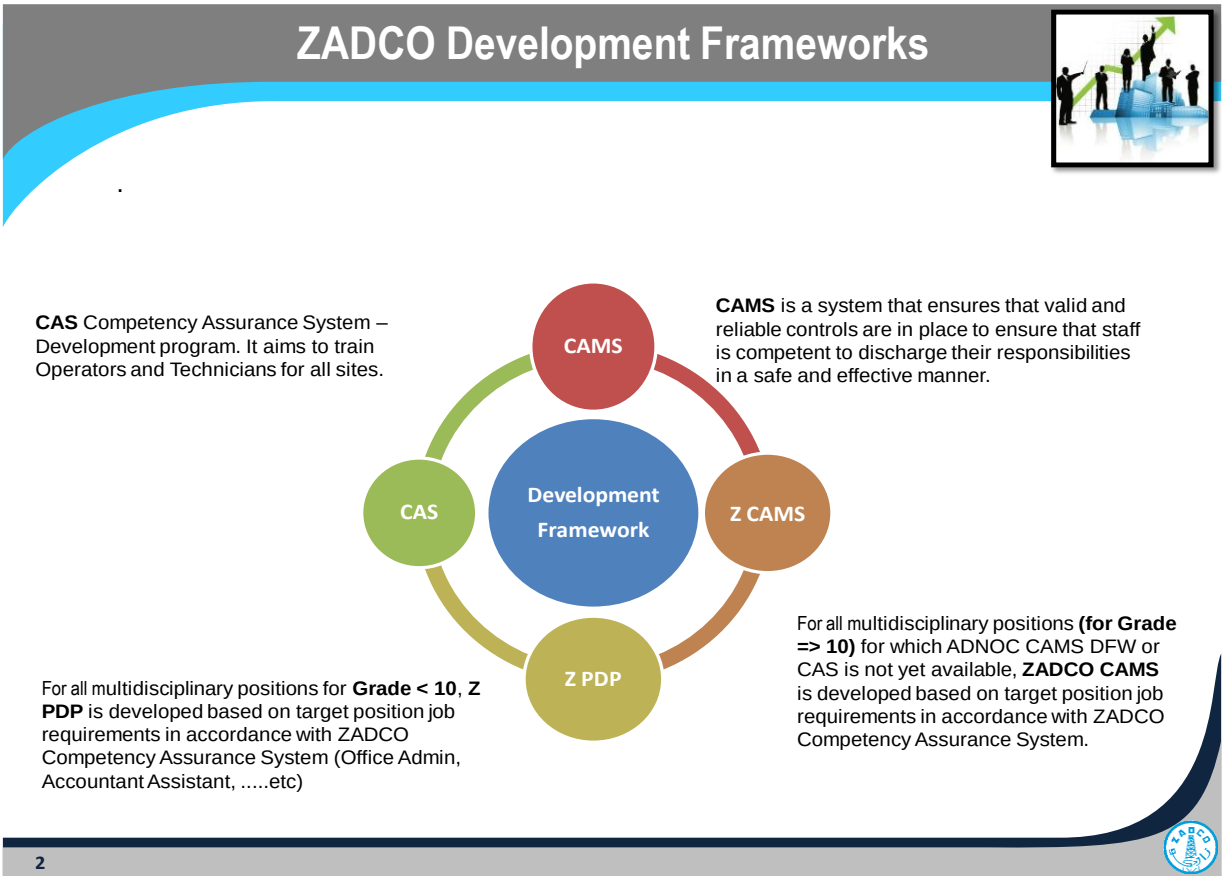

Figure 1. ZADCO Development Framework

B. ZADCO CAMS Supporting Team Roles and Responsibilities

To implement CAMS DFWs successfully, the learning development programs require a support team to guide and help Employee under development performing their competences more effectively. The supporting roles and responsibilities processes are illustrated in Figure. 2.

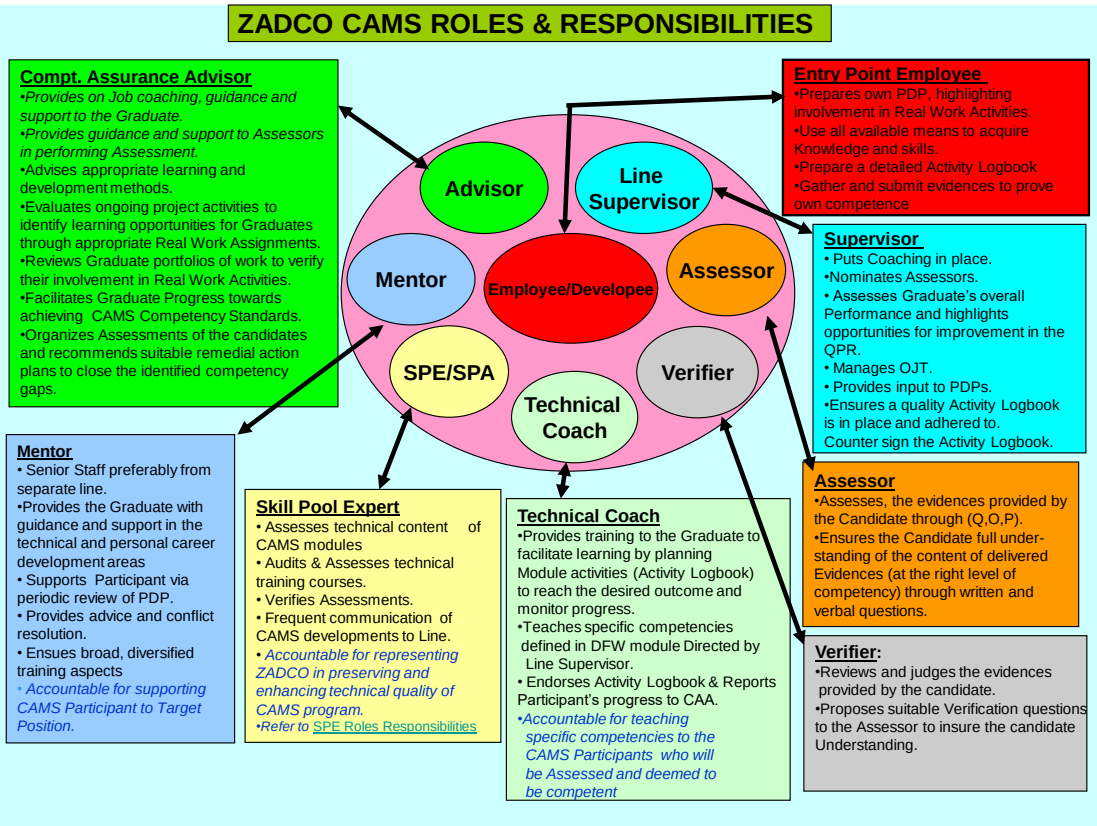

Figure 2. ZADCO CAMS Roles and Responsibilities Process

C. DFW and Evidence Sources

Competency model or framework: describes the component of knowledge, skills and characteristics needed to do the job assignments effectively and it can be used as a tool for employee selection, career development, technical professional development, and talent management.

Competency model consists of Competency Cluster, Performance Criteria (Behavior Indicators: O/P/Q), and Proficiency levels (Awareness, Knowledge, Skill and Mastery).

Usually, an organization specifies their own procedure levels, and assessment and verification process' levels.

The assessment process uses the following four proficiency levels of rating criteria:

I) Awareness (proficiency) level.

II) Knowledge {proficiency) level.

III) Skill (proficiency) level.

IV) Mastery proficiency level.

The DFW is an important reference for competencies against which EPEs a specific business field will be evaluating their competency level. It is used as an Assessment Document for recording ratings, i.e. A (Awareness), K (Knowledge), S (Skill) and M (Mastery), as a conclusion of the given assessment.

Various Evidence from employee own real work activities are provided to support the assessment and verification process. The following three Evidence Sources (O/P/Q):

I) (O) Observations by the immediate line coach or supervisor or manager while the EPE is doing specific job tasks.

II) (P) Products of the EPE's real work output/evidence such as documents, reports, etc.

III) (Q) Questions answered by the EPE.

D. SMART Personal Development Plan (PDP)

Annually, bi-annually, or quarterly Personal Development Plan (PDP), following the SMART principles, must be developed at for EPE in the CAMS learning & development program. Updating the PDP is made after assessing the EPE and reflects his/her current progress his development.

The Competency Assurance Management System PDP is a monitored record/document consists of seven components: Employee Profile, Executive Summary, Planned Real Work Tasks, Actual Real Work Tasks, Training Courses, and Assessment Progress.

E. Learning Development: The Current Competence A & V Processes

The implementation of CAMS requires a framework to support A & V processes. These processes are based on "Minimum A & V Standard Processes".

A & V process generally consists of the following three levels (Figure. 3):

Level 1: Planning for Assessment for one or more competence.

Level 2: Conducting Assessment/Verification for one or more competence.

Level 3: Conducting Verification for Integration and Graduation (Assignment 3 & Assignment 4 Milestone Panel Sessions).

Figure 3. CAMS Assessment and Verification Process

III. ENHANCEMENT OF COMPETENCE ASSESSMENT PORTFOLIO

A. The criteria for judging the quality of assessments

The following principles provide the criteria for judging the quality of assessments:

Principle1: Manageable assessment strategies that promotes learning through interaction between assessor and candidate.

Principle 2**:** Clarity for the candidate and assessor the goals of the learning (tasks or activity).

Principle 3**:** Designing an assessment to help better learning over better marks for the candidate to maximize the output of the candidate.

Principle 4**:** Facilitate the ways for candidates to use feedback from assessment.

Principle 5**:** Helping candidate to take responsibility for their learning.

Principle 6**:** Equality of assessment of all the candidates.

B. Implementation of LMS to enhance the workflow process

It was noticed that a big amount of effort and time are spent in administration verifying the manual documents of the CAMS candidate assessment forms, evidence, and other supporting documents.

It is highly recommended to implement the LMS for more accuracy and correctness of the Learning development processes. This will minimize the administration work and tasks performed by the CAMS supporting team.

C. Competence Assessment Portfolio

The portfolio is an educational resource to provide evidence for, and evaluate the progress made by an EPE/employee during her/his learning development process. It is made up of a set of evidence of learning that the EPE selects, analyses and presents with the aim of demonstrating the achievement levels. In assessment learning based on the e-portfolio, the supervisor suggests a process of constructive reflection about the EPE's performance. This requires innovation in educational practice, moving the center from the supervisor to the EPE and demanding that the latter takes a more active role. This new role for the EPE is an essential component of their success in learning, strengthens the development of new attitudes and practices, and empowers EPEs to successfully meet their leaning challenges.

The assessment and verification process are suggested 6 separate levels including the technical coaching level as follows. These assessment levels are implemented across the system. The corresponding and relevant records are maintained consequently.

Level 1: Technical Coaching

As per current practice, majority of coaches have no enough time for coaching EPE and since they are no recognition award they don't provide proper coaching on one hand. On the other hand, they lack coaching skills, and some EPEs violate the coaching processing others' evidence.

It is highly recommended to add a technical coaching step as a pre-requisite for the EPE's assessment where he gets proper technical coaching. Approve recognition award and consider technical coaching as KPI for coaches.

It is also suggested to deliver a training course "competence-based coaching" that is totally aligned with CAMS and other learning and development programs implemented by ZADCO.

Level 2: Self-Assessment

Where the employee practices his /her self-assessment and that he reviews it with his immediate line supervisor prior to conducting the assessment.

Level 3: Planning for Assessment

Where the employee requests for conducting assessments after reviewing the assessment materials with his line supervisor, then he discusses the assessments requirements and put a plan for conducting the assessment with the assigned assessor.

Level 4: Conducting Assessment with Certified/Trained Assessors and Ensuring Quality Assurance

Assessment Level 4 is the main step and main method of assessment. The two main persons of the assessment process are: the assessor and the EPE/employee. Various types of evidence should be submitted by EPE from his own real work. In addition to verifying the employee's assessment, the verification process, as a part of Level 4, assesses the assessor. The assessment identifies where the EPE is regarding his DFW within CAMS. Level 4 assessment is planned, approved, carried out, and must be followed by Assessor upon conducting the assessment.

The Assessment Form (Document) is used to record and maintain ratings based on the one-on-one assessment process. The current assessment document form should be updated to reflect that EPE has provided with a proper technical coaching. The technical coach name and signature must be clearly mentioned.

The fourth person is the Competency Assurance Advisor (Independent silent Observer) observing a percentage of the assessments to ensure consistency of the overall CAMS assessment process. He is checking the quality of the assessment process, and advising and supporting assessors, and main duties are to:

I) Ensure assessors are qualified, certified and have attended the "Assessor" training course.

II) Ensure assessors are qualified experts in the subject of assessment of competences (elements).

III) Ensure assessors have the appropriate experience in using the recording forms, documents, system, and following the approved assessment procedures.

Level 5 – Conducting One-on-one Verification by a Qualified Technical Verifiers

This verification is used to ensure the quality of assessment results. Conducting the professional a verification interview must be by Technical Verifier. The competency assurance advisor has to ensure that the verifier is qualified to play the verification role, certified, and has attended the "Verifier" technical course. On the other side, assessor (Level 4) has no role in Level 5 verification process.

As for Quality Assurance of the verification process, the competency assurance advisor will provide feedback to the verifier, although he must be a silent observer during the verification process.

Level 6 – Conducting Panel Session Committee Interview Verification for A1-A4

The sixth level of quality assurance in the CAMS A & V process is "Conducting Panel Session Interview". The main purpose is to ensure the quality of assessment results. A verification process involving the EPE/employee and other panel committee members as follows:

I) EPE/Employee under development.

II) Primary technical coach.

III) Line supervisor/team leader/line manager.

IV) Learning development advisor (Independent Observer).

V) Certified/Trained Technical verifier (Skill Pool expert).

VI) Certified/Trained Assessor.

On the top of that, the verification process provides further quality check on assessment for EPE milestone events involving: (Poor Progress and performance, Appeals, Promotions; Transfers; Succession).

Panel members are expected to attend a "Verifier" training course and to be recognized technical experts. They supposed to play an additional level of quality assurance.

IV. CONCLUSION AND RECOMMENDATIONS

The following points are recommended to:

I) Learning Management System LMS must be implemented for more accuracy and correctness of the Learning Development processes. This will maximize the effectiveness of the CAMS supporting team and minimize their administration tasks.

II) Conduct Verification Panel Session upon completion of all assignments (A1-A4)

III) Enhance the assessment and verification process workflow.

IV) Enhance the Assessment and Verification systems to have 6 Levels by adding a technical coaching step as a pre-requisite for the EPE's assessment where he gets proper technical coaching. Approve recognition award and consider technical coaching as KPI for coaches. Assessment form to be revised to reflect coaching role.

V) Develop and deliver a training course "competence-based coaching" that is totally aligned with CAMS and other learning and development programs.

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Robustness of EPS in Determining Share Price: An Empirical Evidence from PSX

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***Abstract*- The stock market is considered as the major indicator of the success of any country. The various dynamics operating therein are of enormous interest for a financial analyst, policymakers, stakeholders or more or less the majority of the people across the globe. Within the stock market, the most interested and controversial topic is a determination of valuation mechanics by which share prices fluctuations can be understood and a model fit for investment criteria could be established. Boundless factors have discovered and some are still in the process of discovery to get a hang of share prices fluctuations mechanism. So keeping this in mind this research is targeted to explore a linkage between earning per share (EPS) and share prices, taking a sample of five fertilizer Sector Company for a period of 12 years making the aggregative amount of data up to 60 observations. Data is collected from the company fundamentals released in annual reports of the company. In order to explore the causal mechanism between the two variables, a regression test is employed. Pearson correlation is also used as an extension to the analysis. The results of the study approved the previous literary contributions in this area by highlighting the highly statistically significant positive relationship between share prices and EPS since $F(1,58)=191.205$, $p<0.05$.**

Keywords: EPS, PSX, share prices, fertilizer sector, investment criteria**.**

I. INTRODUCTION

Amongst the most important means to gauge the material success of any organization includes its ratio analysis. The intrinsic practicalities of the corporation may be spotlighted by analysis of its ratios [1]. Functional including financial outcomes can be tracked by them. Stakeholder majorly investors concentrates on the stock's market worth and directional analysis of its ratios [2]. Amongst these ratios price to earnings ratio, dividend payout ratio, dividend yield ratio, and dividend per share and earning per share are frequently used [3].

Warren Buffet a renowned investor having ranked in one of the top 10 richest men in the world has made his investment criteria. Within his successful investment criteria, he will be delighted to invest in the organization reporting positive corporate earning consistency or consistent rise in EPS at least for ten years of their recent history but with some conditions applied [4].

Earning per unit of average common stockholder predominates as a predictor of stock prices and as an element in the computation of price earning analysis [5].

A. Background of the Study:

While exploring characteristics of Pakistan's stock exchange it has been explored that Pakistani market is featured to be a weak market and investing criteria can be made keeping in mind the usual sequel of corporate accounting information leading towards the path of higher returns [6]. By keeping this in mind, different analysts have developed their conceptual framework of regressing corporate stock values by its fundamental data. [7]. This research also tracks stock price relation with earning per share.

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B. Significance & Objective of the Research:

Analyst usually considers an investment in stocks securities as of having a high liquidity. Therefore they have regarded it as of having prime importance and grounded various theories on it. They have worked on boundless variables so that any insight can be drawn and highly profitable portfolio could be constructed. Eventually, a number of variables are found to emerge as a result of these findings which are earning per unit of the average shareholder, dividend per unit of average shareholder etc.

This analysis is designed to unveil the linkage between EPS and market prices of shares by taking five companies listed in sector seven of Pakistan stock exchange. The names of the companies taken for analysis are listed in the methodology section.

C. scope of the Study:

The scope of the study is limited to five companies of sector seven that is fertilizers sector, listed on Pakistan stock exchange. The data also composed of 12 years starting from 2004 and ending up at 2015. Within this time frame, EPS and market value of the stock of each individual company are taken out for analysis.

D. Statement of the Problem:

The developed markets are often used in the analysis for testing a number of stock market assumptions such as the markets of UK and USA. The results of the test in these markets indicated and pointed out the relevance of the "efficient market hypothesis" and "information content hypothesis". With respect to emerging markets, the researchers, in general, having aware of its complexities found it challenging to spot impact of various variables since emerging markets constitute a significant amount of inexperienced and uninformed investors, declining levels of liquidity, shaky legal, political, economic and institutional and operational structure [8]. There exist numerous studies to engage the stock value fluctuations within the context of developed countries but only limited studies were conducted to test such fluctuations within emerging markets especially south Asia [7].

Although the analysis of numerous studies has ended up with the strong and positive relationship between EPS and share prices but a study conducted by [9] on pharma and chemical organizations of Pakistan stock exchange revealed a different result. This research will again test this relationship by taking fertilizers companies within Pakistan stock exchange.

II. Literature Review

Within the domain of financial literature, the most widely explored topic is the forecasting and estimation of stock prices. Critical evaluation of varied components within the stock market has been done to determine the rapid ups and downs in the stock of various companies or the overall market. Different theories emerged as a result of this investigation with varying results such as Keynesians work of "animal spirit", Fama's proposition of the efficient market hypothesis [10].

Although there exist various methods for the evaluation and forecasting of stock prices analyst majorly follows two approaches namely fundamental and technical analysis [11]. Fundamental analysis relies on the corporate generated information such as the company's financial reports, horizontal, vertical and ratio analysis [12]. Share prices are sensitive to the corporate fundamental as a pretested rule. It is believed that if an organization is reporting high earning consistently its stocks would appreciate [13]. Looking at the other side of the coin technical analysis base its focus on historical trends or fluctuations in prices. Historical Price graphs, charts, and data are studied to make predictions about the future [14]. Usually, the Fundamental analysis is expected to outperform in the long run as compared to technical analysis. It is considered to be a long run indicator of the intrinsic worth of stock [15] [16] [17].

While discussing company specific-factors, corporate earnings are primarily regarded as an influential factor in determining the worth of any organization or values of its shares as traded in the market. The primary function of any

organization is to produce and sell goods and services hence benefiting its customers and earning an amount above it cost so that its reserve would appreciate and its cost could be covered. Once the company has passed its introductory stages and starts to contribute towards its reserve development, it would definitely plan to increase the size of its operational processes and hence ultimately contributing to its inflows. When the organization have developed enough customer bases and gathered a lump sum amount, the demand for equity shares of that organization would boost so as its market values. Earnings when deducted from all the operational expenses, governmental taxes, and interest and accounting depreciation are a stake of its shareholders [18].

One of the byproducts of organizational earnings is its earnings per unit of the average common shareholder (EPS). EPS is a detachment of corporate earning representable to each holder of common stock. This detachment of aggregate income comes from the exclusion of preferred shareholders share and government share in the form of its taxes [5].

Ground works have been done to reveal the linkage of EPS and market share value. A study on the insight of successful 50 organizations 0f Indian market disclosed powerful linkage between EPS and stock value in the market [19], similar findings were found in [20]. Whereby he addressed and concluded the worth of EPS for the investment criteria. Authors in [21] establish this connection by widening its research scope and taking into account five variables and twenty-year data of eight major players within the cement sector of India, ending up with the same findings. Malhotra in 1987 has done a cross-sectional examination with a panel data of four sectors and four years [22].

Researchers in [23] studies have taken three measurements for assessing share market values. Among this three Measurement, the measure of EPS was found to have a sound positive effect on share prices. The earning per unit of common stockholder affected the stock market values for an extended period.

Studies conducted by [21] highlighted that earning per unit of the average shareholder is linked with share prices significantly. The time period for which data is analyzed ranged from 1968-1988 or twenty-year data. The cases constitute approximately eight cement sector firms whose shares are publicly traded. Earning per unit of the average stockholder was not the only variable that is taken in this research h rather there were five variables in total, which were dividend per unit of the average shareholder, earnings per unit of the average shareholder, proceeds of sales values, share prices on which they are traded in the market and retained earnings.

Another research conducted by [24], taking four years cross-sectional data staring from 1989-93 for one hundred and five firms revealed that earning per unit of the average common stockholder ineffective measure for the share price.

Studies in [22] conducted in cross-industrial settings taking into account four industries which were cotton textile, general engineering, paper and food-related products also depicted similar findings with data ranging from 1982-1985. The same relationship in [25] used the statistical power of linear regression in addition to correlation.

Despite various analyst have Unisom conclusion regarding positive and strength of the relationship between EPS and value of stocks but some have reported inverse scores. An analysis of twenty-two Bangladesh banks revealed the opposite finding and the same research concluded the rationality for such findings [26].

III. HYPOTHESIS

The theoretical framework comprises two variables; therefore, the hypothesis is as follows:

H_0 : EPS doesn't have statistically significant influence market price of stocks

III. METHODOLOGY

A regressive mechanism is been establish by taking EPS as an independent variable and market prices of stocks depending on it.

A. *Data and Variables:*

Data of EPS and Stock prices are collected from annual reports of the companies and company website from the period of 2004 to 2015. Basic EPS and closing prices of shares are taken for analysis.

B. *Sample and Frequency:*

A sample of five Pakistan stock exchange listed companies namely Arif Habib Corporation Limited (AHCL), Dawood Hercules limited (DAWH), Engro corporation limited (ENGRO), Fauji fertilizers company (FFC) and Fauji fertilizers bin Qasim Limited (FFBL). So the sample constitutes an aggregate of 60 observations. Only annual data is taken by ignoring the fluctuations of figures within the year.

C. *Model:*

Since a causal mechanism is explored between earnings per average common shareholder and share prices in the secondary market, therefore, simple linear regression is applied. Before applying linear regression Pearson correlation test is also applied. The model of the regression can be classified as follows:

$$MPS = \alpha + \beta * EPS$$

Where: MPS stand for the market price of stock & EPS stand for basic earnings per share

III. Results And Discussion

Interpretation of the result is as follows:

A. *Graphical Analysis:*

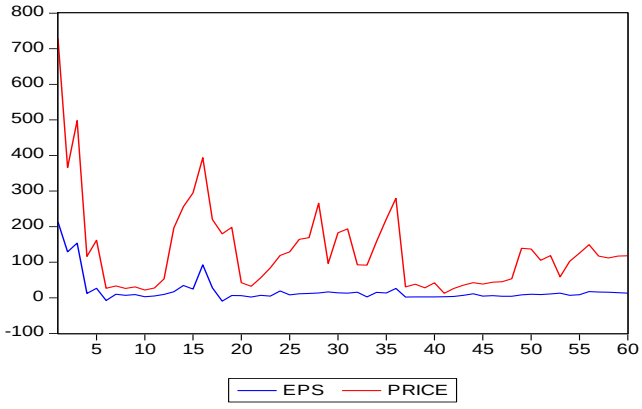

Figure 1. graphical representation of the relationship.

The graph also shows the relationship between EPS and the prices of stocks. The movement of EPS and share prices are in a similar direction initially but in the end, this relationship seems to weaken out as earning per share seems quite stable without many fluctuations but share prices are still fluctuating.

B. *Description Analysis:*

TABLE I
Descriptive Statistics

	Mean	Std. Deviation	N
PRICE	134.1732	127.04023	60
EPS	19.4748	37.10855	60

From the descriptive statistics result we can conclude that mean of the market value of a share is 134.17 and unit earning per average common holder's mean is 19.48. Sample size or total observations are 60, 12-year observation for 5 companies.

B. Inferential Analysis:

For inferential statistics two models results that are applied are as follows:

TABLE II
CORRELATIONS

		PRICE	EPS
Pearson Correlation	PRICE	1.000	.876
	EPS	.876	1.000
Sig. (1-tailed)	PRICE	.	.000
	EPS	.000	.
N	PRICE	60	60
	EPS	60	60

According to the results of person correlation test unit earning per common stockholder is statistically significantly correlated with the market price of the share (r=0.876, N=60, p<.oo5).

TABLE III
MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.876[a]	.767	.763	61.81424
a. Predictors: (Constant), EPS				

From the above table, we can conclude that the simple correlation between EPS and share price is .876 whereas EPS can bring 76.7% variation in share prices. These figures are indicating a strong relationship between both the variables.

TABLE IV
ANOVA

Model		Sum of Squares	d.f	Mean Square	F	Sig.
1	Regression	730596.023	1	730596.023	191.205	.000[b]
	Residual	221618.000	58	3821.000		
	Total	952214.023	59			
a. Dependent Variable: PRICE						
b. Predictors: (Constant), EPS						

ANOVA table signifies the importance of regression model in estimating the independent variable's influence on the dependent variable. P-value smaller than 0.05 indicates that prediction is statistically significant.

TABLE V
COEFFICIENTS [A]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	75.773	9.029		8.392	.000
	EPS	2.999	.217	.876	13.828	.000
A. Dependent Variable: PRICE						

From the above table the regression equation came out to be:

$$Price = 75.773+2.999(EPS)$$

Thus based on our results and analysis, the null hypothesis is rejected since there exists a significant influence of predictor on the criterion variable.

C. Discussion:

Although results given by linear regression are very strong to prove the existence of a causal relationship between EPS and share prices but still the groundwork of previous research studies can help us to add weight to our research.

Researcher in [27] studies into Columbian secondary market revealed the same positive linkage between share prices and dollar earnings per average common stockholder. According to this study, EPS is highly linked to share prices and fluctuations in it can bring fluctuations in a later variable.

Authors unveiled in [28] the comparable findings of positive and strong linkage within the context of Pakistan's secondary market. According to this study, volatility in share prices may come because of changes in EPS.

Authors in [29] find fact within Iran's secondary market and also gave the parallel results that there exists a causal relationship between EPS and stocks market value.

Authors in [30] study based on its analysis on almost 50 corporations whose stock are offered to the general public as a token for ownership within Philippine's stock market, also found that EPS and share's value in the market depicts a convincing association. A reverse and ineffective linkage were also debarred between ROA and market value of shares. The study has employed spare rank correlation together with linear multiple regression for disclosing these relationships.

Authors in [18] exploration into the association between earning per unit of the average common stockholder and MVS within the context of Pakistan's stock exchange taking into account 13 companies registered in cement sector are also consistent with our findings of the positive relationship between the two variables.

Researchers in [31] studies of Chinese secondary markets has also concluded the same results as that of our study since it concluded a strong and positive relationship between the two variables.

IV. CONCLUSION, LIMITATION AND RECOMMENDATION

A. Conclusion:

Based on our results and previous research findings, we can conclude that investors must take care of unit earnings per average stockholder (EPS) since it is having the power to bring fluctuations in share prices. For stock investors, financial market analyst, academician and other stakeholders it is highly suggested that they should consider EPS within their investment criteria together with other economic, country-specific or industry-specific variables. A composition of these may be constructed to derive model fit for determining share market value. Despite this, it is also highly suggested that qualitative factors can also bring a potential change in stock market variables hence they should also be considered.

B. Limitation & Recommendation:

This may not be generalized to other industries (except fertilizers) or in other stock exchanges despite Pakistan's stock exchange. The time frame is also limited to 12 years.

Following recommendations are listed for conducting future research in this area:

1. The research studies in the future comprising of the same topic might use a considerable amount of data that needs to be structured to analyze through fixed effects or random effects in accordance with panel statistics. The respondent or cases that constitute part of the analysis can involve similar or different operational dynamics. For example, different conventional banks that are part of listed stock exchanges are similar cases whereas if data related to banks and manufacturing companies are analyzed than it would be a part of dissimilar cases. Heterogeneous data can be incorporated into the analysis if we categorize data in Pakistan stock exchange in accordance with firms reporting consistently top earnings, net profit or any other categorization in which a researcher is interested. Dependent variable can also be changed in the research and instead of it, stock returns can become part of the analysis [32]. Conducting the analysis with such consideration might demonstrate to be useful.
2. If we were to use some qualitative variables in our research then dummy variable may be incorporated so that the factors that could not be quantified their maximum effect could be captured.
3. Different financial data's should be analyzed using Gretl or eviews since they are powerful soft wares used especially for financial data analysis.

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Forecasting Monthly Maximum Temperature of Karachi City using Time Series Analysis

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Abstract- The maximum temperature has led to several complications in our day to day life in the city of Karachi. Rising temperature has affected human health and in some cases has led to the deaths of civilians. In this study, the temperature data of Karachi city in Pakistan over period from January 2005 to December 2015 is assessed. A preliminary graphical method added with the analysis of Autocorrelation and Partial Autocorrelation Function indicated that the data is not stationary and has seasonal factor. SARIMA model of order (0, 0, 2) with seasonal order (2, 1, 1) and period 12 is used to forecast the maximum temperature of the Karachi city over a period of 12 months. We use R software to complete this study. This study will help the policy makers and the insurers to better plan for the future.

Key words: Maximum Temperature, Weather Conditions, and Time Series Analysis.

I. INTRODUCTION

Recently, the city of Karachi has witnessed thousands of deaths due to high temperature. Several researches have shown links between high temperature and rising level of sea , and other extreme weather conditions leading to many casualties and even deaths. Continuous rise in temperature is also linked with heavy claims losses to the insurance industry. This study aims at developing and identifying a model for the past data of maximum temperature in the Karachi city of Pakistan.

A report by United States Environmental Protection Agency stated that since 1901, per decade, the average rate of increase of temperature of global surface is 0.13°F or 1.3°F per century, the global perception increased to 1.9% /century [1] [2]. It has also been observed that the intensity, and frequency of extreme temperature is increasing day by day. A study by World Meteorological Organization indicates that the decade 2001-2010 was the warmest in all over the world, especially the 2010 was recorded as the warmest year around the globe with (+0.53C) increase in temperature. The year 2005 showed (+0.52°C) increase while the year 1998 was 0.52°C warmer. Furthermore

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during last two decades the sixteen years were the warmest years [3]. The increase of 2.9°C in temperature of has been observed in last century, this research was based on past climate data of Pakistan, later it was converted to Regional Climate Models (RCM) and Global Climate Models (GCM). These departments evaluated that with start of 20th century with the temperature of Pakistan is increasing consistently [4]. In an another research on Pakistani climate, it has been found that during last 40 years the annual mean temperature of Pakistan has increase by 0.76°C [5]. Reference [6] has examined increase in the maximum temperature of Karachi due to urbanization. We use SARIMA model to forecast the maximum temperature of Karachi city, however, various other statistical methods could be employed to measure the temperature however, we assess the maximum temperature with the time series analysis .Several other researches have used this method to analysis temperature [7] .

II. LITERATURE REVIEW

A research regarding the raise in temperature suggested that in case of greenhouse effect, global warming and warming trends in capital city of Jordan, are due to the effect of local urbanization, including land used [8]. Another research about the trends of annual temperature in USA, for the period of 1900-2011, showed that the temperature decreased has been observed in two states and increased in the rest of states [9]. Some studies link variation in weather to the rise in temperature. Variability in rainfall is considered one of the many consequences of increase in temperature. An increase in annual rain fall has been seen geographically in past decades [10]. In Pakistan about 40% people are prone to frequent disasters such as floods, storms and rain fall [10] [11]. All these calamities are attributed to rise in temperature. Our lives are greatly affected by warm temperatures and large amount of rainfall [12]. The weather of Karachi city is mostly arid and hot with range of 25C to 40C [13].

III. RESEARCH METHODOLOGY

A. The Data

For the purpose of this study, we collected simulated monthly temperature data of Karachi City over the period from January 2005 through December 2015 [14]. Monthly maximum data was extracted from this data. The data was cleaned and scrutinized. Outliers such as maximum temperature of 57℃, and 59℃, were removed from the data and were replaced with the average of the maximum temperature data of the same month in other years.

B. Data Analysis

An important aspect of time series analysis is that the underlying set of data must be stationary. In other words, mean and variance of the given time series should be constant with respect to time. We use three different methods to assess whether the underlying historic data of the maximum temperature in Karachi city is stationary. These include method of graph, Method of Autocorrelation Function and using Statistical Tests. These methods are explained below:

C. Assessing Stationarity Of Data

i. Graphic Analysis

The graphic analysis of monthly maximum temperature indicates that there is no trend in the given data. It is not clear whether the variance of the historic maximum temperature is constant. Apparently, no outliers are observed, however, seasonality is quite evident. On the basis of the given plot one cannot conclude about the stationary of the historic temperature data. In addition to graphical analysis, we use several other techniques to assess the nature of the underlying set of data.

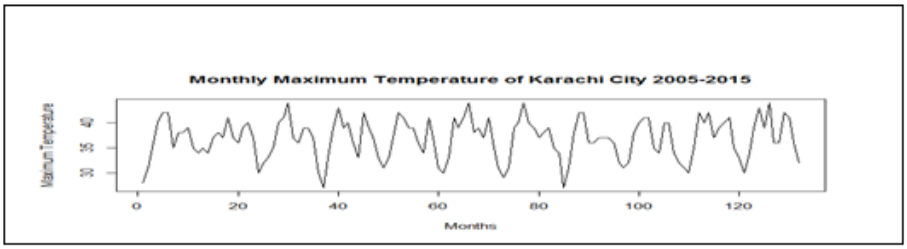

Fig.1: Time Series graph of the Monthly Maximum Temperature (Karachi 2005-2015)

ii. Autocorrelation Function

The graph of the Autocorrelation function indicates that there is correlation between the maximum temperatures. The graph also indicates a seasonal dependency. The Autocorrelation graph of the maximum temperature is given below:

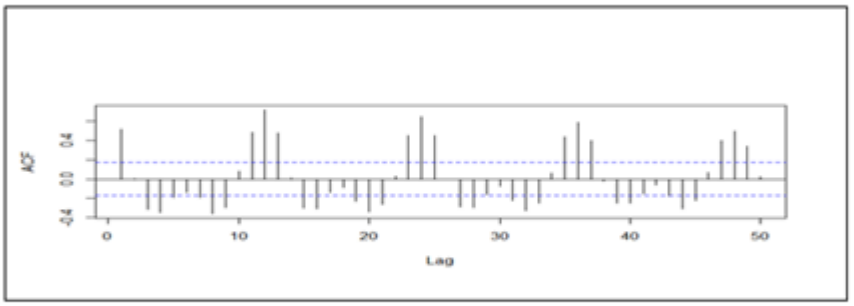

Figure. 2: Autocorrelation graph of the Monthly Maximum Temperature (Karachi 2005-15)

iii. Dickey Fuller Tests

Several tests are used to test the independency of the underlying data. Dickey Fuller is among many tests used to assess the independency of the underlying data. The result of Dickey Fuller test carried out in R rejects the independency of the maximum temperature data of the Karachi City indicating that the data is not stationary. The result of the ADF test is summarized below:

Dickey-Fuller Test
Data: temperature
Dickey-Fuller = -6.6669, Lag order = 5, p-value = 0.01
Alternative hypothesis: stationary

For time series analysis, a major requirement is that the underlying data is stationary. Our graphical as well numerical analysis indicates that the underlying data is not stationary; however, the given data of the maximum temperature is seasonal with period of twelve months. Further analysis of the data shows that the first order difference lagged by a period of twelve months is stationary.

In this work, a model is identified that fits best to the maximum temperature data of the Karachi City. ACF (Autocorrelation Function) and PACF (Partial Autocorrelation Function) are used to determine the order of the model. A diagnostic analysis of the residuals and Akaike Information Criterion (AIC) is used to determine the model that best fit to the data.

The parameters of the model are estimated using the method of least square estimation. On the basis of the chosen model, we forecast the maximum temperature of the Karachi City for the next

one year. Back testing is carried out to check the accuracy of the forecasted values of the maximum temperature.

D. The Model

As the maximum temperature of Karachi city is seasonal. SARIMA model of order ((p, d, q) (P, D, Q)S) is used. Where "p" is the order of non-Seasonal Autoregressive model AR(p), "q" is the order of non-seasonal moving average model MA (q) and "d" indicates "dth" order differences) and P, D,Q (Where "P" indicates the seasonal order of Autoregressive model, "Q" indicates the seasonal order of Moving Average while "D " indicates the seasonal difference and "S" is the number of periods in the season to model the maximum temperature data. Several Authors have used the SARIMA models to forecast temperature and rains in different part of the world[15], [16],[17].

The seasonal ARIMA model in back shift notations is defined by:

$$\rho_{AR}(B)\delta_{SAR}(B^s)(1-B)^d(1-B^s)^D Y_t = \tau_{MA}(B)\tau_{SMA}(B^s)e_t \quad (1)$$

where the parameters represent the following:

ρ_{AR} Non seasonal Auto regressive

τ_{MA} Non seasonal Moving Average

δ_{SAR} Seasonal Autoregressive

τ_{SMA} Seasonal MA

B Backward shift operator.

E. Model Detection

The ACF and PACF tell us about the model to be used that best fits the data. The first order difference of Autocorrelation Function as well as Partial Autocorrelation Function is given below in Fig.3.

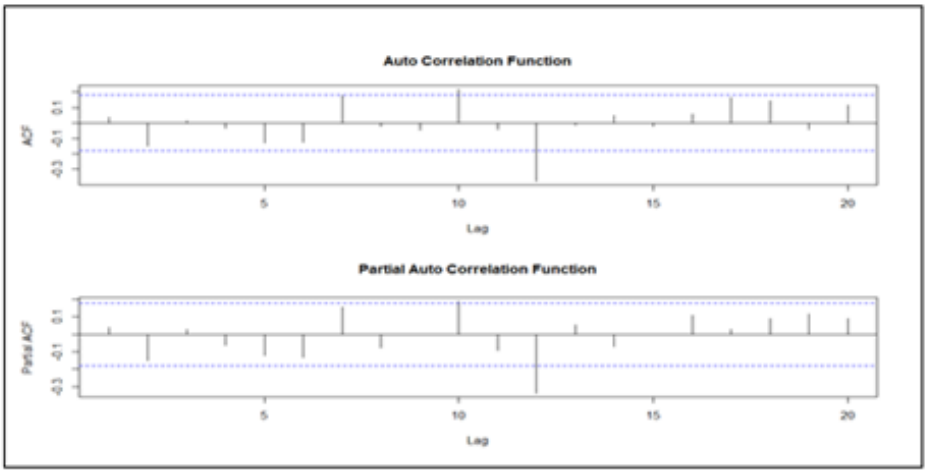

Fig. 3 Autocorrelation and Partial Auto Correlation Plot

Several models were assessed on the basis of the AIC and Likelihood ratio. A summary of the AIC and Likelihood ratio test is given in Table-1 below. From the table below, it is observed that the model SARIMA$(0,0,2)(2,1,1)_{12}$ has the lowest AIC value. Similarly, the same model has the highest likelihood ratio. On the basis of two measures we conclude that the model SARIMA $(0,0,2)$ $(2,1,1)_{12}$ best fit to the underlying data. We chose this model as a possible model to forecast the future maximum monthly temperature of Karachi city of Pakistan.

TABLE I
AIC AND LIKELIHOOD RATIO OF VARIOUS MODELS TESTED

Model	Likelihood	AIC
SARIMA$(0,0,2)(2,1,0)_{12}$	-260.95	529.90
SARIMA$(0,0,2)(2,1,1)_{12}$	-253.40	518.81
SARIMA$(0,0,1)(2,1,0)_{12}$	-261.27	528.54
SARIMA$(2,0,0)(2,1,0)_{12}$	-260.98	529.95
SARIMA$(1,0,0)(1,1,0)_{12}$	-268.48	540.96

F. Diagnosis Of The Model And Forecasting

1. Residual Analysis

In order to test the model adequacy, we carry out diagnosis of the model through the residual analysis. The residuals of the model to determine the appropriateness of the model. The normality as well as independence of the residuals is assessed to check the suitability of the underlying model for the given data. Fists, the residuals of the model are checked for their independence. For this purpose, the ACF and PACF of the residuals of the model are analyzed used. The ACF and PACF of the model are given in Fig.4.

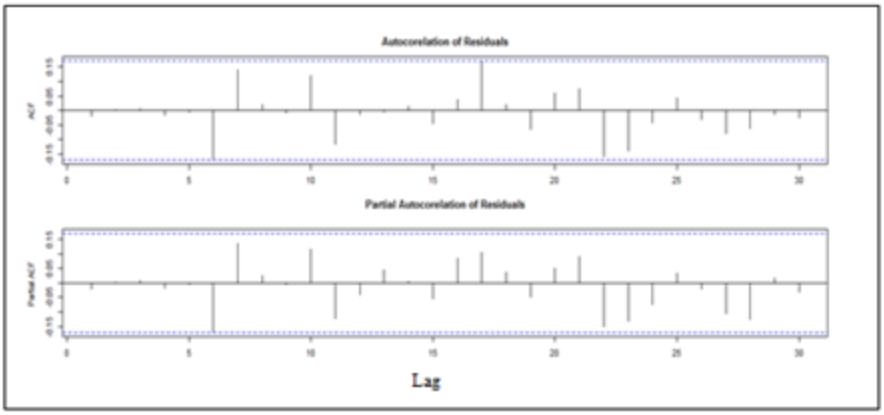

Fig. 4 Autocorrelation and Partial Autocorrelation Function of the Residuals.

The above correlogram of ACF and PACF of the residuals of the proposed model are shows that the residuals are independent of each other. Next, the normality of the residuals is checked.

Test of Normality is another test being use to assess the adequacy of the assumption of the underlying model and hence the appropriateness of the model being used. To assess the normality of the residuals, we use Quantile-Quantile plot. This is given in Fig.5. The Q-Q plot of the residuals of the proposed model is approximately normal with heavy tails as compared to the normal density, this indicates the suitability of the model to the given temperature data:

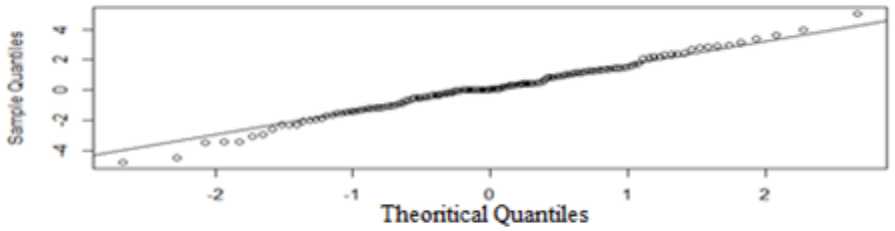

Fig.5 Quantiles to Quantiles plots of Residuals

A further diagnosis of the residuals is carried through the run test as well as the plots of the residuals give in Fig.6 indicate that the residuals of the proposed model are independents.

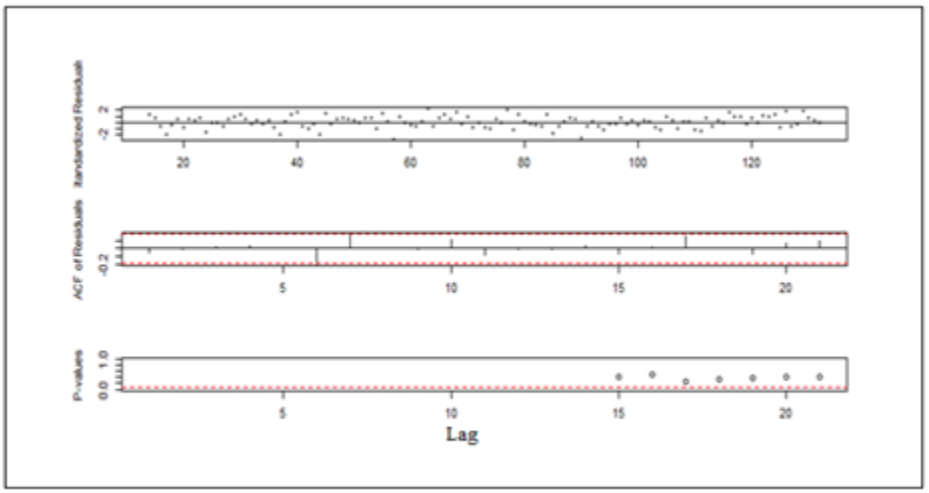

Fig.6 Diagnosis test of the Model

2. Runs Test

$pvalue

[1] 0.998

$observed. runs

[1] 65

$expected. runs

[1] 65.48485

$n1

[1] 56

$n2

[1] 76

$k

[1] 0

3. Forecasting

The underlying model could be used to underlying data to forecast the future temperature. The proposed model is used to forecast the future temperature for the next one. Fig. 7 shows the one-year-ahead predictions with their 95% confidence limits for the monthly maximum temperatures for the next one year (2015 – 2016).

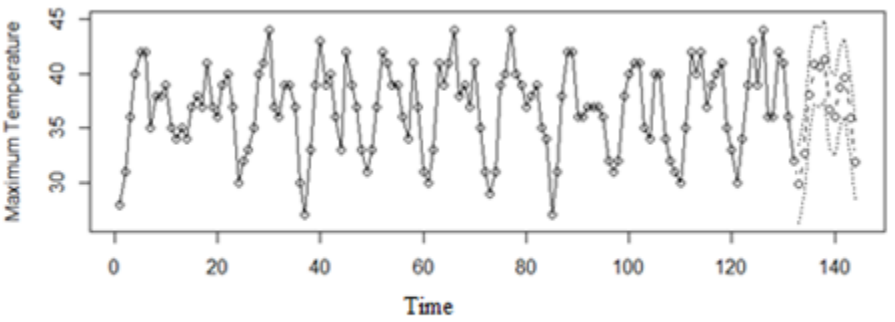

Fig.7 Forecast of One Year Maximum Temperature

To assess the accuracy of the forecasted value, we use the years 2014-2015. The comparison between the forecasted value and the actual values of the 2014-15 are given in Fig.8. It is evident that the error between the actual and the results of trained data is minimal and the proposed model could be applied to forecast the future maximum temperature.

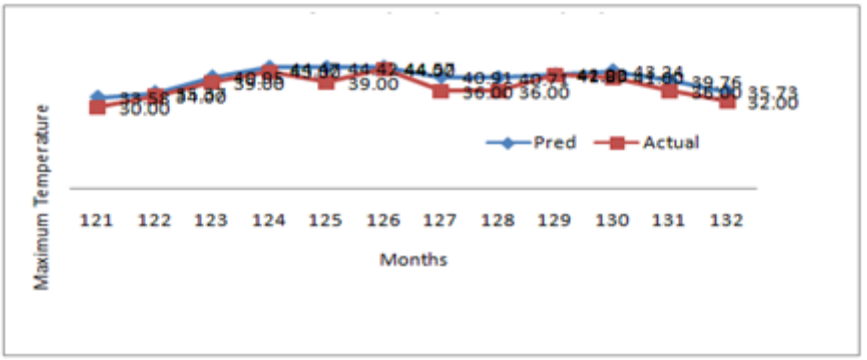

Fig.8 Comparison of Actual and Forecasted values

IV. CONCLUSIONS

The method of using SARIMA is good technique and can be used in forecasting the maximum temperature of the Karachi City. Our result indicates that the proposed model has low level of risk and hence it will help us in estimating the maximum temperature of the Karachi city. It is pertinent to note that this model forecast monthly maximum temperature. It does not forecast the extreme temperature which is a new area to be explored in upcoming research. This proposed model will prove to be beneficial to the policy makers and the insurers to better plan for the future.

ACKNOWLEDGMENTS

All the praises to the ALLAH, I have no words for gratitude to the almighty ALLAH, the most beneficent and gracious compassionate and his beloved prophet MUHAMMAD (peace be upon him) a true torch for guidance forever to whole humanity. We highly obliged to ALLAH. We are also thankful to Dr. Muhammad Ibrahim, Assistant Professor IoBM for his guidance and support.

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Quantifying Urban Karachi's Air Quality Effect on Human Health and Policy Recommendations

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***Abstract*- Today's environmental issues are systematic in nature and cannot be tackled in isolation from man-made activities and impacts. The change in land use and land cover resulting from urbanization has aggravated air quality in urban centers of the country. One of the main sources of air pollution is the use of automobiles in human populated regions resulting in an excess of carbon, sulfur and nitrogen compounds. The emission of greenhouse gases in the form of carbon dioxide from 1990 to 2005 showed an increase of 97.4%. The main source of this increment were vehicular and industrial emissions due to which Pakistan is facing glacier melt in northern areas, earthquakes, flooding and lack of fresh water availability. The authors analyze the effects of vehicular emission on human health; this study is focused on the commercial and industrial areas of Karachi where the flow of heavy traffic and heavy vehicular exhaust emissions are common. The sampled areas are Port Qasim, University Road, Korangi and Mosmiyat. The purpose of this study is to evaluate perceptions of health factors due to air borne pollution in 4 different localities in Karachi. The results showed predominance of headache which is due to an excessive quantity of carbon monoxide and air borne dust in the survey areas as slight exposure of Carbon monoxide affiliated with headache, the second highest complain from respondents is the Eye Irritation, the exposure of NO_2 has acute health effects which include eye irritation, cough and asthma. Based on the above study, recommendations are made to reduce GHG and other pollutants.**

Keywords: Health Effects, Vehicular Emission, Karachi Air content.

I. INTRODUCTION

In urban areas of Pakistan vehicles are major source of producing air pollution [1] and cause 70 percent of pollution in environment [2]. According to the Karachi Metropolitan Corporation (KMC) the total number of registered vehicles increased from 2,614,580 to 3,127,463 in the year 2011-2013[3],[4], this rapid increase contribute towards vehicular emissions like CO (Carbon Monoxide), NO_2 (Nitrogen Oxide), SO_2 (Sulfur dioxide) and Green House Gases (GHG) like CO_2. The effect of these pollutants is degradation in human health, environment and agriculture.

Carbon monoxide has the biggest share among all the emissions due to unburnt natural gas constituents, whereas CO_2 burning of fossil fuel is the secondary constitute of these vehicular

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emissions. Vehicle emissions can cause adverse impact on human health results in coma, headache, breathing difficulty, eye Irritation, cough and asthma.

A recent survey by the World Health Organization (WHO) in 2012 reported that air pollution causes 72% of deaths due to heart disease and strokes, while 14% deaths occur from respiratory infections; the remaining 14 % occur due to lung cancer. A similar assessment done in 2013 by the WHO's International Agency for Research on Cancer (IARC) warned about the increasing cancer incidents within the country due to the continuous increase of air pollutants [5].

A. Climate Change in Pakistan due to Carbon Dioxide ($C0_2$)

Emission of Carbon dioxide from 1990 to 2005 increased by 97.4% the main source of this increase are vehicular and industrial emissions, the weight age of vehicles contributing towards air pollution is estimated between 60-70% [6]. Hence, we are facing climate change in Pakistan such as glacier melt in northern areas, earthquakes, Floods, lack of fresh water availability etc.

B. Climate Related Natural Hazards

Pakistan is now facing a climate related natural hazards of Heat-Waves which attacked on June 2015 due to this the number of mortality occurs especially in Karachi, during 17th to 24th June the Heat-Wave scrolls most of the country and the highest temperature were recorded as 49°C in Larkana and Sibi, 45°C in Karachi [7].

C. Problem Statement

The environmental impact from vehicular exhaust emission is often neglected in Pakistan due to the lack of awareness in our society, which is the major factor contributing to vehicle emission that includes NO_2 (Nitrogen Oxide), Carbon dioxide (CO_2), Carbon Monoxide (CO) and other pollutants. This is demonstrated in the commonly used Euro standard where Pakistan's information and input is minimal. Human health, vegetation and environment of Pakistan are adversely affected due to this negligence standards. As can be seen from Figure 1, Pakistan does not exhibit any conclusive information about Euro standards due to its non-implementation.

D. Study Objectives

The main study objectives of this research are as follows:

1) Qualitative analysis of vehicular exhaust emission impact on human health specifically headaches and relationship to locations with active vehicle exhaust emissions.

2) Policy recommendation to reduce pollutants in order to aid planners and decision makers.

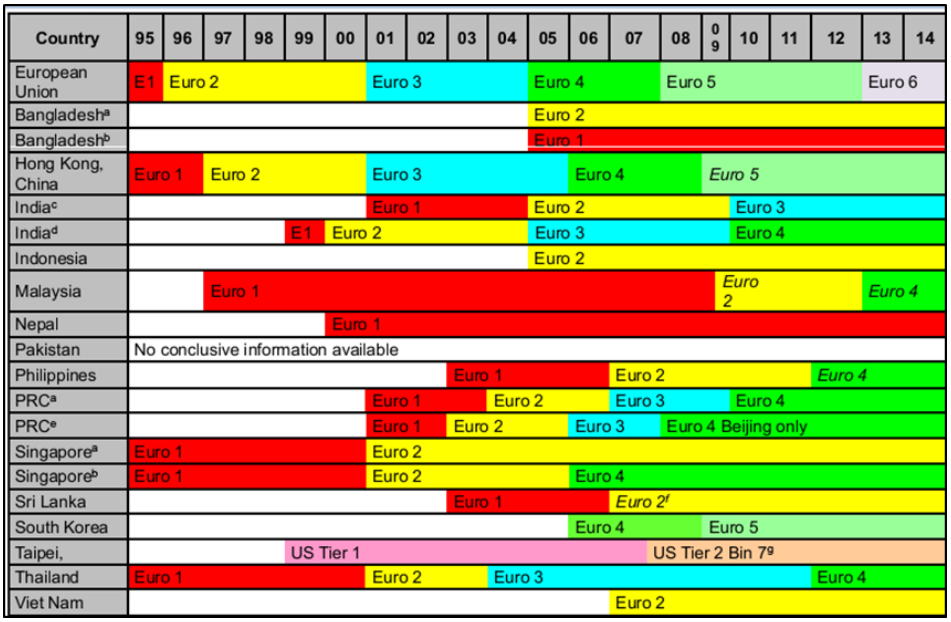

Figure 1. Emission Standards for Light-Duty Vehicles

II. Literature Review

Vehicles are the main source of producing ground level ozone which is an air pollutant and have an adverse impact on human health and environment [8]. In the United States vehicles account for 51% of Carbon monoxide (CO), 34% of Nitrogen Oxides (NOx) and 10% of Particulate Matter (PM) every year [9].

A. Impacts of Carbon Monoxide on Environment and Health

Carbon Monoxide (CO) may be a standout amongst a few pollutants that could associate in the vicinity of daylight to produce ground-level ozone, "Smog" especially with respect to high temp midyear times [10].

Carbon dioxide is colorless, odorless and highly toxic gas, under the Clean Air Act (CAA) the Carbon monoxide is decelerated the hazardous for our environment and human health. Carbon monoxide (CO) mainly produced by incomplete combustion of fuel from vehicles and this chemical is in the list of special health hazards substances.

Following are the short-term health effects that may occur instantly or shortly due to the exposure of carbon monoxide.

- Inhaling of Carbon monoxide (CO) may cause headache, dizziness and fatigue [11]
- Higher exposure can cause sleepiness , memory changes, mental confusion and loss of vision [12]

B. Impacts of Sulfur Dioxide on Environment

When the emission of sulfur dioxide occurs, it causes acid rain. When acid rains fall down it damages forests, vegetation and it also affects our Eco System. The sulfur dioxide also effects visibility; it reduce visibility due to their high light scattering ability as well as resulting in a haze in the environment [13].

C. Impacts of Sulfur Dioxide on Human Health

Sulfur dioxide (SO_2) is a colorless gas having the sharp and irritating smell and produced in the atmosphere due to the burning of coal, fuel, etc. when the SO_2 dissolved in the air it produce major amounts of pollutants which affects human health. When a person experiences 8-12 ppm level exposure of SO_2 for couple of minutes cause throat irritation, where 20 ppm cause cough and eye irritation immediately [14]. According to World Health Organization the sulfur dioxide is more harmful for those who are suffering from lung, cardiac and asthma problems [15].

D. Impacts of Nitrogen Oxides on Environment

Nitrogen oxides are the composition of nitrogen and oxygen, the main sources of producing nitrogen oxides are vehicles, burning of coal, oil and other fuel burning process. When the reaction of Nitrogen oxides (NOx) and sunlight occur, it forms Smog, acid rain [16] and leads to Ozone when it reacts to volatile organic compounds (VOC) [17].

E. Impacts of Nitrogen Oxides on Human Health

Nitrogen oxides are also harmful for human health; the safe exposure limit for Nitrogen dioxide (NO_2) is 5 ppm with the time limitation of up to 15 minutes which should not exceeds more than 4 times in a day and the gap between the exposures should be 1 hour [18]. The direct exposure of Nitrogen Dioxide (NO_2) damage the cells of lung tissues and the acute health effects are eye irritation, Throat infection, lung infection and it also triggers asthma in asthmatics [14].

III. METHODOLOGY

A. *Questionnaire Survey*

The survey was done in four different areas of Karachi. The purpose of this study to determine the effects of pollutants on the health of individual. The interviewee sample size was 50, which divided into four different areas Port Qasim, University Road, Korangi and Mosmiyat were distributed among selected individuals who work or live in the study areas was 12, 13, 12 and 13 respectively. Here the population size of 5,000,000+ is appropriate for margin of error of 11% and the amount of uncertainty that can be tolerated is 90%. This gives us a sample size of 49.

B. *Focused Group*

Two focus group discussions conducted in Korangi and University Road were used to gather information about the health impact due to vehicular emissions. The focused group consisted of 8 participants which live, work and study in the affected areas.

IV. RESULTS

The 50 participants are randomly selected for the sampling from four locations; the locations are based on current automotive settlement. The effect of headache is predominant in the survey questions. However only for IoBM there is no differentiation between headache and sleeplessness.

A. *Qualitative Survey Result*

1) *Port Qasim:* In Port Qasim the sample size was 12, where 50% respondents affected by Headache. It is observed that in this area buses and trucks emit poisonous gases as they are unmaintained and old, 33.3% respondent suffering from sleeplessness which linked to heavy eye as the Port Qasim is a commercial hub and the respondents may stay for a greater period of time for the whole day. 25% respondents affected from Cough and allergy while 16.6% respondents suffered from eye irritation and asthma which caused due to heavy emissions from trucks. As can be seen in Figure 2 vehicle emission does have an impact on human health. We see that Headache has been reported to be the most significant cause of health deterioration based on the survey followed by sleeplessness and allergic reaction. Coughs and eye irritation are then closely followed lastly by Asthma.

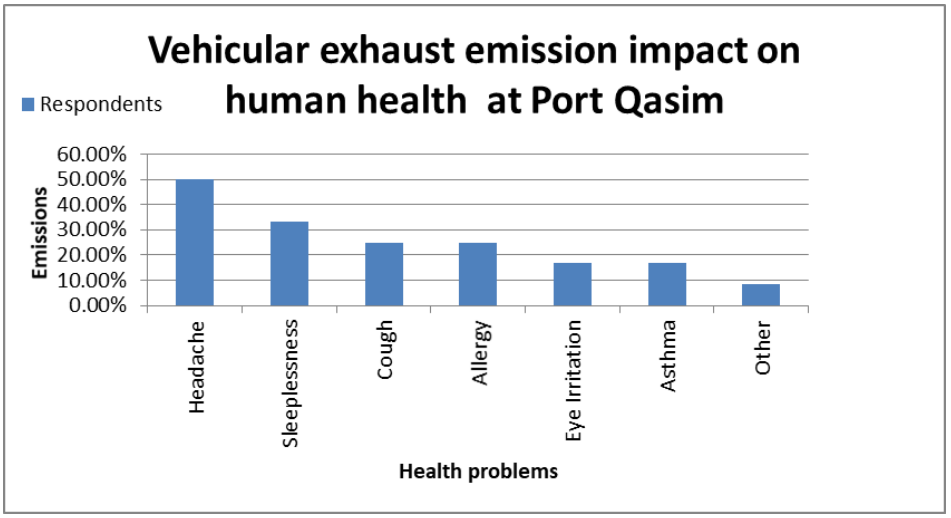

Figure 2. Vehicular Exhaust Emission Impact on Human Health at Port Qasim

2) *University Road:* The respondents were suffered from a headache and Eye Irritation at University Road area is higher than other areas with 69.23% and 61.53% as in Figure 3. This is due to the vehicles emit large amounts of exhaust gases during the daytime while 30.77% respondents affected by cough because the bus stops are near with banks, offices and universities due to that heavy traffic occurs, 15.38 % suffered from allergy and 7.69% respondent was effected by eye irritation and asthma.

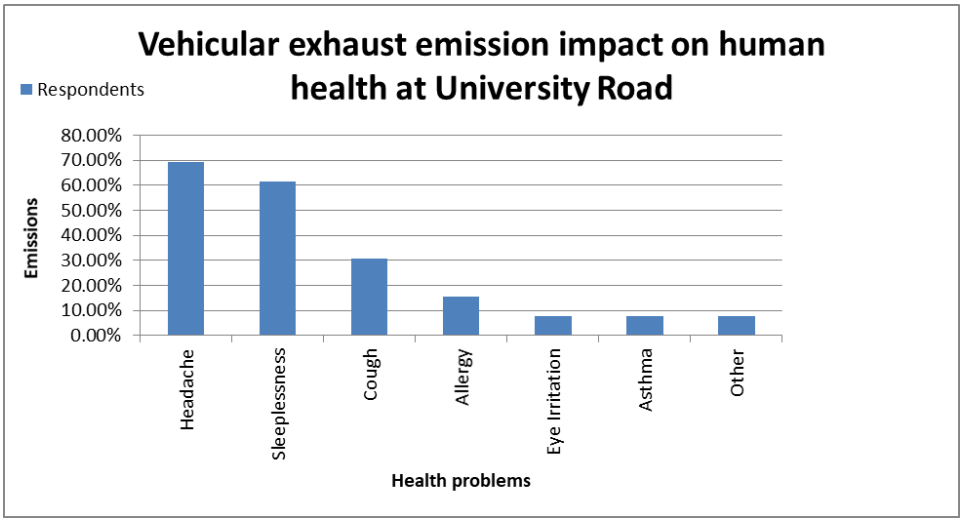

Figure 3. Vehicular Exhaust Emission Impact on Human Health at University Road

3) *Korangi:* At IoBM 38.46% respondents were suffered from Cough, 30.77% respondents affected by sleeplessness, as this is partially residential, industrial and commercial area and emission from neighbor bus stops and car parks during the day may result in sleeplessness while 23% respondents faced headache and allergy due to a mixture of gases from different sources. This is shown in Figure 4.

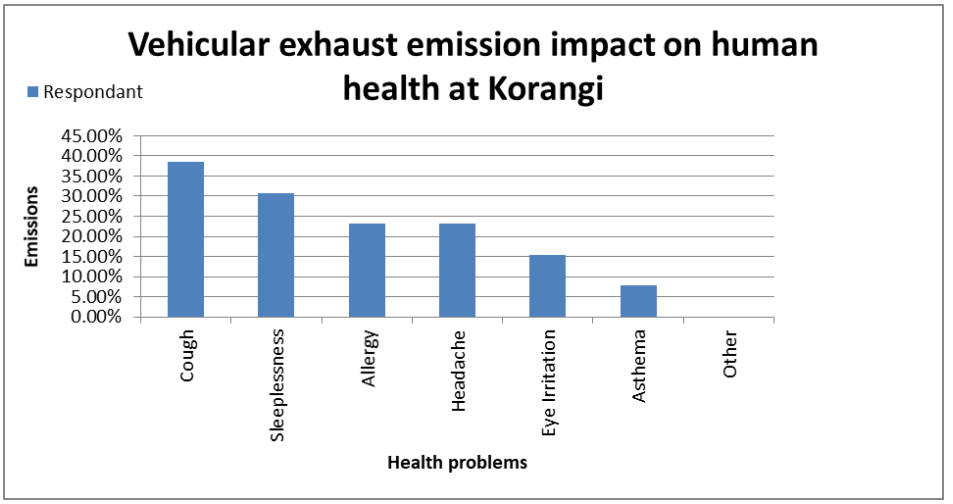

Figure 4. Vehicular Exhaust Emission Impact on Human Health at Korangi

4) *Mosmiyat:* At Mosmiyat as shown in Figure 5, 50% respondents have complained of Headache and 42% Eye Irritation due to the commercial area and having the greater quantity of buses, cars and old vehicles, 25% respondents have Cough, Allergy and Asthma due to lack of space in small buses, cars and other vehicles.

The results shown in Figures 2 to 5 point that out of four areas the respondents of three areas having the highest complains of headache. According to Public Health, England slight exposure of Carbon Monoxide (CO) is affiliated with Headache [19]. The exposure of NO_2 has acute health effects which include Eye Irritation, Cough and asthma [18]. Moreover, according to the Environmental Protection Agency (EPA) the short term exposure of NO_2 having the range from 30 minutes to 24 hours affects the person's health and may cause asthma [20].

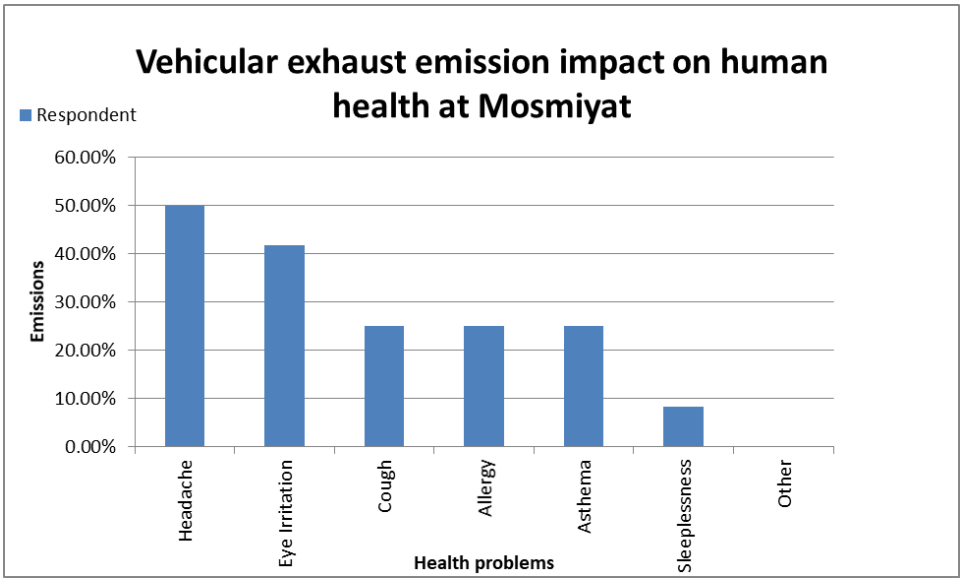

Figure 5. Vehicular Exhaust Emission Impact on Human Health at Mosimyat

5) *Focus Group:* The length focus group discussion was approximately 15 minutes of each group, the specific questions regarding which type of vehicles participant use, duration of exposure per day, what are the vehicle emissions impacts on their health and what they suggest to reduce vehicle emissions was interviewed. The following questions were asked in the focus group discussion:

Question 1: what type of vehicle used for the traveling?

The usage of private transport for traveling is high rather than public transport due to bad reputation; no facilities provide people face inconvenience in rush hours, the condition of buses in Pakistan are poor with lack of availability due to that people prefer to use private transport. As seen in Table I, within group 1 eight out of three participants used car at higher rate for traveling even for short distance on the other hand group two participants used motorcycle whereas the usage rate of public transport is lower.

TABLE I
DURATION OF EXPOSURE TO VEHICLE EXHAUST EMISSION PER DAY

	Group 1 University Road	Group2 Korangi
Motorcycle	02	04
Car	03	02
Rickshaw	02	01
Bus	01	01

Question 2: Duration of Exposure to vehicle exhaust emission per day?

Air pollution is serious issue regarding the health risk as vehicles are increasing day by day the poor quality of air also increasing which affects the human health as the people face higher duration of exposure to vehicle exhaust emission per day, the risk of increasing health impacts are also high. In the group discussion we found that people mostly exposure exhaust emission four to five hours per day and summarized in Table II.

TABLE II
VEHICLE TYPE USED FOR TRAVELLING

	Group 1 University Road	Group 2 Korangi
1 – 3 hours	03	02
4 – 10 hours	05	06
10-14 hours	-	-
14 and above	-	-

Question 3: What do you think what the impacts of vehicular emission on human health?

The higher concentration of air pollutants are harmful for us specially in the rush traffic hours, when the people exposed to high level of air pollutants may cause eye, nose, throat irritation, cough, breathing difficulties, asthma and may cause heart problem. The long term exposure of air pollutants may cause cancer and damage to the immune, neurological, reproductive, and respiratory systems.

Question 4: Suggest the ways for reducing exhaust emission

Representative responses:

- Traffic laws related with pollution and exhaust should be imposed
- Improve public transport facility

- Proper Roads and traffic monitoring system help to reduce emission
- Reduce Private transport and Increase usage of bicycle
- The Government should influence automobile industry to invert R&D vehicle pollution
- Prepare schedule for the car maintenance and use the recommended motor oil.

B. Statistical Test to Categorize Vehicle Emission Impact on Health

Here we apply a statistical test to verify our results and conclude the major form of health concern which is easy to identify namely headache. In this case, we use the observed values shown in Table III.

TABLE III
OBSERVED DATA FOR CONTINGENCY DATA OF HEALTH IMPACT RESEARCH

Location	Headache reported	Other health issues reported	Total respondents
Port Qasim	6	6	12
University Road	9	3	12
Korangi	8	4	12
Mosmiyat	3	10	13
	26	23	49

The reported sample size is 12 for each location, where the majority of the medical issues are related to headaches. Since headaches can be easily identified and linked to automobile exhaust emission it has been considered here. The test results were analyzed for the following hypothesis using Chi-square test method.

H0 - Headaches are not dependent on locations with active automobile exhaust

H1 - Headaches are dependent on locations with active automobile exhaust

The determination is categorical and the above is the case for observed data. The expected values are given in Table IV.

TABLE IV
EXPECTED VALUE OF CONTINGENCY TABLE FOR HEALTH IMPACT RESEARCH

Location	Headache reported	Other health issues reported	Total respondents
Port Qasim	6.367346939	5.632653061	12
University Road	6.367346939	5.632653061	12
Korangi	6.367346939	5.632653061	12
Mosmiyat	6.897959184	6.102040816	13
	26	23	49

Establishing a level of significance to be 0.05, the degree of freedom is r-1 * c-1 which is 3. The X2 value obtained is 7.95. For 2 degrees of freedom and alpha being 0.05 using the Chi Square table the cut off is 7.82. Since the X2 > X cutoff we obtain can now reject the null hypothesis. Hence, health impact characterized by headache is dependent on locations with active vehicle exhaust emission.

The above validates our finding on the topic and can be used to prove our hypothesis that health is impacted by locations where industrial and automobile exhaust emissions take place.

IV. Policy Recommendations

The effect of exhaust on human health helps to focus on reducing exhaust pollutants and Green House Gases emissions as the transportation sector is responsible for the highest growth emission rate and responsible for a quarter of carbon dioxide emission in Pakistan [21]. For this purpose, we have to develop and implement policies that will help reduce vehicle emissions from cars, trucks, motorcycles, buses and rickshaws in Pakistan.

A. Increase Green Public Transport

One favorable way is to introduce environmentally friendly large transportation systems as in Figure 6.

Figure 6. Green Bus as Public Transport

The increase in public transport plays an effective role in reducing carbon emission and other air borne pollutants. The government needs to consider increasing provision of public transport like green buses and identify routes and availability of green buses in every area of the city. It is

important to concentrate on time management, fare reduction, provision of food and additional services which attract the people towards public transport instead of using private transportation.

If an individual which drive 32 km round-trip use public transport to travel he or she will contribute to reduce annual CO_2 emissions by 4,800 pounds per year [22].

B. Vehicle Inspection and Maintenance

It is crucial to create public awareness on the importance of vehicle maintenance to reduce GHG and other harmful pollutants emissions with the help of the media. The policy should make for vehicle inspection and maintenance through which we are able to control the vehicle emissions. Government should organize a campaign to setup vehicle maintenance service centers to inspect vehicles two times in a year free of cost.

C. Ban Old Vehicles and Recycle

The vehicles which are older than 15 years need to be phased out. The reason is that old engines wear out quickly and deposit incomplete combustion by products. There is a need in Pakistan for the government to launch a scheme for old vehicles scrap, where the vehicle owner gets money in return of old vehicle and certificate which help the owner in buying new vehicle with discount.

D. Plant Trees

Due to climate change, temperature of Pakistan is raising almost a fraction of degree every year. The one way to control climate change is to plant as much trees as possible. This can be the main source of reducing carbon dioxide (CO_2). Young trees are able to absorb carbon dioxide (CO_2) more quickly.

E. ECO-Driving

Due to toxic emissions, carbon dioxide (CO_2) is produced by man-made activity in the environment can be controlled by adopting ECO-Driving. It is estimated by experts that on average, for every liter of petrol used in a motor vehicle, 2.2 kilograms of Carbon Dioxide are released from the exhaust [23]. In Pakistan people are unaware of the benefits of ECO-Driving. This needs to be incorporated as it is not only the best way to reduce exhaust emissions to save the environment but also saves on our fuel consumption with an average of 15 % of fuel costs [24].

F. Implement Euro Vehicle Standards

In Pakistan some of the vehicles are EURO II standards specifications. Pakistan had initially agreed to adopt EURO II in 2012. However, this was postponed till 2014 but unfortunately the adoption of EURO vehicles in Pakistan is negligible on the other hand our neighbors China and India have already practiced these standards. India` is recently using EURO III and EURO IV standards for their vehicles, whereas China is following EURO IV [25]. The implementations of these emission standards are necessary to reduce the pollutants effects on environment and human health and in Pakistan we should adopt at least EURO VI standards to avoid further problems regarding vehicle pollutants.

IV. CONCLUSION

Based on the study the finding indicates that the effects from vehicle exhaust pollution cause diseases like Asthma, Cough and also eye irritations and have adverse effect on human health. The way to decrease transport emission can be achieved by the reduction in fossil fuel combustion and by increasing the transport energy use efficiency. To reduce the impact of vehicle emission levels on human health the various methods can be applied which include:

- Improved fuel economy helps to improve the efficiency of vehicles.
- Implementation of EURO standards vehicles.
- Introduce big buses and train in transport system to facilitate public this helps to avoid the more and frequently usage of private vehicles.
- The alternative fuel like bio fuels is another way to reduce the vehicle emissions.
- Traffic Management.
- Walking and cycling must be encouraged as the alternative mode of transport.
- Ban Old Vehicles
- Encourage Car Polling system

The government should focus on the fuel economy improvement, ban old vehicles and non-EURO vehicles, traffic management and introduce campaign to aware the people about the impact of vehicle emissions and to promote ECO-Driving in Karachi. Further specific recommendations with respect to the areas under research are as follows:

1) More localized sampling and testing at different premises and locations within the city. A campaign at IoBM was started recently where average carbon footprint measured in premises was verified to be 0.1 metric tons CO_2 per year in Karachi.

2) Further proposals for pollutant level and the impact of actual versus expected CO_2 emissions to be incorporated before suggested recommendations to be incorporated by SEPA and other regional environmental agencies and Municipal Town Office in Karachi.

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Relative Efficiency of DCC Estimates via Different Algorithms

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Abstract - Volatility plays an important role in capturing the variability in any series, hence multivariate volatility models helps us in figuring out the spillovers across variables. The observation of such spillovers plays a very crucial role in financial decision making. Starting from the pioneering works of [1] and [2] ARCH/ GARCH type models and their multivariate extensions are widely used for capturing volatility spillovers. Dynamic Conditional Correlation (DCC) model proposed by [3] is one of the most widely used multivariate GARCH model. As GARCH type models are non - linear in nature, hence their solutions vary across the algorithms used for their computation. Different algorithms are used in different software and thus give varying results. In this study, we are going to compute and compare DCC model estimates through different software. In our study SAS results would be considered as baseline estimates and the competing results would be obtained from Stata and R. We will model the DCC estimates between returns on NYSE and PSX indices data for the time period of September 2001 to August 2016.This study would help us to determine the relative efficiency and accuracy of algorithms used for estimating the DCC model.

Keywords: GARCH, DCC, SAS, STATA, R-Console.

I. INTRODUCTION

Over the years, ARCH/ GARCH type volatility models have emerged as a prominent tool in capturing the dispersion prevailing in any time series. Starting from [1] Autoregressive conditional heteroscedasticity (ARCH) models and its extension to GARCH (Generalized Autoregressive Conditional Heteroscedasticity) model by [2] becomes very well-known approach to capture volatility in time series analysis. These ARCH/ GARCH models are frequently applied on financial time series where these models yield us the risk factor for any financial asset or phenomenon. Risk factor, from the standpoint of economics gives us the opportunity cost for obtaining the returns. Whereas for investors, it is the degree of uncertainty that must be accounted before making wealth allocation decisions so that they may be aware of potential losses which can occurred at any point in time.

Despite the utility of volatility models, accuracy of ARCH/GARCH is always considered as a serious issue which arises due to the non-linearity of these models. Different packages produce different estimates for the same series or series' owing to different numerical algorithms which are used in different software. One of the reasons for divergence in results. One of the reasons for the divergence in results is that at the time of development standardization of the resulting estimates are

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not been stressed instead notable advancement is considered with respect to the computational speed, and power. This is very important for practitioners to inquire that do estimates obtained through different software packages yield the similar estimates. Are those approximations are accurate? Many software packages enable users to estimate the conventional time series models such as Autoregressive Moving Average ARIMA type and Autoregressive Conditional Heteroscedasticity ARCH/GARCH type models.

The GARCH type model further extended to Multivariate GARCH (MGARCH). MGARCH type models dealt with studying inter-relationship between volatilities & co – volatilities of several variables, i.e. via multivariate GARCH one can have the insight of volatility spillover among the variables. So far, the availability of multivariate GARCH models in software packages is limited despite its usefulness for various applications. However it is possible to get multivariate estimates by only using univariate GARCH estimates [4]. The most leading tool to this model is DCC (Dynamic Conditional Correlation) by researchers in [3] and [5]. How much a shock in one market can generate the volatility on the other market/(s)? Answers to the research questions depends upon the accuracy of the estimated results. Different algorithm yield different approximation and estimates which differentiate each algorithm's accuracy to different level of significance.

Therefore the practitioner in order to maintain accuracy cannot rely on a single estimation. One should have answers to these questions that which software package is the most accurate? Which package should be considered as the base line for the estimated results in comparisons with other? How much one package estimates differ from the other?

The objective of this paper is to evaluate most widely used software packages to estimate results with emphasis on their estimation accuracy. Here we are extending the prior work of researchers in [6] by modeling DCC using different statistical packages on the logarithmic index return of KSE100 and S&P 50O index estimating the coefficients and standard errors for the determination of most accurate package. It will also help determine the volatility spillover among the countries, the impact of past shock, shock impact's nature etc.

Packages considered are SAS (Statistical Analysis Software), R – 3.3.1 and Stata 12.It is also necessary to state that issues regarding calculation speed, power of the software packages are those issues which we are not considered here.

II. LITERATURE REVIEW

Authors in [7] reviewed eminent developments pertaining MGARCH modeling. They analyzed the competing MGARCH models for the same problem and data. They argued that in MGARCH modeling the most crucial issue is provision of realistic and parsimonious specification of the covariance matrix while ensuring its positive definiteness. BEKK models require large number of parameters for estimations as compared to Diagonal VEC and BEKK models. Factor GARCH models also belongs to the category of MGARCH models where conditional variances and covariance's can depend on past variances and covariances. Similarly, DCC model allow for varied degree of persistence between variances and correlations.

Authors in [6] stated that two different packages can produce two different solutions to the same estimation problem. They attempted to benchmark GARCH procedures in several software packages. They discussed the issues encountered while fitting default GARCH model in different packages. They estimated the GARCH model on the daily data of percentage nominal returns for the Great Britain Pound to US Dollar exchange rate. They concluded that large variations in results observed are not possible to draw general inferences when different software packages are used.

Authors in [8] reviewed a number of widely used statistical software packages, with respect to the accuracy of their estimates against a benchmark. They considered numerical consistency of GARCH and EGARCH estimation forecasting in their study. Using the same dataset they found that result obtained via default applications of widely used packages significantly vary from one another.

Researchers in [9] based their research objective to estimate conditional covariance matrices. They analyzed the consistency of most widely used GARCH (1, 1) model. They used weekly market indices of seven developed countries starting from January 1975 to December 2000. They avoid fitting additional restrictions, which led them to the advantage of less computation resulting to go for large sample sizes. They applied their procedure to 25 years of weekly data of the considered stock markets and compared the accuracy of CCC (Constant Conditional Correlation), Diagonal BEKK model, rolling window estimator and exponential smoothing estimator. Direct applications of the method further lead to the portfolio selection.

Researchers in [10] analyzed the statistical adequacy of GARCH models for eight Asian Stock Markets using Hinich portmanteau bi-correlation test as a diagnostic tool to determine the suitability of GARCH models in characterizing the behavior of the stock markets of Thailand, Hong Kong, Indonesia, South Korea, Malaysia, Japan, Philippines & Singapore. Data consist of daily basis stock

indices for the above stock markets starting from January 2, 1990 to December 31, 2003. The result of the study indicated that there exist some statistical structures in the data of all considered Asian markets which cannot be captured by GARCH model. They attribute this inadequacy of GARCH procedures to the non-stationary structure of covariance.

III. Data And Methodology

We have selected the data of the daily market indices of Pakistan Stock Exchange (PSX) and New York Stock Exchange (NYSE) from January 2000 to September 2016. The performance of PSX here is measured by KSE 100 index whereas S &P 500 index returns are used for the NYSE. All the market indices are taken at log level in order to ensure that series' would remain I(0), which would facilitate the volatility analysis carried out here.

Multivariate GARCH modeling generally involves two steps. The estimation for univariate volatility functions are made through the class of ARCH/ GARCH type models proposed by [1] and extended by [2] is carried out in first step using GACRH (1,1) model for figuring out univariate volatility prevailing in each series.

In the second step, the obtained volatility series' are interlinked through multivariate volatility models such as Vector error correction (VECH) of [11], Constant conditional correlation (CCC) of [12], BEKK model of [13], Dynamic conditional correlation (DCC) model of [3] and Orthogonal GARCH model of [4] etc. This inter-linkage actually gives us spillovers existing between/ among two or more series' present in any model.

In this study we are going to deploy the DCC model on our considered series. The model can be shown through the following equations.

$$H_t = D_t R_t D_t \qquad (1)$$

Where

$$D_t = \begin{bmatrix} \sqrt{h_{1t}} & 0 & \cdots & 0 \\ 0 & \sqrt{h_{2t}} & & \vdots \\ \vdots & & \ddots & 0 \\ 0 & \cdots & 0 & \sqrt{h_{nt}} \end{bmatrix} \qquad (2)$$

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1} \qquad (3)$$

And

$$Q_t^{*-1} = \begin{bmatrix} \frac{1}{\sqrt{q_{11t}}} & 0 & \dots & 0 \\ 0 & \frac{1}{\sqrt{q_{22t}}} & & \vdots \\ \vdots & & \ddots & 0 \\ 0 & \cdots & 0 & \frac{1}{\sqrt{q_{nnt}}} \end{bmatrix} \quad (4)$$

In this study, we have computed the above mentioned DCC model through three different software; SAS, R and Stata. Due to nonlinear nature of the DCC model we are aiming to find out the relative efficiency of the given software for computing it. As SAS results are considered most reliable as compared to other software, therefore values obtained through SAS are considered here as true values. By comparing the results of R and Stata results from SAS, we are deriving the relative efficiency of the said software.

IV. Empirical Results

Table I presents the descriptive statistics of PSX and NYSE stock indices returns over the considered time period. As mentioned earlier the stock returns of PSX and NYSE are modeled through KSE 100 index and S&P 500 index respectively.

TABLE I:
Descriptive Statistics

	Mean	Median	Std. Dev.	Min.	Max.	Skewness	Kurtosis
PSX	0.000804	0.001044	0.085071	-0.07741	0.013624	-0.27	6.594204
NYSE	9.42E-05	0.000195	0.109572	-0.09856	0.012684	-0.23741	11.91298

The descriptive statistics depicts comparable market conditions in the above markets. It can be seen the coefficient of skewness is negative for the returns of both markets in a time invariant perspective which implies that the leverage effect is prevalent in both markets and both markets can be influenced more rapidly due to negative developments as compare to the positive developments. Thus, it is found logical to compare both markets.

The first step in the application of multivariate GARCH is to observe volatility values for individual time series. Table II below presents the volatility values through the GARCH (1,1) model.

TABLE II:
UNIVARIATE VOLATILITY ESTIMATES THROUGH GARCH (1,1)

	ω	α	β
PSX	0.000*	0.159*	0.803*
NYSE	0.000*	0.097*	0.888*

*** indicates significance at 1%**

The above results depicts that PSX is more exposed to the shocks as compare to the NYSE as the value of α is found higher as compared to the NYSE. Up to this point, all analysis has been carried out through SAS. Now we will move on to more important component of our analysis that is the spillover analysis. This analysis has been carried out using DCC model through three different software SAS, R and Stata. Its results are depicted below.

TABLE III:
ESTIMATES OF VOLATILITY SPILLOVERS USING DCC

	SAS	STATA	R
DCC α	0.001*	.0378**	0.039**
DCC β	0.09752*	.063	0.008

'*' and '' indicates significance at 1% and 5% respectively**

Table III represents atypical example of nonlinear models where we find huge disparities across software. The results found indicates that shock, or theoretically the development or news component has a spillover impact across US and Pakistani stock market, but the variance spillover component is only found significant through SAS.As the results of SAS are conceived as most reliable hence we may treat the estimates obtained through as the true values of the parameters. In Table IV below presents the relative error found in the DCC estimates of STATA and R.

TABLE IV:
RELATIVE ERRORS OF STATA AND R ESTIMATES

	STATA	R
DCC α	36.8	38
DCC β	-0.1	-0.1

As the values of DCC α and DCC β were found insignificant through STATA and R, hence there values while calculating the relative error are kept as 0. The results of relative error indicate that the techniques used by STATA and R for the estimation of DCC model almost yield the same results. Thus, we can say that both software are subjected to similar degree of error.

V. CONCLUSION

The study investigates the relative accuracy of STATA and R over the SAS for the estimation of volatility spillovers obtained through DCC. Among all the three software; SAS is considered as most reliable hence its values are treated as true values. The study found that there does not exist a tangible difference among the estimates calculated through R and STATA. Hence based on the findings of this study we may conclude that none of the software has an edge on the other in terms of accuracy. In future, the study can be extended by the estimation of DCC model through other software. Nevertheless, the estimation of volatility spillovers through other multivariate volatility models by the usage of different statistical software would be treated as a logical extension of this work.

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