P-08

CHEMICAL PROFILING OF FOUR SPECIES OF *POGOSTEMON* (LAMIACEAE)

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Pogostemon Desf. is an oil rich genus of the family Lamiaceae. The essential oils isolated from the leaves of four species of *Pogostemon*, viz., *P. auricularius*, *P. benghalensis*, *P. heyneanus* and *P. deccanensis*, were analysed by GC-MS. The data obtained from the qualitative analysis was subjected to numerical analysis to understand the possible chemical affinities of pairs of species by arriving at a numerical constant, the coefficient of similitude. These four species were found to be interrelated chemically. The major components in the essential oils from all the four species were found to be sesquiterpenes. Valeranone and cembrene were the major chemical principles in *P. auricularius.* In *P. benghalensis*, the predominant constituents were δ-cadinol, γ-cadinene and α-bisabolol. β-pinene and trans nerolidol occupied the major fraction of *P. heyneanus*, whereas in *P. deccanensis*, τ-cadenol and dehydranone were predominant. The coefficient of similitude between *P. benghalensis* and *P. auricularius* is 30.00 and that of *P. auricularius* and *P. heyneanus* is 40.0. The least similarity is shown by *P. auricularius* and *P. deccanensisie*., 10.0. A coefficient of similitude value of 36.4 was found between *P. benghalensis* and *P. deccanensis*. The

similarity between *P. heyneanus* and *P. deccanensis* was also low (20.0). The terpenoids are of great importance as taxonomic markers. They have a major role in classifying the complicated genera. The presence or absence of essential oil constituents, the distribution of terpenoids, saturated and unsaturated hydrocarbons *etc.* are very much helpful for studying both inter and intrageneric/specific relationships.

BIODIVERSITY STUDIES AT KOMALA KUNNU AND POOLENKARA CHALI

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A detailed biodiversity exploration was carried out at *Komala kunnu* (the tallest hill) and *Poolenkara Chali* (the largest wetland) regions of Olavanna Panchayath, Kozhikode, Kerala for about a year to analyse the diversity, habitat threats and other ecological issues in the conservational point of view. The study also aimed to prepare the *Local Biodiversity Register* for the area, which in turn help to monitor and conserve biodiversity. The Plant diversity was analysed by enumerating the various groups such as *Pteridophytes, Gymnosperms* and *Angiosperms* (limited to trees only). Animal diversity was analysed by enumerating various groups such as *Butterflies, Moths, Dragonflies, Spiders, Prawns/Lobsters, Fishes, Amphibians, Reptiles, Birds, Mammals* etc.

Among plants, altogether 18 *Pteridophytes,* 4 *Gymnosperms* and 139 *Angiosperm trees* could be enumerated. Similarly among animals, 50 *Butterflies,* 17 *Moths,* 16 *Dragonflies,* 20 *Spiders,* 6 *Prawns/Lobsters,* 35 *Fishes,* 5 *Amphibians,* 14 *Reptiles,* 51 *Birds* and 22 *Mammals* were enumerated. The *English/Malayalam* common names and *Scientific* names of the species were collected and tabulated. Distributional details, habitat threats and other ecological issues in the area were also analyzed for better understanding and to plan measures for conservation.

Keywords: Biodiversity Studies, Komala Kunnu, Poolenkara Chali, Olavanna, Kozhikode

Experiments on Revenue Equivalence Theorem

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***Abstract* - Auctions have been conducted since ancient times for the sale of various items. They have gained much importance during past few decades as the primary mechanism for allocating natural resources and procurement of goods and services. The emergence of internet has made auctions very popular where people can request for bids via the internet from a wide range of buyers and for a large number of commodities. We aim to study the equivalences of the revenue generated for the seller by the four basic auction types - English auction, Dutch auction, First price sealed-bid and Second price sealed-bid auctions - as stated by the Revenue Equivalence Theorem. We empirically verify the results of the theorem through various experiments. Since all the benchmark conditions rarely hold together in real world, some auctions may yield better revenue than some others. We, therefore, analyze the auctions by violating some of the benchmark assumptions so as to simulate the real world scenario.**

***Keywords* — Revenue Equivalence Theorem; Auctions.**

I. INTRODUCTION

Auctions are mechanisms for buying or selling of goods where participants submit bids and the allocation and pricing of goods are based on specific rules set by the mechanism. They have been used as means of exchange of goods for most of the history. Earliest evidence of using auction date back to 500 B.C. in the Babylon civilization. In the recent times, auctions are of great significance as the primary means of allocating natural resources and procurement of goods and services. Auctions conducted for the allocation of mobile spectrum, coal fields and other national resources involve huge amount of money and is of national importance. Therefore, it becomes essential to study about various types, their properties and their suitability under different environments.

A. Basic Auction Types

In this report, we focus on the selling of a single indivisible item based on the four basic auction types - English, Dutch, First-price sealed bid and Second price sealed bid auctions. English auction is the most common type of auction. It is also known as open ascending price auction, where the seller puts an indivisible item for sale with a low reserve price. The seller then keeps on increasing the price until exactly one buyer remains interested in buying. The item is then sold to that buyer with the same price. The auction format used in the Indian Premier League for buying players is a very good example for English auction.

Dutch auction is another type of auction where the auctioneer puts up an item for sale with a reasonably high initial price, usually known as asking price. If no one buys the item for that price then the auctioneer will keep on decreasing the asking price until somebody buys the item or a predetermined minimum price is reached. Here the buyer who bids first wins the auction and will pay an amount equal to his bid, which is the asking price of the auctioneer to which he agreed to buy the item.

First Price sealed bid auction is a kind of auction in which the seller will advertise the product details and invite interested buyers to submit their bids in a sealed fashion. After the interested buyers submit their sealed bids all the bids will be compared and the highest bidder will get the item awarded. The winner will pay an amount equal to his bid amount.

Second Price sealed bid auction is a kind of auction very similar to First Price sealed bid auction where the seller will advertise the product details and invite interested buyers to submit their sealed bids. Later the highest bidder will get the item awarded and he have to pay only an amount equivalent to the second highest bid. Here the bidders are always going to pay an amount less than his bid for the item.

The rest of the paper is organized as follows. Section 3 briefly discusses the revenue equivalence theorem and proofs of various equivalences. In Section 4, we describe the results

of empirical investigation conducted through simulation and real world experiments. Section 5 contains some conclusions we could observe and scope for future work.

II. RELEVANT WORK

The paper by McAfee and McMillan [1] provides an excellent literature on various auction types and their equivalences. The paper discusses various benchmark conditions under which the theorem is valid in an intuitive fashion. The book by Vijay Krishna [2] on Auction Theory is a very good reference on the theoretical aspects of the theorem including the proofs of various equivalences. Other useful references include the Lecture notes on Revenue Equivalence Theorem by Prof. Y Narahari [3] and experiments conducted on the revenue equivalence theorem by David Lucking – Reiley [5].

III. REVENUE EQUIVALENCE THEOREM

A. Background

The risk attitude of bidders is modeled as risk-averse, risk-neutral or risk-affine. A person who is risk-averse tend to be reluctant to play a strategy with an uncertain pay off over a strategy with more certain, but possibly lower pay off. A player is risk-averse if and only if his utility function is concave[4] . A risk-affine player behaves opposite to a risk-averse player and a risk-neutral player has equal probability of choosing the lower and higher uncertain situations. The utility function of a risk-affine player is convex while that of a risk neutral player is a straight line.

The valuations of bidders are modeled either by independent-private-values model or common-value model [1]. In independent-private-values model, each bidder observes his valuation of the object for sale and is known only to the bidder. Further, the valuations of every bidder are statistically independent of others. The auctioning of an antique where the bidders buy for their private use and not for resale is an example scenario for this model. In common-value model, each bidder is uncertain about his own valuation, probably arising out of the asymmetric nature of information available to different bidders. The valuations are affiliated and could change when the bidder comes to know about the valuations of others. The auctioning of an antique where the bidders buy for resale is an example scenario for this model.

Bidders are symmetric if they choose valuation from the same probability distribution.

B. Revenue Equivalence Theorem

The Revenue Equivalence theorem states that under the benchmark model, all the four basic auction formats yield the same average revenue to the seller. The benchmark model assumptions are:

1. The bidders are risk neutral.
2. The independent-private-values assumption applies.
3. The bidders are symmetric.
4. Payment is a function of bids alone.

This result was first shown by Vickery (1961).

Proof of Revenue Equivalence Theorem

The revenue equivalence between Dutch-First price auctions and English-Second price auctions is intuitive and quite straight forward. If we can also show equivalence in expected revenue between first price and second price auctions, the revenue equivalence theorem will be proved. In the remaining part of this section, we provide the proof of revenue equivalence of first price and second price auctions. This proof is based on the one presented in the Lecture notes of Prof. Narahari[3]. The Revenue Equivalence Theorem is proved based on the following theorem.

Theorem 1.1

Assume an auction with:

1. n risk-neutral bidders.

2. Bidder valuations lies in real interval [θ 1, θ2] with $\theta 1 < \theta 2$.

3. Bidder valuations are drawn from [θ 1, θ2] with a strictly positive density φ i (.) > 0. Let φi (.) be the cumulative distribution function.

4. Independent bidders.

Now consider a given pair of Bayesian Nash Equilibrium of two different auctions procedures that satisfy:

1. For every bidder i, for each possible realization of (θ_1, ..., θ_n), bidder i has an identical probability of getting the good in the two auctions.

2. Every bidder i has the same expected pay off in the two auctions when his valuation for the object is at its lowest possible level.

Then the two auctions generate the same expected revenue to the seller.

We now show that both the first price auction and the second price auction satisfy the conditions of the theorem on revenue equivalence of two auctions. In both the auctions, the bidder with the highest valuation wins the auction. Bidders' valuations are drawn from [θ1, θ2] and a bidder with valuation at the lower limit of the interval has a payoff of zero in both the auctions. Hence theorem can be applied to the equilibrium of the two auctions.

IV. Experiments

Experimentations were carried out in two phases. In the first phase, all the four auctions namely the English Auction, Dutch Auction, First Price Sealed Bid Auction and the Second Price Sealed bid Auctions were modeled using MATLAB. These auction models were simulated and the expected revenue was estimated. In the second phase of experimentation a practical auction environment was created in ebay.com with an iTunes Gift card as an item for sale.

A. Modelling of Simulation Experiments

Modelling English Auction

The English Auction was modelled as follows:

• A single indivisible item was assumed for the auction.
• The auctioneer will put a reserve price. The item will not be sold if there is no interested buyer for this price.
• Bidders with valuations greater than the reserve price will go to the next round during which the reserve price is incremented by a fixed increment.
• The auction will stop at the point where the second last bidder drops out.
• To minimize numerical boundary issues the fixed increment is made as small as possible.
• Valuations are drawn from a Normal Distribution N (μ, σ) with μ = reserveprice + 10 and σ = 5.0
• Hundred experiments each with 100 players with different valuation distributions were carried out and the expected value is found out.

Modelling Dutch Auction

The English Auction was modelled as follows:

• A single indivisible item was assumed for the auction.
• The auctioneer will put a reserve price which will be much higher than the true valuation of the item. This is understood as the seller will like to maximize his/her revenue.
• If there are no interested buyers then the reserve price is reduced by a fixed amount.
• The auction will stop at the point one bidder becomes interested to buy the item.
• To minimize numerical boundary issues the fixed decrement is made as small as possible.
• Valuations are drawn from a Normal Distribution N (μ, σ) with μ = reserveprice − 10 and σ = 5.0.
• Hundred experiments each with 100 players with different valuation distributions were carried out and the expected value is found out.

Modelling First Price Sealed Bid Auction

The Dutch auction was modeled as follows:

• A single indivisible item was assumed for the auction.
• The bids are derived from a Uniform Distribution, given by $b_i = \frac{N-1}{N} v_i$ under risk neutrality.
• The bidding is done only once.
• The item is awarded to bidder who has the highest bid.
• One hundred experiments are carried out and the expected value is found out.

Modelling Second Price Sealed Bid Auction

The Dutch auction was modeled as follows:

• A single indivisible item was assumed for the auction.
• Valuations are drawn from a Normal Distribution N (μ, σ) with μ = 110 and σ = 5.0.
• Since its a weakly dominant strategy to bid one's valuation in a second price auction, the bids are assumed to be equal to each players' valuation.
• The item is awarded to bidder who has the highest bid, but he will only pay the second highest bid.
• One hundred experiments are carried out and the expected value is found out.

B. Simulation

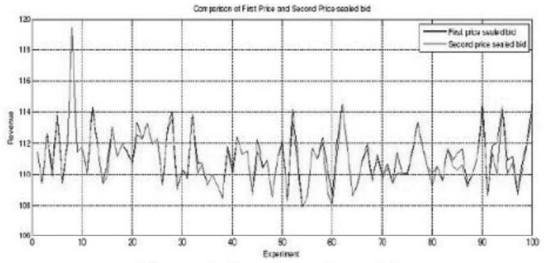

Figure 1: Benchmark model

The four models of auctions were simulated under the benchmark conditions. The results were collaborating with the theoretical versions which suggest that all the four form of auctions yields the same expected revenue to the seller. A comparison of the revenue between first price sealed bid and second price sealed bid auction is shown in Figure 1. As evident from the figure, the revenue obtained from both the First Price Sealed Bid Auction and Second Price Sealed Bid Auction are similar. The First price sealed bid auction is equivalent to the Dutch Auction and the Second price sealed bid auction is similar to English Auction. So a similar comparison can be made in this regard. The average revenue from all the four Auction models were found to be same under the benchmark assumptions.

The behaviour of the celebrated Revenue Equivalence Theorem when one or more of the **benchmark** conditions are violated is analyzed and studied in the later part of the experimentation. The conditions violated are the **risk neutral** and **Independent Private** Values.

Risk Averse Bidders

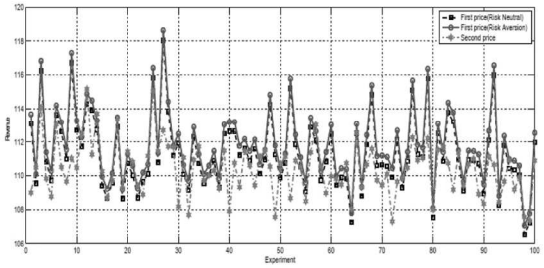

Figure 2: Risk Aversion

When the bidders become Risk Averse they will bid more so that the probability of winning the item becomes high. Thus under such conditions the First Price and the Dutch auctions will fetch more revenue than English or Second Price Auction. The risk averseness is modeled in First Price Sealed bid auction only as it is not applicable in a weakly dominant environment of Second Price Sealed Bid Auction.

The bidding is modeled as $b_i = \frac{N-1}{N-1+r} v_i$ where r is the Risk Aversion Coefficient and it takes value between 0 and 1[6] . The result is shown in Figure 2 in which the First Price Sealed Bid Auction with Risk Averse bidders is compared with Risk Neutral bidders and Second Price Sealed Bid Auction.

Affiliated Valuations

In the case of Affiliated Valuations, bidders will increase their valuations thinking that their counterparts perceive the value of the item to be high.

This is modeled by increasing the valuations of all losers and decreasing the valuation of the winner. A bidder who had lost in Auction i will perceive that his/her valuation was much below the winning bid and in Auction i+1 he/she will increase his/her valuations by **Δ/2** where **Δ = winnervaluation − losservaluation** . The winner will reduce his valuation by a small amount to increase his utility. Since to implement this logic the valuations of the bidders need to be known English Auction was chosen for the analysis.

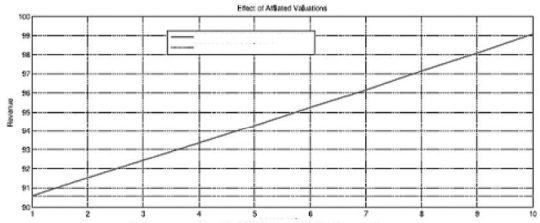

Figure 3: Affiliated Valuations

The result of the experiment is shown in Figure 3. Since the valuations are going up due to dependence in valuations among the bidders the average revenue obtained is much higher than that obtained in Second Price Sealed Bid Auction which has weakly dominant strategy equilibrium.

Summary of Simulation Experiments

Conditions	Auctions
Independent Private Value + Risk Neutral	D = F = S = E
Independent Private Value + Risk Averse	D = F < S = E
Affiliated Private Value + Risk Neutral	D = F < E

Table 1: Summary of Simulation Experiments

Table 1 summarizes the results from the simulation experiments on Revenue Equivalence Theorem.

V. Real world Experiments

As part of the real world experimentation we auctioned same kind of product by using three basic auction formats such as English auction, first price sealed bid auction and Second price sealed bid auction. These auctions are conducted in the internet market where the interested buyers can participate in the auction. We announced each auction one after the other in order to avoid the bidders waiting for the next auction. If the buyers know the fact that the same item is coming for auction in the next week or so, they are likely to skip the current one and wait for the next one. So we conducted English auction first and we announced the details of the other auctions to all those who participated in English auction one after the other.

A. Modelling of Experiments

ebay.com[10] is a popular e-commerce website where the products can be put up for sale. ebay gives the flexibility for conducting an auction for the product we want to sell. ebay by default supports a modified version of English auction, where the seller can keep the item for bidding with a reserve price and expiration time. At the time of expiry of auction the highest bidder will be awarded the product. During the bidding time interested buyers can keep on bidding until the auction get expired. As a part of Real world Experimentation We conducted the English auction in ebay. As Apple iTunes gift cards have a huge demand in the market, we selected Apple iTunes gift card worth $10.00 as a product for auction.

We put up the gift card for Bidding on ebay with a reserve price of $4.99 and a validity of 7 days. During the first few days several people watched the item and book marked, but bids received during the first five days compared to the last 2 days were very low. At the end of the auction the winning bid was $12.00 which yielded revenue of $2.00. After the end of English Auction we contacted all the bidders and informed them about a First Price sealed Bid Auction and asked them to submit their bids to an email id before a specific time. Most of the bidders participated in First price auction, in which the bids were ranging from $2.00 to $8.00. After that we conducted a Second Price sealed Bid auction in the similar fashion, in which the highest bid was $9.50 and the second highest was $8.80 .Here English Auction dominated the other two auction formats in terms of revenue generated for the seller. It is not possible to conclude any results from this unless the experiments are repeated foe a number of times.

B. Summary of Results

Now let us see what are all the violations of benchmark happened here in the case of real world experiments. As there are repeated auctions being conducted by several sellers for the same kind of items on ebay, bidders usually have dependent valuations. When the bidders were bidding for relatively cheap products, they are unlikely to be highly sensitive to minor variations in the price. Even though we can't conclude any major results from these experiments, it is matching with the simulation experiment. During English auction bidders are able to realize that they are not going to win the auction when someone bids higher than them, So they may bid again if they really want the product. This attitude of bidders is one of the reasons behind the

increased revenue from the English auction. In the case of First price sealed bid and Second price sealed bid auction bidders will know about the winning bid only after the auction completes. Under these conditions - Dependent Valuations or Affiliated valuations - English auction may perform better than First price sealed bid auction and Second price sealed bid auction in terms of generated revenue to the seller.

VI. Conclusions and Future Work

First part of our work mostly included the simulation experiments to validate the equivalences of four different types of auctions, conforming to the benchmark model at large. At times, we had to put in diligent and deliberate efforts to model the agents' behaviour, strictly coinciding with the benchmark assumptions. However, it is highly unlikely that all the four conditions would simultaneously hold in a typical practical scenario. One cannot rule out the possibility of one auction turning out to be better to the seller, should some benchmark conditions be violated. In fact, in the latter part of our work, we largely focused on experiments to closely examine the deviations in revenue equivalence theorem, when the bench mark conditions don't necessarily hold together. We were able to extract some interesting information and this has been elaborated in prior sections. Setting up a field study to validate the revenue equivalence under the bench mark conditions turned out to be infeasible, given the limited time frame and minimal resources. The behavior of laymen may not always be precisely predictable and may actually turn out to be weird at times, as was evident from our ebay experiment. Ideally, in any real world experiment to validate the revenue equivalence theorem, a sizeable number of rational agents should be engaged and the experiment itself should be repeated for a sufficiently large number of times. Albeit these stringent requirements and constraints, we made our best efforts to discover and characterize the deviations under different conditions, using carefully designed simulation experiments and techniques. Furthermore, the results obtained were religiously validated to rule out any possible error induced at hap hazard.

When too many auctions are being conducted for the same kind of item over a small period of time the players will keep on bidding low values due to the oversupply to the demand, for taking care of this issue we need a reasonable time.

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Study of Photon Based Computing for the Improvement of the Performance of Computation Process

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Abstract - **Moor's law almost accurately predicted growth of computing capacity of a processor and it's not questioned till today. As per recent research results, silicon chips may come to its maximum capacity as reducing size of its transistors further may be practically impossible. But the globe demands more computing power to manage its huge needs like processing big data, mobility, processor intensive cloud solutions, super computers, etc. So the world is seeking for alternatives and researchers focusing on new methodologies like quantum computing. Here, we are trying to propose a method for computing using laser beams with different wavelengths. Multiple laser beams will not mix together if its passing through vacuum or normal mediums, but it will mix and produce a different wavelength when its passing through some special mediums, and we consider it as a computation.**

Keywords — **Computing; Photon computing; Laser based computing.**

I. INTRODUCTION

Modern digital computers are achieving huge growth in computational capacity in a rapid rate. As personal computing devices are evolving as mobile/handheld devices, there is high demand for powerful, less in size, and energy efficient processors. Standalone, Mission critical, dedicated super computers etc are also demand processors with higher processing capacity. There is immense amount of research happening in the field in many universities, private companies and research organizations. Many researches are focusing on replacing copper/metal cables and circuits with optical alternative to achieve high transmission rate. Light fleet and some other technologies succeeded on their research, and communication between micro processors & internal components are achieving huge data transfer rate. When we are using such technologies for communication between components, data processing is being a bottle neck. Even the data is reached in the components, the time taken to process it will slow down the entire system. So we have to achieve high processing capacity.

Many researches are happening to increase processing capacity of a silicon/Metal chip. Optimizing it for more micro components, increasing the clock speed, implementing multiple cores in a single chip, etc are the focus areas. But many researches are happening to find a complete game changer which will be using different concepts and technologies for computing. Quantum computer is a classic example for such research and scientists achieved to develop few quantum computers which is under experimental use. As quantum computing gives more possibilities in solving problems in a different way unlike normal computers, scientists are experimenting it with special set of problems which may be difficult to solve in conventional methods.

This work proposes using light/laser beams with different wavelengths for computing. Here, we assume a value for each band of wavelength of visible light spectrum. By mixing two or more different bands of the wavelength, we assume that it will produce a different band, and we assume it as a processing done. Here, we consider two or more bands as input and the produced band as output. By measuring the wavelength of the produced band, we can decide the output value. We can use multiple inputs and can create a nested structure for using one output as next input. So we assume that processing will be done at the speed of light. Here, we assume a fresh computational logic as digital computing logic may not be suitable with the system. We may need to develop a new level of computational logic, algorithms, architecture, and Turing machine etc for the proposed method. Co working with existing digital devices may be possible but converting input to the new system and converting the output back is needed.

We assume that we can achieve nearby speed of light in processing theoretically, Clocking architecture, capacity and speed of sensors, speed of intermediate storage etc have to be considered when calculating speed. Advancement in researches in the

field of optical flip-flops, optical computing etc are giving more confidence for the proposed model.

II. Current Technologies

Most of the optical technologies are focused on interconnection between micro components inside digital systems. Each digital component produce signals to be transferred in between and normally metal wires or printed board are used. Electrons from each components flow through the cables or printed boards and it gives very low cost and simple solution. But as the industry demands more processing capacity, researchers were focused on improving processing capacity. Industry is growing as per Moore's Law predictions and we are achieving huge processing capacity., But as intercommunication between processors are through metal wires, its being a bottleneck. So many researches are going on for solving this issue. As a result industry leaders like Intel, IBM etc came up with cutting edge technologies for inter connection using optical alternatives. Optical communication was used for data communication but it was unable to use it directly inside a Machine as it need huge infrastructures and machineries. But new findings are capable of managing interprocessor communication effectively as it needs very small components and less energy. IBM Holy OptoChip is an example for such a solution. It uses Silicon photonics to work with both electron and photon, and claim to transfer 1 TB/second Image. There will be a converter connected to each processor, and the converter converts electrical signals to optical signals to transmit through optical channels. The optical signals again converted to electrical signals in other end to make use of the transferred data by second processor/component.

III. Limitations

The optical signals again converted to electrical signals in other end to make use of the transferred data by second processor/component. IBM Holy OptoChip, and other optical interconnection methods makes high bandwidths between processors a reality but we need huge processing capacity to process the transferred data. Even though we achieve huge data transfer speed, we have to increase the speed of processing too to avoid the bottle neck. Optical inter connectors can only increase the speed of communication , but to increase the speed of overall processing, we have to increase the processing capacity. Each time, data need to be converted in to optical signals and it should be converted again to its previous format for processing in a microprocessor as it can only deal with electrons.

IV. Proposed Solution

We are proposing a fresh processing concept with the help of mixing/ making alterations on laser waves. Laser waves can be "mixed" together or can be make alterations when it passes through some special mediums. Those changes can be considered as a logical operation and it can be used for computation. As it s a fresh concept, it's hard to implement it with the existing software, tools or simulators. We are planning to design a simple arithmetic calculator by using a set of Light sources and light detectors. We can use lasers to get more accurate result in such a design. Light sources emit different colored (wavelength) light beams and optical components are used to focus beams, position beams, 'mix' beams or separate beams according to the logical needs of the operations. Here, we are considering each beam with a wavelength as a pre defined value and different beams represent different values. We can use sensors and light sources in all surface of the box, as light beams will not mix in normal conditions, light beams with different wavelength can pass through same physical space.

We have to use highly flexible light sources, sensors, color mixers, prisms and other optical tools to mix, guide, reflect and use the light beam according to the instructions from a stored program.

We have to design a new computational logic for the proposed system. Suppose we are splitting the spectrum A in to a1, a2, ……., a10 and assigning 0 to a1, 1 to a 2, 2 to a3, …. 9 to a10, and if we are implementing the arithmetic logic addition, we have to check the possibility of finding the spectrum such a way that a1+a2 results a3, a1+a3 results a4 etc. We may need to develop a Turing machine to implement the computational

logic. As the output of each combination of light beams is complex, we have to map it in to a logical method and to implement it in to computation logic.

V. Color Box

Color Box is a small box with few color beam generators and color sensors to demonstrate the concept. Its only for the demonstration purpose of the concept and it's not a POC as it assumes mixing of colors which is impossible in normal conditions. The box is having 3 holes on the top side with 3 different color beam generators. bottom side of the box, a color sensor is fixed and its connected to a Digital display through a electronic circuitry. here, three colors c1, c2, c3 are having different values assigned v1,v2, v3 respectively. Each of the color beams can be turn on/ off by separate switches. If we turn on c1, the sensor will sense the color and the digital display will display v1, the same will happen for c2, c3 as v2, v3 respectively. This is happening because we already assigned a value for each color and the value will be displayed on the screen as the sensor detects the colors. Now, if we turn on any two colors, we will get a different color as that two beams "mix" together. If we turn on c1 and c2, the beams together for ma different color and the sensor detect a different value d1 which we assume d4=v1+v2 where + is the operation we intended to perform with v1 and v2. If we turn on c1 and c3, it will give a different color and the sensor detect a different value d5 where d5=v1+v3, where + is the operation we intended to perform with v1 and v3. Such as we can find other combinations too which are d6=v2+v3 d7=v1+v2+v3. So we are having 8 states for the system where as d0 is the absence of all light beams, d1=v1, d2=v2, d3=v3, d4= v1+v2, d5=v1+v3, d6=v2+v3, d7=v1+v2+v3. Its evident that mixing of two visible light beams is impossible in normal conditions. So this demonstration can't be considered as a Proof of concept, but it can give a clear idea about the concept and can be used for study purpose. The color sensor is a normal color sensor which will output value of RGB to the circuit and based on the RGB values, the circuit decided which value to be displayed on the digital display. Value for each color is pre defined and the electronic circuitry is only selecting the values to be displayed from the pre defined table based on the color identified by color sensor, so that we can argue that processing is already done by "mixing" color beams inside the box and not by the electronic circuitry.

VI. Materials Identified

There are many materials identified which will show non linear properties. We can select materials already developed for dealing with laser beams according to our needs and situations. There are lot of materials that will be resisting laser beams to a particular intensity and it will transmit the beams if it reached about the intensity. There are materials which will act as a medium and combine two different laser beams in to a single beam.

VII. Practicality

As we already have many researches in the field of lasers, non leaner materials, changes to the laser beams when passing through different mediums, etc, the concept is a workable one. But there are many practical difficulties and need huge advancements in the supporting technologies and environments to make it for commercial purpose. As per the previous research findings, its possible to add wavelength of two laser beams with different wavelength when its passing through a special medium. So its clear that we can achieve a computation by using the process. If we consider a1 as first laser beam with a wavelength w1 and a2 as second laser beam with wavelength w2, and both beams are passing through a special medium, will get a different laser beam with w3, which is w3= w1+w2. So we can consider it as a computation, if we are able to design a computation logic based on it, we can use laser beams with different wavelengths for different computation purpose. We need to identify laser beams with different wavelength and to assign each one to a value or logic. Mapping of laser beams for each value is a very important task as each beam should be easily distinguishable from other one. Mixing of two or making alteration on a beam should result in a identified beam to make the system simple and practical. The system may not be possible to use for a general purpose computing in near future, but it can be used to design a processor for a special kind of logic which will solve a limited no of problems in a very effective way.

VIII. Benefits

As silicon based computing has the above said limitations, new methods are necessary. We can assume several benefits for the proposed system like, high speed in processing, Low energy consumption, easy management of different lasers in same chamber, low temperature, etc.

IX. Threats

There are many threats for the proposed concept as its still in a conceptual stage. We are not even aware about unexpected practical complexities and problems may arise at the time of practical implementation of a complete general purpose system. But we are certain with the practicality of the special purpose systems on the basis of already proven concepts based on researches in the field of lasers and non linear materials. Mapping of values in to the laser beams is a difficult task as it should be picked based on its consistency, easiness to handle, detection of property changes when its passing through special mediums or mixing with other beams, etc. Preparation of a new computational logic is another threat. If we are creating a fresh computational logic, it will be hard to co work with existing systems. So that we have to find a way to map it in to the existing computational logic if possible. Environment and components to co work with the proposed model have to be developed and it may take time. If we are dealing with electronic circuitry with the proposed model, we have to do conversion between electronic signal to optical signal to process the data and to optical signal to electronic signal after processing it. It will complex system and may affect the performance. So the proposed method will be practical for a general purpose computer only if we can achieve an environment where the components co working with processor will manage optical data. Optical flip flops, optical switching and other micro components are developed already and many other components are under research. The success of the proposed system for general purpose computing depends on the advancements of research in components in optical technology.

X. Conclusion

There is a huge demand for computation power after invention of first computer and industry is supplying computation power for the thirsty applications. Moors low accurately predicted the growth of computation power related to the growth of number of transistors used for the purpose. Even we have huge supply of computation power, there are many problems remain unsolved or taking time to be solved as the algorithms are very complex and it needed huge amount of computation power. Here the proposed system may not be able to use for general purpose computing in near future but it can be used to design special purpose processors to solve some particular problems. We wish to propose the idea to bring the attention of researchers to this area and to conduct further research on this.

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GSM Controlled Integrated Robot

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Abstract— **Robots are generally a boot which are modeled, planned, sensed, actuated and controlled whose motion and behavior can be influenced by "programming". When a robot is controlled using RF technology, the inherent limitations of the technology such as limited working range causes problems in controlling robots. The GSM Controlled Integrated Robot is an electromechanical machine which doesn't need any kind of "programming". The inherent limitations of RF circuits can also be overcome when mobile phones can be used to control robots. In this paper a model using Dual Tone Multi Frequency (DTMF) which decodes the signal, from GSM Module which controls the boot and helps to move along forward, backward, left, right direction and along 360 degree rotation, is discussed.**

Keywords— Robot, boot, GSM Controlled Robot, DTMF

I. INTRODUCTION

Robots can be controlled in a wireless environment. A wireless controlled Robots make use techniques such as Remote, Bluetooth, Wi-Fi that are based on RF circuits. RF circuits have few inherent limitations such as limited working range, limited frequency range and limited control [1][3]. This is a hindrance in controlling and navigating a robot within a long perimeter.

One of the ways to circumvent this issue is use of mobile phones to control the robots. When the robot is connected to GSM modem which is controlled by user mobile phone, the robot can be controlled using the mobile phone with a working range as large as the area of the service provider. Also it has no interference with other controllers. This approach is a handy solution to all the limitations of RF circuit-based methods. A general concept of mobile controlled robot is that it can be controlled from any part of the world with just an inclusion of a camera.

The remaining portions of this paper are organized as follows: Section II briefly discusses about the components of the proposed system using mobile phones. In Section III, a brief technical application of the proposed architecture is discussed. Section IV is about merits, demerits and applications of the proposed method. Section V concludes the paper.

II. COMPONENTS OF THE PROPOSED SYSTEM

The robot which can controlled by 2 mobile phones one phone as in robot and other one is like a remote. To avoid extra camera building in the robot we use the receiving end mobile camera by using video call. It can be work any range where we have a mobile network.

Button	Low DTMF Frequency (Hz)	High DTMF Frequency (Hz)	Binary Coded Output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	1	1
5	770	1336	1	0	0	0
6	770	1477	1	0	0	1
7	852	1336	1	0	0	0
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1366	1	0	1	0
*	941	1209	1	1	0	0
#	941	1477	1	1	0	0

Table I: DTMF Codes

Any mobile phone can be used as a remote and receiver. When a mobile phone button is pressed to make a call, tone corresponding to the button pressed is heard at the other end of the call. This tone is called Dual Tone Multiple-Frequency (DTMF) tone. This DTMF tone is caught by the robot with the help of the phone attached to the robot. The modulation of sound is taking as an input. For every button the frequency is different (See Table 1) and this frequency is decoded using an DTMF decoder IC.

The components of the system are:

- GSM module,
- DTMF decoder (MT8870),
- Motor driver (l293D),
- Camera,

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- Gear motor, and
- Tyres.

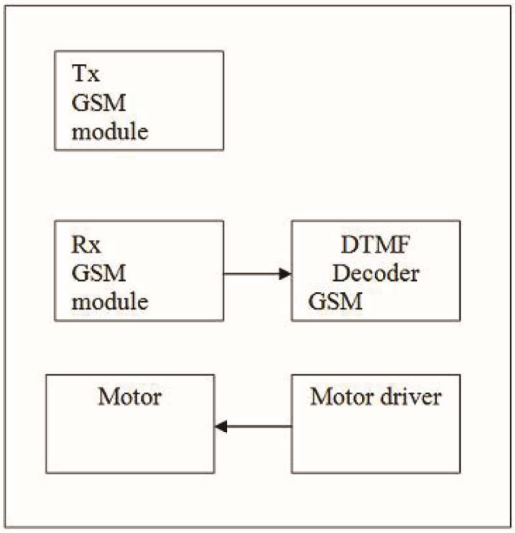

Fig 1: Block Diagram of the Proposed System

A. GSM Module

It does the function of both receiving and sending the signals which helps to make a video and audio call over the phone. The normal robots are being controlled over limited Radio Frequency range but these GSM controlled robots are controlled using the mobile networks which expands its limitation, and make it a wide range controlled boot.

B. GSM Module DTMF Decoder (MT8870)

The DTMF receiver's main function is to decode the input signal. DTMF receiver integrates both the band split filter and digital decoder functions.

It is the frequency produced when different keys from a remote mobile device is pressed while connecting a call.

C. Motor Driver (L293D)

This device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays, solenoids, DC and stepping motors) and switching power transistors.

D. Gear Motors

The gear motors are the normal motors which are being attached with gears that drive the shaft. The maximum power of the motor is 200 rpm.

E. Camera

A camera is attached to the GSM controlled integrated robot.

III. Discussion

The GSM Controlled Integrated Boot can be activated by making a video and audio call from the mobile phones and then by pressing the numbers in the keypad. The DTMF tones generated are sent to GSM module which receives the signal and, the signal is sent to the DTMF module. The DTMF module decodes the signal and passes it to motor driver. As per the signal, the motor driver instructs the gear motor to move. since logical IC MT8870 is used, instead of a microprocessor, without writing a program the robot can be controlled.

IV. Discussion

A. Merits

1. The GSM Controlled Integrated Robot is cheaper compared to other similar devices.
2. It doesn't require "programming".
3. It can be controlled by GSM network over wide range.
4. As this boot is being controlled using GSM network, the receive calls can be preset, and it more secure.

B. Demerits

1. It can't be airborne.
2. It can't dodge gait objects as this boot is tiny.
3. As once the video call gets disconnected, another call is be made to connect the interface.

C. Applications

There are several applications for this technology which includes:

- GSM based home appliance control
- GSM based home security system
- GSM based generator start stop.

V. Conclusion

The GSM Controlled Integrated Robot can be used as alternative to RF circuit based robot controlling. Compared to the limited range of RF based circuits, GSM controlled robots can work in a wide range – range is constrained by the mobile service operator's vast perimeter range. DTMF encoding and decoding techniques are applied to exchange commands between robots and the machine. Use of logical IC MT8870 enables the system to be used without any programming. The

system has a wide range of applications in areas such as military, medicine, industries, and space exploration.

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LTL for Verifying Digital Electronic Circuits

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***Abstract* - The design and implementation of digital electronic circuits is to undergo proper testing so that bugs can be eliminated from the development environment itself. Since digital electronic circuits and computer programs are similar in nature, methods adopted in program verification can be effectively used for the verification of digital systems also. Formal modeling is an important method in any kind of verification and in this paper, we present a novel approach to formally modeling a digital system. We prove that our approach can be used for modeling digital systems with any number of gates as the resulting model will have a finite number of states only. We use LTL to specify properties of digital systems and we use a symbolic model checker to verify those properties.**

***Keywords* — Digital electronic systems; program verification for digital systems; LTL for specifying properties of digital systems; formal modeling; using SAL for verification.**

I. INTRODUCTION

Proving correctness of programs have always been a hot topic in the realm of computer science. The software systems always stressed the importance of testing from the very beginning and as a result, software development life cycle (SDLC) always had an important component in testing [1]. A software does not turn out to be usable unless it passes the test cases prepared by the testing team. Modern day SDLC systems present large number of testing methods to avoid any minor defect in the software.

Although the present black box testing is sufficient for a large number of software applications as a passing criterion, there are certain mission critical applications where the present black box testing is not enough. On June 4, 1996, the unmanned rocket Ariane 5 (from European Space Agency) exploded just after 40 seconds from its launch. On detailed evaluation later, it was found out that a 64-bit integer relating to its velocity component was converted to a 16-bit integer [2]. The system had passed all the black box test cases, though it is not easy for that kind of testing to reveal the bug.

We need a better system which can figure out the bugs and thereby verifying the correctness of the program. Since it is not even possible to run and verify certain systems, it would be really beneficial if there is a testing / verification system which predicts errors by static analysis of the code

/ algorithm. Moreover, if the entire software system can be considered as a mathematical model, verification of certain properties would be really easy. That is the whole idea behind program verification.

A program may have a large number of components like variables, semaphores, locking mechanisms etc. and it is really hard to determine and verify all the features of all the components. Hence we limit the components and features.

As an example, consider the following program segment.

```
for (;;)
{
        x = 0;
        .....
        x = 1;
}
```

Here we would like to verify the properties of x only. Hence we convert the program as a finite state machine with two states, i.e., x = 0 and x = 1, as shown in figure 1.

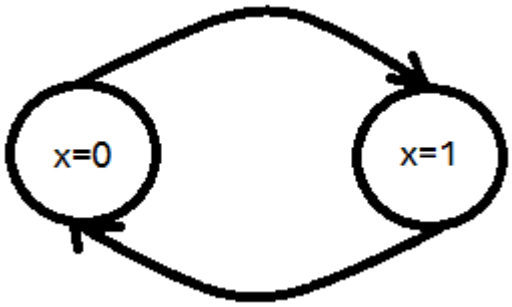

Figure 1. Transition system for the states of the variable x.

The start and final states of the automaton are not shown in figure 1 as the variable x does not feature them. Hence it is rather a transition system than a deterministic finite automaton. However, the transition system itself is powerful enough to prove certain properties of the program. For example, suppose we want to verify that the value of x is always either 0 or 1. It is very easy for a model checker to do the above, given the above verification condition is provided in the corresponding language.

The example given above may seem slightly naive as there is no real bug in the program. However, in real world complex programs, even after multiple peer reviews, it is common that there are semantic errors which go undetected. The development and production environments can be really different and it is very hard to reproduce bugs in development environments which appear in production arena. A black box tester who does not know much about the program can do little in above kind of bugs. Also, it is not easy to reproduce the entire production settings in the development site. That is why formalization comes as a handy tool to find out potential bugs at the development site itself, which otherwise would have been hazardous to the system. As an example, consider the following program segment.

```
byte temperature = 0;
bool fan_on = false;
. . . . . .
if (temperature > 500)
fan_on = true;
. . . . . .
```

Just like programs, design of every digital electronic system goes through rigorous phases of testing. However, the basic black box testing is not enough in this case also. In this work, we present a few ideas on formalizing digital systems. We then present a novel approach to verifying certain properties of digital electronic systems, using linear temporal logic (LTL). This paper is divided into following sections. Section II gives a brief idea about the basics of LTL. Section III puts forward how digital systems can be truthfully modeled and how LTL can be used for proving certain properties of those systems. Section IV shows the experimental work we have done and section V proposes the conclusions and future work.

II. THE LINEAR TEMPORAL LOGIC (LTL)

Logic is an integral part of formal verification. Temporal logic extends propositional or predicate logic by temporal modalities [3]. LTL implements a transition system where each state holds a proposition. Figure 2 depicts the transition system where α1 is the proposition that holds in the first state. A LTL formula ϕ can be expressed to be

$$\varphi = true \mid a \mid \varphi_1 \wedge \varphi_2 \mid \varphi_1 \vee \varphi_2 \mid \neg\varphi \mid O\varphi \mid \varphi_1 U \varphi_2 \mid \Box\varphi \mid \Diamond\varphi$$

where a ∈ AP, the atomic proposition.

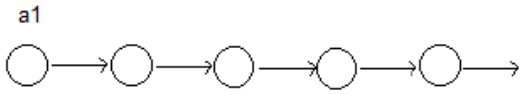

Figure 2. A transition system.

- *Next* operator, O - shows a holds in the second state from beginning. Figure 3 shows O_{a2}.
- *Until* operator, U - shows the first proposition continues to hold in all states until the second proposition is met. Figure 4 shows a U b.
- *Eventually* operator, - shows that the operand is true eventually in the transition system.

$$\Diamond\varphi = \text{true U } \varphi$$

Figure 4 shows $\Diamond b$.

- *Always* operator, □ - as the name indicates, the operand holds in all states of the transition system. Figure 5 shows □a.

- *And* operator, ^ - used to connect two propositions using logical AND.
- *Or* operator, ∨ - used to connect two propositions using logical OR.
- Not operator, ¬ - used to assert negation of the proposition holds.

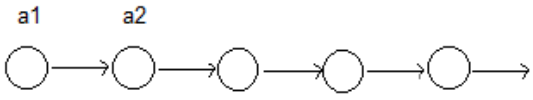

Figure 3. A transition system for the O operator.

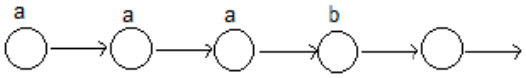

Figure 4. A transition system for the U operator.

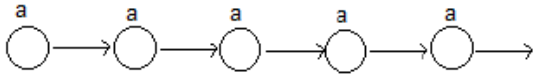

Figure 4. A transition system for the □ operator.

These formulas are very powerful and almost every logical feature of the model can be expressed using LTL. As an example, consider an emailing system where the property is that whenever we try to send an email, the next state should be that it is delivered. It is expressed as a simple LTL formula:

$$\Box\ (\text{try} \rightarrow \text{O delivered})$$

Later, if we want to change the property that the emailing system should continue to try sending the email until it is delivered, we change the LTL formula as using logical AND.

$$\Box\ (\text{try} \rightarrow \text{try U delivered})$$

Finally, if the desired property of the system is that whenever we try to send an email, it should be delivered some time in future, the corresponding LTL formula can be written as

$$\Box\ (\text{try} \rightarrow \Diamond\ \text{delivered})$$

We have two more derived semantics for LTL. They are:

- infinitely often, $\Box\Diamond\varphi$ and
- eventually forever, $\Diamond\Box\varphi$

III. LTL FOR DIGITAL ELECTRONIC CIRCUIT VERIFICATION

Digital electronic circuits are mostly made of logic gates and the data they deal with are normally logical zeros and ones. This makes them an ideal candidate for logic verification. Digital electronic circuits can be quite complex and debugging and verifying the circuit is not an easy task. It would be really helpful if they are modeled in a suitable format so that automated verification of certain properties can be done.

LTL is an ideal tool for verification of properties of a digital electronic circuit. An electronic circuit, combinational or sequential, can be considered to produce a finite set of states where each state is an output of a combination of logical operations on the inputs. We can create an exploded model of the circuit by taking each logic gate in the circuit and adding a state corresponding to every combination of the possible inputs to that gate. (For a digital circuit, the possible values of an input are 0 and 1 only).

As an example, consider a simple circuit given in figure 6. The possible combinations of inputs for the pair (x1, x2) are (0, 0), (0, 1), (1, 0) and (1, 1). Hence the corresponding transition system model will have five states, as in figure 7.

Lemma 1. *The number of states in a transition system model of a digital electronic circuit remains finite*.

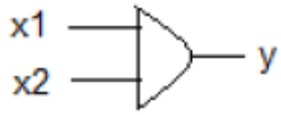

Figure 6. A simple circuit having only one logic gate.

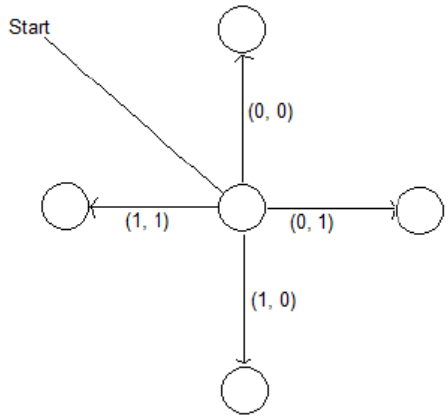

Figure 7. Transition system for the circuit in figure 6.

Proof: We prove the claim using the method of mathematical induction on the number of logic gates in the system, by adding gates progressively one by one. If there is only one gate with k inputs, the maximum number of states in the transition system will be 2^k. For a circuit with m gates, let the no. of states in the transition be n. The maximum number of outputs possible in the above circuit is m. If we add an extra gate to the above circuit (total number of gates = m+ 1) with k' external inputs to the new gate, the maximum number of extra states needed in the transition system to accommodate the new gate will be $2^{m+k'}$ Since the total number of gates in any electronic circuit is finite, the total number of states needed in the transition system also remains finite ■.

A. *Abbreviations and Acronyms Using LTL for verification*

The debugger has to go through output of each state corresponding to each combination of inputs and obviously this is a tedious and error prone process. However, once we have a model of the circuit, each state corresponds to an output for an input combination. Verifying whether a particular
output is obtained is simply a graph reachability [4] problem through a specific path. There may be other aspects of verification also. For example, under certain conditions, the output should never be a particular value. These properties can be easily expressed in LTL and then can be given as
an input to a model checker. The model checker can easily verify whether the LTL property is satisfied by the system.

B. *SAL - A symbolic model checker*

SAL (Symbolic Analysis Laboratory) is a framework used for model checking, program analysis and theorem proving of transition systems [5]. The language of SAL allows the users to specify the transition systems. Just like many other model checking frameworks, SAL input language allows the transition system to be specified in terms of initialization and transition commands. It has a binary decision tree (BDD) based symbolic model checker for finite state systems. Most importantly, LTL properties can be specified using the language of SAL which the
symbolic model checker can easily verify. SAL generates a counter example sequence of steps if it is not able to verify a property.

We use SAL for model checking of digital electronic circuits.

IV. EXPERIMENTS AND RESULTS

The modeling method suggested in section III has an exponential complexity. The state space grows really big as the number of gates and inputs increase. As a result, the number of lines of code for specifying the transition system in SAL is considerably high for an average electronic circuit that uses tens of gates. This results in prolonged
execution time for the model checker and a considerable use of system resources.

However, our first aim is to verify the result for all possible combinations of inputs and the result is obtained by performing a series of logical operations on the inputs. SAL allows to specify these operations directly in the transitions. For example, consider the circuit shown in the figure 8. The circuit has three gates and one input, viz. x. The final output is y_2 and the intermediate outputs are y_0 and y_1. They can be represented as:

$$y_0 = x \text{ AND } y_2,\ y_1 = \text{NOT}(x \text{ AND } y_1),$$
$$y_2 = y_0 \text{ AND } y_1$$

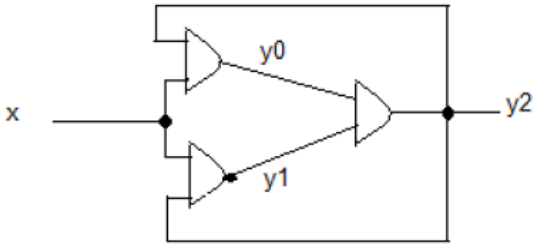

Figure 8. A circuit using three gates and one input.

A. *Modeling using SAL*

As we are interested in the output only, we need only two variables. The type of the variable is boolean.

```
input x: boolean
output y2: boolean
```

The initial states of the above variables are indeterminate. Hence there is no initialization section for our model.

Transition is the most important stage that helps us to truthfully model the circuit. Since SAL allows the logic operations that are performed by gates, we can directly model them as follows.

```
transition
[
    true --> y2' = (x AND y2) AND
                   (NOT(x AND y2));
[]  else -->   % Do nothing
]
```

Once we model the entire circuit, we can specify the properties as LTL. Here we verify the basic property that once the input is 0, the output

continues to be 0 forever. This can be represented in LTL as

$$\neg x \rightarrow \Diamond\Box\neg y_2$$

The corresponding SAL statement is

```
low_output: THEOREM circuit |-
((x = false) =>
(F(G(y2 = false))));
```

It specifies that in the module circuit, the LTL property low_output holds.

C. Results

We use the symbolic model checker of SAL to verify the LTL assertions. For the above sample, it verified the assertion quickly.

We validated the above method of verification using sample circuits like flip-flops and counters and all the time, the results were satisfactory.

V. Conclusion and Future Work

We have presented an easy way to convert a digital electronic circuit to a transition system and then to verify their properties. The method uses the BDD based symbolic model checker of SAL. The method can verify almost any feature expressable in LTL.

As the future work, we would like to create a system that can automatically convert digital systems to the transition system based model. We need to identify methods to reduce the number of states in the system. We would also like to extend the work to some complex electronic circuits and see if there is any upper bound on the number of gates and inputs.

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Experiments on Revenue Equivalence Theorem

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***Abstract* - Auctions have been conducted since ancient times for the sale of various items. They have gained much importance during past few decades as the primary mechanism for allocating natural resources and procurement of goods and services. The emergence of internet has made auctions very popular where people can request for bids via the internet from a wide range of buyers and for a large number of commodities. We aim to study the equivalences of the revenue generated for the seller by the four basic auction types - English auction, Dutch auction, First price sealed-bid and Second price sealed-bid auctions - as stated by the Revenue Equivalence Theorem. We empirically verify the results of the theorem through various experiments. Since all the benchmark conditions rarely hold together in real world, some auctions may yield better revenue than some others. We, therefore, analyze the auctions by violating some of the benchmark assumptions so as to simulate the real world scenario.**

***Keywords* — Revenue Equivalence Theorem; Auctions.**

I. INTRODUCTION

Auctions are mechanisms for buying or selling of goods where participants submit bids and the allocation and pricing of goods are based on specific rules set by the mechanism. They have been used as means of exchange of goods for most of the history. Earliest evidence of using auction date back to 500 B.C. in the Babylon civilization. In the recent times, auctions are of great significance as the primary means of allocating natural resources and procurement of goods and services. Auctions conducted for the allocation of mobile spectrum, coal fields and other national resources involve huge amount of money and is of national importance. Therefore, it becomes essential to study about various types, their properties and their suitability under different environments.

A. Basic Auction Types

In this report, we focus on the selling of a single indivisible item based on the four basic auction types - English, Dutch, First-price sealed bid and Second price sealed bid auctions. English auction is the most common type of auction. It is also known as open ascending price auction, where the seller puts an indivisible item for sale with a low reserve price. The seller then keeps on increasing the price until exactly one buyer remains interested in buying. The item is then sold to that buyer with the same price. The auction format used in the Indian Premier League for buying players is a very good example for English auction.

Dutch auction is another type of auction where the auctioneer puts up an item for sale with a reasonably high initial price, usually known as asking price. If no one buys the item for that price then the auctioneer will keep on decreasing the asking price until somebody buys the item or a predetermined minimum price is reached. Here the buyer who bids first wins the auction and will pay an amount equal to his bid, which is the asking price of the auctioneer to which he agreed to buy the item.

First Price sealed bid auction is a kind of auction in which the seller will advertise the product details and invite interested buyers to submit their bids in a sealed fashion. After the interested buyers submit their sealed bids all the bids will be compared and the highest bidder will get the item awarded. The winner will pay an amount equal to his bid amount.

Second Price sealed bid auction is a kind of auction very similar to First Price sealed bid auction where the seller will advertise the product details and invite interested buyers to submit their sealed bids. Later the highest bidder will get the item awarded and he have to pay only an amount equivalent to the second highest bid. Here the bidders are always going to pay an amount less than his bid for the item.

The rest of the paper is organized as follows. Section 3 briefly discusses the revenue equivalence theorem and proofs of various equivalences. In Section 4, we describe the results

of empirical investigation conducted through simulation and real world experiments. Section 5 contains some conclusions we could observe and scope for future work.

II. RELEVANT WORK

The paper by McAfee and McMillan [1] provides an excellent literature on various auction types and their equivalences. The paper discusses various benchmark conditions under which the theorem is valid in an intuitive fashion. The book by Vijay Krishna [2] on Auction Theory is a very good reference on the theoretical aspects of the theorem including the proofs of various equivalences. Other useful references include the Lecture notes on Revenue Equivalence Theorem by Prof. Y Narahari [3] and experiments conducted on the revenue equivalence theorem by David Lucking – Reiley [5].

III. REVENUE EQUIVALENCE THEOREM

A. Background

The risk attitude of bidders is modeled as risk-averse, risk-neutral or risk-affine. A person who is risk-averse tend to be reluctant to play a strategy with an uncertain pay off over a strategy with more certain, but possibly lower pay off. A player is risk-averse if and only if his utility function is concave[4] . A risk-affine player behaves opposite to a risk-averse player and a risk-neutral player has equal probability of choosing the lower and higher uncertain situations. The utility function of a risk-affine player is convex while that of a risk neutral player is a straight line.

The valuations of bidders are modeled either by independent-private-values model or common-value model [1]. In independent-private-values model, each bidder observes his valuation of the object for sale and is known only to the bidder. Further, the valuations of every bidder are statistically independent of others. The auctioning of an antique where the bidders buy for their private use and not for resale is an example scenario for this model. In common-value model, each bidder is uncertain about his own valuation, probably arising out of the asymmetric nature of information available to different bidders. The valuations are affiliated and could change when the bidder comes to know about the valuations of others. The auctioning of an antique where the bidders buy for resale is an example scenario for this model.

Bidders are symmetric if they choose valuation from the same probability distribution.

B. Revenue Equivalence Theorem

The Revenue Equivalence theorem states that under the benchmark model, all the four basic auction formats yield the same average revenue to the seller. The benchmark model assumptions are:

1. The bidders are risk neutral.
2. The independent-private-values assumption applies.
3. The bidders are symmetric.
4. Payment is a function of bids alone.

This result was first shown by Vickery (1961).

Proof of Revenue Equivalence Theorem

The revenue equivalence between Dutch-First price auctions and English-Second price auctions is intuitive and quite straight forward. If we can also show equivalence in expected revenue between first price and second price auctions, the revenue equivalence theorem will be proved. In the remaining part of this section, we provide the proof of revenue equivalence of first price and second price auctions. This proof is based on the one presented in the Lecture notes of Prof. Narahari[3]. The Revenue Equivalence Theorem is proved based on the following theorem.

Theorem 1.1

Assume an auction with:

1. n risk-neutral bidders.

2. Bidder valuations lies in real interval [θ 1, θ2] with $\theta 1 < \theta 2$.

3. Bidder valuations are drawn from [θ 1, θ2] with a strictly positive density φ i (.) > 0. Let φi (.) be the cumulative distribution function.

4. Independent bidders.

Now consider a given pair of Bayesian Nash Equilibrium of two different auctions procedures that satisfy:

1. For every bidder i, for each possible realization of (θ_1, ..., θ_n), bidder i has an identical probability of getting the good in the two auctions.

2. Every bidder i has the same expected pay off in the two auctions when his valuation for the object is at its lowest possible level.

Then the two auctions generate the same expected revenue to the seller.

We now show that both the first price auction and the second price auction satisfy the conditions of the theorem on revenue equivalence of two auctions. In both the auctions, the bidder with the highest valuation wins the auction. Bidders' valuations are drawn from [θ1, θ2] and a bidder with valuation at the lower limit of the interval has a payoff of zero in both the auctions. Hence theorem can be applied to the equilibrium of the two auctions.

IV. Experiments

Experimentations were carried out in two phases. In the first phase, all the four auctions namely the English Auction, Dutch Auction, First Price Sealed Bid Auction and the Second Price Sealed bid Auctions were modeled using MATLAB. These auction models were simulated and the expected revenue was estimated. In the second phase of experimentation a practical auction environment was created in ebay.com with an iTunes Gift card as an item for sale.

A. Modelling of Simulation Experiments

Modelling English Auction

The English Auction was modelled as follows:

• A single indivisible item was assumed for the auction.
• The auctioneer will put a reserve price. The item will not be sold if there is no interested buyer for this price.
• Bidders with valuations greater than the reserve price will go to the next round during which the reserve price is incremented by a fixed increment.
• The auction will stop at the point where the second last bidder drops out.
• To minimize numerical boundary issues the fixed increment is made as small as possible.
• Valuations are drawn from a Normal Distribution N (μ, σ) with μ = reserveprice + 10 and σ = 5.0
• Hundred experiments each with 100 players with different valuation distributions were carried out and the expected value is found out.

Modelling Dutch Auction

The English Auction was modelled as follows:

• A single indivisible item was assumed for the auction.
• The auctioneer will put a reserve price which will be much higher than the true valuation of the item. This is understood as the seller will like to maximize his/her revenue.
• If there are no interested buyers then the reserve price is reduced by a fixed amount.
• The auction will stop at the point one bidder becomes interested to buy the item.
• To minimize numerical boundary issues the fixed decrement is made as small as possible.
• Valuations are drawn from a Normal Distribution N (μ, σ) with μ = reserveprice − 10 and σ = 5.0.
• Hundred experiments each with 100 players with different valuation distributions were carried out and the expected value is found out.

Modelling First Price Sealed Bid Auction

The Dutch auction was modeled as follows:

• A single indivisible item was assumed for the auction.
• The bids are derived from a Uniform Distribution, given by $b_i = \frac{N-1}{N} v_i$ under risk neutrality.
• The bidding is done only once.
• The item is awarded to bidder who has the highest bid.
• One hundred experiments are carried out and the expected value is found out.

Modelling Second Price Sealed Bid Auction

The Dutch auction was modeled as follows:

• A single indivisible item was assumed for the auction.
• Valuations are drawn from a Normal Distribution N (μ, σ) with μ = 110 and σ = 5.0.
• Since its a weakly dominant strategy to bid one's valuation in a second price auction, the bids are assumed to be equal to each players' valuation.
• The item is awarded to bidder who has the highest bid, but he will only pay the second highest bid.
• One hundred experiments are carried out and the expected value is found out.

B. Simulation

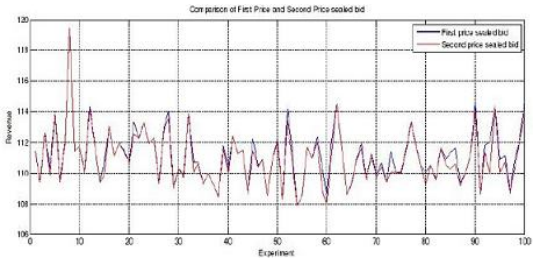

Figure 1: Benchmark model

The four models of auctions were simulated under the benchmark conditions. The results were collaborating with the theoretical versions which suggest that all the four form of auctions yields the same expected revenue to the seller. A comparison of the revenue between first price sealed bid and second price sealed bid auction is shown in Figure 1. As evident from the figure, the revenue obtained from both the First Price Sealed Bid Auction and Second Price Sealed Bid Auction are similar. The First price sealed bid auction is equivalent to the Dutch Auction and the Second price sealed bid auction is similar to English Auction. So a similar comparison can be made in this regard. The average revenue from all the four Auction models were found to be same under the benchmark assumptions.

The behaviour of the celebrated Revenue Equivalence Theorem when one or more of the **benchmark** conditions are violated is analyzed and studied in the later part of the experimentation. The conditions violated are the **risk neutral** and **Independent Private** Values.

Risk Averse Bidders

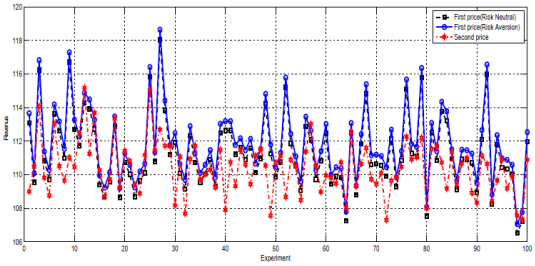

Figure 2: Risk Aversion

When the bidders become Risk Averse they will bid more so that the probability of winning the item becomes high. Thus under such conditions the First Price and the Dutch auctions will fetch more revenue than English or Second Price Auction. The risk averseness is modeled in First Price Sealed bid auction only as it is not applicable in a weakly dominant environment of Second Price Sealed Bid Auction.

The bidding is modeled as $b_i = \frac{N-1}{N-1+r} v_i$ where r is the Risk Aversion Coefficient and it takes value between 0 and 1[6] . The result is shown in Figure 2 in which the First Price Sealed Bid Auction with Risk Averse bidders is compared with Risk Neutral bidders and Second Price Sealed Bid Auction.

Affiliated Valuations

In the case of Affiliated Valuations, bidders will increase their valuations thinking that their counterparts perceive the value of the item to be high.

This is modeled by increasing the valuations of all losers and decreasing the valuation of the winner. A bidder who had lost in Auction i will perceive that his/her valuation was much below the winning bid and in Auction i+1 he/she will increase his/her valuations by **Δ/2** where **Δ = winnervaluation − loservaluation** . The winner will reduce his valuation by a small amount to increase his utility. Since to implement this logic the valuations of the bidders need to be known English Auction was chosen for the analysis.

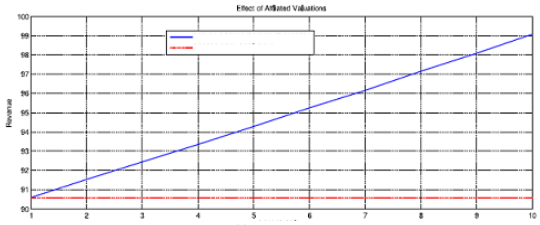

Figure 3: Affiliated Valuations

The result of the experiment is shown in Figure 3. Since the valuations are going up due to dependence in valuations among the bidders the average revenue obtained is much higher than that obtained in Second Price Sealed Bid Auction which has weakly dominant strategy equilibrium.

Summary of Simulation Experiments

Conditions	Auctions
Independent Private Value + Risk Neutral	D = F = S = E
Independent Private Value + Risk Averse	D = F < S = E
Affiliated Private Value + Risk Neutral	D = F < E

Table 1: Summary of Simulation Experiments

Table 1 summarizes the results from the simulation experiments on Revenue Equivalence Theorem.

V. Real world Experiments

As part of the real world experimentation we auctioned same kind of product by using three basic auction formats such as English auction, first price sealed bid auction and Second price sealed bid auction. These auctions are conducted in the internet market where the interested buyers can participate in the auction. We announced each auction one after the other in order to avoid the bidders waiting for the next auction. If the buyers know the fact that the same item is coming for auction in the next week or so, they are likely to skip the current one and wait for the next one. So we conducted English auction first and we announced the details of the other auctions to all those who participated in English auction one after the other.

A. Modelling of Experiments

ebay.com[10] is a popular e-commerce website where the products can be put up for sale. ebay gives the flexibility for conducting an auction for the product we want to sell. ebay by default supports a modified version of English auction, where the seller can keep the item for bidding with a reserve price and expiration time. At the time of expiry of auction the highest bidder will be awarded the product. During the bidding time interested buyers can keep on bidding until the auction get expired. As a part of Real world Experimentation We conducted the English auction in ebay. As Apple iTunes gift cards have a huge demand in the market, we selected Apple iTunes gift card worth $10.00 as a product for auction.

We put up the gift card for Bidding on ebay with a reserve price of $4.99 and a validity of 7 days. During the first few days several people watched the item and book marked, but bids received during the first five days compared to the last 2 days were very low. At the end of the auction the winning bid was $12.00 which yielded revenue of $2.00. After the end of English Auction we contacted all the bidders and informed them about a First Price sealed Bid Auction and asked them to submit their bids to an email id before a specific time. Most of the bidders participated in First price auction, in which the bids were ranging from $2.00 to $8.00. After that we conducted a Second Price sealed Bid auction in the similar fashion, in which the highest bid was $9.50 and the second highest was $8.80 .Here English Auction dominated the other two auction formats in terms of revenue generated for the seller. It is not possible to conclude any results from this unless the experiments are repeated foe a number of times.

B. Summary of Results

Now let us see what are all the violations of benchmark happened here in the case of real world experiments. As there are repeated auctions being conducted by several sellers for the same kind of items on ebay, bidders usually have dependent valuations. When the bidders were bidding for relatively cheap products, they are unlikely to be highly sensitive to minor variations in the price. Even though we can't conclude any major results from these experiments, it is matching with the simulation experiment. During English auction bidders are able to realize that they are not going to win the auction when someone bids higher than them, So they may bid again if they really want the product. This attitude of bidders is one of the reasons behind the

increased revenue from the English auction. In the case of First price sealed bid and Second price sealed bid auction bidders will know about the winning bid only after the auction completes. Under these conditions - Dependent Valuations or Affiliated valuations - English auction may perform better than First price sealed bid auction and Second price sealed bid auction in terms of generated revenue to the seller.

VI. Conclusions and Future Work

First part of our work mostly included the simulation experiments to validate the equivalences of four different types of auctions, conforming to the benchmark model at large. At times, we had to put in diligent and deliberate efforts to model the agents' behaviour, strictly coinciding with the benchmark assumptions. However, it is highly unlikely that all the four conditions would simultaneously hold in a typical practical scenario. One cannot rule out the possibility of one auction turning out to be better to the seller, should some benchmark conditions be violated. In fact, in the latter part of our work, we largely focused on experiments to closely examine the deviations in revenue equivalence theorem, when the bench mark conditions don't necessarily hold together. We were able to extract some interesting information and this has been elaborated in prior sections. Setting up a field study to validate the revenue equivalence under the bench mark conditions turned out to be infeasible, given the limited time frame and minimal resources. The behavior of laymen may not always be precisely predictable and may actually turn out to be weird at times, as was evident from our ebay experiment. Ideally, in any real world experiment to validate the revenue equivalence theorem, a sizeable number of rational agents should be engaged and the experiment itself should be repeated for a sufficiently large number of times. Albeit these stringent requirements and constraints, we made our best efforts to discover and characterize the deviations under different conditions, using carefully designed simulation experiments and techniques. Furthermore, the results obtained were religiously validated to rule out any possible error induced at hap hazard.

When too many auctions are being conducted for the same kind of item over a small period of time the players will keep on bidding low values due to the oversupply to the demand, for taking care of this issue we need a reasonable time.

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Study of Photon Based Computing for the Improvement of the Performance of Computation Process

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Abstract **- Moor's law almost accurately predicted growth of computing capacity of a processor and it's not questioned till today. As per recent research results, silicon chips may come to its maximum capacity as reducing size of its transistors further may be practically impossible. But the globe demands more computing power to manage its huge needs like processing big data, mobility, processor intensive cloud solutions, super computers, etc. So the world is seeking for alternatives and researchers focusing on new methodologies like quantum computing. Here, we are trying to propose a method for computing using laser beams with different wavelengths. Multiple laser beams will not mix together if its passing through vacuum or normal mediums, but it will mix and produce a different wavelength when its passing through some special mediums, and we consider it as a computation.**

Keywords **— Computing; Photon computing; Laser based computing.**

I. INTRODUCTION

Modern digital computers are achieving huge growth in computational capacity in a rapid rate. As personal computing devices are evolving as mobile/handheld devices, there is high demand for powerful, less in size, and energy efficient processors. Standalone, Mission critical, dedicated super computers etc are also demand processors with higher processing capacity. There is immense amount of research happening in the field in many universities, private companies and research organizations. Many researches are focusing on replacing copper/metal cables and circuits with optical alternative to achieve high transmission rate. Light fleet and some other technologies succeeded on their research, and communication between micro processors & internal components are achieving huge data transfer rate. When we are using such technologies for communication between components, data processing is being a bottle neck. Even the data is reached in the components, the time taken to process it will slow down the entire system. So we have to achieve high processing capacity.

Many researches are happening to increase processing capacity of a silicon/Metal chip. Optimizing it for more micro components, increasing the clock speed, implementing multiple cores in a single chip, etc are the focus areas. But many researches are happening to find a complete game changer which will be using different concepts and technologies for computing. Quantum computer is a classic example for such research and scientists achieved to develop few quantum computers which is under experimental use. As quantum computing gives more possibilities in solving problems in a different way unlike normal computers, scientists are experimenting it with special set of problems which may be difficult to solve in conventional methods.

This work proposes using light/laser beams with different wavelengths for computing. Here, we assume a value for each band of wavelength of visible light spectrum. By mixing two or more different bands of the wavelength, we assume that it will produce a different band, and we assume it as a processing done. Here, we consider two or more bands as input and the produced band as output. By measuring the wavelength of the produced band, we can decide the output value. We can use multiple inputs and can create a nested structure for using one output as next input. So we assume that processing will be done at the speed of light. Here, we assume a fresh computational logic as digital computing logic may not be suitable with the system. We may need to develop a new level of computational logic, algorithms, architecture, and Turing machine etc for the proposed method. Co working with existing digital devices may be possible but converting input to the new system and converting the output back is needed.

We assume that we can achieve nearby speed of light in processing theoretically, Clocking architecture, capacity and speed of sensors, speed of intermediate storage etc have to be considered when calculating speed. Advancement in researches in the

field of optical flip-flops, optical computing etc are giving more confidence for the proposed model.

II. Current Technologies

Most of the optical technologies are focused on interconnection between micro components inside digital systems. Each digital component produce signals to be transferred in between and normally metal wires or printed board are used. Electrons from each components flow through the cables or printed boards and it gives very low cost and simple solution. But as the industry demands more processing capacity, researchers were focused on improving processing capacity. Industry is growing as per Moore's Law predictions and we are achieving huge processing capacity., But as intercommunication between processors are through metal wires, its being a bottleneck. So many researches are going on for solving this issue. As a result industry leaders like Intel, IBM etc came up with cutting edge technologies for inter connection using optical alternatives. Optical communication was used for data communication but it was unable to use it directly inside a Machine as it need huge infrastructures and machineries. But new findings are capable of managing interprocessor communication effectively as it needs very small components and less energy. IBM Holy OptoChip is an example for such a solution. It uses Silicon photonics to work with both electron and photon, and claim to transfer 1 TB/second Image. There will be a converter connected to each processor, and the converter converts electrical signals to optical signals to transmit through optical channels. The optical signals again converted to electrical signals in other end to make use of the transferred data by second processor/component.

III. Limitations

The optical signals again converted to electrical signals in other end to make use of the transferred data by second processor/component. IBM Holy OptoChip, and other optical interconnection methods makes high bandwidths between processors a reality but we need huge processing capacity to process the transferred data. Even though we achieve huge data transfer speed, we have to increase the speed of processing too to avoid the bottle neck. Optical inter connectors can only increase the speed of communication , but to increase the speed of overall processing, we have to increase the processing capacity. Each time, data need to be converted in to optical signals and it should be converted again to its previous format for processing in a microprocessor as it can only deal with electrons.

IV. Proposed Solution

We are proposing a fresh processing concept with the help of mixing/ making alterations on laser waves. Laser waves can be "mixed" together or can be make alterations when it passes through some special mediums. Those changes can be considered as a logical operation and it can be used for computation. As it s a fresh concept, it's hard to implement it with the existing software, tools or simulators. We are planning to design a simple arithmetic calculator by using a set of Light sources and light detectors. We can use lasers to get more accurate result in such a design. Light sources emit different colored (wavelength) light beams and optical components are used to focus beams, position beams, 'mix' beams or separate beams according to the logical needs of the operations. Here, we are considering each beam with a wavelength as a pre defined value and different beams represent different values. We can use sensors and light sources in all surface of the box, as light beams will not mix in normal conditions, light beams with different wavelength can pass through same physical space.

We have to use highly flexible light sources, sensors, color mixers, prisms and other optical tools to mix, guide, reflect and use the light beam according to the instructions from a stored program.

We have to design a new computational logic for the proposed system. Suppose we are splitting the spectrum A in to a1, a2, ……., a10 and assigning 0 to a1, 1 to a 2, 2 to a3, …. 9 to a10, and if we are implementing the arithmetic logic addition, we have to check the possibility of finding the spectrum such a way that a1+a2 results a3, a1+a3 results a4 etc. We may need to develop a Turing machine to implement the computational

logic. As the output of each combination of light beams is complex, we have to map it in to a logical method and to implement it in to computation logic.

V. Color Box

Color Box is a small box with few color beam generators and color sensors to demonstrate the concept. Its only for the demonstration purpose of the concept and it's not a POC as it assumes mixing of colors which is impossible in normal conditions. The box is having 3 holes on the top side with 3 different color beam generators. bottom side of the box, a color sensor is fixed and its connected to a Digital display through a electronic circuitry. here, three colors c1, c2, c3 are having different values assigned v1,v2, v3 respectively. Each of the color beams can be turn on/ off by separate switches. If we turn on c1, the sensor will sense the color and the digital display will display v1, the same will happen for c2, c3 as v2, v3 respectively. This is happening because we already assigned a value for each color and the value will be displayed on the screen as the sensor detects the colors. Now, if we turn on any two colors, we will get a different color as that two beams "mix" together. If we turn on c1 and c2, the beams together for ma different color and the sensor detect a different value d1 which we assume d4=v1+v2 where + is the operation we intended to perform with v1 and v2. If we turn on c1 and c3, it will give a different color and the sensor detect a different value d5 where d5=v1+v3, where + is the operation we intended to perform with v1 and v3. Such as we can find other combinations too which are d6=v2+v3 d7=v1+v2+v3. So we are having 8 states for the system where as d0 is the absence of all light beams, d1=v1, d2=v2, d3=v3, d4= v1+v2, d5=v1+v3, d6=v2+v3, d7=v1+v2+v3. Its evident that mixing of two visible light beams is impossible in normal conditions. So this demonstration can't be considered as a Proof of concept, but it can give a clear idea about the concept and can be used for study purpose. The color sensor is a normal color sensor which will output value of RGB to the circuit and based on the RGB values, the circuit decided which value to be displayed on the digital display. Value for each color is pre defined and the electronic circuitry is only selecting the values to be displayed from the pre defined table based on the color identified by color sensor, so that we can argue that processing is already done by "mixing" color beams inside the box and not by the electronic circuitry.

VI. Materials Identified

There are many materials identified which will show non linear properties. We can select materials already developed for dealing with laser beams according to our needs and situations. There are lot of materials that will be resisting laser beams to a particular intensity and it will transmit the beams if it reached about the intensity. There are materials which will act as a medium and combine two different laser beams in to a single beam.

VII. Practicality

As we already have many researches in the field of lasers, non leaner materials, changes to the laser beams when passing through different mediums, etc, the concept is a workable one. But there are many practical difficulties and need huge advancements in the supporting technologies and environments to make it for commercial purpose. As per the previous research findings, its possible to add wavelength of two laser beams with different wavelength when its passing through a special medium. So its clear that we can achieve a computation by using the process. If we consider a1 as first laser beam with a wavelength w1 and a2 as second laser beam with wavelength w2, and both beams are passing through a special medium, will get a different laser beam with w3, which is w3= w1+w2. So we can consider it as a computation, if we are able to design a computation logic based on it, we can use laser beams with different wavelengths for different computation purpose. We need to identify laser beams with different wavelength and to assign each one to a value or logic. Mapping of laser beams for each value is a very important task as each beam should be easily distinguishable from other one. Mixing of two or making alteration on a beam should result in a identified beam to make the system simple and practical. The system may not be possible to use for a general purpose computing in near future, but it can be used to design a processor for a special kind of logic which will solve a limited no of problems in a very effective way.

VIII. Benefits

As silicon based computing has the above said limitations, new methods are necessary. We can assume several benefits for the proposed system like, high speed in processing, Low energy consumption, easy management of different lasers in same chamber, low temperature, etc.

IX. Threats

There are many threats for the proposed concept as its still in a conceptual stage. We are not even aware about unexpected practical complexities and problems may arise at the time of practical implementation of a complete general purpose system. But we are certain with the practicality of the special purpose systems on the basis of already proven concepts based on researches in the field of lasers and non linear materials. Mapping of values in to the laser beams is a difficult task as it should be picked based on its consistency, easiness to handle, detection of property changes when its passing through special mediums or mixing with other beams, etc. Preparation of a new computational logic is another threat. If we are creating a fresh computational logic, it will be hard to co work with existing systems. So that we have to find a way to map it in to the existing computational logic if possible. Environment and components to co work with the proposed model have to be developed and it may take time. If we are dealing with electronic circuitry with the proposed model, we have to do conversion between electronic signal to optical signal to process the data and to optical signal to electronic signal after processing it. It will complex system and may affect the performance. So the proposed method will be practical for a general purpose computer only if we can achieve an environment where the components co working with processor will manage optical data. Optical flip flops, optical switching and other micro components are developed already and many other components are under research. The success of the proposed system for general purpose computing depends on the advancements of research in components in optical technology.

X. Conclusion

There is a huge demand for computation power after invention of first computer and industry is supplying computation power for the thirsty applications. Moors low accurately predicted the growth of computation power related to the growth of number of transistors used for the purpose. Even we have huge supply of computation power, there are many problems remain unsolved or taking time to be solved as the algorithms are very complex and it needed huge amount of computation power. Here the proposed system may not be able to use for general purpose computing in near future but it can be used to design special purpose processors to solve some particular problems. We wish to propose the idea to bring the attention of researchers to this area and to conduct further research on this.

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MOMENT BASED NORMALISATION FORONLINE MALAYALAM CHARACTERS

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Abstract

The normalization strategy is popularly used in character recognition to reduce the shape variation. It is an important preprocessing factor as it regulates the size, shape position and shape of the characters. Normalization accelerates the recognition process. It consists of a sequence of operations to prepare the character for feature extraction and classification.

In this study we proposed moment based normalization technique. Moment normalization aligns the centroid of the input image to the geometric center of normalized plane and scales the image on second order one dimensional moment. This is a global transformation method and the computational effort is less for the transformation process. But shape distortions occur due to boundary resetting so futher normalization techniques should be combined or rotational invariant transformation should be introduced to accelerate the classification and recognition process.

Introduction

Handwriting recognition refers to the problem of machine recognition of handwritten script. Handwrittten data is converted to digital form either by scanning the writing on paper or by writing with a special pen on an electronic surface such as a digitizer combined with a liquid crystal display. The two approaches are distinguished as offline and online handwriting [1,2,3], respectively. In the online case, the two-dimensional coordinates of successive points of writing as a function of time are stored in order, i.e., the order of strokes made by the writer is readily available.

Recognition of Indian scripts are more challenging as it has large character set and high similarity between characters . When dataset is created from samples of handwritten data, recognition becomes complex as large variation is observed in the collected samples. The structure of the Malayalam scripts and the variety of writing styles pose challenges that are different from other Indian scripts and hence require customized techniques for recognition. devices would play an important role in making these devices more user friendly for those who wish to communicate in their regional languages. Compared to olden days, we now have more accurate electronic tablets, more compact and powerful computers, and better recognition algorithms.

Considering the restriction on use of the regular keyboard, designed for English the word processing in Indian languages, especially Malayalam is a tedious job. Elaborate keyboard mapping systems are normally used , which are not convenient to use. A comfortable solution would be to let the user write in a natural, normal fashion using a suitable pen like device and let e to the computer. This is the motivating idea of the present work which describes a system for normalistaion of online characters of Malayalam script, a language most widely spoken in South India.

Literature Review

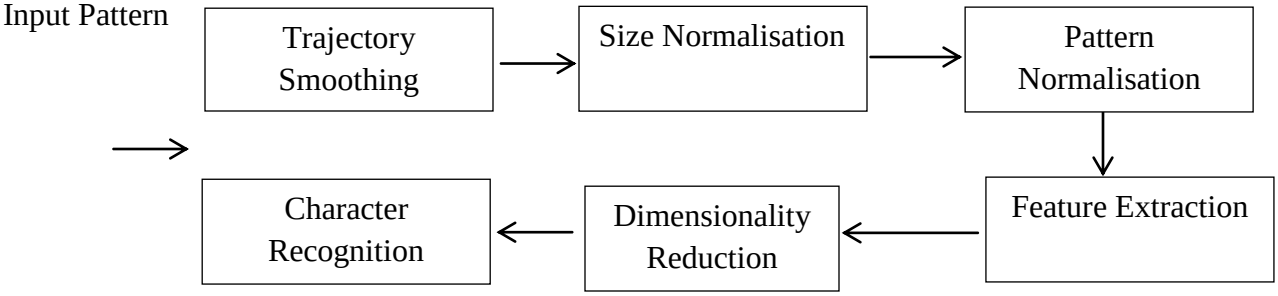
Cheng-Lin Liu and Xiang-Dong Zhou [11] have implemented an online handwritten Japanese character recognition system using efficient trajectory based normalization and direction feature extraction methods. One dimensional and pseudo 2D normalization methods, and direction features from original pattern and from normalized pattern is compared. The recognition results are superior to previous ones. It is found that pseudo 2D normalization methods yield higher accuracies than one dimensional ones, where as direction features from original and normalized patterns perform comparably. The future work is to modify the pseudo 2D normalization methods for better transforming patterns of simple structures. On the other hand, the recognition accuracy can be improved by better dimensionality reduction and classification methods.

AmitArora and Anoop M. Namboodiri [15] presents a complete online handwritten character recognition system for Indian languages that handles the ambiguities in segmentation as well as recognition of the strokes. The recognition is based on a generative model of handwriting formation, coupled with a discriminative model for classification of strokes. The recognition is performed in a purely bottom up fashion, starting with the strokes, and the ambiguities at each stage are preserved and transferred to the next stage for obtaining the most probable results at each stage. The results of various preprocessing, feature selection and classification studies on a large data set collected from native language writers in two different Indian languages: Malayalam and Telugu. The system achieves a stroke level accuracy of 95.78% and95.12% on

Malayalam and Telugu data, respectively. The akshara level accuracy of the system is around 78% on a corpus of 60, 492 words from 367 writers.

YoshuaBengio and Yann Le Cun [17] has proposed a system on word normalization for online handwritten word recognition. In this work a new approach to normalizing words written with an electronic stylus that applies to all styles of handwriting (upper case, lower case, printed, cursive, or mixed) is introduced. A geometrical model of the word spatial structure is fitted to the pen trajectory using the EM algorithm. The fitting process maximizes the likelihood of the trajectory given the model and a set a priors on its parameters. The method was evaluated and integrated to a recognition system that combines neural networks and hidden Markov models. Tests of this new algorithm with a neural network based word recognizer yielded large reductions in error rates.

Components of an HCR System



Online character recognition system consists of three pre-processing steps (trajectory smoothing ,size, normalization and pattern normalization), feature extraction, dimensionality reduction and classification.

Online handwriting recognition requires a data capturing device that captures the writing as it is written. The most common of these devices is the electronic tablet or digitizer, and an indication of pen down. Electronic tablets accurately capture the x-y coordinate data of pen tip movement. An advantage of online devices is that they capture the temporal or dynamic information of the writing. This information consists of the number of strokes. A stroke is the writing from pen down to pen up.

The availability of a dataset that contains adequate number of appropriate samples is a critical part of any pattern recognition research. Now days, recognition of handwritten characters is very challenging task because different people have different handwriting styles. So, handwritten character recognition is still a subject of active research . For an online recognition system it is necessary to collect the data as it is being written so that the order of the strokes of the pen can be recorded as well as the position of the pen. The writing is collected using a special pen and writing surface called a digitizer or digitizing tablet. This may provide a number of details about the motion of the pen. Typically, the information is stored as a time ordered list of coordinates with an indication of whether the pen is up or down. However, some digitizers also supply data about the angle at which the pen is being held, timing information that may be used to calculate dynamic information on the pen-tip travel, or vertical position of the pen above the digitizing surface.

Malayalam Character Set

Malayalam is one of the major Dravidian languages of South India and one among the twenty two scheduled languages of India. It is the official language in the State of Kerala and Union territories of Lakshadweep and Mahe, spoken by around 30 millions of people and ranked eighth in terms of the number of speakers. This language is derived from the Grantha script, which is the descendant of Ancient Brahmi. Character types of Malayalam script consists of Independent vowels, Dependent vowel signs, Consonant letters, Consonant signs, Consonant conjuncts and Chillu.

The Online Handwriting recognition for Malayalam script is a greater challenge compared to the recognition of western scripts because of the following reason

- Presence of a large number of characters
- Different writing styles and writing speed
- Complexity of the characters and similarity in character shapes
- Poor reliability of extracted stroke features due to variance in handwriting

Writing of most Indian scripts are non-cursive as the pen is always lifted while moving from one akshara to the next. Hence strokes are used as the basic primitives for recognition.

Writing of most Indian scripts including Malayalam are non cursive as the pen is always lifted while moving from one akshara to the next. Hence strokes are used as the basic primitives for recognition.

Hi-Tech e-WriteMatehave been used for data aquisition. Hi-Tech e-WriteMate is a portable handwriting capture device based on natural handwriting as an input. It provides facility to attach plain paper of any kind and use the Hi-Tech's electronic pen to capture, store and share handwritten data. We can use standard paper andno special paper required.

Figure 3.1 a-b shows theHitech data capturing device and the special pen used in this work for creating Malayalam online handwritten character database.

(a) (b)

Figure 1.1(a) Hi-Tech e-WriteMate (b) Hi-Tech Pen

The device captures the movement of pen tip on its screen in terms of x, y co-ordinates, sampled at equal intervals of time. It also captures the PEN DOWN and PEN UP information. The recognition is challenging because of varying styles of writing the same character.

Characters with different size, shape variation, thickness etc. is important to evaluate the performance of any HCR system. A total of 20 writers belonging to different age groups contributed handwriting samples. Each writer was prompted to provide 10 samplesof characters selected from Malayalam character set. Thecharacters selected were sorted based on their frequency of occurrence .In the present study we considered only isolated characters of vowels and consonants. The character set consists of 44 letters which includes 8 vowels and 36

consonants. Consonant conjuncts are not considered here as this would make the system little more complex. All these symbols can be written in a single stroke .

This dataset contains all the possible variations in handwriting styles. Data collected can be used for the analysis of the possible features of each character/stroke and also or the study and analysis of different writing styles of Malayalam characters.

1	അ	a	[a]	16	ജ	ja	[ʤa]	31	ബ	ba	[ba]
2	ആ	ā	[a:]	17	ഝ	jha	[ʤʱa]	32	ഭ	bha	[bʱa]
3	ഇ	i	[i]	18	ഞ	ña	[ɲa]	33	മ	ma	[ma]
4	ഉ	u	[u]	19	ട	ṭa	[ʈa]	34	യ	ya	[ja]
5	ഋ	r̥	[r̥]	20	ഠ	ṭha	[ʈʰa]	35	ര	ra	[ɾa]
6	എ	e	[e]	21	ഡ	ḍa	[ɖa]	36	ല	la	[la]
7	ഏ	ē	[e:]	22	ഢ	ḍha	[ɖʱa]	37	വ	va	[ʋa]
8	ഒ	o	[o]	23	ണ	ṇa	[ɳa]	38	ശ	śa	[ɕa]
9	ക	ka	[ka]	24	ത	ta	[t̪a]	39	ഷ	ṣa	[ʃa]
10	ഖ	kha	[kʰa]	25	ഥ	tha	[t̪ʰa]	40	സ	sa	[sa]
11	ഗ	ga	[ga]	26	ദ	da	[d̪a]	41	ഹ	ha	[ɦa]
12	ഘ	gha	[gʱa]	27	ധ	dha	[d̪ʱa]	42	ള	ḷa	[ɭa]
13	ങ	ña	[ŋa]	28	ന	na	[na, n̪a]	43	ഴ	ḻa	[ɻa]
14	ച	ca	[ʧa]	29	പ	pa	[pa]	44	റ	ṟa	[ra]
15	ഛ	cha	[ʧʰa]	30	ഫ	pha	[pʰa]				

Table 1 Malayalam character set used in the experimental database

Preprocessing

The main objective of preprocessing is to remove variations among character samples of the same class .without the preprocessing step recognition accuracy may be reduced. Data, directly collected from users are often incomplete noisy and inconsistent, which are needed to be preprocessed before applying to the system in order to receive the correct classification. Techniques to refine the data suitable for analyzing are included under the preprocessing technique.

Pen up and pen down information is captured as an integral part of data acquisition. A string of coordinates as a function of time is recorded along the pen trajectory during the pen movement over the surface of the sensitive screen.

Preprocessing is to regulate the pattern shape for reducing the within class shape variation. Preprocessing of captured strokes involves two steps: noise elimination and normalization. The noise elimination in the system involves removal of duplicate points and smoothing. Duplicate points, successive points that have identical values of *x* and *y*are redundant and do not contain any information. Hence these were removed from the stroke before processing further.

Smoothing

Smoothing of strokes is required to remove any noise in the trajectory due to erratic pen motion. The primary purpose of smoothing is to get real number coordinates instead of the integer numbers in the raw data. Smoothing in this work is performed byreplacing each stroke point with mean value of its 2 neighbors' and the stroke point itself.

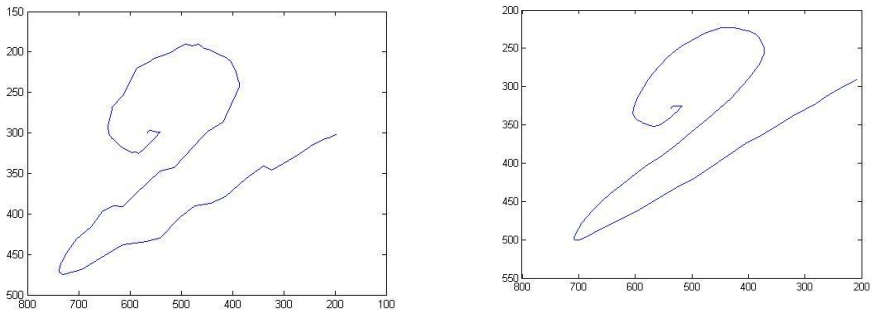


Figure1.2(a-b)Original and smoothed representation of vowel [u]

Moment Based Normalization

Different writing styles is the major source of difficulty in handwritten character recognition. This problem can be reduced to a great extend by normalization. Various normalization techniques have been proposed to reduce the shape variation of character images. Size normalization is most popularly used and was reported to significantly improve the recognition accuracy [16,17,18]. Normalization techniques, such as moment normalization , Linear normalization, , nonlinear normalization etc, were proposed to solve the variations remained by size normalization. They can also be combined to solve multiple sources of variation.

Normalization is performed by mapping the input character onto a standard image plane of fixed dimension. The input characters size and position are not always unique.Therefore the size and position normalization is required. Normalizationaligns the size, position and shape of character images so as to reduce the shape variation within the class.

For Online handwritten character recognition, the stroke is collected as the sequence of data points traced by the position of the pen tip captured at equal intervals of time and is represented as:

$$P = [p_1\ p_2\ \ldots\ p_n]^T$$

Here P represents the captured stroke and T represents the number of data points in the time sampled stroke. The i^{th} data point is represented as $p_i = (x_i, y_i)$. of data points, T, varies for different stroke instances and depends on the duration associated with writing the stroke. The stroke is preprocessed, to obtain a sequence of data points:

$$Ps = [p_{1'}\ p_{2'}\ \ldots\ p_{n'}]^T$$

Here p' represents the preprocessed stroke, $p' = (x', y')$, represents the positional coordinates of the i^{th} data point in the stroke and n represents the number of data points in the stroke, following preprocessing.

In present study moment based normalization is performed. Moment normalization aligns the centroid of the input image to the geometric center of normalized plane and scales the image on second order one dimensional moment.Shape analysis of objects in a binary object is doneby two types of descriptors line descriptors and area descriptors. Area descriptors are used to find

the shape of the objects ,its characteristic properties such as area, moments, central moments, centroid , orientation of the object with respect to x, y axis of the image.

Moments are defined as the sequence of numbers which are used to characterize the shape of any object. Zeroth order moment m_{00} gives the area of the foreground region R or the count of the total number of pixels in the region R or it is the measure of the size of the region R. m_{10} gives the first order moment along x axis. m_{01} gives the first order moment along y axis. m_{20} gives the second order moment along x axis. m_{02}gives the second order moment along y axis. Lower order momentsm_{kj}, central moments μ_{kj} characterize the region R and are invariant to translations and scaling of R. They are variant to rotations of the foreground region R.Invariancy to translations means that, if the object is translated along x or y axis the properties of the object remains the same.

The central moments are obtained by using the centroid. The centroid (xc,yc) of an image is calculated by dividing the first order moments by zeroth order moments ,

$$(x_c, y_c) = \left(\frac{m_{10}}{m_{00}}, \frac{m_{01}}{m_{00}}\right)$$

$\mu_{20}$is the second order central moment along x axis. This gives the Moment of Inertia of the foreground region R about the x axis. μ_{02} gives the second order central moment along y axis.

The coordinate mapping of moment based normalization given by

$$x' = (x - x_c)\frac{W_2}{\delta_x} + x'_c$$

$$y' = (y - y_c)\frac{H_2}{\delta_y} + y'_c$$

$$\delta_x = \alpha\sqrt{\mu_{20}}$$

$$\delta_y = \alpha\sqrt{\mu_{02}}$$

$$\mu_{kj} = \sum (x - x_c)^k . (y - y_c)^j$$

In coordinate mapping the centroid (x_c ,y_c) is shifted to the center of the normalized plane (x_c', y_c')= (W_2/2, H_2/2) whereW_2 and$H2$ are the width and height of the normalized plane respectively. Scaling the width and height is performed according to the second order moments.The moment based normalization sets the boundaries of the input image equally distant from the centroid.

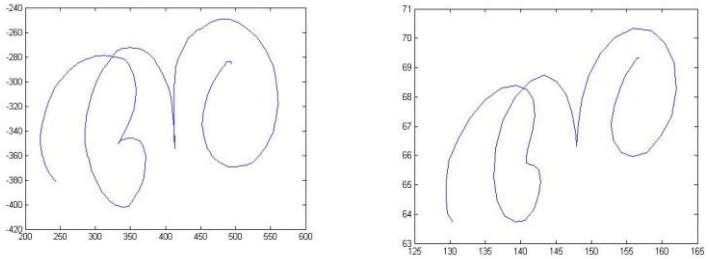


Figure 1.3(a-b) Original and moment normalizedrepresentation of vowel [a]

From figure 1.3 it is clear that the moment normalization causes distortion in the shape of the normalized image. The boundaries are set equidistant from the centroid. Though normalization is invariant to translation it is variant to rotation.This may change the properties of the character during directional feature extraction which depends on the orientation of the character.

Conclusion

Moment based normalization is centroid based transformation of characters and the centroid of the orginal character is transformed to the center of the normalized plane. The computational effort is much less but shape distortion of character may occur in some cases. It is also variant to rotation. This may causeadverse effects in accuracy of recognition.So further modifications should be done on moment normalization of Malayalam characters for rotation invariant feature extraction or new rotation invariant normalization should be introduced.

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The features of databases used in automatic detection of breast cancer in digital mammograms

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***Abstract*— Computer aided diagnosis (CADiag) systems help radiologists in analyzing and interpreting digital mammograms for detection and classification of abnormalities. Nowadays, a large number studies and experiments are happening in this field many techniques are introduced. In order to check and compare the efficiency and improvements of the techniques we are using standardized databases which are available online. This paper presents a study report of the features of most commonly and easily accessible mammographic databases.**

Keywords—mammogram; cancer; database

I. INTRODUCTION

Cancer is a term used for diseases in which abnormal cells divide without control and are able to invade other tissues. Cancer cells can spread to other parts of the body through the blood and lymph systems. Cancer cell growth is different from normal cell growth and instead of dying, cancer cells continue to grow and form new, abnormal cells. Cancer cells are formed when the genetic material (DNA) of a cell start producing mutations that affects normal cell growth and division by being damaged. When this happens, sometimes these cells do not die but form a mass of tissue called a tumour.

According to the World Health Organization, the number of deaths due to cancer, which was just 13% in 2008, is currently having a significant increase and one estimates that this number could reach approximately 12 million until 2030 [1]. Breast cancer is the most common cancer and continues to be a significant public health problem among women around the world [2], and is the second leading cause of female cancer mortality after lung cancer [3]. Breast cancer has the highest incidence of all cancers in the female population [4]. According to [5], it is also the type of cancer that kills the most women. The best-known method for preventing breast cancer is early diagnosis, which lowers the mortality rate and enhances treatment efficiency.

There are several ways in which breast cancer can be diagnosed, including self-examination of breast, clinical examination of breast, imaging or mammography, and surgery. A mammogram is the most effective technique for breast cancer screening and early detection of masses or abnormalities; it can detect 85–90% of all breast cancers.

The commonly used early detection method of breast cancer is the mammographic examination. Radiologists are able to diagnose breast cancer from images by analyzing the results of mammogram. This diagnosis step is a sensitive stage because the examinations of same mammogram can be interpreted differently by different radiologists depending on their expertise. So the judgment of mammograms mainly depends on training and experience level of the radiologists.

Also there are a lot of other factors that can affect or influence the analysis of the images like hunger, tiredness, lack of interest, etc. of the radiologist. Moreover, the factors like size and location of the lesion, density of the breast tissue and patient's age etc. are affects the decision making process. So the reliability of analysis of mammograms varies between approximately 70% and 90% [6].

One of the most recent advances in x-ray mammography is digital mammography. Digital mammography allows faster and more accurate analysis. This results in shorter examination times and significantly improved patient comfort and convenience since the time the patient must remain still is much shorter. With digital mammography, images are acquired digitally and displayed immediately on the system monitor.

Computer aided diagnosis (CADiag) systems help radiologists in analyzing and interpreting digital mammograms for detection and classification of abnormalities [7]. Since 65–90% of the biopsies of suspected cancer turned out to be benign, it is very important to utilize CADiags that can distinguish benign and malignant lesions. The combination of CADiag system and experts' knowledge would greatly improve the detection accuracy. The detection sensitivity without CADiag is 80% and with CADiag is up to 90% [8].

Screening mammography is the best and widely used reliable method for early detection of breast cancer in women without any symptoms. Computer-Aided Detection has been applied to mammographic images to assist radiologists on lesions analysis such as micro calcification, mass and architectural distortions.

Studies indicate that a large number of research works in the area of mammograms were started in the early 1970s. In the mid-1980s, however, medical physicists, radiologists, etc. began major research efforts for Computer Aided Detection (CADet) and Computer Aided Diagnosis (CADiag). That is, using the computer output as an aid to radiologists-as opposed to a completely automatic computer interpretation-focusing initially on methods for the detection of lesions on chest

radiographs and mammograms. Since then, extensive investigations of computerized image analysis for detection of abnormalities in a variety of 2D and 3D medical images have been conducted [9].

CADet / CADiag research includes many aspects - collecting relevant normal and pathological cases; developing computer algorithms appropriate for the medical interpretation task including those for segmentation, feature extraction, and classifier design; developing methodology for assessing CAD performance; validating the algorithms using appropriate cases to measure performance and robustness; conducting observer studies with which to evaluate radiologists in the diagnostic task without and with the use of the computer aid; and ultimately assessing performance with a clinical trial.

The U.S. Food and Drug Administration (FDA) approved first Computer Aided Detection system for screening mammography was in 1998 [10]. The wide use of Computer Aided Detection system in digital mammograms is started in early 2000s. In recent days there are many techniques are introduced to improve the efficiency of Computer-Aided Detection but still not achieved 100% efficiency and accuracy.

A large number of mammographic databases are available nowadays but most of them are not publicly available. The most easily accessed and commonly used databases are the Mammographic Image Analysis Society (MIAS) database and the Digital Database for Screening Mammography (DDSM) and these databases can be used rigorously to compare the different analysis techniques. The other such available mammographic databases are B- SCREEN - Bayesian Decision Support in Medical Screening, AMDI, IRMA (Image Retrieval in Medical Applications), MammoGrid, GPCALMA, etc.

II. The most commonly used databases

A. *MIAS (Mammographic Image Analysis) Database*

Mammographic Image Analysis Society (MIAS) is a UK based research group on digital mammograms and this group has created this database. This database contains films from the UK National Breast Screening Programme. The films in the database have been digitized to 50-micron pixel edge with a Joyce-Loebl scanning microdensitometer and representing each pixel with an 8-bit word. This database contains 322 digitized films and is available on 2.3GB 8mm (Exabyte) tape. This database also includes radiologist's "truth"- markings on the locations of any abnormalities that may be present.

The MIAS database contains an info file, which list the image names. The images names in the info file is follows a particular naming system, which is very useful and helpful to easily identify image characteristics such as database reference number of the image, class of abnormality present in the image, severity of abnormality, etc.

B. *DDSM (Digital Database for Screening Mammography)*

The Digital Database for Screening Mammography (DDSM) is a collaborative effort between Massachusetts General Hospital, Sandia National Laboratories and the University of South Florida Computer Science and Engineering Department. This database is widely use by the research community for mammographic image analysis. Each study of this database includes two images of each breast, i.e. Craniocaudal (CC) view and mediolateral oblique (MLO) views of each breast, along with some associated patient information and image information. Separate directories for each cases and each cases include four compressed image files in JPEG format, an ICS file, between zero and four OVERLAY files and a thumbnail mosaic image stored in PGM format. The DDSM images also contain image information such as scanner details, spatial resolution details, etc.).

Images containing suspicious areas have associated pixel-level "ground truth" information about the locations and types of suspicious regions. Also provided is software both for accessing the mammogram and truth images and for calculating performance figures for automated image analysis algorithms.

The ICS file stores the date of study, the patient age, the ACR breast density rating, the date of digitization, and the size and scanning resolution of each image. The OVERLAY file of each image contains marked lesions. It also contains the assessment, subtlety rating and pathology, and description and chain code of each lesion. The Ground Truth is provided by expert radiologists for each non-normal case and these data is stored in the OVERLAY files. DDSM have been improved over the years such as enhanced web interface with preview of each case, additional software and additional cases [11]. This database contains both normal and cancerous images.

C. *B-SCREEN (Bayesian Decision Support in Medical Screening)*

This is a project of Digitization of Dutch breast cancer screening and it has started in 2006. They have stored all their mammograms in one national archive, which is be facilitated by the use of broadband technology. As a result, a large database of breast cancer cases is now become available to the researchers. This provides a unique opportunity for the development of decision-support in this domain.

The aim of this project is to use Bayesian networks and Bayesian classifiers to further address the problem of interpretation failures by radiologists. However, interpretation of lesions requires more medical background knowledge than is currently taken into account in CAD systems. This problem is addressed by a tight collaboration between radiologists and computer scientists [12].

D. *AMDI (Indexed Atlas of Digital Mammograms)*

The AMDI is a public system, accessed via Web, integrating tools that help construction and editing of digital mammograms database and activities research and teaching in the breast radiology area. The module is a SISPRIM integrated with AMDI that allows correlate the clinical history of the patient and lifestyle with automatically extracted features of mammographic images using a friendly graphical interface.

Currently SISPRIM includes six descriptors features and two similarity operators, but new extractors can be easily included in the user-system administrator. This flexibility is

due the fact that the SISPRIM have been developed using PostgreSQL-IE an extension of PostgreSQL, which supports images by content recovery. Studies are being made to develop a method of indexing to evaluate all simultaneously the characteristic vector elements incorporating a weight for each element in calculation of distance between vectors.

The AMDI database was modeled in such a way to allow multiple tests of the same patient are inserted along the time. AMDI (Indexed Atlas of Digital Mammograms) supports content-based image retrieval combined with conventional queries. AMDI includes not only mammographic images, but also the clinical history and data related to the style of the patient.

The system was developed using Postgres SQL-IE, an extension of Database Management System Postgres SQL that incorporates in SISPRIM powerful resources related to content-based image retrieval. SISPRIM may be accessed via the Web through an easy- to-use graphical interface. The AMDI database also maintains information about the presence of injuries, and their characteristics according to the bank, shape, density and texture.

However, access and query the database using mammographic the AMDI SQL commands directly-IE can be a difficult task for professionals not trained in the database area [13]. AMDI provides a tool that enables the user to download cases from the mammographic database, so as to make the information available to authorized medical and research communities interested in breast cancer diagnosis.

This mammographic database was projected to include cases with all of the available mammographic views, radiological findings, diagnosis proven by biopsy, the patient's clinical history, and information regarding the life style of the patient. Each exam of each case includes four views (two views of each breast: cranio-caudal [CC], and medio-lateral oblique [MLO]).

To address the teaching and research aspects, the database links each mammogram with the contour of the breast, the boundary of the pectoral muscle (MLO views only), the contours of masses (if present), the regions of clusters of calcifications and the number of calcifications (if present), and the locations and details of any other features of interest. This mammographic database also supports the inclusion of several mammographic exams of the same patient performed at different instants of time. All the AMDI resources are available via web.

E. IRMA (Image Retrieval in Medical Applications)

IRMA (Image Retrieval in Medical Applications) is a cooperative project of the Department of Diagnostic Radiology, the Department of Medical Informatics, Division of Medical Image Processing and the Chair of Computer Science VI at the Aachen University of Technology (RWTH Aachen). Aim of the project is the development and implementation of high-level methods for content-based image retrieval with prototypical application to medico-diagnostic tasks on a radiologic image archive [14].

III. CONCLUSION

As the technology advances imaging systems become more complex and there is a demand for better methods for the retrieval of quantitative information from images. Computer-aided detection (CADet) systems are being developed to assist radiologists in the interpretation of ambiguous mammographic features corresponding to possible signs of early breast cancer. That is, still there is an increasing demand for higher accuracy and reliability in the methods to identify the masses and calcifications from digital mammographic images for the early detection of breast cancers in women.

Currently, the research works are focusing on automatic segmentation system of suspicious lesions for mammographic images and the discrimination and classification of regions extracted from mammograms like masses, calcifications, architectural distortion and bilateral asymmetry.

The Mammographic Database is a resource for use by researchers investigating mammogram image analysis. The competence, functioning and proficiency of the newly developed Computer-Aided Detection methods are measured based on the results achieved when these methods are applied on the mammographic images obtained from the standard mammographic databases.

Also when benchmarking an algorithm it is recommendable to use a standard data set from different mammographic databases. This selection of the dataset will help the researchers to directly to compare the results of different datasets from different mammographic databases. The most commonly used publicly available mammographic databases features are discussed this paper.

IV. ABBREVIATIONS AND ACRONYMS

CADet - Computer Aided Detection

CADiag - Computer Aided Diagnosis

MLO - Medio Lateral Oblique

CC - Cranio Caudal

SISPRIM - Sistema de Pesquisa para Recuperação de Imagens Mamográficas

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The power of machines in automatic detection of diseases: a review on computer aided detection of breast cancer in digital mammograms

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1.INTRODUCTION

Healthystate is the power of human immunityand keeping of the healthy state is a challenging thing. Human body has the power to regain its healthy state when there is a disease. This retaining of healthy state is faster with right medicine with right usage and dose. So, for early diagnosis, early detection is also needed. That is, one of the main challenges in medical field is the early detection or identification of the diseases. Nowadays machines are playing a vital role in early detection of diseases and most of the doctors and medical expertsare utilizing these advantages. So we can say that the doctors, medicines and the machines are playing vital roles in the early detection and diagnosis of diseases in human bodies.

Cancer is one of the deadliest diseases in the world. Cancer disease is a state in which abnormal cells divide without control and are able to invade other body tissues. Cancer cells can spread to other parts of the body through the blood and lymph systems. Cancer cells are formed when the genetic material (DNA) of a cell start producing mutations that affects normal cell growth and division by being damaged. When this happens, sometimes these cells do not die but form a mass of tissue called a tumour [1].

According to the World Health Organization, the number of deaths due to cancer, which was just 13% in 2008, is currently having a significant increase and one estimates that this number could reach approximately 12 million until 2030 [2].

Breast cancer is the most common cancer and continues to be a significant public health problem among women around the world [3], and is the second leading cause of female cancer death rate after lung cancer [4]. Breast cancer has the highest incidence of all cancers in the female population [5]. According to Global Cancer Statistics, the most common causes of cancer death are breast cancer and also the most prevalent cancer in the world is breast cancer[6]. The best-known method for preventing breast cancer is early diagnosis, which lowers the mortality rate and enhances treatment efficiency.

There are several ways in which breast cancer can be diagnosed, including self-examination of breast, clinical examination of breast, imaging or mammography and surgery. Mammogram is

the most effective technique for breast cancer screening and early detection of masses or abnormalities; it is usually done by radiologists and can detect 85–90% of all breast cancers [7]. The screening of mammogram image is a sensitive stage, because different radiologists depending on their expertise level can interpret the examinations of same mammogram image differently. So the judgment of mammograms mainly depends on training and experience level of the radiologists.

Also there are a lot of other factors that can affect or influence the analysis of the images like hunger, tiredness, lack of interest, etc. of the radiologist. Moreover, the factors like size and location of the lesion, density of the breast tissue and patient's age etc. are affects the decision making process. So the reliability of analysis of mammograms varies between approximately 70% and 90% [8].

One of the most recent advances in x-ray mammography is digital mammography. Digital mammography produces faster and more accurate digital images. The fast processing of the digital mammography results a significant improvement in patient's comfort and convenience. That is, digital mammography reduces the time to produce images and it turn reducesthe timeeach patient must remains still during the scanning process [9]. And, as the digital mammography images are acquired digitally and it can be displayed immediately on the system monitor.

Computer aided Detection (CADet) systems help radiologists in analyzing and interpreting digital mammograms for detection and classification of abnormalities [10]. Since 65–90% of the biopsies of suspected cancer turned out to be benign, it is very important to utilize CADetthat can distinguish benign and malignant lesions. The combination of CADetsystem and experts' knowledge would greatly improve the detection accuracy. The detection sensitivity without CADetis 80% and with CADetis up to 90% [11].

In this paper a review on the research works in the field of Computer Aided Detections of Digital Mammograms are discussed. The main challenges of this field are determining the precise location and size of the lesions in the digital mammograms. Section II of this paper proposesan approach for general CADet frameworks. Section III of this paper contains aliterature review in the field of CADetof Digital Mammograms. Section IVof this paper is conclusion.

2. COMPUTER AIDED DETECTION FRAMEWORK

A general framework for computer-aided detection of breast cancers in digital mammograms is proposed in this section. The block diagram for the proposed framework is shown in Fig.1.

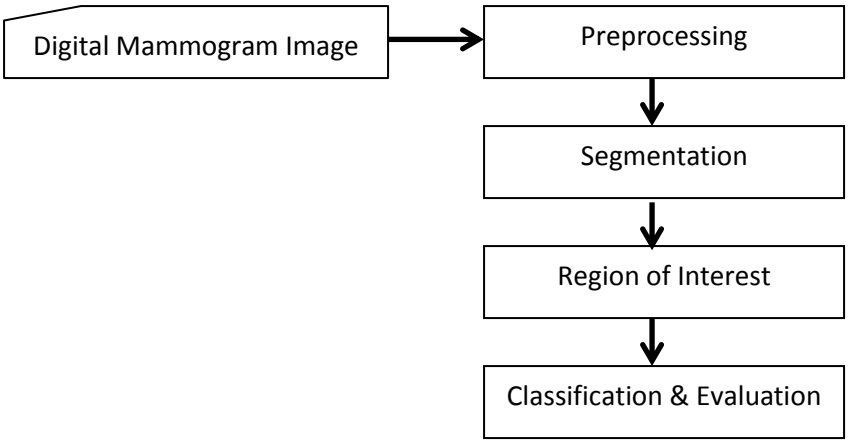

Fig.1: Proposed Framework for Computed Aided Detection

This framework takes digital mammogram images as input and performs preprocessing operations to remove or reduce the noises and artifacts from the images. Then performs segmentation process for differentiating different structures in the imagesuch as lesions. In the next step, it finds out the region of interest (ROI) and every detected region is analyzed individually for special characteristics like size and location.Then finally performs the Classification & Evaluation operations.

3. REVIEW OF COMPUTER AIDED DETECTION METHODS

Screening mammography is the best and widely used reliable method for early detection of breast cancer in women without any symptoms [12]. To get accurate results in analysis of mammographic images, the advantages of computers can be used in early detection of breast cancers. That is,Computer-Aided Detection methodsareapplied in mammographic images to assist radiologists on lesions analysis such as micro calcification, mass and architectural distortions.

Studies indicate that a large number of research works in the area of mammograms were started in the early 1970s. In the mid-1980s, however, medical physicists, radiologists, etc. began major research efforts for Computer Aided Detection (CADet) andComputer Aided Diagnosis (CADiag). That is, using the computer output as an aid to radiologists-as opposed to a completely automatic computer interpretation-focusing initially on methods for the detection of lesions on chest radiographs and mammograms. Since then, extensive investigations of computerized image analysis for detection or diagnosis of abnormalities in a variety of 2D and 3D medical images have been conducted [13]. CADet research includes many aspects-collecting relevant normal and pathological cases; developing computer algorithms appropriate for the medical interpretation task including those for segmentation, feature extraction, and classifier design; developing methodology for assessing CAD performance; validating the algorithms using appropriate cases to measure performance and robustness; conducting observer studies with which to evaluate

radiologists in the diagnostic task without and with the use of the computer aid; and ultimately assessing performance with a clinical trial.

The U.S. Food and Drug Administration (FDA) approved first Computer Aided Detection system for screening mammography was in 1998 [14]. The wide use of Computer Aided Detection system in digital mammograms is started in early 2000s. The research articles shows that many techniques are introduced in recent days to improve the efficiency of Computer-Aided Detections, but still not yet achieved 100% efficiency and accuracy and investigations are happening to improve the performance [15].

M.P. Sampat et al. [16] presented a new algorithm in 2005 for classifying lesions into shape categories: round, oval, lobulated, or irregular. For this classification task, they have developed a new set of features using the Beamlet Transform, which is a multi-scale image analysis transform. They claim that this method obtained a classification accuracy of 78% for classifying masses as oval or round and an accuracy of 72% for classifying masses as lobulated or round.

S. V. Engeland et al. [17] presented a method to improve computer aided detection (CAD) results for masses in mammograms by fusing information obtained from two views of the same breast in 2007. Using correspondence between regions, they extended their CAD scheme by building a cascaded multiple-classifier system, in which the last stage computes suspiciousness of an initially detected region conditional on the existence and similarity of a linked candidate region in the other view. A statistically significant improvement was found in the lesion based detection performance. At a false positive (FP) rate of 0.1 FP/image, the lesion sensitivity improved from 56% to 61%. But case based sensitivity did not improve.

Jun Wei et al. [18] developed a computer-aided detection (CAD) system that combined a dual system approach with a two-view fusion method to improve the accuracy of mass detection on mammograms in 2009. A two-view fusion score for each object was generated by weighting the similarity measure with the cross correlation measure of the object pair. With this new two-view dual system approach, the average case-based sensitivities were improved around 17 to 20% for average masses.

In 2011, B. Surendiran et al. [19] presented a classification system for the malignant and benign masses present in mammogram using Hue, Saturation and Value (HSV) weight function based statistical measures. The weight function is robust against noise and captures the degree of gray content of the pixel. The statistical measures use gray weight value instead of gray pixel value to effectively discriminate masses. The PASW data mining modeler has been used for constructing Neural Network for identifying importance of statistical measures. The experimental results were found to be encouraging. Also, the results will agree to the standard specified by the American College of Radiology-BIRADS Systems.

A. Vadivel et al. [20] proposed a fuzzy rule-based approach for characterization of mammogram masses into shape categories in 2013. It uses geometric shape and margin features for classifying

mammogram mass lesions into four main shapes categories: round, oval, lobular and irregular. They states that their approach is twice effective thanBeamlet based features [16] for classifying the mass as round, oval, lobular or irregular.

Danilo Cesar Pereira et al. [21] recommended a set of computational tools to aid segmentation and detection of mammograms in 2014. They have first implemented an artifact removal algorithm and followed by an image de-noising and gray-level enhancement method based on wavelet transform and Wiener filter. Finally, a method for detection and segmentation of masses using multiple thresholding, wavelet transform and genetic algorithm is employed in mammograms, which were randomly selected from the Digital Database for Screening Mammography (DDSM). The authors claim that their experimentshave a strong potential to be used as the basis for mammogram mass segmentation.

Year	Authors/Citation	Methods Used	Results/Advantages
2005	M.P. Sampat, A.C. Bovik, M.K. Markey [16]	Used the multi-scale transform method called Beamlet Transform to classify the lesions into shape categories: round, oval, lobulated, or irregular.	Obtained a classification accuracy of 78% for classifying masses as oval or round and an accuracy of 72% for classifying masses as lobulated or round.
2007	S.V.Engeland, N.Karssemeijer [17]	A cascaded multiple-classifier system is used in this method to fuse information obtained from two views of the same breast.	Improvement in the lesion based detection performanceat a false positive rate of 0.1 per image, the lesion sensitivity improved from 56% to 61%. But case based sensitivity did not improve.
2009	Jun Wei et al. [18]	Used a system that combined a dual system approach with a two-view fusion method to improve the accuracy of mass detection.	The average case-based sensitivities were improved around 17 to 20% for average masses.
2011	B. Surendiran et al. [19]	Used a classification system for the malignant and benign masses present using Hue, Saturation and Value (HSV) weight function based statistical measures. The PASW data mining modeler has been used for constructing Neural Network for identifying importance of statistical measures.	The results were found to be encouraging and agrees to the standard specified by the American College of Radiology (BIRADS) Systems.

2013	A. Vadivel et al. [20]	Used fuzzy rule-based approach for characterization of mammogram masses into shape categories. Also used geometric shape and margin features for classifying mammogram mass lesions into four main shapes categories: round, oval, lobular and irregular.	Theirapproach is twice effective thanBeamlet based features [16] for classifying the mass as round, oval, lobular or irregular.
2014	Danilo Cesar Pereira et al. [21]	Recommended a set of computational tools to aid segmentation and detection of mammograms. The artifact removal, image de-noising and grey level enhancement methods are based on wavelet transform and Wiener filter.	Their experimentshave a strong potential to be used as the basis for mammogram mass segmentation.

Table 1: A review on computer aided detection approaches for breast cancer in digital mammograms.

4. CONCLUSION

As the technology advances imaging systems become more complexand thereis a demand for better methods for the retrieval of quantitative information from images. However the problems in computer aided detections and diagnosticsare not completely solved. That is,still there is an increasing demand for higher accuracy and reliability in the methods to identify the masses and calcifications from digital mammographic images for the early detection of breast cancers in women. Currently, the research works are focusing on automatic segmentation system of suspicious lesions for mammographic images and the discrimination and classification of regions extracted from mammograms like masses, calcifications, architectural distortion and bilateral asymmetry. The above reviewalso shows that there are little works have been reported to be carried out in the area of computer aided detection system that utilizes the applicability of different imaging methods and algorithms to identify the masses and calcifications and the future works in computer aided detections area will be to identify the exact shape and size of the cancerous regions.

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Understanding the nexus between oil and gold

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ABSTRACT

This paper tries to explore the relationship between real oil price and real gold price over a period of 1990 April to 2013 August. In order to check for the impact of real oil price on the real gold, return on real oil and return on real gold are used. The study employed types of GARCH models which suggested that an increase in real oil price has positive effects on gold. The EGARCH model provides the evidence that a 10% increase in the oil price returns leads to 4.7% increase of gold and shocks to gold price have an asymmetric effect, which means positive and negative shocks have different effect on gold price in terms of magnitude.

1. Introduction

Oil is the most traded raw material, was initially traded for its primary purposes such as industrial use and transportation, but over the course of time it achieved a crucial position in the investment portfolio of the individuals and institutional investors. Oil prices remained fairly stable before 1973. A group of major oil companies based in America, collectively known as the 'Seven Sisters', by means of price and production controls, kept the oil price stable throughout most of the century. When the Arab–Israeli War of 1973 broke out, the price controls passed out of the hands of the US companies into those of the OPEC. This was the beginning of the era of price fluctuation.

Today oil is the most traded commodity in the world; of which price is more volatile. The swing in oil prices is mainly due to certain market factors such as variation in supply, expected future production, consumption, market power, speculation by various investors, policies of the government concerned and the international market. In the period between 1999 and 2004, the greatest fluctuation in price at any given time was $16; while it was $52 in 2005 and rose to $115 in 2008. One more reason for a high volatile oil price is that, a lot of the world's oil comes from somewhat politically unstable countries.

In recent years, the intellectual curiosity of researchers and policy pragmatism of economists and policy makers have focused to investigate the fluctuation in oil price and its relationship with macroeconomic and financial variables such as interest rate, output, exchange rate and stock price. This tendency was partly due to the surge in oil price, its increasing role in an economy, its changing role from a pure raw material to an investment avenue and its interrelation with asset variables.

2. Oil and gold

Oil and gold are two commodities which have an irreplaceable role in an economy due to their frequent tradability, voluminous trades, high liquidity and synchronization of its movement. Oil is the most traded commodity in the world; of which price is more volatile, while gold is a leader among precious metals, of which the volatility is least. When we examine the historical data of oil and gold, one could easily learn that both prices tend to up and down in sympathy with one another. Over the last 50 years, gold and oil have generally moved together in terms of price with a positive correlation of 80% (see, Nick Barisheff). A large body of studies supports the view that oil price changes lead to variations in gold price. Sari et al. (2010) postulated that the variations in the price of gold were primarily due to oil price fluctuation whose returns accounted for 1.7% of that of gold.

The relation between oil price and gold price can explain through various channels. For instance, most of the oil-importing countries pay for their supplies of oil in gold. Also a sizable portion

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of the revenue from oil export is invested in gold as it is considered a safe investment. Likewise, a major part of the costs incurred in gold mining is due to energy and oil issues. Thus, a rise in the oil price corresponds to a rise in the cost of the extraction of gold thus reducing the profit margin. Therefore, there is an inverse relationship between the oil prices and share prices of gold mining companies.

The link between oil and gold can also be explained through the inflation channel. Narayan et al. (2010) state that inflation channel is the best to explain the relationship between the oil and the gold markets. *Ceteris paribus*, a rise in international crude oil price leads to a rise in general price level as it rise the transportation and production cost; negatively affect an oil import country, thus a negative relationship between oil and inflation. Now gold is a unique instrument of long run inflation hedge, when inflation increases investors buy gold to balance their portfolio (Ghosh, 2011). Thus, gold will move up in an inflationary period and thereby a positive relationship between oil and gold. According to the World Gold Council, throughout history, gold has held its own against inflation.

Similarly higher oil price may hit the import bill of any country, especially net-oil importing countries. An increase in import bill raises the trade deficit. Higher trade deficit may hit the value of domestic currency and affect money in circulation thereby leading inflation. Here also gold will move up with a rise in crude oil prices.

The studies related to the oil and gold prices and their relationship with macroeconomic and financial variables are relatively fewer. After the new economic crisis, it became a passion to study the interrelationship between oil and gold due to the surge in their prices and people's tendency to go for safe haven investment. The precursor of this type of study was the work of Melvin and Sultan (1990). In their study, they made a strong correlation between oil and gold through the export revenue channel, similar observation was made by Kim and Dilts (2011). However, other studies do not find evidence of the relationship between the rises in prices of oil with that of gold. The example of such studies are Soytas et al. (2009), Liao and Chen (2008), Sari et al. (2007), Hammoudeh and Yuan (2008), Narayan et al. (2010), Simakova (2011), Le and Chang (2011a) and Lee et al. (2012).

3. Review of Literature

Melvin and Sultan (1990) were the first men, who researched the link between oil and gold and established a strong positive correlation between oil and gold through the export revenue channel. If a crisis leads to expectations of official purchase of gold, there will be a corresponding increase in the price of the metal. In the case of a rise in the oil price, the oil exporters' revenues also rise. The authors state that this may have a corresponding impact on the prices of gold, provided that it forms a significant section of the asset portfolio of the oil investors. The demand for gold will increase which will drive up the price of the metal. Thus the rise in oil price will have effect on the price of gold as well. The most important study in this area was made by Sari et al. (2007), they have examined the link between commodity prices such as oil, gold, silver and copper and two financial variables such as exchange rate and interest rate and suggested that both gold and exchange rate can explain some of the movements in oil price.

In 2009, Soytas et al. (2009) attempted to study the long- and short-run dynamic relationships among the world oil prices, gold and silver prices, the Turkish lira/US dollar exchange rate and Turkish bond rate and suggested that that world oil prices did not impact gold prices in Turkey. But their study in 2010 examined movements among precious metals, oil price, and exchange rate and found the absence of cointegration. They also found very weak and asymmetric link between return of oil price and return of gold price. On the contrary to the previous result Narayan et al. (2010) analyzed the long run relationship between gold and oil price and suggested that the oil market can be used to forecast the gold market prices and vice versa.

Through the inflation channel, Le and Chang (2011b) examined the relation between oil and gold price and their interrelation with U.S dollar and found the evidence for a long run association between oil price and inflation, inflation and gold price, and the prices of oil and gold. They also indicated that, variation in gold price is better explained by fluctuations of US dollar than oil price. Recently Lee et al. (2012) found a long run association between oil and gold and a unidirectional relationship causing from oil to Gold.

Zhang and Wei (2010) analyzed cointegration, causality and price discovery between gold market and the crude oil market for the period January of 2000 to March of 2008. They found that there are consistent trends between the crude oil price and the gold price with significant positive correlation coefficient 0.9295 during the sampling period. They also found significant evidence of a long-term equilibrium between the two markets, and the crude oil price change linearly Granger causes the volatility of gold price, but not vice versa. They further mentioned that the two market prices do not face a significant nonlinear Granger causality, which overall suggests their fairly direct interactive mechanism. Last but not least, with regard to the common effective price between the two markets, they found that the contribution of the crude oil price seems larger than that of the gold price, whether with the permanent transitory (PT) model (86.50% versus 13.50%) or the information share (IS) model (50.28% versus 49.72%).

However, none of the study has adequately addressed the issues of volatility clustering and structural breaks which is often exhibited by gold and oil prices. We, in our study, make an attempt in this regards using several asymmetric GARCH models and by taking into account structural breaks.

4. Data, methodology and analysis

In order to examine the relation between oil and gold, we measured crude oil price in dollar per barrel as a proxy for oil price and Mumbai-gold price (Rupees per 10 g) as a proxy for gold price. Specifically, crude oil (petroleum), (price index, 2005 = 100) used is the simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh. Further, to convert oil price in Indian Rupees terms, Rupees–USD exchange rate data is used and convert oil price and gold price in real terms Wholesale Price Index (WPI) is used.

The data on oil price is obtain from International Monetary Fund (IMF) data base (Series_Code: POILAPSP_Index), gold price and WPI data is collected from Handbook of Statistics on Indian Economy (www.rbi.org.in) and exchange rate data is collected from IMF–IFS (International Financial Statistics) CD-ROM (2014). The data are collected on monthly basis over a period of 1990 April to 2013 August. The choice of sample period is due to the availability of data. In order to check for the causal nexus between oil and gold, return on oil and return on gold are used and employed GARCH and EGARCH model.

Since India is the fourth largest oil-consuming and first largest gold-consuming country, the up and downs in oil and gold prices would have a substantial implications for the movement of macroeconomic and financial variables. The International Energy Agency has made a prediction that in the period between 2008 and 2030, the annual growth rates in China and India will average 3.5% and 3.9% respectively in oil consumption compared to the 1% average annual growth rate for the rest of the world economy.

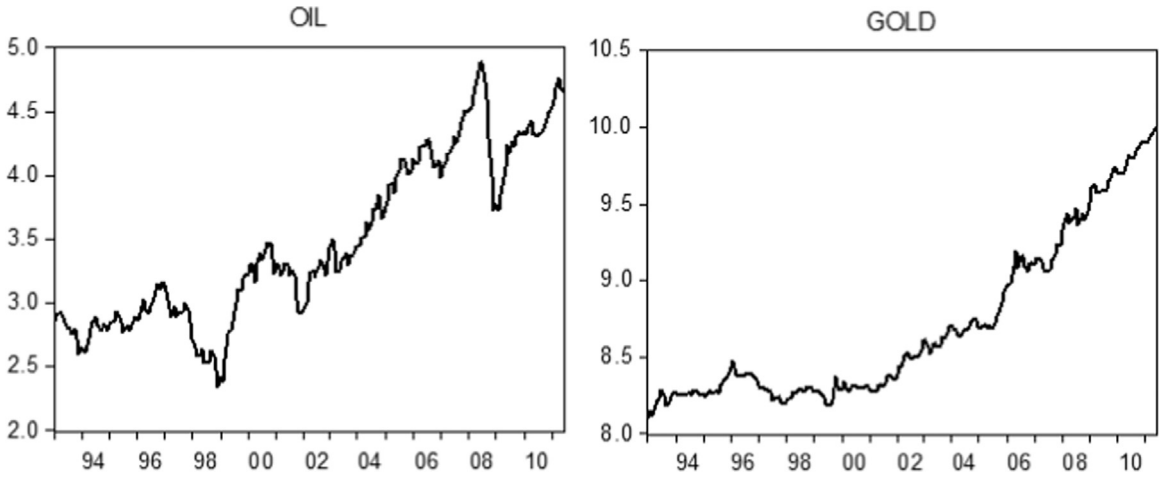

Fig. 1. Plot of gold and oil.

These two countries are accumulating large reserves of foreign exchange, mainly US dollars. This will lead to their playing a bigger role in the world financial markets. Also, the two countries are the world's largest gold consumers. So the above mentioned facts itself shows the importance of figuring out the relationship between gold price and oil. A trend plot of both series i.e., oil and gold is presented in Fig. 1.

Fig. 1 shows the graphical representation of monthly data of oil price and gold price. The graph of oil price per barrel indicates that until 2003 the ups and down in prices was relatively stable. During the period of recent financial crisis oil price was at its peak level, but soon after it fell down rapidly and again raised. The on gold shows that, at the initial four years, the price was almost stable and after that it gradually increased.

The conventional econometric models keep the variance of the disturbance term as constant over time, but most of the financial and economic time series exhibit volatility clustering, i.e., in some period a unusually high volatility followed by more tranquil periods of low volatility. There for in such cases it is clear that the assumption of constant variance is limiting and application of OLS method provides biased variance estimate; hence, inference based on OLS estimates will be misleading. So in such cases, it is better to examine not the unconditional variance but the conditional variance. A growing body of research has recently been directed towards investigation of conditional variance models. These models include the Autoregressive Conditional Heteroskedastic model (ARCH) introduced by Engel (1982), the Generalized Autoregressive Conditional Heteroskedastic model (GARCH) proposed by Bollerslev (1986), and the ARCH and GARCH in the mean (ARCH-M,GARCH-M) extensions introduced by Engle et al. (1987). We employ several types of GARCH models for monthly data to investigate the nexus between oil price and gold price.

5. Modeling conditional volatility of oil price and gold price

The monthly returns of each series can be calculated as

$$goil_t = \log\left(\frac{oil_t}{oil_t - 1}\right)$$

$$ggold_t = \log\left(\frac{gold_t}{gold_t - 1}\right)$$

Here, oil is monthly oil price and goil is the return on oil prices, gold is the monthly gold price and ggold is the return on gold price. We test the relationship between oil and gold using the GARCH and EGARCH model. One of the major advantages of this model is that they jointly estimate a conditional mean and a conditional variance equation.

The Generalized ARCH (GARCH) model of Bollerslev (1986) is based on an infinite ARCH specification and it allows to reduce the number of estimated parameters by imposing nonlinear restrictions on them. The GARCH (1,1) model can be expressed as:

$$Y_t = X_t'\phi + \varepsilon_t \tag{1}$$

$$\sigma_t^2 = \omega + \beta\sigma_{t-1}^2 + \alpha\varepsilon_{t-1}^2 \tag{2}$$

in which the mean equation given in (1) is written as a function of exogenous variables (in our case it is only $goil_t$) with an error term. That is our equation is: $ggold_t = \phi_0 + \phi_1 goil_t + \varepsilon_t$. Since σ_t^2 is the one-period ahead forecast variance based on past information, it is called the *conditional variance*. The conditional variance equation specified in (2) is a function of three terms:

1. A constant term: ω.
2. News about volatility from the previous period, measured as the lag of the squared residual from the mean equation: ε_{t-1}^2 (the ARCH term).
3. Last period's forecast variance: σ_{t-1}^2 (the GARCH term).

And the variance representation of higher order GARCH (q,p) may be written as follows:

$$\sigma_t^2 = \omega + \sum_{j=1}^{q}\beta_j\sigma_{t-j}^2 + \sum_{i=1}^{p}\alpha_i\varepsilon_{t-j}^2 \tag{3}$$

As Eq. (2) represents exogenous or predetermined variables that are included in the mean equation. If we introduce the conditional variance or standard deviation into the mean equation, we get the GARCH-in-Mean (GARCH-M) model (Engle et al., 1987) that may be written as follows:

$$Y_t = X_t'\phi + \delta\sigma_t^2 + \varepsilon_t \tag{4}$$

Specifically, Eq. (4) for our purpose may be written as follows:

$$ggold_t = \phi_0 + \phi_1 goil_t + \delta\sigma_t^2 + \varepsilon_t \tag{5}$$

The EGARCH or Exponential GARCH model was proposed by Nelson (1991). The specification for the conditional variance is:

$$\log(\sigma_t^2) = \omega + \sum_{j=1}^{q}\beta_j\log(\sigma_{t-j}^2) + \sum_{i=1}^{p}\alpha_i\left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right| + \sum_{k=1}^{r}\gamma_k\frac{\varepsilon_{t-k}}{\sigma_{t-k}} \tag{6}$$

where ω is a constant, the GARCH component is given by σ_{t-j}^2 and the ARCH component ε_{t-i} reflects news about volatility from previous periods. The parameter γ captures leverage effects, so for $\gamma < 0$ the future conditional variance will proportionally increase more following a negative shock than following a positive shock of the same magnitude. Note that the left-hand side is the *log* of the conditional variance. This implies that the leverage effect is exponential, rather than quadratic, and that forecasts of the conditional variance are guaranteed to be nonnegative. The presence of leverage effects can be tested by the hypothesis that $\gamma_i < 0$. The impact is asymmetric if $\gamma_i \neq 0$. For an EGARCH (1,1) model the variance specification may be written as:

$$\log(\sigma_t^2) = \omega + \beta \log(\sigma_{t-1}^2) + \alpha \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma_1 \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad (7)$$

Further we also used GJR, IGARCH and asymmetric IGARCH models to see the robustness of our results. Glosten et al. (1993) proposed another model to take in to account the asymmetry by adding an asymmetry component into the standard GARCH model which is known as the GJR model. However, there is small difference between Nelson's model and GJR in terms of sign conventions. Specifically, in the GJR model, a positive coefficient means that negative residuals increase the variance. In other words, for $\gamma > 0$ the future conditional variance will proportionally increase more following a negative shock than following a positive shock of the same magnitude. Given that these two specifications are sufficiently different, and the sign conventions are well-established, use of both models will allow us to do robustness analysis. Hence γ on a GJR model would be expected to be positive, rather than negative.

Another most interesting case is when $\alpha + \beta = 1$. This is the case of an integrated GARCH or IGARCH model. In IGARCH model if ω is non-zero, this is a drifting I-GARCH model and if ω is zero, it's a driftless I-GARCH. Further in the study following Nelson and GJR we added an asymmetric term into the I-GARCH model. This is done further to see the robustness of results when we find $\alpha + \beta = 1$.

6. Data analysis and findings

We begin with descriptive statistics and stationarity analysis and presented the results in Table 1.

The results reported in Table 1 shows that both mean and volatility of the oil is greater than the gold. Consistent with the descriptive statistics of our data, return of oil exhibit high volatility clustering with a standard deviation of 0.086, while gold exhibit a very low volatility clustering.

Table 1 also shows the results of unit root test over the return series. We perform both ADF and PP test to check the property of the data series. Here in all cases, we are able reject the null hypothesis of unit root at 1% level of significance. Thus, all series are stationary in the level form. This is also evident from the time series plot of return series of both the variables, which is presented in Fig. 2.

Fig. 2 shows the monthly return on oil and gold. From Fig. 2 itself one can understand that the return on oil is highly volatile, while the return on gold shows less volatile. The return on gold shows that during the period of financial crisis (2006–2008) the gold was more volatile compare to another period.

Table 1
Descriptive statistics and stationarity analysis.

Statistics	Real gold	Real oil
Mean	0.002318	0.006119
Median	−0.000290	0.015489
Maximum	0.129699	0.471431
Minimum	−0.118632	−0.273619
Std. Dev.	0.034902	0.086032
Skewness	0.222828	0.131062
Kurtosis	4.572966	6.569794
Jarque-Bera	31.18303* (0.000)	149.4749* (0.000)
Unit root test		
ADF(Constant)	−5.11511* (0.000)	−13.0208* (0.000)
ADF(Constant and Trend)	−15.41639* (0.000)	−13.0003* (0.000)
PP(Constant)	−15.18753* (0.000)	−12.6375* (0.000)
PP (Constant and Trend)	−15.35483* (0.000)	−12.6132* (0.000)

Note: In the parenthesis we report *p*-values.

* denotes significance at 1% level of significance.

7. The Quantile–Quantile test (*Q–Q* plot)

The *Q–Q* plot helps us to compare shapes of probability distributions by plotting their quantiles against each other. When we compare two distributions, if the points in the *Q–Q* plot lies approximately on the line $y=x$, then both distribution have similar pattern. If the *Q–Q* plot lies exactly on a line, then the distributions are linearly related. The Quantile–Quantile plots results (Fig. 3) suggest that both share common and similar distributions.

In the next step, we moved to conduct the empirical estimation and at the first step we performed the OLS regression on oil–gold mean equation and found that the variable goil is significant at 5% level. Then we checked the model for ARCH effect and found significant presence of ARCH effect at 5% level of significance[1]. Further, using Ljung-Box *Q*-statistics and Ljung-Box Q^2-statistics for 10 and 20 lags, we tested the presence of serial correlation. The results of Ljung-Box *Q*-statistics and Ljung-Box Q^2-statistics show the presence of serial correlation in the data.

As a further step, GARCH (1,1), GARCH-M (1,1) and EGARCH (1,1) have been conducted using Maximum Likelihood method. The results are presented in Table 2. The mean equation of GARCH (1,1) shows that an increase in oil price has a positive effects on gold. A 10% increase in the oil price returns leads to 0.46% increase of gold. This result is significant at 5% level of significance. Here we found that, the residual is free from autocorrelation and ARCH effect.

The result form GARCH-M (1,1) has reported in the fifth column of Table 2, the coefficient δ is found to be insignificant which implies that gold price volatility has no impact on the gold price itself. Both *Q* statistics and LM test suggest that, the residual is free from autocorrelation.

The result from EGARCH model has reported in the fourth column of Table 2. From the mean equation it is confirmed that oil has positive impact on gold at 1% level of significance, which suggest that 10% increase in the oil leads to 4.7% increase of gold price. Coming to the variance equation, the coefficient γ, which measure the asymmetry, is found to be significant at 1% level. This implies that shocks to gold price have an asymmetric effect, which means positive and negative shocks have different effect on gold price in terms of magnitude. The diagnostic check for autocorrelation shows that the model is free from autocorrelation. In short the model is well fitted. The results from GJR, IGARCH and asymmetric IGARCH (denoted as IGARCH-A in tables) model's confirm the findings of EGARCH model except the difference that in GJR and IGARCH-A models constant of the variance equation (i.e., ω) and the ARCH term, α, turn outs to be significant. However, the Log-Likelihood and model fitness tests still prefers EGARCH model.

[1] The ARCH effect results for all cases are not reported for brevity of presentation but are available upon request to the corresponding author.

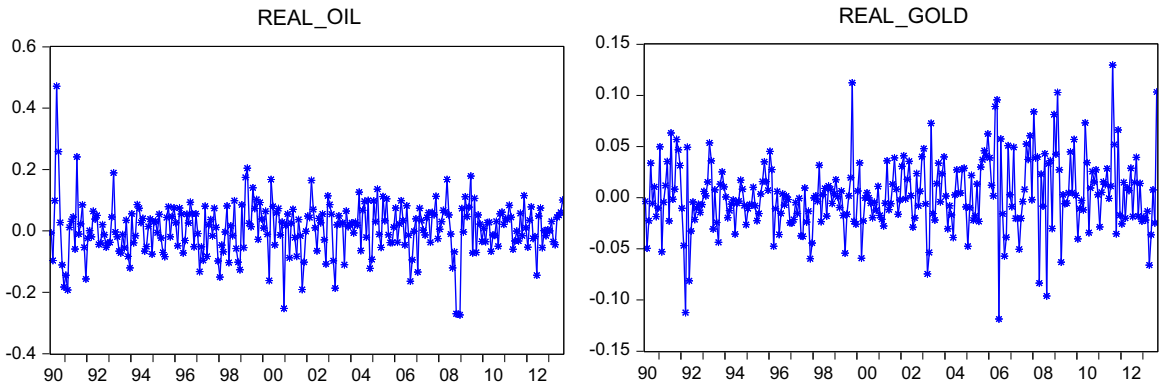

Fig. 2. Return on oil and gold.

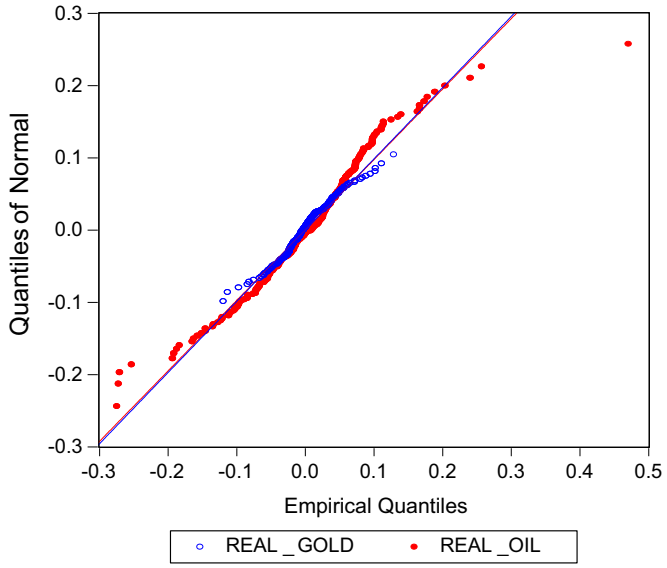

Fig. 3. Quantile–Quantile test plot.

It is worthy to notice that if the assumption underlying the estimation of a GARCH model is that the same process generates the data throughout the range, results obtained from any GARCH model would be reliable. However, in several cases it does not hold good. In other word data generation process is variable phenomenon and it gets changed with the occurrence of policy shocks, in the presence of outliers and so on so forth[2]. Therefore, one has to take into account such cases in the GARCH models. However, as Doan (2014, p. 57) documented "the GARCH model is non-linear and because its log likelihood is a recursive function of the data, it's not easy to do a standard Chow-type structural break test. In the Chow test in a linear model (or a non-recursive non-linear model), the estimates from the two subsamples can be done independently of each other. That's not true with the GARCH model. The lagged h values at the start of the second subsample should come from the data in the first sub sample if the split is supposed to match the behavior of the full-sample estimates."

To overcome this issue one may use the fluctuations test proposed by Nyblom (1989)[3] which tests for a once-and-for all structural break based upon the time sequence. However, this test has limitations in terms of having inability in taking care of outliers or systematic but scattered effects (like Monday or post-holiday effects). However, we relied on this test and reported results obtained in Table 3 for only GARCH (1,1) model that we used. Note that this test does both tests on the individual coefficients, and a joint test.

From the results it is evident that there is a major problem with the third and fifth coefficient, which is the variance intercept, ω, and GARCH component, β. In Fig. 4 we report the Cumulated Gradient for Variance Intercept in order to understand its behavior and thereby do the rectifications.

It is evident from Fig. 4 that for first four years of the sample really want that parameter to be higher, as the derivatives there are almost all positive, and then till 2003 negative and then again positive. To take into account this problem there are two ways – one way is to do analysis for different periods and other is to use impulse, and/or shift, and/or crash dummies. Using the first approach there will be problem of small sample size. Therefore, we proceeded with the second approach of including the dummies in the variance equation. Based on Fig. 4, we in our model used 2011:12 as crash dummy (i.e., Crash 2011M12), and for period 1991M1 to 1994M10 (i.e., DTO1994) and 1995M1 to 2003M1 (DTO2003) used shift dummies.[4] Results for all GARCH type models that we used before are presented in Table 4 with inclusion of these dummies. Now when we compare the results of Tables 4 and 2 we find that in all GARCH models the shape parameter for the t error process is increased somewhat but values is still quite low, so even without the largest outlier and breaks, there is still strong evidence of fat-tailed conditional residuals. Our overall findings remain the same as reported for Table 2.

[2] Certainly, series which are generated by GARCH processes which are stationary but with infinite variance donot appear to be governed by a single process, and distinguishing those from series which truly have different data generating processes in different ranges can be difficult.

[3] If one has a converged set of maximum likelihood estimates, each component of the gradient of the log likelihood sums to (machine-) zero across the sample. If

(*footnote continued*)
one of the parameters is subject to a structural break partway through the sample, one would expect to find that its gradient tended to have one sign before the break and the other sign after it, rather than having roughly equally mixed signs throughout. Nyblom's test looks at the fluctuations of those partial sums of the gradient, which form a Brownian Bridge under the null of a stable model, and judges whether the observed fluctuations are significantly different from that.

[4] In a GARCH model, there are two places where one could put a dummy: in the mean model, or in the variance model. If we put it in the mean model, it will have the expected behavior of pushing the residual at that point towards zero. The problem with that is that, if the GARCH model is correct, the outlier should provide a "natural experiment" for the period afterwards—the variance should be high after that, and should be high for quite a while. With the mean shift dummy, the variance never gets the pop from a large residual. Instead, we can put the dummy in the variance equation.

Table 2
Estimation result of the model (oil on gold).

	OLK	GARCH (1,1)	EGARCH (1,1)	GARCH-M (1,1)	GJR (1,1)	IGARCH (1,1)	IGARCH-A (1,1)
Mean equation							
ϕ_0	0.0019	−0.0009	−0.0004	−0.0006	−0.0006	−0.0014	−0.0006
	(0.0021)	(0.0018)	(0.0017)	(0.0039)	(0.0018)	(0.0017)	(0.0018)
ϕ_1	0.0594**	0.0460**	0.0475**	0.0461**	0.0447**	0.0447**	0.0446**
	(0.0241)	(0.0206)	(0.0181)	(0.0206)	(0.0203)	(0.0198)	(0.0187)
δ (GARCH term)				−0.2893			
				(3.2683)			
Variance equation							
ω	–	0.0002	−0.6876**	0.0002	0.0002**	0.0002	0.00022**
		(0.0001)	(0.3221)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
α	–	0.2121*	0.0893	0.2131**	0.3642**	0.3192**	0.36598***
		(0.1172)	(0.0839)	(0.1183)	(0.1500)	(0.1281)	(0.1163)
β	–	0.6432**	0.9097**	0.6405***	0.6338***	0.6808***	0.6340***
		(0.1638)	(0.0446)	(0.1659)	(0.1037)	(0.1281)	(0.1163)
γ	–		0.1548**		−0.3123*		−0.31410***
			(0.0584)		(0.1596)		(0.11251)
Shape	–	4.825768	5.184834	4.837063	4.8053	3.71299	4.7952
Model fitness							
Log-Likelihood	545.6905	564.5979	567.9470	564.6005	567.4713	563.4952	567.4711
$Q(10)$	2280.4***	18.545*	13.462	18.564**	15.8375*	19.1856**	15.83098*
$Q(20)$	3868.0***	28.296	22.004	28.329*	24.17192	28.641*	24.15572
$Q^2(10)$	1257.1***	3.8831	8.6047	3.8682	6.52778	4.88457	6.54857
$Q^2(20)$	1449.0***	11.223	11.795	11.190	11.84623	11.63311	11.85476

Notes: $Q(10)$, and $Q(20)$ are the Ljung-Box statistics for serial correlation in the model residuals computed with 10 and 20 lags, respectively. $Q^2(10)$, and $Q^2(20)$ are the Ljung-Box statistics for serial correlation in the model squared residuals computed with 10 and 20 lags, respectively. An asterisk (***, **, and *) indicates significance at the 1%, 5%, and 10% level respectively.

Table 3
Nyblom (1989) fluctuations test.

Test	Statistic	*p*-Value
Joint	1.488997	0.10
1	0.428178	0.03
2	0.119095	0.48
3	0.590835	0.02
4	0.321957	0.12
5	0.591937	0.02
6	0.325575	0.11

8. Conclusions

Gold is a precious metal while oil is a raw material, and both are traded for their primary purposes like store of wealth and industrial and transportation use respectively. But over the course of time, both are achieved a pivotal position in the investment portfolio of the individuals and institutional investors. In the financial press, it is a confirmed fact is that, gold is a safe haven, can be used as a hedge against inflation and investors often switch between oil and gold or combine them to diversify their portfolios.

A rise in international crude oil price leads to a rise in inflation due to an increase in production cost; gold as a unique hedge against inflation, investors buy gold to balance their portfolio. Thus gold will move up in an inflationary period and thereby a positive relationship between oil and gold. Similarly, higher oil price may rise import bill of an oil importing country and raise the trade deficit. Higher trade deficit may hit the value of domestic currency and affect money in circulation there by losing purchasing power. Here also gold will move up with a rise in oil price.

In order to check for the impact of oil on gold, return on oil and return on gold are used in several GARCH models. The result suggested that increase in oil price has positive effects on gold. A 10% increase in the oil price returns leads to 4.7% increase of gold and shocks to gold price have an asymmetric effect, which means positive and negative shocks have different effect on gold price in terms of magnitude.

The gold has highest average return; while oil has the least average return. Similarly Oil has highest volatility, whereas gold has the lowest volatility. And these two commodities are highly positively correlated (0.87). During the period of financial crisis (2006–2008) the gold was more volatile compare to another period.

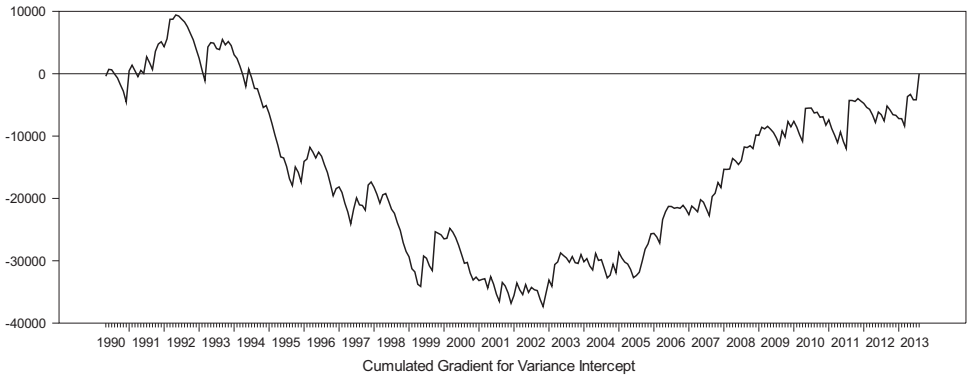

Fig. 4. Nyblom (1989) fluctuations test.

Table 4
Estimation result of the model (oil on gold with breaks).

	GARCH (1,1)	EGARCH (1,1)	GARCH-M (1,1)	GJR (1,1)	IGARCH (1,1)	IGARCH-A (1,1)
Mean equation						
ϕ_0	−0.0012	−0.0006	−0.00172	−0.00072	−0.00148	−0.00073
	(0.0019)	(0.0017)	(0.0044)	(0.00178)	(0.00186)	(0.00171)
ϕ_1	0.04412**	0.04413**	0.04392**	0.042923**	0.04296**	0.04332**
	(0.0202)	(0.0188)	(0.0204)	(0.01976)	(0.0195)	(0.0178)
δ (GARCH term)			0.51269			
			(3.6197)			
Variance equation						
ω	0.00169***	−4.35158***	0.00169***	0.00167***	0.00166***	0.00168***
	(0.0003)	(0.17792)	(0.0002)	(0.00029)	(0.00034)	(0.0003)
α	0.20828**	0.14332	0.20630**	0.349608**	0.282358***	0.32489***
	(0.0898)	(0.14505)	(0.0904)	(0.14586)	(0.1085)	(0.1084)
β	0.68229 ***	0.89607***	0.68545***	0.679276***	0.71764***	0.67511***
	(0.1197)	(0.0669)	(0.1307)	(0.10493)	(0.10854)	(0.1084)
γ		0.16392***		−0.31169**		−0.2851***
		(0.0589)		(0.148539)		(0.10438)
DTO1994	−0.00001**	0.03273***	−0.000014**	−0.000014**	−0.000014**	−0.00001**
	(0.00001)	(0.0033)	(0.000005)	(0.000005)	(0.000006)	(0.000006)
DTO2003	−0.000005***	0.011549***	−0.00001***	−0.000005**	−0.000005**	−0.00001**
	(0.000002)	(0.00117)	(0.000002)	(0.0000019)	(0.000002)	(0.000002)
Crash 2011M12	−0.002496***	−1.68147*	−0.00249***	−0.00378***	−0.00347***	−0.0035***
	(0.000906)	(1.01211)	(0.00087)	(0.001089)	(0.00083)	(0.00066)
Shape	5.105044	5.303869	5.08789	5.068550	4.171203	11.78067
Model fitness						
Log-Likelihood	565.6683	569.5480	565.6771	569.0411	564.8376	569.0044
$Q(10)$	19.31187**	14.45990	19.29173**	16.28267*	19.96233**	16.3922*
$Q(20)$	29.56511*	23.07044	29.51104*	25.03226	29.85101*	25.29935
$Q^2(10)$	4.23671	8.97496	4.23055	7.06025	4.88163	6.75835
$Q^2(20)$	11.46292	12.12553	11.47824	11.83954	11.41365	11.78067

Notes: $Q(10)$, and $Q(20)$ are the Ljung-Box statistics for serial correlation in the model residuals computed with 10 and 20 lags, respectively. $Q^2(10)$, and $Q^2(20)$ are the Ljung-Box statistics for serial correlation in the model squared residuals computed with 10 and 20 lags, respectively. An asterisk (***, **, and *) indicates significance at the 1%, 5%, and 10% level respectively.

The major policy implication of this paper is that the volatility of oil is very least, whereas its return is high. During the financial crisis also, the volatility of gold was low compared to other investment avenues such as oil and stock price. This provides an important implication to the investors that, it is better to keep more gold in investment portfolio. Because the estimated risk in investing gold is very low, while its return is high.

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PROFITABILITY OF AGRICULTURE AND FARMERS' INDEBTEDNESS IN WAYANAD: A STUDY ACROSS VARIOUS CROPS

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ABSTRACT

The sustainability of agriculture is a major issue in Kerala. Increasing cost of cultivation and fluctuating commodity prices have reduced the profitability of crops, especially food crops, which are highly labour absorbing in nature. As a result, agriculture is presently not considered as a consistent source of income. Many people are moving out of agriculture due to the agrarian crisis, which to a greater extent is attributed to the neoliberal policies adopted by the central government since 1990s. On this back drop, the present study tries to analyse the profitability of major crops in Wayanad, by comparing cost and revenue. The study also examines the indebtedness of farmers. Using the data collected from a sample of 90 farmers, we find that commercial crops like coffee, pepper and rubber, have incurred only profits. On the other hand, food crops like paddy and tapioca have incurred both profit and loss. Out of 90 farmers, almost 70 farmers have taken loans from various banks. Among them, 56 (62.22%) farmers could not repay the amount fully and are indebted. Amount of Indebtedness mostly ranges between 51 thousand and 5 lakh. This higher amount of indebtedness is a result of lower profitability or loss from cultivation of various crops and also of higher level of household expenditure. The lower profitability and higher amount of indebtedness threaten the sustainability of agriculture in Wayanad.

Introduction

It is widely recognised that Indian agriculture has experienced a complete stagnation during the period of economic liberalization and consequently the welfare of farmers is significantly deteriorated (Vakulabharanam,2007, Mohankumar and Sharma,2006, Mishra,2007). The recurring farmer suicides in different parts of the country unfold the agrarian crisis and farmers' distress during the reform period. Though different central and state governments have announced and implemented many programmes to mitigate the impact of such crisis, the economic conditions of farmers have not improved. Farmers in different states have become victims of a severe crisis, which to a greater extent is attributed to the neoliberal policies adopted by the central government since 1990s.

The policies introduced since 1990s aimed to integrate Indian economy with global market by introducing trade liberalization policies. Some trade liberalization policies were introduced as a part of structural adjustment programmes. Some measures were introduced as India's commitments to WTO.

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Being a member in WTO India has signed WTO agreements and was committed towards these agreements. The major WTO agreements include tariffication, reduction in tariff barriers and reduction in domestic support or subsidies given to agriculture. Tariffication means all nontariff barriers like quotas must be converted into equivalent amount of tariff barriers. Once tariffication is done, then the developing countries like India have to reduce tariffs by 24 % over a span of 10 years. India accomplished it's commitment towards WTO in 2001 by phasing out most of the quantitative restrictions and also by reducing tariff rates substantially below the final bound rates.

As tariff and nontariff barriers were minimized or removed, the Indian economy became more integrated with the world market. Many cheaper agricultural commodities from other countries started flowing to the country resulting in excess supply, which in turn brought down the commodity prices during post liberalization period. One important factor to be noted here is that commercialisation of agriculture in Kerala happened before WTO regime, i.e., the total area under agriculture shifted towards commercial crops.

Thus, WTO had greater Impact on prices of commercial crops than food crops. On the other hand, the prices of farm inputs like fertilizers and seeds have increased. Moreover, the farm wages in Kerala kept on increasing due to rise in cost of living and efficient labour market interactions, further adding to cost of production. The reduction in commodity prices combined with the increasing cost of production has adversely affected the profitability of agriculture in India. Many farmers take loans from formal and informal sources for cultivation. Due to the falling profit many of them are not able to repay the loans. Ultimately such poor farmers commit suicides due to their high level indebtedness.

Statement of the Problem

Wayanad is a backward and tribal district of Kerala. Most of the people in Wayanad adopted agriculture as their livelihood. Almost 47.44 percent population depends on agriculture in Wayanad. The climate and geographical conditions in Wayanad are favorable to the cash crops like Pepper, Coffee, Tea, and Rubber. Thus the area under agriculture in Wayanad shifted in favor of commercial crops. This is no surprise if it is viewed in the context of statewide shift in cropping pattern in favor of commercial crops. Larger the share of cash crops, which are export oriented, higher will be the causalities. This is true in case of Wayanad. Export orientation of tea, coffee and pepper is high. This means that, these crops depend on world market for demand to a greater extent, thus any price movements in the world market, will definitely affect the earnings from these crops. There are evidences that the prices of these crops have been highly volatile during post reform period, especially after 1997-98. The uncertainty in the price has significantly contributed to the welfare deterioration of farmers.

As price became volatile, the income earned from agriculture by the farmers, also has been fluctuating. This uncertainty in income from agriculture has significantly contributed to the indebtedness of farmers. Due to lower

earnings from agriculture, the farmers are not able to repay the loans, ultimately forcing them to commit suicides. Many farmer suicides were reported in the district during last some years.

Thus the present study examines the indebtedness of farmers in Wayanad. The study analyses profitability of different crops by comparing cost incurred and revenue received from different crops. The study also analyses the amount of loans taken, interest rate charged by different banks, and the level of indebtedness. The study has great importance in present scenario, especially in the context of looming agrarian crisis in India. The introduction of the new economic policy has a great impact on the farmer's life, as it created distress in farmer's life. The farmers' indebtedness leads to increase in the suicide rate. Thus a micro level study on the indebtedness of farmers is important. Such kind of study can throw some lights into the level of indebtedness and difference in level of indebtedness by types of banks.

Objectives

- To study the area, cost, revenue and probability of different crops.
- To study the incidence of indebtedness of farmers.

Data and Methodology

The present study is based on both primary and secondary data. Secondary data is collected from various reports, published research papers and general articles. Primary data is collected from 90 Farmers by interview method using a structured questionnaire. It contains the questions about revenue, expenditure and profitability of different crops, amount of loan, rate of interest, repayment status and level of indebtedness.

Farmers were selected using a multi stage random sampling. Firstly form different Thaluks in Wayanad, Sulthan Batheri Thaluk was selected on a random basis. From Sulthan Batheri Thaluk, Poothadi Panchayat was selected on a random basis. From Poothadi Panchayat, ward 10 and 12 were selected on random. From each ward, 45 Farmers were selected, thus constituting the total sample of 90. For the analysis purpose, study has used simple statistical tools like frequencies, percentages, minimum, maximum and average values.

Profitability of Cultivated Crops in the Study Area

Table 1 shows the multiple responses for the number of farmers cultivating various crops. Here a single famer cultivates various crops, say 2 or 3 crops, thus the total number responses for crops cultivated by farmers will be a multiple of the total number of farmers. In our case the total number of farmers is 90 and total number of responses by farmers for crops cultivated by them is 214.

Table 1: Multiple Response Table of Farmers Cultivating Various Crops

Crop	Frequency	Percentage
Paddy	26	28.88
Coffee	48	53.33
Aloe plant	34	37.77
Rubber	8	8.88
Ginger	32	35.55
Yam	16	17.77
Pepper	14	15.55
Tapioca	12	13.33
Areca nut	24	26.66
Total	214	100

Source: Sample Survey

As we can see, the majority of the farmers cultivate coffee. Almost 48 farmers cultivate coffee. Aloe plant is considered as the second major crop cultivated by the farmers, Aloe Plant was cultivated by 34 farmers and next to this, Ginger was cultivated by 32 farmers. Paddy is cultivated by 26 farmers and 24 farmers cultivate Areca nut. Yam is cultivated by 16 farmers and Pepper is cultivated by 14 farmers. Tapioca and Rubber are the least cultivated items.

Table 2 shows average cost incurred and revenue earned per acre for various crops. From the table we can identify that Aloe plant is the crop which involves highest average expenditure of 40270.27 rupees. Next to this Ginger involves an average of 44100.71 rupees expenditure on it's cultivation process. Tapioca is having minimum average cost of 13281.25. More or less similar picture can be observed in case of revenue earned by farmers.

Though Areca nut gives highest average revenue of 64705.88 rupees, Ginger (63309) and Aloe plant (60594.59) gives average revenue above 60,000. Tapioca gives the least average revenue of 17500. All commercial crops are giving comparative higher return. These higher returns in case of commercial crops are due to the recent rise in their prices, especially the prices of Pepper, Banana and Rubber. The recent rises in prices are reflected in the earnings from these prices.

Table 2 : Details on the Cost and Revenue for the Cultivation of Various Crops

Crop	Average Cost (Cost/Acre)	Average Revenue (Revenue/Acre)
Paddy	17703.7	21925.93
Coffee	17809.76	36713.15
Aloe plant	40270.27	60594.59
Rubber	19000	46000
Ginger	44100.71	63309.35
Yam	16400	28800
Pepper	32772.73	172272.7
Tapioca	13281.25	17500
Areca nut	25926.47	64705.88

Source: Sample Survey

Table 3 shows the number of farmers who earned profit or incurred loss and average profit and loss for each crop cultivated. All 48 farmers who cultivated coffee have earned profit, and the average profit from the cultivation of coffee is 18903.39. Rubber, Yam, Pepper and areca nut are the other major crops which have no loss. Among these crops, Pepper has the highest average profit (139500), which is accounted to the recent remarkable rise in price of pepper. Famers who cultivated Crops like Paddy, Aloe plant, Ginger and Tapioca have both profit and loss. Aloe plant has the highest loss (-15730.34) and tapioca has very low loss (-7941.17). Almost 18 famers who cultivated Aloe plant suffered loss and 14 famers who cultivated Ginger suffered loss. In total there are 164 cases of profit and 50 cases of loss.

Table 3 : Details on Profit and Loss for Various Crops

Crop	Frequency of Profit	Average profit	Frequency of Loss	Average loss
Paddy	16	9333.33	10	-6000
Coffee	48	18903.39	NA	
Aloe plant	16	55833.33	18	-15730.34
Rubber	8	24000	NA	
Ginger	18	38513.51	14	-12000
Yam	16	12400	NA	
Pepper	14	139500	NA	
Tapioca	4	18000	8	-7941.17
Areca nut	24	37308.82	NA	
Total Cases	164		50	

Source: Sample Survey

Analysis of Farmers' Indebtedness

This section presents an analysis of indebtedness of famers. Table 4 presents the distribution of farmers by the amount of loans taken. Out of 90 farmers, about 70 (78%) farmers have taken loans from various banks. In case of amount of loans, it is clear from the frequency distribution that, the loan amount of 22 (31.42%) farmers range in between 50001 and 100000 rupees and 20 farmers (28.57%) have taken loans in between 10000 and 50000. Only 10 farmers have taken loan above 2 lakh.

Table 4 : Distribution of Farmers by Amount of Loans

Amount	Frequency	Percentage
10000-50000	20	28.57
50001-100000	22	31.42
100001-150000	6	8.57
150001-200000	12	17.14
200001-above	10	14.28
Total	70	100

Source: Sample Survey

Further, Table 5 presents the distribution farmers who have taken loans from various banks. Out of 70 farmers, almost 28 farmers (40 %) have taken loan from Kerala Grameen Bank. This is due to the fact the Kerala Grameen Bank Charges comparatively lower interest rate. Similarly 22 farmers (31. 42 %) have taken loan from State Bank of Travancore (SBT). Only few farmers have taken loans from SBI and Canara Bank. Only 12 farmers have taken loan from SBI and 8 farmers have taken loan from Canara Bank. Maximum amount of loan taken is 3 lakh and Minimum amount of loan taken is 10000. Average amount of loan taken accounted for 121034.48, and this indicates a higher level of indebtedness of farmers.

Table 5 : Distribution of Farmers Taken Loans from Various Banks

Bank Name	Frequency	Percentage
Canara Bank	8	11.42
Kerala Grameen Bank	28	40
SBI	12	17.14
SBT	22	31.42
Total	70	100

Source: Sample Survey

Table 6 shows amount of interest rate charged by various banks from farmers. It can be seen from the table that Canara bank charges the highest rate of interest equal to 14 %. Kerala Gramin Bank (KGB) charges the lowest rate of interest equal to 4 %. In Kerala Gramin Bank, the loans are given as agricultural loans on subsidy. In fact here the rate of interest is 8 %, but the government will

pay 4 % interest as subsidy on agricultural loans if the famer repays the loan in time. Thus in this case famer has to pay only 4 % of interest. From table we can see that 44 farmers have taken loans at an interest rate equal to 9 % and 32 farmers have taken loans at an interest rate equal 12 % from various banks.

Table 6 : Rate of Interest Charged by Various Banks from Farmers

Rate of Interest	14%	13%	12%	9%	8.50%	7%	4%	Total
Canara Bank	8	0	0	0	0	0	0	8
Kerala Grameen Bank	0	0	8	8	4	4	4	28
SBI	0	0	4	4	2	2	0	12
SBT	0	8	4	10	0	0	0	22
Total	8	8	16	22	6	6	4	70

Source: Sample Survey

Table 7 shows the repayment status of farmers who have taken loans from various banks. 10 farmers who have taken from Kerala Grameen Bank have fully repaid their loans. This is due to the fact that Kerala Grameen Bank charges very low interest rate and provides only lower amount of loans. 9 farmers who have loans from Kerala Grameen Bank could not fully repay loan and are indebted. In case of SBT and SBI 2 famer has fully repaid the loan. Remaining farmers are indebted, 10 for SBI and 20 for SBT. 8 farmers who have taken loan from Canara Bank could not fully repay loan and are indebted. Totally 14 farmers have repaid loan and 56 farmers are indebted. Thus out of 90 farmers, 70 have taken loan, and almost 56 are indebted, which constitute 62.22 per cent of sample households. Thus almost 62.22 percent farmers are indebted in the study area. This shows a higher incidence of indebtedness of farmers.

Table 7 : Repayment Status of Farmers

Bank	Fully Repaid Farmers	Indebted Farmers	Average amount of Indebtedness
Canara Bank	0	8	-2440000
Kerala Grameen Bank	10	18	-49162.5
SBI	2	10	-133400
SBT	2	20	-99900
Total	14	56	

Source: Sample Survey

Table 8 shows the distribution of indebted farmers by the amount of indebtedness. The amounts of indebtedness of 28 farmers range between 1 lakh to 5 lakh and for 18 famers this ranges between 51,000 to 1 lakh. This indicates high level of indebtedness among famers in Wayanad. The loss from cultivation and insufficient profit are the major reasons for indebtedness of farmers. Another reason is that higher level of monthly household expenditure. Being a chronically

food deficit state, Kerala has to import food items and other necessary commodities from neighbor states. Thus the prices of essential commodities are very high in Kerala. This has led to increased monthly household expenditure. This higher level of expenditure of households has reduced their capacity to repay the loan and ultimately resulted in larger amount indebtedness.

Table 8 : Amount of Indebtedness of Farmers

Amount	Frequency	Percentage
Up to 50,000	10	17.86
51,000 to 100000	18	32.14
100001to 500000	28	50
Total	56	100

Source: Sample Survey

Summary and Conclusion

The main objective of the study was to analyse the level of indebtedness of farmers in Wayanad. For this purpose study has collected data from 90 farmers in Poothadi Panchayat on the socio and economic conditions of farmers, revenue, expenditure and profitability of various crops, amount of loan, rate of interest, repayment status and level of indebtedness. For the analysis purpose, study has used simple statistical tools like frequencies, percentages, minimum, maximum and average. Considering the social characteristics, majority of the farmers are Scheduled Tribes and 84.4 per cent of the households belong to Hindu religion. About 72 per cent of the respondents have attained education equal to high school and above, indicating a better educational status of members.

In case of land holding almost 55.56 percent of land holding belong to the category of marginal holding and 40 percent belong to the category of small holding. Coffee, Aloe Plant and Ginger are the mostly cultivated crops by famers. Average cultivation cost is high for Aloe plant and Ginger and low for Tapoica. Areca nut, Aloe plant and Ginger have higher average revenue. Almost all commercial yielded profit from cultivation. All 48 farmers who cultivated coffee have earned profit. Rubber, Yam, Pepper and areca nut are the other major crops which have no loss. Famers who cultivated Crops like Paddy, Aloe plant, Ginger and Tapioca have both profit and loss. About 70 farmers have taken loans from different banks. Amount of loan mostly range between 10000 to 2 lakh. Considering the interest rate charged by various banks, Canara bank charges the highest rate of interest equal to 14 %. Kerala Gramin Bank (KGB) charges the lowest rate of interest equal to 4 %. Totally 14 farmers have repaid loan and 56 farmers are indebted. Thus almost 62.22 percent farmers are indebted in the study area, indicating a higher incidence of indebtedness of farmers. The amounts of indebtedness of 28 farmers range between 1 lakh to 5 lakh and for 18 famers this ranges between 51,000 to 1 lakh. This indicates high level of indebtedness among famers in Wayanad.

The study in nutshell reveals a gloomy picture of agriculture and farmers' welfare in Wayanad. Most of the farmers are indebted. This debt trap will have distressing impact on their life, and may probably lead to farmer suicides. This is clear that agriculture has almost become a stagnant sector, on which people cannot depend for their livelihood. As a result many young generations are moving out of agriculture. This is evident in case of Kerala, where the share of agriculture in total employment has been declining.

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AN ECONOMETRICS APPROACH TO THE GROWTH PATTERN OF INDUSTRIAL INDICES IN THE STATE OF KERALA- A PRE AND POST REFORM COMPARISON

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ABSTRACT

The study analyses the growth pattern of industrial development in the state of Kerala during the period from 1973-74 to 2008-09 by adopting simple statistical techniques and econometric tool of ordinary Least squares and Granger causality. A comparison of state-wise industrial performance shows that, the states like Tamil Nadu, Maharashtra, Andhra Pradesh, Gujarat, and Karnataka are in a better position in all the indices such as number of factories, amount of capital, number of workers and total volume of industrial output. While, the position of Kerala in all the indices compared to the other states is very dismal. The percentage share of Kerala in number of factory, workers and industrial output are very low. The share in total number of factories is only 3.814%, regarding the number of workers; its share is 3.764% and Kerala generating only 2% of total industrial output in India. The study also compares the growth pattern of industrial development in two periods, viz post and pre reform period, which reveals that the economic reforms in India has a positive impact on the industrial development in Kerala. The results from OLS indicates that, in Kerala, one percent increase in the amount of capital will leads to a 1.22% growth in gross industrial output, while one percent increase in the amount of labour will only leads to an increase in industrial output by 0.632%. This suggests that, in order to increase the industrial output in Kerala the Government has to invest more in capital and it also indicates the need of foreign investments in the states. The result from Causality test suggests that, in Kerala both gross state domestic product and gross industrial product are bidirectional.

Keywords: Causality, Industrial Development, Kerala, Ordinary Least Squares, Economic Reform

Introduction

Kerala is one of the small and verdant states of India, accounting for nearly 1.18 percent of its territory and 3.1 percent of its population, which is located between Arabian Sea on the west and forested Western Ghats on the eastern border. The state came into existence in 1956 and has made considerable economic progress with its limited population and natural resources. This economic progress witnessed a great

paradoxical situation which shows significant improvements in material conditions of living such as highest literacy rate, highly skilled human resources, high Human Development Index, efficient public transport system, economic excellence, best public health care system that are comparable to that of many western countries, even though the state's agriculture and industrial sector remains at low ebb.

From the early centuries itself, the development economists all over the world considered industry as an engine of economic development. The modern economists considered the movement of labours from traditional activities to industrial activities as the root cause of economic growth. To quote Kaldor,"it is the rate of growth of manufacturing production which is likely to exert a dominating influence on the overall rate of economic growth, partly on account of its influence on the rate of growth of productivity in the industrial sector itself and partly so because it will tend, indirectly to raise the rate of productivity growth in other sectors".

Historically, rapid economic growth in Britain, United States and Japan is associated first with the rapid expansion of industrial activities. Moreover, industrial development has had an important role in the economic growth of Asian countries like China, Korea, Taiwan and Indonesia.

The industrial sector of Kerala is relatively underdeveloped at present it is in a state of stagnation too. It is the traditional industries, comprising of coir making, cashew-processing, file-making, handloom-weaving, rubber processing, tea and coffee processing, and handicrafts that account for the bulk of the employment generation in the industrial sector of the state. Technological stagnation, rising costs of production, labour militancy and strong competition have led to the decline in the importance of the traditional sector. The growth of the secondary sector is largely accounted for by construction, power, etc; the share of the manufacturing sector in the state's SDP is still relatively small and the growth rate recorded in it has been marginal as compared to the all India and neighboring states' performance.

Kerala, which shares 3.7 per cent of the country's total population, accounts for 3.07 per cent of the number of factories, 3.12 per cent of employment, 2.61 per cent of fixed capital, 2.56 per cent of gross output and 2.90 per cent of net value added in the factory sector of the country. According to data from India's Annual Survey of Industries (ASI), two industries-chemicals and rubber industries dominate value added in the factory sector and two industries-cashew processing and beedi making dominate employment in the factory sector of Kerala. Kerala's share in the total value added by India's factory sector has always been lower than Kerala's share in India's population.

Literature Review

In India, the pioneer work in the field of industrial economics was undertaken by Ahluwalia (1985). In his study, "Industrial Growth in India" examined various issues on the trends in industrial growth, stagnation in productivity, and the role of import substitution. He found that industrial stagnation since mid-sixties was due to slow growth in agricultural income, the slowdown in public investment, poor management of infrastructure sector and industrial policy frame work and she concluded that the growth rate in capital goods industries was less active than that in case of consumer goods industries. In his study, Vijay K Seth (1987) entitled "Industrialization in India" by using step wise regression technique; found that in the existing economic circumstances the government would be well advice to concentrate on the institutional sector in various regions to achieve regional spread of modern industry.Goldar and Vijay's study (1989) entitled "Spatial Variations in the Rate of Industrial Growth in India" focused on the trends in industrial output in 12 major states during the period 1960-61 to 1985-86. By using kinked models, they analyzed changes in the growth rate of industrial output for the 12 states and found that all the states experienced a deceleration in the rate of industrial growth after the mid sixties. They also find that Kerala and Madhya Pradesh experienced a continuing deceleration in the rate of industrial growth beyond the mid seventies.

There exist a number of studies on industrialization and industrial growth in Kerala. Subrahmanian and Azeez's (2000) Study entitled "Industrial Growth in Kerala: Trends And Explanations" examined the trends in industrial growth against the backdrop of the overall economic growth in Kerala under the influence of the ongoing economic reforms and evaluates it against the performance of Karnataka, Tamilnadu and all-India. Though the manufacturing industry has improved its growth performance over time, the growth rates

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recorded during the nineties are not higher than the corresponding figures for the eighties. It is argued that inadequate growth of investment has constrained the pace of modernization of old units and establishment of new units based on 'state-of-art' technology needed for the survival and growth of industries in a globally competitive environment. It underlines the need for a new vision and strategy, which could fully utilize Kerala's comparative advantage in human resources, and place greater emphasis on developing knowledge based and service industries, for accelerating the growth of income and employment in industry.

The study made by B. A Prakash (1989) on the economic causes of unemployment in Kerala is also relevant here. He has pointed out that the 'restrictive labour practices, imposed by labour and labour organizations had distorted the labour market operations in Kerala. Based on the available literature on traditional and non-traditional industrial sectors of the State, the study has concluded that the unfavourable labour atmosphere arising out of the frequent strikes, confrontations, bands, inter-union rivalries and prolonged closure of industrial units due to militant trade union activities have created a bad impression about the climate of Kerala, which are the major causes for the slow pace of industrialization in the state.

Scholars have evaluated and explained Kerala's industrial backwardness in different ways. The radical nature of politics and labor relations in Kerala is often singled out as being the cause of the State's industrial backwardness. This view is widely held in the general discussions on Kerala within and outside the State (Oommen, 1979; Thampi, 1990; Albin, 1990). In a recent study, Thomas notes that an outstanding feature of labor organization in Kerala is that it brought in informal sector workers into its fold, while informal sector workers in other parts of the country continue to survive under oppressive working conditions. As wage rates of informal-sector workers in Kerala rose above the corresponding Indian average and above the corresponding wage rates in neighboring States, Kerala, apparently, lost its advantages in industries. Annual growth of employee earnings in Kerala's factory sector was found to be positively associated with annual growth of labor productivity, more than in 13 other Indian States. Thomas thus clearly disputes the general suggestion that industrial slowdown in the State is "caused" by labor problems. Some scholarly studies trace Kerala's industrial backwardness to a weak industrial structure (Subrahmanian and Pillai, 1986; Subrahmanian, 1990; Subrahmanian, 2003)

Data and methodologies

The major objectives of this study are, firstly to document the industrial spectrum of Kerala and secondly to assess and compare the growth pattern of industrial development in two periods, viz post and pre reform period. For different analysis the study adopted different study period. For regression the period is from 1973-74 to 2008-09 and for causality analysis the period is from 1980-81 to 2007-08. The study also divided the study period into two in order to make, compare and analyse pre and post reform period industrial developments in Kerala. The required data have been collected from only one source, namely secondary. The secondary data are collected from various sources such as Kerala development reports, Report of ASI, Government of India Ministry of Statistics and Programme Implementation, Central Statistical Office, Department of Economics and Statistics, Centre for Development studies, Directorate of Industries and Commerce, Government of Kerala, etc. Some related date and information are collected from official websites of different agencies. The data collected were analysed with the help of simple statistical techniques such as percentages, averages, ratios and growth rates. Further diagram and other statistical tools were also used in the analysis. The study also made use of some advanced time series econometrics tools, for that the statistical and time series properties of each and every variable were examined using the conventional unit root test and employed ordinary Least squares and Granger causality test.

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Results and Discussion

The table (1) gives the total number of factories, capital, number of total industrial workers and the value of gross output of all states and UTs in India.

Table 1: All India and State-Wise Performance and Comparison of the various Industrial indices (2007-08)

States/UTs	Number of factories	fixed capital	working capital	Invested capital	Number of workers	wages to workers	value of gross output
All India	146385	845132	316953	1280126	8198110	51030	2775709
Andhra Pradesh	16741	64251	21465	95835	862414	4229	182533
Assam	1859	8911	3462	13020	113132	427	31044
Bihar	1783	3015	1636	5637	62319	229	21874
Chhattisgarh	1854	22948	26592	30862	118228	869	57950
Goa	522	4500	3451	7576	37617	331	18873
Gujarat	15107	145400	51121	209558	797443	5289	448243
Haryana	4707	28868	8089	47856	400895	2537	124884
Himachal Pradesh	1160	20003	5320	24476	72095	396	33008
Jammu & Kashmir	672	2473	2930	4048	42219	194	16230
Jharkhand	1615	22399	1357	29761	117548	1820	60338
Karnataka	8443	59967	12392	86224	567836	3832	184258
Kerala	5584	9143	4182	17076	308641	1332	55566
Madhya Pradesh	3165	24418	10741	36432	194046	1237	78722
Maharashtra	18304	137292	46935	214768	953097	8461	519939
Manipur	69	11	8	20	2442	6	58
Meghalaya	90	610	551	833	4574	30	1715
Nagaland	104	28	24	70	2494	5	136
Orissa	1822	43370	5707	52218	145276	1300	48014
Punjab	10178	21783	12366	39987	435386	2163	96163
Rajasthan	6337	22587	12858	34303	278541	1380	76627
Tamil Nadu	21042	79337	21590	129523	1283478	6440	265438
Tripura	340	245	213	464	20696	36	766
UttaraKhand	1474	12971	4559	18677	97687	708	33067
Uttar Pradesh	10717	58450	22420	91959	589695	3247	193815
West Bengal	5987	32332	13237	50802	421280	3103	109464
A & N. Island	12	59	59	67	283	2	119
Chandigarh	294	516	450	938	8209	61	3326
Dadra & N Haveli	1014	8997	6800	13798	67469	328	41863
Daman & Diu	1487	4309	9737	10993	63912	294	28792
Delhi	3198	2926	4253	6967	88664	506	26858
Pondicherry	703	3010	2447	5379	40494	241	16027

Sources: ASI, Government of India Ministry of Statistics and Programme Implementation Central Statistics Office

The table 2 shows the percentage share of states in terms of number factory, workers and industrial output of India**.** On the basis of three indices such as number factory, workers and industrial output, the study ranked the states. From these ranking one can clearly make a statement regarding the industrial position of Kerala and can also compare the different states. The table 2 is based on the table 1, but the table 2 gives the shares of each state in industrial output, labour and capital of India. Both tables are based on the 2007-08 data which are collected from Annual survey of industries, Ministry of Statistics and Programme Implementation Central Statistics Office, India.

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Table2: Percentage share of states in number factory, workers and industrial output of India (2007-08)

SL. No	States/UTs	% of total factories	Rank	% of total workers	Rank	Percentage of total gross output	Rank
1	Andhra Pradesh	11.43628	3	10.51967	3	6.576086	6
2	Assam	1.269939	14	1.379977	16	1.118417	19
3	Bihar	1.218021	17	0.760163	22	0.788051	22
4	Chhattisgarh	1.266523	15	1.442137	14	2.087755	13
5	Goa	0.356594	25	0.45885	25	0.679934	23
6	Gujarat	10.32005	4	9.727157	4	16.14877	2
7	Haryana	3.215493	11	4.890091	9	4.499175	7
8	Himachal Pradesh	0.792431	21	0.87941	19	1.189174	18
9	Jammu & Kashmir	0.459063	24	0.514985	23	0.584715	24
10	Jharkhand	1.103255	18	1.433843	15	2.173787	12
11	Karnataka	5.767667	7	6.926426	6	6.638232	5
12	Kerala	3.814598	10	3.764782	10	2.001867	14
13	Madhya Pradesh	2.162107	13	2.36696	12	2.836104	10
14	Maharashtra	12.50401	2	11.62581	2	18.73175	1
15	Manipur	0.047136	30	0.029787	30	0.00209	31
16	Meghalaya	0.061482	29	0.055793	28	0.061786	27
17	Nagaland	0.071046	28	0.030422	29	0.0049	29
18	Orissa	1.244663	16	1.772067	13	1.729792	15
19	Punjab	6.952898	6	5.310809	7	3.464448	9
20	Rajasthan	4.328995	8	3.397625	11	2.760628	11
21	Tamil Nadu	14.37442	1	15.65578	1	9.56289	3
22	Tripura	0.232264	26	0.252448	26	0.027597	28
23	UttaraKhand	1.006934	20	1.19158	17	1.191299	17
24	Uttar Pradesh	7.321105	5	7.19306	5	6.98254	4
25	West Bengal	4.0899	9	5.138745	8	3.943641	8
26	A & N. Island	0.008198	31	0.003452	31	0.004287	30
27	Chandigarh	0.20084	27	0.100133	27	0.119825	26
28	Dadra & N Haveli	0.692694	22	0.822982	20	1.508191	16
29	Daman & Diu	1.015814	19	0.779594	21	1.037285	20
30	Delhi	2.18465	12	1.081518	18	0.967609	21
31	Pondicherry	0.48024	23	0.493943	24	0.577402	25

Sources: ASI, Government of India Ministry of Statistics and Programme Implementation Central Statistics Office

A comparison of state-wise as well as, all India performance on the basis of 2007-08 data shows that the states like Tamil Nadu, Maharashtra, Andhra Pradesh, Gujarat, and Karnataka are in a better position in all the indices such as number of factories, amount of capital, number of workers and total volume of industrial output. While, the position of Kerala in all the indices compared to the other states is very dismal. From an overall analysis of the above table we can understand that Kerala's position in industrial map of India is negligible.

Regarding the number of factories, Tamil Nadu possesses 14.37% of total factories in India following Maharashtra, Andhra Pradesh and Gujarat. These states' shares in total number of factories are 12.50%, 11.43% and 10.32% respectively. Whereas, the share of Kerala in total number of factories is only 3.814% and is occupying 11th position in total number of factories. Regarding fixed capital, Gujarat having 16.245 % of total all India fixed capital followed by Maharashtra, Tamil Nadu, Andhra Pradesh, Uttar Pradesh and Karnataka. Their shares in total fixed capital are 17.204%, 9.38 %, 7.60%, 7.09 % and 6.91% respectively. In these indices, Kerala ranked 17 out of 31. With regard to the working capital Maharashtra is possessing 16.12 % of total all India working capital followed by Gujarat (14.08%), Tamil Nadu (7.07%), Chhattisgarh

(6.81%), UP (6.77%), Rajasthan (4.17%) and Daman Diu(4.05%). Kerala's share is only 1.09% and ranked 20th in all India level.

Workers are defined to include all persons employed directly or through any agency whether for wages or not and engaged in any manufacturing process or in cleaning any part of the machinery or premises used for manufacturing process or in any other kind of work incidental to or connected with the manufacturing process or the subject of the manufacturing process . Labour engaged in the repair & maintenance, or production of fixed assets for factory's own use, or employed for generating electricity, or producing coal, gas etc. are included. Regarding the number of workers we can draw enormous number of facts. Tamil Nadu is giving employment to the 15.65 % of the total industrial workers in India followed by Maharashtra, Andhra Pradesh, Gujarat, Uttar Pradesh and Karnataka. Their shares in total number of workers are 11.62%, 10.51%, 9.727%, 7.19% and 6.926% respectively. Regarding the number of workers, Kerala's condition is relatively better. Kerala's share in total industrial workers is 3.764% and possessing 10th rank in this regard.

With concern to the total output the state Maharashtra gives 18.73% of total industrial output in India followed by Gujarat, Tamil Nadu, Uttar Pradesh, Karnataka and Andhra Pradesh. These state's shares in total output are 16.14%, 9.56%, 6.98%, 6.638% and 6.576% respectively. Coming to Kerala, it is generating only 2% of total industrial output in India and with this view point Kerala is in 14th rank.

Table 3: Pre and Post Reform Comparison of Selected Indices in Kerala

Growth rate	No. of factory	Capital	Outstanding Loans	Workers	Gross Output	Profit
Pre-reform period (1974-75 to 1990-91)	2.068%	0.856%	14.71%	0.843%	16.27%	29.69% (1980 to 1991)
Post reform period (1991-92 to 2008-09)	2.958%	2.653%	17.42%	2.265%	21.07%	31.42%
Total (1974-75 to 2008-09	2.53%	1.780%	16.14%	1.539%	18.80%	30.79%

Source: Calculated on the basis of ASI data from 1974 to 2008

Table throws some lights on the pre-reform (1974-75 to 1990-91) and post reform (1991-92 to 2008-09) performance of Kerala's Industrial Sector. Growth rate of number of factories in pre-reform period is only 2.068%, but in Post reform Period it is 2.958% and it is more than the total growth rate of number of factories in whole period. Similarly, in the case of capital, and workers growth rate are 0.85% and 0.8.4% respectively in pre reform period. However, the growth rate has tremendously increased to around 2.5 % in post reform period which is above the total average growth rate of entire study period. In the case of industrial output, there is only a small difference between growth rate in pre and post reform period. The growth rate in pre-reform period was 17% where as in post reform period it is around 20%. Nevertheless, the growth rate in post-reform period is more than that of growth rate in overall study span. In the case of growth of industrial loans and profit post reform period shows a significant deviation from that of pre-reform period.

As a concluding remark, we can make a point here that, concerning the overall development of industrial sector in Kerala, the economic reforms in India has a positive impact on the industrial development in Kerala. Regarding the growth rate of all the indices the post reform period has shows some benefits over pre-reform period and which support the basic notion that the reform has a favorable effects on industrial development.

Econometric Methodology and results

Generally speaking, Econometric models are best equipments to understand the real fruits of a research. Hence, OLS and Granger causality test are used in the present study to understand the performance of industrial economy of Kerala.

The general specification of econometric model begins with the following Cobb-Douglas Production Function

$$\log(Q_t) = C + \beta_1 \log(K_t) + \beta_2 \log(L_t) + \varepsilon_t$$

Q=Gross industrial output

L= Industrial Labours

K= fixed capital

We expressed all the three variables in logarithm transformation, because there is general consensus that the log linear version is the most appropriate functional form because it performs better than the other forms and it allows for interpretation of coefficients of variables in logarithms as elasticities.

We start with a standard production function in which industrial output is expressed as a function of industrial labours and fixed capital. We expect the estimate of both labour and capital to be positive.

Unit root test

The first step of the strategy of our empirical analysis involves determining the order of integration of the series used in the analysis by applying unit root test. The key concept underlying time series process is that of stationary. Most time series are trended and therefore in most cases are nonstationary. The problem with nonstationary or trended data is that the standard OLS regression procedure can easily lead to erroneous conclusion. A series of Augmented Dickey-Fuller unit root test is performed to determine the degree of integration of the variables. The following table shows the ADF test results at the level on intercept and intercept and trend

Table 4: ADF Test Result

LEVEL		
Variables	Intercept only	Intercept and trend
	Prob: value	Prob: value
Log Q	0.62	0.03
Log L	0.82	0.01
Log K	0.39	0.026

The reported reveals that the hypothesis of a unit root is rejected in all variables in level itself. So we can go ahead with classical ordinary least square method.

The estimation of the equation by direct OLS gives the following integration equation.

Log Q= -9.795110+1.22 K_t +0.632989 L_t
(-2.092957) (19.84078) (1.508293)
(0.0446) (0.000) (0.1416)
Adj R^2= 0.9633 F= 437.3739 DW=0.990105

The estimated parameters of equation are in accordance with Cobb-Douglas Production Function. As we expected, both the coefficients of labour and capital is giving much desired positive sign. The coefficient of capital is significant at 5% level of significance whereas the labour coefficient is significant only at 10% level. The estimated result can be interpret as, one percent increase in the amount of capital will leads to a 1.22% growth in gross industrial output, on the other hand, one percent increase in the amount of labour will leads to an increase in industrial output by 0.632%. So in order to increase the industrial output in Kerala the

Government has to invest more in capital. Here we have high R^2 and t-values and all the variables give the expected result, but the low value of DW shows that the problem of autocorrelation is occurred.

Causality Test

Granger developed in 1969 relatively a simple test which defined causality as a variable Y_t is said to granger cause X_t, if X_t can be predicted with greater accuracy by using past values of the Y_t. In this study we considered Gross State Domestic Product (GSDP) and Gross Industrial Output (GIO), according to this test there are two types of equation

1. Restricted equation

   $$\mathbf{GSDP=\alpha_0+ \alpha_1 GIO+ \alpha_2 GIO_{t-1}+ \alpha_3 GIO_{t-2}}$$

   $$\mathbf{Where,\ \alpha_1= \alpha_2= \alpha_3=0}$$

2. Unrestricted equation

   $$\mathbf{GSDP=\alpha_0+ \alpha_1 GIO+ \alpha_2 GIO_{t-1}+ \alpha_3 GIO_{t-2}+\beta_1 GSDP_{t-1+}\ \beta_2 GSDP_{t-2}}$$

   $$\mathbf{Where,\ \beta_1 \neq \beta_2 \neq 0}$$

The empirical analyses start with determining the order of integration of the GSDP and GIO series by applying unit root test. The key concept underlying time series process is that of stationarity. Augmented Dickey-Fuller unit root test is performed to determine the degree of integration of the variables. The result shows that the hypothesis of a unit root can't be rejected in both variables in levels as well as first difference. However, the hypothesis of a unit root is rejected in second differences at 0.05 level of significant which indicates that all variables are integrated of degree two, I(2). That means all the variables achieve stationarity only after second differencing.

Table 5: Result of Granger Causality test

PAIRWISE GRANGER CAUSALITY TEST		
Sample: 1980-81 to 2008-09 (25 observation)		
Null Hypothesis:	F-Statistic	Prob.value
GSDP does not Granger Cause GIO	4.49903	0.0244
GIO does not Granger Cause GSDP	4.45117	0.0252

The Granger Causality test, which is performed for annual data spanning the period from 1980-81 to 2007-08 shows that the null hypothesis of casual relationship between GSDP and GIO and between GIO and GSDP are rejected at 0.05 % significance. So we have to reject both the null hypotheses indicating that in Kerala both gross state domestic product and gross industrial product are bidirectional. More specifically an increase in GSDP does leads to an increase in GIO and increase in GIO does leads to an increase in GSDP. Our result is consistent with empirical proof that as the share of industry in GSDP increases the GSDP will increases.

Conclusion

After prolonged years of industrial stagnation, Kerala has realised the urgent need of rapid industrialisation. The available industrial statistics shows that Kerala has lagged far behind the other major industrial states of India. The major reasons for this lagging are political factors, labour problem, militant trade unions, industrial disputes, limited land resources, power shortage etc. However, it would be concluded that the performance of the Kerala's industrial sector improved since its formation especially after first five year plan and it has positive impact on gross state domestic product.

The main observations and conclusions are given below:

1. The result from the regression analysis shows that, on an average a one percent increase in the amount of capital will lead to a 1.22% growth in gross industrial output in Kerala, on the other hand, one percent increase in the amount of labour will lead to an increase in industrial output by 0.632%.

2. The causality test concluded that in Kerala both gross state domestic product and gross industrial product are bidirectional; specifically an increase in GSDP does leads to an increase in GIO and increase in GIO leads to an increase in GSDP.
3. A comparison of state-wise as well as all India performance on the basis of 2007-08 data shows that the state Kerala is far behind in number of factories, amount of labour, capital and gross output compared to the states like Tamil Nadu, Maharashtra, Andhra Pradesh, Gujarat, and Karnataka.
4. The pre-post reform analysis shows that, the economic reform in India has a positive impact on the industrial development in Kerala. Regarding the growth rate of all the indices, the post reform period has shown some benefits over pre-reform period and which supports the basic notion that the reform has favorable effects on industrial development.

Policy suggestions:

1. Kerala should concentrate more on public private participation (PPP) model and thereby establish new industries as well as expand the existing ones.
2. The effect of labour unions should be reduced. In Kerala labour strikes are very common. Even if there is a small problem unions call for strikes rather than going for negotiation. This system has to be changed for the efficient working of industries.
3. Kerala's traditional industries are on the verge of extinction. The government should give more attention to the revival of those industries in the form of increased investment subsidies and so on.
4. Kerala Govt. should concentrate on green development.ie, while establishing industries; we should take into account the method of waste management and sewage treatment in such a way that, along with rapid development, environmental sustainability can also be assured.
5. This state should invite more foreign investment and adopt better foreign technologies.
6. Take necessary helps to revive the efficiency of government owned industries in the state that are currently functioning in a deteriorating condition.

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An Exponential GARCH Approach to the Effect of Impulsiveness of Euro on Indian Stock Market

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Abstract

This paper examines the effect of impulsiveness of euro on Indian stock market. In order to examine the problem, we select rupee-euro exchange rates and S&P CNX NIFTY and BSE30 SENSEX to represent stock price. We select euro as it considered as second most widely used currency at the international level after dollar. The data are collected a daily basis over a period of 3-Apr-2007 to 30-Mar-2012. The statistical and time series properties of each and every variable have examined using the conventional unit root such as ADF and PP test. Adopting a generalized autoregressive conditional heteroskedasticity (GARCH) and exponential GARCH (EGARCH) model, the study suggests a negative relationship between exchange rate and stock prices in India. Even though India is a major trade partner of European Union, the study couldn't find any significant statistical effect of fluctuations in Euro-rupee exchange rates on stock prices. The study also reveals that shocks to exchange rate have symmetric effect on stock prices and exchange rate fluctuations have permanent effects on stock price volatility in India.

Keywords: Euro, Stock price, Unit root, GARCH, India.

JEL Classification Codes: E44, F31, F37, G01, G15.

1. Introduction

Foreign exchange market and stock market are the most important constituents of a financial system. Foreign exchange market deals in foreign exchange and it is reflected in exchange rates, as stock market deals in shares of corporate and it is reflected by share prices. In recent years, the intellectual curiosity of researchers and investors has much focused to examine the link between exchange rate and stock price. This is partly due to the advent of floating exchange rate regime, relaxation of Government control over international trade and adoption of liberal policy regarding import and removal of restriction on foreign investment. Many factors, such as enterprise performance, dividends, stock prices of other countries, gross domestic product, exchange rates, interest rates, current account, money supply, employment, their information etc. have an impact on daily stock prices (Kurihara, 2006). Kim (2003) has reported that the unprecedented increases in the volume of world trade and free capital movements across the nations have increased the role of exchange rate in profitability and equity prices.

Exchange rate is one of the important and most confusing risk elements in the stock market. There is a common belief that, stock prices are significantly affected by ups and downs in the exchange rate. The variation in exchange rate affects the firm value and the firm value is reflected in its share prices. A booming stock market will attract foreign investment, and it will lead to the inflow of foreign exchange and the resulting rise in the value of domestic currency. The opposite also may happen in case of falling stock prices. In an open economy, the expectations of relative currency values influence the level of domestic and foreign interest rates, which in turn affect the present value of a firm's assets. Similarly the firms and corporations use the foreign exchange market for a variety of purposes related to their operations such as payment for imports, conversion of export receipts, hedging of receivables and payables, payment of interest on foreign currency loans, placement of surplus funds and so forth. This suggests that exchange rates play a crucial role in the movement of stock prices.

2. Theoretical Explanations

The theoretical support for the impact of exchange rate on stock prices is very strong. The impact of exchange rates on stock prices can be explained with the help of two approaches, one is goods market approaches and another one is Portfolio balance approach.

Goods market approach by Dombusch and Fischer suggest that changes in exchange rates affect the competitiveness of a firm as fluctuations in exchange rate affects the value of the earnings and cost of its funds as many companies borrow in foreign currencies to fund their operations and hence its stock

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price. A depreciation of the local currency makes exporting goods attractive and leads to an increase in foreign demand and hence revenue for the firm and its value would appreciate and hence the stock prices. On the other hand, an appreciation of the local currency decreases profits for an exporting firm because it leads to a decrease in foreign demand of its products. We can conclude from the above premises that appreciation in exchange rate is negatively related to the stock prices of the exporting firm and positively related to stock price of importing firm.

Portfolio balanced approach stresses that exchange rate are determined by the fluctuation in the equity market and work under the demand and supply framework. An upward moving stock market of the country grabs the attention of the foreign investors to invest in the stock and diversify their portfolios; hence the upward movement brings more foreign currency to the country and increases the demand for the local currency, which leads to appreciation of the local currency. On the other side, when the stock market falls, the stocks lose its attraction to be added in the portfolio. And the investors then sell out their stocks to avoid further losses this leads to lower demand for local currency and the local currency depreciates. As a result the upward (downward) movement of the stock market of country will lead to appreciate (depreciate) the exchange rate of the country.

3. Literature Review

While both goods market and portfolio theory suggests that changes in exchange rate can have an important impact on the stock price, there is no conclusive empirical results has established. Some studies support negative association, while some studies support positive relation. The early studies, which examined the stock price-exchange rate link shows no valid pattern of responses by stock prices to exchange rate (e.g., Ang & Ghallab, 1976; Franck & Young, 1972). This result may be attributed to the fixed exchange rate regime of Bretton Woods era. After the advent of floating exchange rate regime, the role of exchange rate in influencing macroeconomic and financial variables has been heightened.

Aggarwal (1981) was the first to examine the link between stock price and exchange rate and found a positive significant correlation between the two variables in U.S. On the other hand the studies by Soenen and Hennigar (1988), Goodwin et al. (1992), Ibrahim and Aziz (2003) and Kim (2003), suggested a negative link between the stock prices and the exchange rates. As a contrary to the above said studies Solnik (1987) and Ong and Izan (1999) suggested that changes in exchange rates do not have any significant impact over stock prices.

Enormous number of studies has been examined the causal relationship between exchange rate and stock price using granger causality technique. Some studies support a unidirectional causality from exchange rate to stock price; some studies from stock price to exchange rate and some studies support bidirectional causality. Most of the studies suggested a unidirectional causality from stock price to exchange rate. Bhmani et al. (1992) examined both short run and long run relationship between stock price and exchange rate and found one way causal relationships from stock prices to exchange rates in short run, and no causal relationship in the long run. Libly (1993) suggested a unidirectional causality which moves from stock prices to exchange rate.

The study by Ajayi et al. (1998) reported a one way causal relation from the stock market to the exchange rate in Indonesia and the Philippines, while in Korea it runs in the opposite direction. They couldn't find any significant relation in Hong Kong, Singapore, Thailand, or Malaysia. However, in Taiwan, they detected a two-way relationship. Granger, Huang and Yang (2000) conducted a detailed study of the Philippine and South Korean market and concluded that in Philippine the unidirectional causality exists between stock market and exchange rate, and the direction of the causality is from stock price to exchange rates. Mansoor (2000), found no long run relationship between stock prices and exchange rates, but found unidirectional causal relationship from stock prices to exchange rates in short run. Hatemi-J and Irandoust (2002) suggested a unidirectional causality running from stock prices to exchange rates. On the contrary to above study Yu (1997) detected a unidirectional causality from exchange rates to stock prices for Singapore, and bidirectional causality for Tokyo Market during the period from 1983 to 1994.

A detailed study made by Erbaykal and Okuyan (2007) for 13 developing countries suggested a unidirectional causality from stock price to exchange rates in the five countries, a bidirectional causality in the three economies and no relation found in remaining economies. Similarly Doong et al. (2005) studied the relationship between stock price and exchange rate for Asian countries and detected bidirectional causality in Indonesia, Korea, Malaysia, and Thailand.

A sizable number of studies have tried to examine the long run association using cointegration approach. Nieh and Lee (2001) examine the relationship between stock prices and exchange rates for G-7 countries and find that there is no long-run equilibrium relationship between stock prices and exchange rates for each G-7 countries. Similarly by taking 45 years of U.S quarterly data, Ozair (2006) investigated the link between stock prices and exchange rates and showed no causal linkage and no cointegration between these two financial variables.

The studies on the link between exchange rate and stock market are relatively spheres in India and the existed studies shows mixed results. One of the earliest studies conducted by Abdalla and Murinde (1997) detected a unidirectional causality from exchange rate to stock prices in India. Smyth and Nandha (2003) also find a unidirectional causality running from exchange rates to stock prices for India and Sri Lanka. On the contrary to the above result, Muhammad and Rasheed's (2002) study on the exchange rates and stock price relationships for Pakistan, India, Bangladesh and Sri Lanka shows no any significant relation between exchange rates and stock prices in India. Similarly

Bhattacharya and Mukherjee (2003) suggested that there is no significant relationship between stock prices and exchange rates in India.

Even though, there are enormous studies focusing on exchange rate and stock price relationships, to the best of our knowledge, we find some drawbacks of existing works. Firstly, no studies examined the effect of impulsiveness of euro exchange rate on Indian stock market. Second, the studies that examined the link between exchange rate and stock prices overwhelmingly applied the traditional econometric tool of Granger causality test and cointegration. The studies with the application of new financial econometrics model such as GARCH and EGARCH model are hard to find.

The main objective of the paper is to examine the effects of impulsiveness of Euro-rupee exchange rates on two major stock price indices in India such as S&P NIFTY and SENSEX.

4. Data and Methodology

In order to examine the problem, the following secondary data are used. We select rupee-euro exchange rates and S&P CNX NIFTY and BSE30 SENSEX to represent stock price. We select euro as it considered as second most widely used currency at the international level after dollar. The data are collected a daily basis over a period of 3-Apr-2007 to 30-Mar-2012. The daily data on rupee-euro exchange rates are collected from Handbook of Statistics on Indian Economy (www.rbi.org.in), while the daily data on S&P CNX NIFTY and BSE30 SENSEX are collected from the official website of National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) respectively. The statistical and time series properties of each and every variable have been examined using the conventional unit root such as ADF and PP test. In order to check for the effect of impulsiveness of euro on Indian stock market, return on euro and stock price are used and employed GARCH and EGARCH models.

The conventional econometric models keep the variance of the disturbance term as constant over time, but exchange rate and stock price series exhibit volatility clustering, i.e.in some period a unusually high volatility followed by more tranquil periods of low volatility. There for in such cases it is clear that the assumption of constant variance is limiting and application of OLS method provides biased variance estimate; hence, inference based on OLS estimates will be misleading. So in such cases, it is better to examine not the unconditional variance but the conditional variance. For that we employ generalized autoregressive conditional heteroskedasticity (GARCH) of Bollerslev and exponential GARCH (EGARCH) of Nelson for daily data to investigate the link between exchange rate and stock price.

The returns on exchange rate and stock price can be calculated using the following formula,

$$r_t = \log(\frac{y_t}{y_{t-1}})$$

Where yt and yt–1 are exchange rate and stock prices for the periods t and t-1. Let denotes greur, grnif and grsen be the daily returns on euro-rupee exchange rate, nifty and sensex respectively.

The general form of Mean and GARCH-M Equation can be written as

$$gry_t = \alpha + \beta x_t + \varepsilon_t$$

We can also consider alternative mean equation, which can be written as $gry_t = \alpha + \beta x_t + \xi\sigma_t^2 + \varepsilon_t$

The variance equation for both GARCH and GARCH-M model can be written as

$$\sigma_t^2 = \psi + \mu_1 \varepsilon^2_{t-p} + \mu_2 \varepsilon^2_{t-q}$$

The variance equation for the EGARCH model can be written as

$$\log(\sigma t^2) = \psi + \delta(\left|\frac{\varepsilon_{t-p}}{\sigma_{t-q}}\right| - \sqrt{\frac{2}{\pi}}) + \gamma\frac{\varepsilon_{t-p}}{\sigma_{t-q}} + \lambda\log(\sigma^2{}_{t-q})$$

5. Empirical Results

Table 1 gives a detailed descriptive statistics of all study variables. The mean shows the average returns, in which nifty has highest returns followed by sensex among stock prices, euro has also highest return. Sensex has highest volatility followed by nifty as indicated by the coefficient of variation which indicates the highest standard deviation relative to the mean. Similarly, euro has the highest volatility.

<Table 1> Descriptive Statistics

	gsensex	gnifty	geuro
Mean	0.000267	0.000300	0.000142
Std.dev	0.019156	0.019021	0.007180
Skewness	0.263358	0.157905	-0.112767
Kurtosis	9.423479	10.49928	5.184980
Jarque-Bera	2080.387	2821.641	241.6522
Observations	1202	1202	1202

Table 2 gives the correlation among the variables. As expected, sensex and nifty has the highest positive correlation, which is close to one. On the other hand both stock prices and a euro exchange rate is negative related.

<Table 2> Contemporaneous Correlation Coefficients

	gsensex	gnifty	geuro
gsensex	1.000000		
gnifty	0.990673	1.000000	
geur	-0.077622	-0.062279	0.307641

Table 3 shows a series of Augmented Dickey-Fuller and Philip-Perron unit root test results of daily return series; we are able reject the null hypothesis of unit root at 1% level of significance. Thus, all series are stationary.

<Table 3> UnitRoot Test Results

Variables (Level)	ADF		PP	
	intercept	Trend & intercept	intercept	Trend & intercept
gsensex	-32.0660	-32.0547	-31.972	-31.960
gnifty	-32.5112	-32.5002	-32.453	-32.441
geur	-34.1628	-34.1487	-34.162	-34.148

All values are t statistics

At the first instance, we performed OLS regression on all equations such as euro on sensex and euro on nifty and found that the variable greur in both equations are significant at 5% level. Then we checked the model for ARCH effect using Ljung-Box Q-statistics for 5, 15 and 36 lags and also using LM test. This indicates that we are able to reject the null hypothesis of no ARCH effect in all models and we concluded that OLS regression models do suffer from ARCH effect.

As a further step, GARCH (1, 1), GARCH-M (1, 1) and EGARCH (1,1) have been conducted using Maximum Likelihood method. The results of the effect of euro on both sensex and nifty are presented in Tables 4 and 5. The mean equation of GARCH (1,1) shows a negative relation between euro and both stock price indices. More precisely, increase in rupee-euro exchange rates have a negative effect on sensex and nifty. A 10% depreciation of rupee against euro decreases the sensex and nifty by 0.07% and 0.69% respectively. Regarding the effect the effect of euro on stock price is very low. Here for all the cases, we found that, the residual is free from autocorrelation and ARCH effect.

<Table 4> Estimation Result-Effects of Euro on SENSEX

Parameters	EURO ON SENSEX			
	OLS	GARCH(1,1)	GARCH-M(1,1)	EGARCH(1,1)
I. Mean equation				
α	0.000296 (0.5908)	0.000783 (0.0473)	0.000676 (0.2488)	0.00037 (0.3175)
β	-0.207097 (0.0071)	-0.077072 (0.1736)	-0.07712 (0.1735)	-0.07023 (0.2420)
ζ	—	—	0.51243 (0.8227)	—
II. Variance equation				
w	—	3.66E-06 (0.0001)	3.65E-06 (0.0002)	-0.33991 (0.000)
μ1	—	0.092159 (0.0000)	0.09202 (0.0000)	—
μ2	—	0.900465 (0.000)	0.900594 (0.0000)	—
δ	—	—	—	0.206521 (0.0000)
γ	—	—	—	-0.06320 (0.000)
λ	—	—	—	0.97785 (0.0000)
III. Diagnostic				
Q-Stat (5)	12.255 (0.031)	6.4824 (0.262)	6.4600 (0.264)	5.4855 (0.360)
Q-Stat (15)	20.907 (0.040)	10.836 (0.764)	10.925 (0.758)	11.030 (0.750)
Q-Stat (36)	49.281 (0.069)	25.901 (0.893)	25.921 (0.893)	28.310 (0.816)
LM test (1)	21.0848 (0.0000)	0.18681 (0.6657)	0.18141 (0.6702)	0.8825 (0.3477)

<Table 5> Estimation Result-Effects of Euro on NIFTY

Parameters	EURO ON NIFTY			
	OLS	GARCH(1,1)	GARCH-M(1,1)	EGARCH(1,1)
I. Mean equation				
α	0.000324 (0.5547)	0.000804 (0.0489)	0.000667 (0.2818)	0.00055 (0.1664)
β	-0.164991 (0.0308)	-0.069554 (0.2221)	-0.069691 (0.2216)	-0.06874 (0.2652)
ζ	—	—	0.633454 (0.7931)	—
II. Variance equation				
w	—	4.15E-06 (0.0001)	4.15E-06 (0.0001)	-0.40131 (0.000)
μ1	—	0.098288 (0.0000)	0.09820 (0.0000)	—
μ2	—	0.894734 (0.000)	0.89482 (0.0000)	—
δ	—	—	—	0.226833 (0.0000)
γ	—	—	—	-0.07398 (0.000)
λ	—	—	—	0.97219 (0.0000)
III. Diagnostic				

Q-Stat (5)	8.8077 (0.017)	5.1657 (0.396)	5.1553 (0.397)	4.7247 (0.450)
Q-Stat (15)	19.724 (0.018)	11.245 (0.735)	11.396 (0.724)	12.442 (0.645)
Q-Stat (36)	48.477 (0.080)	26.656 (0.872)	26.726 (0.869)	30.424 (0.731)
LM test (1)	17.37485 (0.0000)	0.06286 (0.8021)	0.05563 (0.8136)	0.52762 (0.4677)

The result form GARCH-M (1,1) is listed in the forth column of Tables 4 and 5, in all cases, the coefficient ζis found to be insignificant which implies that the volatility in euro has no impact on the euro itself. Both Q statistics and LM test suggest that, the residual is free from autocorrelation. The result from EGARCH model is reported in the final column of table 4 and 5. From the mean equations it is confirmed that euro is negatively affecting stock prices, but both the euro equations show insignificant relations. Coming to the variance equation, the coefficient γ, which measures the asymmetry, is found to be significant at 1% level. This implies that shocks to euro rupee exchange rate have an asymmetric effect on stock prices, which means positive and negative shocks have different effect on stock prices in terms of magnitude. The volatility persistence term, λ, is positive and statistically significant at 5% level. The coefficient is close to 1, implying that shocks have permanent effect on stock price volatility. The diagnostic check for autocorrelation shows that the model is free from autocorrelation. In short the model is well fitted.

6. Conclusion

This paper empirically analyzed the impact of euro-rupee fluctuations on Indian stock prices. The study found that exchange rate and stock price series exhibit volatility clustering, i.e. in some period a unusually high volatility followed by more tranquil periods of low volatility. So GARCH and EGARCH model has been adopted. The major conclusions of the study are:

Firstly, an increase in rupee-euro exchange rates has a negative effect on sensex and nifty. A 10% depreciation of rupee against euro decreases the sensex and nifty by 0.07% and 0.69% respectively. Regarding the effect, even though India is a major trade partner of European Union, we couldn't find any significant statistical effect of fluctuations in Euro-rupee exchange rates on stock prices. This finding will be highly informative to both domestic and foreign investors and financial analysts to understand the direction of relationship between euro and stock prices.

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FINANCIAL DEVELOPMENT AND FINANCIAL INCLUSION IN INDIA: AN INTERSTATE COMPARISON

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ABSTRACT

Financial development plays a decisive role in economic development. It encourages economic growth of the nation through capital accumulation and its efficient allocation. By widening the financial access to the poor and vulnerable sections of the people it reduces poverty and inequality. The financial development results in the financial inclusion. As per the UNO reports, 2.5 billion peoples across the world are excluded from financial services. India is not exempted from this. India is second largest country in the population and majorities are living in the village. According to the 59th NSSO survey estimates, about 73% of the households in India were located in the rural areas. Among them only 24.3 % of the peoples gets the banking facility. From the 27% of the urban people only 18.1% of the people avails the banking facility. Even though RBI has initiated different schemes for the financial inclusion, still a large section of the peoples are unbanked. The poor and weaker sections of the society are kept out of the financial services. The present study focuses on the depth of financial inclusion provided by these banks. This is an interstate comparison on financial development and financial inclusion. Empirical results show the extent of disparity in the financial development and financial inclusion. Region-wise analysis reveals that the Northern Region, Western Region and southern regions of India are financially developed than any other regions. These regions also more included in the financial services provided by the bank

Introduction

Financial development plays a decisive role in the economic development of any nation. It encourages economic growth of the nation through various financial services such as savings, payment, credit, and risk management. By widening the financial access to the poor and vulnerable sections of the people it reduces poverty and inequality. Access to financial services has a critical role in reducing extreme poverty, boosting shared prosperity, and supporting inclusive and sustainable development (Global Financial Development Report 2014**,** The world Bank).Financial deepening fosters economic growth and reduces income inequality (Bekaert et al., 2005, Beck, Levine, and Levkov, 2010). The financial development provides spectrum of services to the people. These services allow the people to take advantage of business opportunities, invest in education, and insure against risks. Thus the policy makers in the developing countries adopt various policy measures to reap the benefit of financial development. These measures include judicial and regulatory reforms.

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The financial development shows the development of financial institutions, financial markets and financial products. It is a process of reducing the costs of acquiring information, enforcing contracts, and making transactions (GFDR, World Bank). The financial development results in the financial inclusion. The delivery of financial services at an affordable cost to the vast sections of the disadvantaged and low-income groups is termed as financial inclusion. These services include not only banking services but also other financial services like insurance. The accessibility of financial services is more important than the use of service. Because some group of the peoples are self excluded from the financial services. Personal, religious, cultural and other beliefs are responsible for this self exclusion. Financial inclusion ensures equity and inclusive growth in the economy. Financial inclusion is an inevitable tool for the economic growth and poverty alleviation. Financial exclusion leads to poverty traps and inequality (Aghion and Bolton 1997).

According to the 59th NSSO survey estimates, about 73% of the households in India were located in the rural areas. Among them only 24.3 % of the peoples gets the banking facility. From the 27% of the urban people only 18.1% of the people avails the banking facility. This shows that the majority of the peoples are still out of the banking services. The Government of India and RBI have been made a serious effort to foster the financial inclusion in the country. These efforts include nationalization of banks, expansion of branches of various banks, initiative on priority sector lending, lead bank scheme, zero balance account, etc. Even though RBI initiated these schemes for the financial inclusion, still large sections of the peoples are excluded from the formal financial institutions. The poor and weaker sections of the society are kept out of the financial services. At the national level, commercial banks play a decisive role in promoting financial inclusion. The present study focuses on the depth of financial inclusion provided by these banks.

Objectives:

1- To compare the financial development of various states
2- To examine the extent of financial inclusion in the different sates of India.

For handiness, this paper is divided into five sections. The first section gives the back ground of the study. The second section considers the methodological aspects of the present study. Section three examines the degree of financial development of different states of India. Section four analyse the financial inclusion of various states and UTs of India. Conclusion and summary are given in the last section.

Data and Methodology

In this section, we describe the data sources and other methodology used in this study. We have drawn data from RBI, CSO, and NSSO. Empirically, the direct measurement of economic development is difficult. The financial

development can be measured by its depth, access, efficiency, and stability. In this paper we consider only financial depth and access. The depth of financial development can be measured by various indicators like credit to NSDP ratio, deposit to NSDP, gross value added by the financial sector to NSDP and the number of financial institutions in the state. By using the indicators of number of branches per 1000, accounts per 1000, number ATMS we can measure the accessibility.

The financial inclusion can be measured either by index or simply by its user side and provider side indicators. The share of adults who own an account is user side indicator. Bank branch density and ATM density comes under provider-side indicator. In this study we use these indicators of financial inclusion to measure financial inclusion. These indicators include penetration (Number of bank accounts as a proportion of the total adult population), availability of banking service (Number of bank branches per 100 population) usage of banking services(Volume of credit and deposit as a proportion of the state's Net State Domestic Product and the number of ATMs per 10000 people. We measure financial depth by bank debt and credit to NSDP .

Financial Development in India

The analysis clearly indicates a wide disparity in financial development across the region. The volume of credit to NSDP is found to be high in the Western Region (0.950) and Northern Region (0.862). The Credit to NSDP is very poor in the North-Eastern Region (0.198) and Eastern Region (0.359). In the case of deposit to NSDP the western Region and Northern Region has placed at the top level. Their Deposit to NSDP ratio is 0.98 and 1.09 respectively. Based on the indicator of value added by the financial sector to the NSDP the financial depth can be found in the Western and Northern, and Southern states. These three indicators clearly depict the financial development of Western and Northern Region.

Table 1: Basic Financial Development Indicators (Region Wise)

SL NO	REGION	CREDIT-NSDP	DEPOSIT-NSDP	VALUE ADDED
1	Northern	0.862	0.983	7.775
2	North-eastern	0.198	0.580	3.557
3	Eastern	0.359	0.708	4.896
4	Central	0.314	0.665	4.665
5	Western	0.950	1.092	8.978
6	Southern	0.698	0.730	6.259

Sources: Author calculation based on BSR2012 and Handbook of Statistics of Indian Economy

Table 2: Basic Financial Development Indicators-Highest and Lowest States

CREDIT-NSDP RATIO	STATE	CREDIT-NSDP	RANK	DEPOSIT-NSDP RATIO	STATE	DEPOSIT-NSDP	RANK
	Delhi	2.194	1		Delhi	2.296	1
	Chandigarh	2.163	2		Chandigarh	1.873	2
	Maharashtra	1.22	3		Maharashtra	1.329	3
	Tamil Nadu	0.815	4		Goa	1.208	4
	Manipur	0.137	29		Manipur	0.438	29
	Nagaland	0.137	30		Andaman & Nicobar Islands	0.428	30
	Arunachal Pradesh	0.136	31		Rajasthan	0.409	31
	Uttarakhand	0.032	32		Uttarakhand	0.092	32

Sources: Author calculation based on BSR 2012 AND NSDP DATA

In the state wise analysis the credit to NSDP is found to be high in the states of Delhi, Chandigarh, Maharashtra and Tamilnadu. A poor ratio is found in the some states like Arunachal Pradesh, Manipur, Meghalaya , Nagaland and Uttarkhand (see table 2). Delhi, Chandigarh, Maharashtra and Goa have been occupied highest position in the Deposit to NSDP ratio. Delhi and Chandigarh occupied highest position in the Deposit to NSDP ratio. A poor indicator is observed in Manipur, Andaman, Rajathan and Uttarkhand .

The next financial development indicator is the value added by the banking and insurance sector in to the NSDP. It is found to be high in Delhi, Chandigarh, and Maharashtra. But at the same time the states like Arunachal Pradesh, Meghalaya, Assam, Sikkim, Rajastan and Chattisgarh ranked poorly in this indicator (see table 3). This analysis shows a great disparity in the financial development of the states.

Table 3: Value Added By the Banking and Insurance Sector

STATE	Value added	RANK
Chandigarh	18.21	1
Delhi	18.202	2
Maharashtra	10.785	3
Tamil Nadu	7.071	4
Manipur	2.51	29
Andaman & Nicobar Islands	2.494	30
Arunachal Pradesh	2.218	31
Uttarakhand	0.503	32

Sources: Author calculation based on Handbook of Statistics of Indian Economy

Financial Inclusion in India

The analysis shows a wider interstate disparity in the financial inclusion indicators. Northern region, southern region and western region holds more than one account per individual. The branches of commercial banks are concentrated in the northern, southern and western region. The percentage of unbanked population is higher in north-eastern and eastern regions. North-Eastern Region, Eastern Region and Central Region have less bank branches than the all India average of 0.96 branches per 10000 adult populations.

Table 4: Basic Financial Inclusion Indicators (Region Wise)

SL NO	REGION	ACCOUNT/100	BRANCH/10000	ATM/10000
1	Northern	105	1.3215	2.12736
2	North-eastern	60	0.6691	1.86273
3	Eastern	62	0.6812	1.442562
4	Central	73	0.7630	1.256833
5	Western	99	1.0259	1.950803
6	Southern	109	1.2567	2.044258

Sources: Author calculation based on BSR 2012, NSSO and CSO Data

Table 5: Basic Financial Inclusion Indicators (State Wise)

SL.	STATES	ACCOUNT/100	BRANCH/10000	ATM/10000
1	Haryana	107	1.3755	2.5293
2	Himachal	122	1.9124	2.2853
3	Jammu	96	1.1385	1.8009
4	Punjab	131	1.7619	2.6136
5	Rajasthan	62	0.8525	1.1321
6	Chandigarh	277	3.8781	6.4742
7	Delhi	226	2.1451	5.8685
8	Arunachal	62	0.8194	1.3401
9	Assam	63	0.6169	1.1010
10	Manipur	35	0.4211	0.9901
11	Meghalaya	58	0.9882	1.2842
12	Mizoram	53	1.1953	0.9907
13	Nagaland	43	0.6400	1.4934
14	Tripura	74	0.8427	1.0821
15	Bihar	47	0.5473	0.5696
16	Jharkhand	49	0.5940	0.7577
17	Odisha	72	0.9043	1.2722
18	Sikkim	81	1.6286	2.8913
19	West Bengal	79	0.7511	1.1095

20	A&N Islands	108	1.3541	2.7377
21	Chhattisgarh	58	0.7298	1.1611
22	Madhya	66	0.7773	1.1563
23	Uttar Pradesh	75	0.7157	0.7177
24	Uttarakhand	109	1.6608	2.3561
25	Goa	294	3.9652	6.6289
26	Gujarat	90	1.0535	1.7931
27	Maharashtra	101	0.9700	1.9405
28	Dadra & Nagar Haveli	117	1.3661	3.1419
29	Daman & Diu	136	1.5718	4.1606
30	Andhra	105	1.1046	1.9008
31	Karnataka	111	1.3233	2.3334
32	Kerala	121	1.6724	2.3599
33	Tamil Nadu	107	1.1806	2.4716
34	Lakshadweep	111	2.0972	1.9225
35	Puducherry	136	1.5335	3.1477
	ALL-INDIA	**86**	**0.9566**	**1.5188**

Sources: Author calculation based on BSR 2012, NSSO and CSO Data

If we consider the bank accounts per hundred peoples, states like Haryana, Himachal Pradesh, Goa, Punjab, Delhi Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Pondicherry, Uttaranchal, Chandigarh, , Haryana, Andaman and Nicobar
islands, Maharshatra, Dam and Diu, Dadra & Nagar Haveli and Gujarat occupies highest position, above the national level(86). It means an average individual has more than one bank account. But at the same time there are highly unbanked areas in the country. These state include Arunachal Pradesh, Meghalaya, Assam, and Chattisgarh, approximately 40 % of the people do not have any bank account. It is very worst in the case of Jharkant, Bihar, Manipur and Nagaland.

An interstate disparity can also be seen in the availability of banking services. This is measured by the number of branches and the number of ATMs per 10000 people. The availability of bank branches is very low in the states of Assam, Manipur, Nagaland, Bihar and Jharkhand. Delhi occupies highest position in the availability of bank branches. It is evident that Northern Region , Sothern Region and Western Region has more ATMs than any other group of states. The availability of ATMs is high in Goa and Delhi. The worst case is observed in Manipur, Mizoram, Jharkhand, and Uttarpradesh (see table 5)

Summary and Conclusion

In this paper an attempt has been made to compare the financial development and financial inclusion of various states and UTs in India. Empirical results show the extent of disparity in the financial development and financial

inclusion. Region-wise analysis reveals that the Northern Region, Western Region and southern regions of the country are financially developed than any other regions. These regions also more included in the financial services provided by the banks. In India, still a large section of the population is excluded from the formal financial services. The supply of financial services provided by commercial banks is very low in the certain regions of the country. It is evident from the availability of bank branches and ATMs/1000 people. Thus the Government must design a special inclusion plan for these financially excluded areas. This will automatically bring them in to the net of financial services. The Reserve Bank of India must consider a special priority lending facility to the areas with low level of financial inclusion, especially for the North-eastern and eastern region.

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Kerala Public Libraries Act – Authority and Finance in the Perspective of Library Legislation in India

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Keywords: Public library, library legislation, library authority, library cess

Introduction

There has been a long and chequered history of public library legislation in Kerala. The abortive attempts for a library law for the State can be traced since 1946 when Ranganathan drafted a Bill for Travancore State at the request of Sir. C. P. Ramaswamy Iyer, the then Dewan of the princely state. Ranganathan drafted a bill for Cochin State too at the request of the then Education Minister Panampalli Govinda Menon. There has been a trace of public library law in Malabar being a part of Madras Presidency with a public library law enacted in 1948. After the formation of the Kerala State, Ranganathan drafted a Bill along with a thirty-year development plan at the request of the first Chief Minister.

E. M. S. Namboodiripade

There must be some factors causing a long delay in the enactment of public library law in the State while all the neighbouring states in South India got through the enactment of public library legislation, though Kerala being a state with the presence of a strong public library movement at the initiative of the Kerala Granthasala Sanghom. I am not going to an introspection of these factors as they are not relevant now.

However, after a long struggle, the Kerala State has been provided a legal basis for the public library organization and service in 1989. The Kerala Public Libraries Bill was introduced in the State Legislative Assembly by the Education Minister. K. Chandrasekharan on 25th January 1989. More than 1600 amendments were moved on the original Bill and 60 were accepted. The Bill in the course of the discussion in the Assembly was renamed as the 'Kerala Public Libraries (Kerala Granthasala Sanghom) Bill. The Bill was unanimously passed in the Assembly on 23rd February 1989. The Kerala Granthasala Sanghom (KGS) is deemed to have been merged in the Kerala State Library Council. Earlier the KGS was taken over by the State Government to resolve the internal tussle in the Sanghom in 1977.

Objectives

The Model Public Libraries Act drafted by S.R. Ranganathan in 1972 which is the final version of the bills he drafted since 1930 when he presented one in the library section of the All Asia Educational Conference at Varanasi and the subsequent bills he drafted from time to time which came into force in a few states with some amendments, emphasises in its preamble the objective of the establishment and maintenance of a system of public libraries. The Model Public Libraries Bill drafted by the Committee under the Chairmanship of M. D. Sen in 1963 for the Ministry of Education, Government of India and all the public libraries acts in force in India do not maintain the view of establishing and maintaining a public library system in a state, but rather provides for unitary libraries.

The Kerala Public Libraries Act (KPL Act) aims at reorganising the public libraries under different streams like

libraries organised by local bodies, grant-in-aid libraries affiliated to the Kerala Granthasala Sangham and libraries established by the local library authorities in the erstwhile Malabar as per the provision of the Madras Public Libraries Act (1948) which came into effect in the Malabar area as it was once under the jurisdiction of Madras Presidency. The KPL Act seems to be in consonance with the Model Public Libraries Act (1972) with regard to the objective of establishment and organisation of public library system which envisages a well-knit network of libraries planned in an hierarchical structure with village libraries at grassroots level coming under the central public libraries at taluk and district and state levels. Even after two decades of the enactment of a library law in the state no such central libraries have been established to bring the grant-in-aid libraries under hierarchical structure of a public library system as envisaged in the KPL Act.

Library Authorities

Unesco principles of public library legislation strongly advocated for the Minister for Education/Public Libraries to be made the State Library Authority (SLA) as the minister is directly responsible to the legislature and through it to the people at large. The public library legislation experts such as Gardner, Hewitt and Ranganathan too recommended the Minister for Education or the Minister for Public Libraries to serve as the SLA as it gives a unified command from the administrative point of view and also it justifies direct representation in the state legislature. Even a nominated council with the Minister for Education as the President/Chairman is not recommended for being the SLA as it is desirable to make only one person instead of a body corporate to be the supreme authority for providing so important an activity as the provision of public library and information services.

While Unesco Principles and Model Public Libraries Act provide for a library council to advise the Minister in all matters relating to the organization of public library services in the state, the Model Public Libraries Bill (1963) of Ministry of Education, Government of India and the State Public Libraries Acts in India provide for no separate library council to advise the Minister

but rather for a council which would serve as library authority as well as library council or as an advisory council alone.

Kerala belongs to a group of states with a library council which is vested with both library authority and advisory functions. While Model library bill/act and state library acts in India provide for an adequate professional content in the state library council, the Kerala state library council vested with both authority and advisory functions has only a token representation to library profession. The council with this token professional representation seems to be incompetent to have a high authority in the library policy making process and to advise the government in the entire library affairs in the state. The matter becomes more serious when there is no provision for a highly qualified person with rich experience to be the state librarian/director discharging the executive authority (secretary) of public library policies and programmes in the state as recommended by Ranganathan.

Three-Tier System

The KPL Act provides for a three tier structure of library authorities at taluk, district and state levels – Taluk Library Council (TLC), District Library Council (DLC) and State Library Council (SLC). And all these statutory bodies are constituted with representatives of the bona fide users of the grant-in-aid libraries affiliated to the KGS through a democratic electoral process. But the meager or no representation to the library professionals in these library authorities can not be compensated with the adequate representation to user community.

City Library Authority

City Library Authorities have been constituted in the State Public Library Acts with a view to meeting the increasing needs of the urban users with complex and diverse nature. Ranganathan has advocated for a city library authority taking the size of population as the criterion for such an entitlement to a municipal town. The Public Libraries Acts of Madras, Andhra Pradesh, Karnataka, Maharashtra and Haryana provide for City Library Authority for metropolitan cities and big municipal corporations. Kerala is a state with a strong public library movement at

grassroots with four thousand and odd village libraries affiliated to the KGS. The democratically elected library authorities certainly reflect the aspirations of this movement. On the other hand, the absence of city library authorities for metropolitan cities in the state shows the failure to assess the complex and varied information needs of urban community especially in the context of emerging information communication technologies.

Library Finance

Public library law should provide for the various sources of finance and the mechanism to mobilise it. A library fund is maintained to meet all the expenses for the development and organisation of public library services in the state. The library fund is maintained generally at state and local levels.

The Unesco principles of Public Library Legislation provide for an authority for library taxation by the local authority. It also allows allocating part of general taxation (budget allocation and grants) to public library funds. The Unesco provides for a financial grant from the state government and also from the central government in a federal set up.

The Library Development Plan drafted by S. R. Ranganathan (1950), National Policies on Library and Information Systems drafted by Raja Rammohun Roy Library Foundation (1984), Indian Library Association (1985) and Chattopadhyaya Committee under the Ministry of Education, Government of India (1986) recommend six per cent of the annual education budget of the State to be set apart for the development and organisation of public library services in the State. An accepted form for public library expenditure is either one per cent of the total State Budget or five per cent of the education budget of the State.

The KPL Act provides only for a state library fund to be maintained by the state library council though there are three library authorities at taluk, district and state levels. The main sources of the library fund are the government grant allotted in the budget and library cess levied upon the property / building tax. The KPL Act is said to belong to the 'Madras pattern' of library legislation in India as it provides for both library cess and State Government grant through a budget allocation.

Library Cess

Ranganathan has recommended a wide tax base of a variety of items such as octroi, vehicle, profession, trade, calling and employment, apart from the land and building tax, for mobilizing the city library fund for organizing library services in cities and municipal towns. The KPL Act provides for no city library fund for meeting the varied information needs of urban community. The Act provides only for district library council for every revenue district covering both urban and rural areas in the district. The library cess levied in the form of a surcharge at the rate of five paise for every one rupee collected only on one item of tax either property or building will not bring sufficient amount required to meet the expenses of organizing library services especially in urban areas. A wide tax base of a variety of items as recommended by Ranganathan is required to moblise adequate amount for providing a variety of library and information services in the changing scenario of modern society. Though the rate of library cess in the KPL Act is well within the range of library cess being levied generally in the public library legislation in India, the Panchayats, Municipal Councils and Corporations entrusted to collect the cess are not prompt remit the amount collected to the state library fund.

Library Grant

The Karnataka Public Libraries Act (1965) is the most progressive library legislation in India in terms of library finance. It provides for an annual grant of an amount equal to three per cent of the land revenue collection of the district to be credited to the district library fund. The KPL Act provides for the allocation of an annual grant of a sum which shall not be more than one per cent of the amount allotted for education in the state budget for the year and to be credited to the state library fund maintained by the state library council which shall distribute amounts as may be required for district library councils and taluk library councils.

The KPL Act has obviously put a maximum limit for the grant allotted by the Government in the state budget, but it evades cleverly the minimum limit for the annual library grant to the

state library council. The evading statement may give the State Government a chance to sanction only a small portion of the amount allotted for the library grant from the education budget of the state, especially when the pressing demands for more grants are pending before the Government for some other subjects of immediate concern to the people, with the result that it may adversely effect the development of public library services in the State.

State Library Service

The KPL Act has not provided for a state library service that pools the manpower for the library and information service in a state. The state library service with the provision for recruitment, cadre, services, excellence etc is very essential for the establishment of a public library system and for providing quality library service in the state. A band of qualified librarians with proper training and cadre in modern librarianship should be made part of the state library services with opportunities for professional competition and excellence and paid from the consolidated fund of the state exchequer.

Conclusion

The KPL Act is enforced with a progressive view of streamlining the existing public libraries in the state and democratization of library authorities with a greater representation to library users and other stakeholders. But even after two decades of the enactment of the law the state has not yet been able to bring about a public library system in its true sense with all the traits of modern librarianship in the context of emerging information and communication technologies. The wrongly spelt out provisions while framing the KPL Act may be the reasons subscribed for this unhealthy development of public libraries. A lot has to be made to be to improve the public library situation in the state. Let us start this process with cleansing a number of evading provisions of the law, especially with reference to representation of library professionals in the library authorities, library finance, executive authority and recruitment and training of manpower services.

AN EVALUATION OF STUDENTS' AFFINITY TO INTERNET

Dr. Lakshmi Pradeep

Only connect, and the beast and the monk, robbed of the isolation that is life to either, will die.

[E.M.Forster, Howard's End (1910)]

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Barring the odd beast and monk, just about everyone is connected these days (Wellman, 2005). Internet has revolutionized the communication world. It has fundamentally changed the way people learn, play, create and communicate. Today it has become a part of our life. It is not just a technology, but an engine of social change, one that has modified work habits, education, social relations and maybe most important, our hopes and dreams.

The Internet scenario has undergone a transformation in the past few years. In 2015 it has reached 46.4% of the world population and 30% of Indian population. In 2010, it had penetrated 28.7 percent of the global population and only 8.5 percent of the Indian population (internetworldstats, 2016) India is one of the fastest growing Internet markets in the word growing at 14% in 2014 (internetlivestats, 2016). The increasing popularity of internet has attracted the attention of communication scholars, to

fathom its promising developments, uncertainties and lurking dangers in the horizon of our cyber society.

The net is so vast and growing at lightning speed that each person's experience with it can only be a tiny sample of the whole. 'I am not sure that I know what the internet is; I am not sure that anyone does' James Costigan (1999. P.XVII). The chameleon like nature of internet and its mutability makes it like a bowl of jelly, keeps on changing, meaning different things to different people at different times. The degree of affinity of different people to this medium is also different.

The benefit internet is capable of providing to the society depends to a large extent on what the users do with it and their attachment to the medium. So it was pertinent to gauge the affinity to internet among the students who happen to be the most avid users of internet. Media affinity can be described as an attitude toward a medium that reflects the importance people attach to a medium and its content. It is an indicator of audience attachment to a medium. The credit for conceptualizing affinity and developing a Likert scale to measure audiences' intensity towards television goes to Greenberg (1974) and subsequently Rubin (1981). This study focused on students as youngsters being instinctively exploratory and inquisitive take to new media technology more quickly. One can see the emergence of vertical networks that function between generations where the skills are no longer passed on from oldest to youngest but from teenagers to adults as they are early adopters and act as technological gurus who pass on information about new technology to the elders in the family. (Drotner, 1999).

Using a longitudinal approach the present study sought to gain an insight into the changing patterns of internet use and affinity. The first phase was a survey conducted in 2009. The second phase of the study in 2015 adopted quantitative and qualitative methods.

Objectives

To compare changes in the following social dimensions of internet in 2009 and in 2015 .

1. To assess students' Internet affinity and correlate it with Internet usage (i) longevity, (ii) regularity and (iii) time spent.
2. To gauge students' Internet affinity variations, in respect of demographic variables.
3. To assess the satisfaction from the Internet.
4. To explore popular websites amongst the students

Study Design

The study was conducted in two phases. In the first phase in 2009, survey was conducted using a questionnaire. To arrive at a representative student sample of Internet users in the state of Kerala, a multi- stage sampling procedure was adopted. A total of 900 students were surveyed in the three districts; 300 each in Thiruvananthapuram, Ernakulam, and Kozhikode districts respectively. Following elimination of 183 incomplete questionnaires, the sample size was reduced to 717.

In this study, Rubin's affinity scale (1981) was adapted to assess the importance of Internet among students. The five-point, five-item Likert type scale consisted of the following five statements: (i) I would rather access Internet than do anything else, (ii) I could easily do without Internet for several days, (iii) I would feel lost without Internet, (iv) If I am unable to access Internet I would not miss it, and (v) Accessing Internet is one of the most important things I do each day. For each statement, respondents were expected to indicate their level of agreement on a five-point scale ranging from strongly disagree to strongly agree which were to be scored from 1 to 5 to develop an affinity index. The affinity index could range from 5 – 25. The higher the mean index score, the higher is the affinity; the lower the score, the lower the affinity towards Internet.

Internet usage pattern was explored from three perspectives of

(i) longevity of use, (ii) regularity of use, and (iii) time spent using Internet. The influence of demographic variables on affinity was examined.

In the second phase quantitative and qualitative methods were used. In December 2015 data was collected from 50 students using a questionnaire, and 10 students were interviewed. The study seeks to make a comparative analysis of internet affinity in 2009 and 2015.

FINDINGS

This longitudinal study seeks to throw light on changing trends and patterns of Internet use and affinity from 2009 to 2015 amongst students from different demographic categories.

1. Affinity

In 2009 students did not have a strong attachment to internet. Using the affinity scale , the affinity score could range from 5 to 25. But their mean affinity score was a mere 13.12 (Std. deviation 4.62; std error .17), so students' Internet affinity could best be described as moderate. Perhaps, this could be attributed to the fact that Internet was comparatively a new medium in India in 2009 and affinity was yet to get firmed up.

By 2015, much water had flowed under the bridge, the scenario was transformed. With a mean affinity score of 20.8 clearly their affinity to internet has increased remarkably. A majority have developed a strong attachment to this medium as it is an important, inseparable part of their life.

2. Longevity of Internet Use

In 2009 rural students formed the bulk of the new users of Internet (76%), ie those who had used internet for less than 6 months. This substantiates the proposition that technologies often spread from the urban centres to rural hinterlands. Such a disparity between urban and rural areas has been noted even in some parts of developed countries like rural US, Canadian North, Australian Outback (Hudson, 2007). Students from high income families had a longer experience of using Internet. Historically those with disposable income are the early adopters of technology.

However by 2015, 90% of the students have been using the internet since more than three years. Hence it has become a part of their lives. Yet glimpses

of the second level digital divide existed in terms of quality of access, defined in terms of factors such as the technical specifications of smartphones, broadband connections, multiple internet access points, speed of connectivity and related peripherals. This difference was seen between the high income and low income groups.

3. Regularity of Internet Use

Early research had suggested that girls lagged behind in using Internet as they had less access to computers (Kubey & Larson, 1990). The results of the 2009 phase of this study also lent support to the existence of the 'gender gap' in Kerala as male students were more regular users of Internet than females. So also, the younger and affluent school students residing in urban locations scored high on Internet use regularity. One plausible reason for the female students lagging behind in regularity of Internet use in 2009 could be lack of Internet facilities at home and colleges. More than one-third of the sampled students reported using Internet at cybercafés. Many girl students mentioned about societal pressures which inhibited them from going alone to cybercafés.

However the popularity of inexpensive smart phones coupled with falling internet prices has helped to bridge the gender gap and digital divide. Most of the students are regular users of the internet with 87% accessing it on a daily basis. Many access net on their smart phones.

4. Time Spent

In 2009 students from higher income families were spending more time on the net than their less affluent counterparts. By 2015, income was not significant. Now students are spending more time on net compared to 2009, with 26% spending more than 2 hours daily, now the pattern of time spent has also changed. Earlier they were sitting for longer periods of time at one stretch, but now they are accessing net frequently, but only for a short period of time. The reason is that most students are accessing net on their smart phones, which is always easily accessible to them. They frequently check WhatsApp, Facebook. Is this the beginning of internet addiction

amongst youngsters? The falling cost of smart phones and internet access has brought it within the reach of average middleclass. The few students who do not have internet access in phones or at home, use net occasionally, and whenever they use for specific purposes, spend more time at one stretch.

5. Correlation of Internet Affinity with Usage Longevity, Regularity and Time Spent

It is appropriate to assess the possible relationship between Internet affinity and the three dimensions of Internet usage – longevity, regularity and time spent – as these also indirectly reflect the importance students attach to Internet. So the four variables were subjected to Pearson correlation. A positive correlation would suggest of a linear relation where one is reflective of the other. The results reported in Table 1 demonstrate the presence of a positive linear correlation between and among them. The strongest correlation (.441) was between Internet affinity and regularity of usage followed by time spent on Internet activity (.347) and longevity of Internet use (.272). There was also a positive correlation among the three Internet usage dimensions: regularity of use, time spent and longevity of use.

Table 1

Correlation of Internet Affinity, Usage Longevity, Regularity and Time Spent

Variables	Affinity	Regularity	Time spent	Longevity
Affinity	1.000			
Regularity	.441 (.000) **	1.000		
Time spent	.347 (.000) **	.240(.000) **	1.000	
Longevity	.272 (.000) **	.281(.000) **	.382(.000) **	1.000

Note: Pearson correlation is significant beyond .01 level (2- tailed)

Perhaps, it is the regularity of Internet use that defines users' affinity. Those who consider Internet an important media, in all probability access it regularly and thereby attach a high importance to it.

Such a correlation unambiguously points out that affinity is a reflection of the three usage dimensions of regularity, longevity and time spent. That being the case, there is immense scope to examine whether the three usage dimensions could be used in conjunction to assess the affinity to a medium. In fact, there is a need for an alternative affinity determinant to Rubin's affinity scale as the five statements of the scale are not free of semantic shortcomings. A summated index of the three media usage dimensions of regularity, longevity and time spent could be used in lieu of Rubin's affinity in ascertaining the affinity to a medium.

6. Internet Affinity and Gender

Affinity was higher among male students (mean 13.88) in 2009.

Table 2

T Test – Affinity and Gender

Gender	N	Affinity Mean	Mean Difference	Standard Deviation	*T*	Df	Sig (2-tailed)
Male	327	13.88	1.41	4.84	4.114	715	.000*
Female	390	12.47		4.33			
Total	717	13.12					

***Note:* * *t* is significant at the .01 level and beyond (2-tailed)**

In 2015 no significant differences were seen in affinity patterns amongst males and females. Perhaps it is an indication that the gender divide is narrowing.

7 Internet Satisfaction

In 2009 a whopping 86.8 per cent of the respondents expressed satisfaction with the medium.

Table 3: Internet Satisfaction

Level of satisfaction	N (%)
Satisfied	622 (86.8)
Neither	87 (12.1)
Not satisfied	8 (1.1)
Total	717 (100.0)

Satisfaction levels increased in 2015 to 92%.

8. Popular websites

Which are the websites or Apps commonly frequented by students today? A notable finding in 2015 was the overwhelming popularity of WhatsApp, followed by Google, Facebook, Wikipedia, and Youtube in that order. In 2009 Google, was ranked first, followed by Orkut, Gmail, Yahoo and Facebook. Email which was one of the popular uses of internet is no longer important for the students, as they increasingly turn to Whatsapp, Facebook or Twitter for interpersonal and group communication. Pass time, and social interaction appear to be the primary drivers of net use amongst youngsters. These findings were also reflected in latest figures released by Mobile messaging App WhatsApp. It has crossed the one billion user milestone globally with the addition of 100 million users in the last five months. Nearly one in seven people on earth use WhatsApp each month to stay in touch. 42 billion messages, 1.6 billion photos and 250 million videos are shared everyday on the platform (Indian Express, 2016). Online banking, shopping, downloading music and films have also become more popular now.

Wikipedia is the most popular informative website. Very often it is used for assignments, seminars. Many students said it was the only site they referred for assignments, and often they did not search in other detailed websites. Perhaps this gives an indication of the 'cut, copy, and paste' culture very common among youngsters, wherein they don't bother to seek detailed knowledge on that topic.

The interviews with students reveal they are yet to realize the immense potential of WWW in serving their education related needs despite the fact that it is a treasure trove of information and education on every conceivable subject. Some of the reasons could be lack of awareness about the education potential of the net, lack of efficacy in searching for educational content, limited high speed access, language barriers in educational content and expenses involved in downloading large amount of data.

Only in one college visited by the researcher for data collection in 2009 (Sacred Heart College, Thevara, located in an urban area in Ernakulam district), all post graduate classrooms were equipped with computers and Internet connectivity. Here, the postgraduate students were regular users of Internet. Even In 2015, other colleges have not yet adopted this practice. They have a centre where students can access internet, yet this is located away from the classrooms and does not give the convenience of having a computer in class. The practice in vogue in Sacred Heart College could be followed in other colleges. Higher educational institutions must change with time and utilize new media and new technology.

These findings demand the attention of society, in particular the education subsystem. Concerns arise as a large majority of students are using Internet for pass time and social interaction. This trend is disturbing as it negates the multimedia and interactive potentials of internet to serve the important instrumental uses of education and learning.

Yet another perspective has been put forward by technology writer Nicholas Carr in his seminal work 'Is Google making us stupid? What the Internet is doing to our brains'. He argues that Internet might have detrimental effects on cognition that diminish the capacity for concentration, contem-

plation and memory retention. "Thinking has taken on a staccato quality, I fight to stay focused having lost the ability to read and absorb a longish article or book" (Carr, 2008). But long term psychological and neurological studies have yet to yield definite results. Whenever any new media arrives, such fears are common in society.

The fast growing popularity of internet among Indian students certainly augurs well for it to become a medium of daily use. In general the students are enamoured of this medium and consider it important in their lives. The interviews suggest Internet use is associated with decline in traditional media use, such as newspapers more so among youngsters, as Internet is a more interactive and interesting option.

Some of these findings are on expected lines, some are pointers to future trends, and their implications are thought provoking, especially in the light of increasing diffusion of Internet in Indian society. Such studies besides providing a new theoretical framework to explain Internet will perhaps also give a framework for formulating policies suited to prevailing conditions.

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Fourier Analysis and Signals

Presentation in the Natioal Seminar at Govt. College, Mokeri 17, Jauary 2015
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1 Introduction

People appreciate only the things which are either beautiful or useful. Is this applied to mathematics also ? Yes, of course; since mathematics is both beautiful and useful. "The profound study of nature is the most fertile source of mathematical discoveries". Jean Baptiste Joseph Fourier's words about mathematical analysis in one of his writings. "...mathematical analysis is an extensive as nature itself... This difficult science grows slowly but once ground has been gained it is never relinquished. It grows, without ceasing, in size and strength, amid the constant error and confusion of the human spirit... it follows the same path when applied to all phenomena and interprets them all in the same language as if to attest to the unity and simplicity of the design of the universe and to make still more evident that unchanging order which presides over all natural laws..." Analysis plays a key role in achieving the technology related to processing and transmission of signals. Fourier Analysis, Wavelet Analysis, Frame Theory and many more come as tools in this line.

2 Fundamentals

Before we go into the details, let us look at some of the basic ideas. Any point in the three dimensional space is a vector. The tree vectors $\hat{i}$, $\hat{j}$ & $\hat{k}$ have special importance. Any vector $\vec{r}$ can be written as

$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$$

where x, y & z are found using dot product

$$x = \vec{r} \bullet \hat{i}, \quad y = \vec{r} \bullet \hat{j} \quad \& \quad z = \vec{r} \bullet \hat{k}.$$

If $\vec{\mathbf{a}} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ and $\vec{\mathbf{b}} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ are two vectors, their dot product is $\vec{\mathbf{a}} \bullet \vec{\mathbf{b}} = a_1b_1 + a_2b_2 + a_3b_3$.

The vectors $\hat{i}$, $\hat{j}$ & $\hat{k}$ have the following properties.

- They are unit vectors.
- They are orthogonal to each other.
  (Means their dot product is 0.)
- Any vector can be uniquely expressed in terms of $\hat{i}$, $\hat{j}$ & $\hat{k}$.
- Dot product of any two vectors is found using the coefficients of $\hat{i}$, $\hat{j}$ & $\hat{k}$ in the expression of the vectors.

The concepts discussed so far in three dimensional spaces can be extended to *spaces* of higher dimensions. For that we need the special type of vectors that can generate all vectors. We call them the basis vectors. If $e_1, e_2, \cdots e_n$ are the basis vectors, then any vector $\vec{\mathbf{x}}$ in the n-dimensional space can be written as

$$\vec{\mathbf{x}} = x_1e_1 + x_2e_2 + \cdots + x_ne_n$$

where the coefficients $x_1, x_2, \cdots x_n$ are determined by $x_i = \vec{\mathbf{x}} \bullet e_i, \quad i = 1, 2, \cdots n$. Each vector in the n-dimensional space is an n-tuple. Each n-tuple can be considered as a function from the set $\{1, 2, \cdots n\}$ into the set of real numbers if the space is $\mathbf{R}^n$.

How can we pass on to infinite dimensional spaces ? To start with, consider a sequence $e_1, e_2, \cdots e_n, \cdots$ of vectors using which any vector $\mathbf{x}$ is expressed as a series of the form

$$\mathbf{x} = \sum_{n=1}^{\infty} x_n e_n$$

where the coefficients are determined by

$$x_n = \mathbf{x} \bullet e_n \quad \forall n.$$

As it is a series, the problems of convergence arise. Then we realise that sequences $\{x_n\}$ satisfying $\sum_{n=1}^{\infty} x_n^2 < \infty$ only are able to define vectors using the formula $\sum_{n=1}^{\infty} x_n e_n$. The space of all sequences of this type is called the l^2-space. For two such vectors $\mathbf{x} = \sum_{n=1}^{\infty} x_n e_n$ and $\mathbf{y} = \sum_{n=1}^{\infty} y_n e_n$, the dot product is defined as $\mathbf{x} \bullet \mathbf{y} = \sum_{n=1}^{\infty} x_n y_n$. We call it an inner product. The convergence is taken care of by $\sum_{n=1}^{\infty} x_n^2 < \infty$ and $\sum_{n=1}^{\infty} y_n^2 < \infty$ and the Schwarz inequality. As in the n-dimensional space, here also vectors can be considered as functions from the set $\mathbf{N}$ of natural numbers into the set $\mathbf{R}$ of real numbers. Thus if

$$\mathbf{x} = \sum_{n=1}^{\infty} x_n e_n$$

is a vector, then

$$\mathbf{x} \quad : \quad \mathbf{N} \longrightarrow \mathbf{R}$$

is a function defined as

$$\mathbf{x}(n) = x_n.$$

When told in a different way, a function $\mathbf{x} : \mathbf{N} \longrightarrow \mathbf{R}$ satisfying $\sum_{n=1}^{\infty} \mathbf{x}(n)^2 < \infty$ will represent a vector. Can we generalise the things further ? Answer is of course YES. In that case, how does the generalisation work ? Consider the class of functions $f : [a, b] \longrightarrow \mathbf{R}$ satisfying

$$\int_a^b f(x)^2 dx < \infty.$$

The space of such functions is called the $\mathscr{L}^2$-space. If $f \,\&\, g$ are two such functions, the inner product is defined by

$$< f , g >= \int_a^b f(x) g(x) dx.$$

Inner product may be defined even for complex valued functions as

$$< f , g >= \int_a^b f(x) \overline{g(x)} dx$$

where $\overline{g(x)}$ is the complex conjugate function.

With this much of ideas, we pass on to Fourier Analysis. Jean Baptiste Joseph Fourier (Born: 21 March 1768 - Auxerre, Bourgogne, France and Died on 16 May 1830 - Paris, France). By 1807, Fourier had completed a work that series of harmonically related sinusoids (related to sine and cosine) were useful in representing temperature distribution of a body. He claimed that any periodic signal could be represented by a series involving sine and cosine. The series is called a Fourier Series. He also obtained a representation for a periodic signals as weighted integrals of sinusoids – Fourier

Transform.

What is special with the sine and cosine functions ? It is simple to show that $\int_0^{2\pi} \sin(nx)dx = 0$. $\int_0^{2\pi} \cos(nx)dx = 0$. $\int_0^{2\pi} \sin(mx)\sin(nx)dx = 0$. $\int_0^{2\pi} \cos(mx)\cos(nx)dx = 0$ and $\int_0^{2\pi} \sin(mx)\cos(nx)dx = 0$.

The equations indicate pairwise orthogonality of members of $\{1, \sin(nx), \cos(nx) \,|\, n \in \mathbf{N}\}$.

A Fourier series is an expansion of a periodic function in terms of an infinite sum of sines and cosines.

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos(nx) + \sum_{n=1}^{\infty} b_n \sin(nx).$$

The numbers a_n and b_n for $n = 0, 1, 2, \cdots$ are called the Fourier coefficients.

These are obtained as

$$a_0 = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)dx$$

$$a_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos(nx)dx$$

$$b_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)dx\sin(nx)$$

Some more definitions are needed.

Periodic Function : For a function $f(x)$, if $f(x+L) = f(x)$ where L is the least positive number having this property, then $f(x)$ is said to be periodic with period L. As example, $\sin(x)$ and $\cos(x)$ are periodic with period 2π. $\sin(2x)$ and $\cos(2x)$ are periodic with period π. $\sin(nx)$ and $\cos(nx)$ are periodic with period $\frac{2\pi}{n}$. $\tan(x)$ is periodic with period π.

Periodicity can be seen in two forms.

- Time Periodicity.
- Spatial Periodicity.

At the time of Fourier, the real analysis was not much developed.
The concepts of convergence of sequence and series were not much known.
It will be more apt to say that such ideas did not exist at all among the mathematicians.
But years after when these ideas were developed, people could very easily explain what Fourier believed and presented in his papers.

Consider the function $f(x) = \begin{cases} 1 & 0 < x < \pi \\ -1 & -\pi < x < 0 \end{cases}$

It is not difficult to see that the Fourier series of the function to be

$$f(x) = \frac{4}{\pi}\left(\frac{\sin x}{1} + \frac{\sin 3x}{3} + \frac{\sin 5x}{5} + \cdots\right)$$

The graphs of $\frac{4}{\pi}\frac{\sin x}{1}$, $\frac{4}{\pi}\frac{\sin 3x}{3}$, $\frac{4}{\pi}\left(\frac{\sin x}{1} + \frac{\sin 3x}{3}\right)$ and $\frac{4}{\pi}\left(\frac{\sin 5x}{5} + \frac{\sin 7x}{7}\right)$ can be drawn without much effort. It can be found that consideration of more and more terms lead to the graph of a function written as a Fourier series.

If $\sin x$ and $\cos x$ are multiplied by a number, it affects the amplitude of the sine or cosine wave. In $\sin x$ and $\cos x$ if x is multiplied by a number, it affects the frequency of the sine or cosine wave. Fourier used only periodic functions and wanted the coefficients to be real numbers. In other words, only real valued functions with real arguments were considered. But later, people started working with complex arguments also. The theory developed and thus resulted in the Harmonic Analysis.

3 Fourier Transform

How do we treat the situation where there is no periodicity observed ? The best suggestion would be to take the period to be infinity. In other words, we assume the period $L \longrightarrow \infty$. For a function $f(x)$, the Fourier Transform is defined as

$$F(s) = \int_{-\infty}^{\infty} f(x)e^{-2\pi isx}dx.$$

Then

$$f(x) = \int_{-\infty}^{\infty} F(x)e^{2\pi isx}ds.$$

Euler's formula $e^{ix} = \cos x + i\sin x$, the Fourier Transform can be expressed in terms of Fourier Sine transform and Fourier Cosine transform. Fourier Transform decomposes a signal to complex exponential functions of different frequencies. We use slightly different symbols to wrtie the Fourier Transform once more. Taking **t** for time, **f** for frequency, **x** for the signal at hand (or source signal), **X** for the signal in frequency domain, we define Fourier Transform as

$$\mathbf{X}(\mathbf{f}) = \int_{-\infty}^{\infty} x(t)e^{-2i\pi ft}dt$$

and Inverse Fourier Transform as

$$\mathbf{x}(\mathbf{t}) = \int_{-\infty}^{\infty} x(f)e^{-2i\pi ft}df.$$

The Fourier Transform whether zero or non-zero (very close to zero or not close to zero) indicates the quality of the signal at hand in terms of its frequency and amplitude. The Inverse Fourier Transform helps to get back the signal when information about the requency and amplitude are known. But this method has lot of limitations. It is unable to say anything about the time at which the signal has been formed.

4 Other Transforms

Many different transforms were defined. Windowed Fourier Transform (or Short Time Fourier Transform) and Wavelet Transform are two among them. A wavelet means a "small wave". The ideas of the Hungarian mathematician Alfred Haar was the introduction in this field and are now known as Haar Wavelets.

The latest mathematical tool in Signal Analysis is the Frame Theory.

FOP 02. Analysis of gain and noise figure in various erbium doped fiber at four stage enhancement, [1]D.Vigneswaran and [1]C.Mahendran, *[1]Department of electronics and communication, Alagappa Chettiar College of engg and tech, Karaikudi, Tamil Nadu, India.* The main distributed components in optical communication system is, to amplify the optical signals at some tolerable loss, in which the erbium doped fiber is the most accountable component at the point of amplification over other amplifiers like semiconductor amplifier and Raman amplifier. The analyzed parameters are considered here is, gain and noise figure by which an optical communication system is predicted to utilize the EDFA component in respective applications.

FOP 03. Generation of ultra-short optical pulse in resonant periodic media with nonlinear management, [1]B. Kalithasan, [2]R. Vasantha Jayakantha Raja, *[1]Department of Physics, R.M.K. College of Engineering and Technology Puduvoyal, Kavaraipettai Thiruvallur, Tamilnadu, India; [2]Centre for nonlinear Science and Engineering, School of Electrical and Electronics Engineering, SASTRA University, Thanjavur, Tamilnadu, India.* By using the modulational instability (MI), generation of ultra-short optical pulse in resonant periodic media is studied in the presence of with nonlinear management. MI conditions identified in both anomalous and normal dispersion regimes. From a detailed linear stability analysis, the atomic detuning frequency has a strong influence on the MI. Especially in the normal dispersion regime, MI occurs without any threshold condition, which is in contrast with that of conventional fiber Bragg gratings.

FOP 04. Multi Channel Notch Filters using a pair of Mechanically Induced Long Period Fiber Gratings, [1]Anitha S Nair, [2]V.P.Sudeep kumar, [1]Hubert Joe, *[1]Department of Physics, Mar Ivanios, College, Nalanchira,Thiruvananthapuram, Kerala, India; [2]RTTC, BSNL, Trivandrum, Kerala, India.* A pair of mechanically induced long period fiber gratings formed over an optical fiber forms a series of interference fringes centered on the cladding mode resonant stop band of the grating. The fringe space separation depends on the separation between the MLPFGs. The formation of interference can be explained by assuming the optical path through the core and cladding of the fiber as the two arms of a Mach-Zehnder interferometer. The depth of the notches can also be varied by the application of pressure over the gratings. The device can be used as multi channel notch filter for wavelength division multiplexing applications.

FOP 05. Parity-time symmetric nonlinear coupler, [1]K. Aysha Muhsina and [2]P. A. Subh, *[1]Department of Physics, University of Calicut, Kerala, India; [2]Department of Physics, Farook College, University of Calicut, Kerala, India.* This work analyzes propagation of the soliton beam in a Parity-Time (P- T) symmetric nonlinear coupler using semi-analytical method and numerical analysis. In a nonlinear coupler, when the gain/loss coefficient exceeds the coupling constant, the intensity distribution becomes unstable due to the P-T symmetry breaking.

FOP 07. Two Dimensional spatial Solitons in a medium with Nonlinear dissipation and Parametric Gain, [1]C.P.Jaseera, [2]P.A.Subha and [2]Midhun Shah, *[1]Department of Physics, University of Calicut, Kerala, India; [2]Department of Physics, Farook college, Calicut, Kerala, India.* This work analyzes the dynamics of two-dimensional spatial solitons in a dissipative medium with parametric gain. Stable solitons are formed in two-dimensional medium in the presence of nonlinear dissipation. When the beam propagates in a medium with nonlinear dissipation and parametric gain, beam compression occurs.

FOP 08. MEMS Tunable Optical Filter, [1]Poorna Lakshmi U, [1]Balasubramanian M and [1]Prasant Kumar Pattnaik, *[1]Department of Electrical Engineering, BITS-Pilani, Hyderabad Campus, Hyderabad, India.* A simulation model of MEMS tunable optical filter based on circular ring resonator located on a silicon micro-machined cantilever beam is presented in this work. When the beam is electrostatically actuated due to the induced stresses, the resonance frequency of the ring resonator shifts. Thus by varying the voltage to the cantilever beam various frequencies can be filtered out. For the chosen cantilever beam at 40V, 3 GHz frequency shift in resonance frequency at 1550 nm has been achieved.

FOP 09. Gas Sensor using a Spiral Photonic Crystal Fiber, [1]E. Gunasundari, [1]K. Senthilnathan, [2]S. Sivabalan, [3]K. Nakkeeran, and [1]P. Ramesh Babu, *[1]Photonics, Nuclear and Medical Physics Division, School of Advanced Sciences, VIT University, Vellore, India; [2]School of Electrical Engineering, VIT University, Vellore, India; [3]School of Engineering, University of Aberdeen, Aberdeen AB24 3UE, UK.* We propose a new type of evanescent-wave gas sensor based on spiral photonic crystal fiber (SPCF) for air pollution monitoring. Here, we design the SPCF in such a way that it exhibits a broad spectral transmission band which could be used for detecting more gas condensate components. Besides, we study the fractional power inside the air holes, f, relative sensitivity, r and confinement loss, α for various designs. In this study, we are able to enhance the relative sensitivity to 0.6% at 0.760 μm wavelength which is the oxygen absorption line.

FOP 10. Supercontinuum Generation using a Silicon Multi-Nanocore Embedded Photonic Crystal Fiber: Optical Coherence Tomography, [1]Abdosllam M.

VIDEO ANALYSIS & MODELLING TOOLS FOR PHYSICS EDUCATION

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Video motion analysis is a technique used to extract information about moving objects from video by tracking a target point. Video modeliing enables us to make a video of a particular type of motion and to modify the motion parameters. Both these tools can be effectively used to study different types of motions by examining plots and real time processing. In this paper we checked the possibility of using video analysis to study simple harmonic motions of a pendulum and video modelling is used to model projectile and damped motions. The process is done using free software Tracker. This user friendly software provides the flexibility for real time analysis and there by helps the students to see how the change in different parameters and initial conditions affects the motion.

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Non Linear optical absorption studies in $Ga_5 Ge_{20} Sb_{10} S_{65}$ chalcogenide glass thin film

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In this paper we report the preparation and characterization of chalcogenide glass thinfilm GaGeSbS. Thermal evaporation technique is used to prepare the thin film. X-ray diffraction data reveals the amorphous nature of the film. The linear optical properties of the thin film were analyzed through the transmission spectra and reflection spectra. Non linear optical characterization of the thin film is studied by the z-scan technique using an Nd:YAG laser. The studies shows that the material is highly nonlinear. The thin film show saturable absorption and can be used in optical switching.

Introduction:

Chalcogenide glasses belongs to an important class of amorphous solids which contain at least one chalcogen element(sulphur, selenium and tellurium) as a major constituent[1]. Chalcogenide glasses have certain unique properties that make them a potential candidate for opto electronic application[2-4]. Their good infrared transparency, high refractive index, photosensitivity, low phonon energy and compatibility with low temperature processing make them suitable materials for optical integration. Chalcogenide glasses are sensitive to the absorption of electromagnetic radiation and show a variety of photo induced effects as a result of illumination. Various models have been put forward to explain these effects, which can be used to fabricate diffractive, waveguide and fiber structures. Chalcogenide glasses which are highly nonlinear have the ability to generate non linear phase shifts over much shorter interaction lengths compared to all other glass based devices so they can be considered as a good material for optical ultrafast non linear devices such as wavelength converters, optical kerr shutters and demultiplexers[5-7]. Several researchers detailed the linear and nonlinear optical properties of bulk and thin film chalcogenide glasses[8-11]. The thin film of chalcogenide glasses prepared by thermal evaporation technique can be used for most of the optical studies. We have used $Ga_5Ge_{20}Sb_{10}S_{65}$ system, has a glass transition temperature of 293^0c. it is an excellent material for producing infrared components operating in the mid and far infrared region[12].

Experimental Studies:

The chalcogenide glass used in this study was prepared by conventional melt-quenching method. We prepared $Ga_5Ge_{20}Sb_{10}S_{65}$ glasses by melting the Ga, Ge, Sb and S elements in an evacuated quartz ampoule. The ampoule is kept in a rocking and rotating furnace at 900^oc for 24h for thorough mixing and homogenization of the melt and then suddenly quenched to ice cold water. The amorphous nature of bulk glass is confirmed by X-ray diffraction technique(Bruker AXS D8 Advance X-ray Diffractometer). The thin film of the sample was prepared by thermal evaporation vacuum coating unit.

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The prepared thin film were characterized by optical absorption measurements(figure 1)` recorded by a spectrophotometer (Jasco V-570 UV-VIS-NIR). The optical band gap of the samples is calculated from the above measurement. The optical bandgap is taken to be the point at which the absorption changes from a quadratic dependence on energy to an exponential dependence. The optical transmission spectra and reflection spectra(figure 2) have been recorded using the same apparatus. They can be used for optical studies.

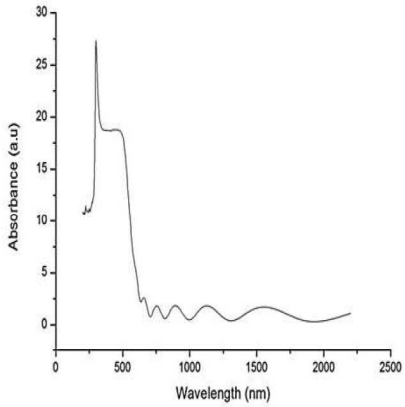

Figure 1*: Absorption spectra of* $Ga_5Ge_{20}Sb_{10}S_{65}$ *thin film*

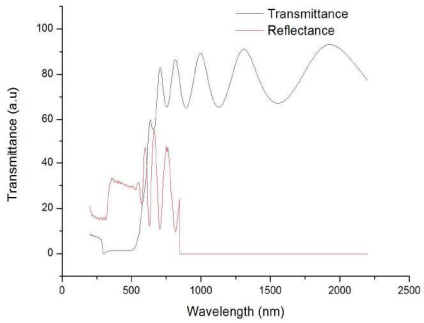

Figure 2:*Transmission and reflectance spectra of* $Ga_5Ge_{20}Sb_{10}S_{65}$ *thin film*

The nonlinear optical characterization of the sample was studied using the Z-scan technique. A Q-switched Nd:YAG laser(Spectra Physics Lab-1760, 532nm, 7ns, 10Hz) was used as the light source and the experimental setup is explained else where[13-15]. The thin film sample was mounted on a computer controlled translation stage to be moved along the z-axis through the focal point of a lens of 20cm in focal length. The radius of the beam waist ω_0 was calculated to be 35.4µm. the Rayleigh length $Z_o=\pi\ \omega_0^2/\lambda$ was found to be 7.4mm. the transmitted beam energy, reference beam energy and their ratio were simultaneously measured by an energy ratio meter(Rj 7620, Laser Probe Corp) having two identical pyroelectric detector heads(Rjp 735)[16].

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Results and Discussions:

The nonlinear optical properties of the sample were studied with the help of open-aperture z-scan technique. We have repeated the experiment by illuminating the sample on the same position so as to ensure that no permenant photoinduced changes has occurred to the sample during laser irradiation. The normalized transmittance for the open aperture is given by[17]

$$T = q^{-1} \ln (1+q) \quad (1)$$

$$\text{Where } q = ß\, I_o\, L_{eff} /(1+Z^2/Z_0^2) \quad (2)$$

Here I_0 is the laser intensity in the focal plane, ß is the nonlinear optical absorption coefficient, L_{eff} is the effective thickness with linear absorption coefficient α. L_{eff} is given by,

$$L_{eff} = (1 - e^{(\alpha l)}/ \alpha \quad (3)$$

The open-aperture curve exhibits a normalized transmittance, indicating the presence of saturable absorption (SA) in the thin film. Saturable absorption is a property of materials where the absorption of light decreases with increasing light intensity. Most materials show some saturable absorption, but often only at very high optical intensities (close to the optical damage). At sufficiently high incident light intensity, atoms in the ground state of a saturable absorber material become excited into an upper energy state at such a rate that there is insufficient time for them to decay back to the ground state before the ground state becomes depleted, and the absorption subsequently saturates. They are commonly used for optical switching[18].Normalized transmittance as a function of the position in the open aperture scheme at the wavelength of 532 nm with different laser power is shown in Figure(3).

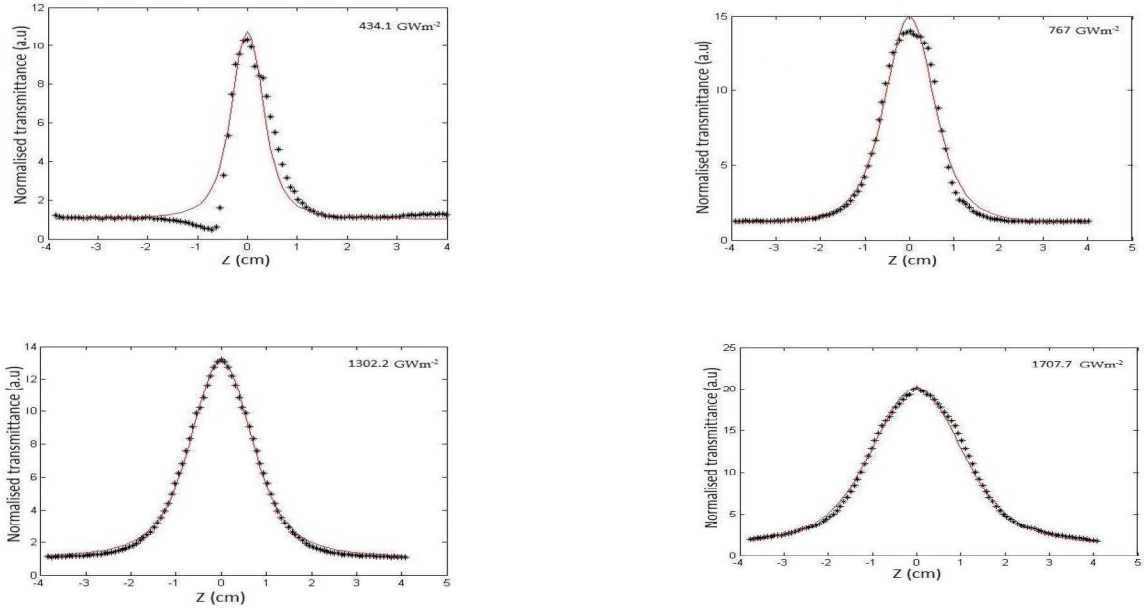

Figure 3:*Normalized transmittance as a function of the position in the open aperture scheme at 532nm with different laser powers. a)434.1GW/m^2 b)767 GW/m^2 c)1302.2 GW/m^2 d)1707.7 GW/m^2.*

NLS-23 Identifier: ISBN: 9788190332156 CP-04-22

	P1 **43.41 MWcm^{-2}**	**P2** **76.7 MWcm^{-2}**	**P3** **130.22 MWcm^{-2}**	**P4** **170.77 MWcm^{-2}**
β (cm/MW)	5.81	3.60	2.052	1.75
$\chi_i^{(3)}$ (cm/MW)	2.4x10^{-9}	1.54 x10^{-9}	0.878 x10^{-9}	0.74 x10^{-9}

It is evident from the above table that as the power is increased the value of nonlinear absorption coefficient deceases so is the value of imaginary part of third order susceptibility ($\chi_i^{(3)}$). The strength of nonlinear absorption depends on the value of $\chi_i^{(3)}$.

Conclusions:

The $Ga_5Ge_{20}Sb_{10}S_{65}$ chalcogenide glass thin film were synthesized and investigated. The nanosecond laser pulses were used to study the nonlinear response of these samples, which shows that they are highly nonlinear exhibiting saturable absorption. The studies shows that these materials are promising components for Optical switching.

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PCM 01. Investigation on synthesis and non linear Optical property of a novel material: L-cysteiniumchloride Nicotinamide Monohydrate, [1]V.Azeezaa, [2]A. Joseph Arul Pragasam, and [3]T.G. Sunitha, *[1]Department of Physics, Sathyabama University, Tamilnadu (Department of Physics, SRR Engineering College, Chennai, India); [2]Department of Chemistry, Pachaiyappa's College, Chennai, India; [3]Department of Physics, Sathyabama University, Chennai, India.* The high optical transparency L-cysteiniumchloride Nicotinamide Monohydrate (LCNM) crystals were grown by slow evaporation technique at room temperature. The grown crystal was subjected to optical studies. The optical studies ascertained high optical transparency and cut off wavelength was found to be 230 nm imperative for nonlinear applications. The optical constants, extinction coefficient, refractive index, optical conductivity, complex dielectric, optical band gap, reflectance were determined to scrutinize the electronic band structure highly demanded for optoelectronics applications.

PCM 02. Optical Properties of Europium doped Boro Bismuth Tellurite Glasses, [1]Keshavamurthy K and [1]B. Eraiah, *[1]Department of Physics, Bangalore University, Bangalore, India.* The glass system $(50\text{-}x)B_2O_3\text{-}30Bi_2O_3\text{-}20TeO_2\text{-}xEu_2O_3$ (x = 0, 0.1, 0.5, 1.0, 1.5 and 2.0 mol%) have been prepared by conventional melt quenching method, their physical and optical properties were investigated. Density of these glasses has been measured and corresponding molar volume of the glass system have been also calculated. The $(\alpha hu)^{1/n}$ vs *hu* graph was plotted and it is well fitted to both direct (n=1/2) and indirect (n=2) band gaps. The band gap values of direct and indirect band gaps are ranging from 2.57 to 2.94 eV and 1.74 to 2.58 eV respectively. The Urbach energy of the glass system was calculated and their values are ranging from 0.29 and 0.62 eV. Photoluminescence (PL) spectroscopy was used to examine emission spectra at 464nm excitation wavelength.

PCM 03. Nonlinear Spectroscopy of Three Level Cascade Systems, [1]Srinivasa Rao Allam and [1]Alok Sharan, *[1]Department of Physics, Pondicherry University, Puducherry, India.* We have carried out theoretical investigations on the nonlinear absorption of three level cascade systems under resonant excitation of 125 fs Gaussian at 671 nm. We present the result of effect of life times, absorption cross sections and photon flux on population among the energy levels for saturable and reverse saturable absorption. Further, we discussed about how the molecular dynamics present among their energy levels for different pulse widths and repetition rates.

PCM 04. Design Challenges and Complexities in Silicon Photonics, [1]T. Singaravelu and [1]A. Arun, *[1]Department of ECE, M.Kumarasamy College of Engineering, Karur, India.* In recent integrated circuit design techniques, design of optical communication chips is an emerging issue and the silicon photonics is an upward stream for high bandwidth applications. Also, applications are emerging in spectroscopy, data com and sensing. The best performance is made by assimilation of both photonics and electronics techniques. Side by side stacking is proceeded with the integration of electronics in a same chip. This combination introduces design problems, that arising at co design and co simulation of complex circuits on photonic circuit design, variability issues and verification algorithms. This paper shows an address of different challenges meet to evolve the requirements of photonic element IC designs. Similarly, photonics cannot be captured in an abstract model, it needs interface as electromagnetic solvers and also EDA tools and verification tools need to be extended for functional verification.

PCM 06. Photonic Crystal based Pulse Amplifier at 400nm, [1]B.Sai Venkatesh, [1]R. Ganapathy and [2]K. Porsezian, *[1]Centre for Nonlinear Science and Engineering, School of Electrical and Electronics Engineering, SASTRA University, Thanjavur, India; [2]Department of Physics, Pondicherry University, Puducherry, India.* A 'T-shaped' defect is introduced in a two-dimensional photonic crystal lattice made of silicon, and for a small-signal optical input, this structure thus acts as an optical amplifier. A detailed analysis yields optimal linear and nonlinear performance of the optical amplifier operating in the visible region with minimal leakage and distortion.

PCM 07. Optical limiting in nanocolloidal $Ga_5Ge_{20}Sb_{10}S_{65}$ chalcogenide glass, [1,2]P N Musfir, [1]C Ajina, [1]E M Aswathi, [1]Sheenu Thomas, *[1]International School of Photonics, Cusat, Cochin, Kerala, India; [2]Department of Physics, Farook college, Calicut, Kerala, India.* In this paper we report the preparation and investigation of nanocolloidal solutions of $Ga_5Ge_{20}Sb_{10}S_{65}$ Chalcogenide glass. It is based on nonlinear optical transmission by the open-aperture Z-scan technique, at the excitation wavelength of 532nm by using the nanosecond laser pulses. The Z scan spectra reveal a strong non-linear absorption (reverse saturable absorption) for the nanocolloid $Ga_5Ge_{20}Sb_{10}S_{65}$ solutions which makes it useful for optical limiting applications.

PCM 12. Electrical and Photopyroelectric studies of L-Proline Cadmium Chloride Monohydrate (L-PCCM) Single Crystals, [1]Prince Thomas, [2]Jacob Philip, [2]M. S. Jayalakshmy, [1]Bitto John, [1]Sreekanth G and [1]Ginson P.Joseph, *[1]Department of Physics, St. Thomas College Pala, Kottayam, India; [2]Department of Instrumentation, Cochin University of Science & Technology, Cochin,Kerala, India.* Single crystals of L-Proline Cadmium Chloride Monohydrate (L-PCCM) have been grown by slow

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On Partial Mean and the Lorenz Curve

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ABSTRACT

In the present paper we discuss certain functional relationships between the Partial mean and some economic as well as reliability concepts. Further some characterization results based on these concepts are also discussed.

1. INTRODUCTION

For a non-negative random variable X admitting an absolutely continuous distribution function F(x) with respect to Lebesgue measure, the r^{th} partial moment of X about a point t is defined as

$$p_r(t) = E\left[\left(X-t\right)^+\right]^r, \quad r = 0,1,2,\ldots \tag{1}$$

where $\left(X-t\right)^+ = \max(0, X-t)$

The partial moments can be used for model identification in the same way as truncated moments. Chong (1977) has characterized the exponential distribution by the property

$$E(X-t-s)^+ E(X) = E(X-t)^+ E(X-s)^+ \text{ for all real t,s>0.}$$

Gupta and Gupta (1983) have established that one partial moment is sufficient to determine the distribution uniquely. Partial moments of discrete random variables have been studied by Nair et.al(2000). Recently, Sunoj(2004) has obtained some characterization results using the partial moments in the context of length biased models and equilibrium distributions. For a detailed discussion on properties and applications of partial moments in reliability analysis, we refer to Hitha(1991).

The random variable $(X-t)^+$, defined in (1) is quite meaningful in the analysis of personal incomes. When X represents the income of an individual and t is the tax exemption level, $(X-t)^+$ represents the taxable income. Then $p_1(t)$ gives the average income that exceeds the exemption level. . In the present work we concentrate mainly on the first order partial moment $p_1(t)$. We use the notation p(t) for the partial mean $p_1(t)$ throughout this paper.

Although several attempts are available in literature aimed at studying properties and characterizations based on the functional form of partial moments, only very little work seems to have been done in examining its relationship with inequality measures such as Lorenz curve . The works of Chandra and Singapurwala(1981) and Sathar(2002) focuses attention on characterization of probability distributions using the summary measures of income inequality.

In the sequel we show that the partial moments uniquely determines the Lorenz curve and the income gap ratio, introduced by Belzunce et.al (1995). The connection between the partial mean and other reliability measures is also examined. Further we look into the problem of characterizing certain probability distributions using relationships between the partial mean and other summary measures.

NOTATIONS

We denote by

$$\bar{F}(x) = 1 - F(x) \quad \text{, The Reliability Function} \tag{2}$$

$$h(x) = \frac{f(x)}{\bar{F}(x)} \quad \text{, Failure Rate} \tag{3}$$

$$r(x)=\frac{1}{\bar{F}(x)}\int_{x}^{\infty}\bar{F}(t)dt \qquad \text{, Mean Residual Life Function} \qquad (4)$$

$$m(x)=\frac{1}{\bar{F}(x)}\int_{x}^{\infty}tf(t)dt \qquad \text{, Vitality Function} \qquad (5)$$

$$p(x)=\int_{x}^{\infty}\bar{F}(t)dt \qquad \text{, Partial Mean} \qquad (6)$$

$$\beta(x)=1-\frac{x}{m(x)} \qquad \text{, Income Gap Ratio} \qquad (7)$$

$$L(p)=\frac{1}{\mu}\int_{0}^{p}F^{-1}(t)dt \qquad \text{, Lorenz curve} \qquad (8)$$

where

$$F^{-1}(t)=\sup_{x}\{x/F(x)\le t\} \text{ with } \quad p=F(x)$$

The following theorems provide the Lorenz curve L(p) and the income gap ratio $\beta(x)$ in terms of the partial mean p(x).

Theorem 1 : Let X be a non-negative random variable admitting an absolutely continuous distribution such that $E(X)<\infty$. If L(p) represents the Lorenz curve and p(x) represents the partial mean, then

$$\frac{L'(p)}{1-L(p)} = \frac{x}{p(x)-xp'(x)} \tag{9}$$

Theorem 2 : For the random variable X considered in theorem 1, if β (x) represents the income gap ratio and p(x) the partial mean, then the following relationship holds.

$$\frac{\beta(x)-1}{x\beta(x)} = \frac{p'(x)}{p(x)} \tag{10}$$

The above theorems are immediate from the definitions of the partial mean, Lorenz curve and the income gap ratio.

Some similar relationships are

$$\bar{F}(x) = -p'(x) \tag{11}$$

$$h(x) = \frac{-p''(x)}{p'(x)} \tag{12}$$

$$r(x) = \frac{-p(x)}{p'(x)} \tag{13}$$

$$m(x) = x - \frac{p(x)}{p'(x)} \tag{14}$$

where $p'(x)$ and $p''(x)$ are the first and second derivatives of p(x) respectively.

2. CHARACTERIZATION RESULTS

Theorem 3 : Let X be a non-negative random variable admitting an absolutely continuous distribution with $E(X)<\infty$. If L(p) represents the Lorenz curve and p(x) the partial mean, then the relationship

$$\frac{L'(p)}{1-L(p)} = \frac{-p'(x)}{p(x)p''(x)} \tag{15}$$

holds for all real x≥0 if and only if X follows the Pareto type-I distribution with survival function

$$\bar{F}(x) = \left(\frac{\alpha}{x}\right)^{a}, x > \alpha, a > 1 \tag{16}$$

Proof : If (16) holds then

$$L(p) = 1-(1-p)^{\frac{a-1}{a}}$$

$$p(x) = \frac{\alpha^{a}}{a-1} x^{-(a-1)}$$

and the relation (15) is straight forward.

Conversely, if (15) holds, using (9) we arrive at the differential equation

$$p(x) - xp'(x) = cp(x)$$

Now using (6), (11) and the boundary conditions we get (16).

In reliability theory, a flexible model that has been widely used is the Generalized Pareto distribution with survival function

$$\bar{F}(x) = \left(\frac{b}{ax+b}\right)^{\left(\frac{1}{a}+1\right)}, x \geq 0,\ a>-1,\ b>0 \tag{17}$$

This model has been considered, among others, by Hall and Wellner(1981), and includes the exponential distribution ($a \to 0$), Lomax(Pareto) distribution(a>0) and the power distribution(-1<a<0). In the following theorems, we obtain some results characterizing the Generalized Pareto distribution based on the functional forms of the partial mean and the Lorenz curve.

Theorem 4: Let X be a non-negative random variable admitting an absolutely continuous distribution such that $E(X) < \infty$. The relationship

$$\frac{-p(x)}{p'(x)} = ax + b \tag{18}$$

holds if and only if X follows the Generalized Pareto distribution with survival function (17).

Proof : When X follow (17), by direct calculations we get

$$p(x) = b^{\left(\frac{1}{a}+1\right)}(ax+b)^{\frac{-1}{a}} \tag{19}$$

The validity of (18) is immediate.

.

Conversely, when (18) is true, using (13) we get

$$r(x) = ax + b$$

which is characteristic to the Generalized Pareto distribution and hence the result.

Theorem 5 : For the random variable considered in theorem 4 , the property

$$\frac{p(x)p''(x)}{\left(p'(x)\right)^2} = k \text{ , } k>0 \tag{20}$$

holds if and only if X follows the Generalized Pareto distribution with survival function (17).

Proof : When (17) holds, (20) is trivial using (19).

Conversely, when (20) holds, using (12) and (13) we get

$$h(x)r(x)=k$$

which is a characteristic property of Generalized Pareto distribution and hence the theorem.

Theorem 6 : For the random variable considered above, the relationship

$$\frac{L'(p)}{1-L(p)} = \frac{kx\left(p'(x)\right)^2}{p(x)p''(x)\left[p(x)-xp'(x)\right]} \tag{21}$$

holds if and only if X follows the Generalized Pareto distribution with survival function (17).

Proof: When (17) holds

$$L(p) = \frac{1}{a}\left[(a+1)\left[1-(1-p)^{\frac{1}{a+1}}\right]-p\right] \tag{22}$$

Using (19) and (22) , we get (21).

Conversely, when (21) holds, using (9) we get (20) and the result follows by theorem (5).

We give below a characterization result for the Pearson family of distributions specified by the differential equation

$$\frac{1}{f(x)}\frac{df(x)}{dx} = \frac{-(x+d)}{b_0+b_1x+b_2x^2} \text{ with } d=b_1,\ d,\ b_0,\ b_1,\ b_2>0 \tag{23}$$

$$2b_2>1$$

Theorem 7: For the random variable considered in the above theorem, the relationship

$$\frac{p''(x)}{xp'(x)-p(x)+E(X)} = \frac{k}{a_0+a_1x+a_2x^2},\ k,\ a_0,\ a_1,\ a_2>0,\ a_2>\frac{k}{2} \tag{24}$$

holds for all real x ≥o if and only if X belongs to the Pearson family of distributions specified by (23).

Proof : When (23) holds we get

$$\frac{d}{dx}\left[f(x)\left(b_o + b_1 x + b_2 x^2\right)\right] = \left[\left(2b_2 - 1\right)x + \left(b_1 - d\right)\right] f(x) \tag{25}$$

Applying the condition b_1=d in (25) and differentiating it with respect to x, we arrive at

$$f(x)\left(b_o + b_1 x + b_2 x^2\right) = \left(2b_2 - 1\right)\left[-x\bar{F}(x) + \int_0^x \bar{F}(t)dt \right] \tag{26}$$

Now using (6) and (11) , we get (24) where k=$2b_2$-1.

Conversely, when (24) holds using (6) and (11) we get

$$f(x)\left[a_0 + a_1 x + a_2 x^2 \right] = k\left[-x\bar{F}(x) + \int_0^x \bar{F}(t)dt \right] \tag{27}$$

Differentiating (27) with respect to x and simplifying we arrive at (23) where

$$d = \frac{a_1}{2a_2 - k},\ b_0 = \frac{a_0}{2a_2 - k},\ b_1 = \frac{a_1}{2a_2 - k},\ b_2 = \frac{a_2}{2a_2 - k}.$$

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قومی سیمنار کی روئداد

کعیل ومعاون یو۔جی۔سی (U.G.C)

اردو شاعری میں علاّمہ اقبال کی جدّتیں

۲۰۱۵ فروری ۲۰ - ۱۸

مدیر

سمینابی کے۔کے

مہتمم ومیزبان

شعبہ اردو، گورمینڈ برنن کالج، تلشیری، کیرالا۔670106

علامہ اقبالؔ کی شاعری کے چند رجحانات

ڈاکٹر سلیم پلسارکت

علامہ ڈاکٹر محمد اقبال کا نام اردو شاعری کے عظیم شعراء میں سرِ فہرست آتا ہے۔ ان کی شاعری کا مطالعہ ہر نقادوں نے مخصوص اور منفرد زاویوں سے کرنے کی کوشش کی ہے۔ وہ اس لئے کہ اقبالؔ کی شاعری میں فلسفے کی آمیزش کے ساتھ ساتھ غیر معمولی تاریخی و ثقافتی، عمرانی اور جمالیات کا شعور ملتا ہے۔ ان کی شاعری اسلامی، ہندوستانی اور یورپی نظریۂ حیات اور فن کے گہرے مطالعے کے بعد ہی وجود میں آیا ہے۔ اسی وجہ سے ان کی شاعری میں ہمہ جہت پہلو دکھائی دیتا ہے۔ بقول آل احمد سرور:

''وہ تین روحانی اقلیتوں کا شاعر ہے۔ ہندوستان، علمِ انسان اور مغرب۔ اس بنیادی حقیقت کو سامنے رکھے بغیر اقبال کے ساتھ انصاف نہیں ہوسکتا۔''

(دانشورِ اقبالؔ۔ آل احمد سرور۔ ص ۲۵۵)

اقبالؔ نے اپنا شعری مجموعہ سب سے پہلی بار فارسی میں شائع کیا تھا اور اردو سے زیادہ فارسی ہی میں شاعری کی ہے۔ ان کی مثنوی اسرارِ خودی ۱۹۱۵ء میں

منظرِ عام آیا اور رموزِ بے خودی اور پیامِ مشرق کی اشاعت کے بعد ہی اردو میں بانگِ درا شائع کیا تھا۔ان کے شعری مجموعوں کی اشاعت کی فہرست اس طرح ہے۔

۱۔ اسرارِخودی ۱۹۱۵ ۲۔ رموزِ بےخودی ۱۹۱۸ ۳۔ پیامِ مشرق ۱۹۲۳

۴۔ بانگِ درا ۱۹۲۴(اردو) ۵۔زبورِعجم ۱۹۲۷ ۶۔ جاوید نامہ ۱۹۳۲

۷۔ بالِ جبرئیل ۱۹۳۵(اردو) ۸۔ ضربِ کلیم ۱۹۳۶(اردو)

۹۔ پس چہ پیادکرد ۱۹۳۶ ۱۰۔ ارمغانِ حجاز ۱۹۳۸ (اردو اور فارسی)

ڈاکٹر اقبالؔ بیک وقت فلسفی، پیامی، فطری، حب الوطنی، سیاسی اور مذہبی شاعر ہیں۔اقبال کی شاعری کا سب سے پہلا موضوع فطرت کی تصویر کشی ہے۔یہ پہلو ہمیں ان کی ابتدائی دور کی شاعری میں زیادہ تر نظر آتا ہے۔ان میں ہمالہ، ایک آرزو اور شعاعِ امید جیسی نظمیں خاص طور پر قابلِ ذکر ہیں۔ان نظموں کے ذریعے اقبال ایک نیچرل شاعر کے روپ میں قاری کے سامنے آتے ہیں۔ بقول ڈاکٹر شوکت سبزواری۔

''اقبالؔ غالباً یورپ جانے سے پہلے جس نظر کے مالک تھے، ذوقِ حسن اس میں ڈھل گیا تھا۔لیکن ذوقِ حکمت کا رنگ ابھی اس میں نہیں آیا تھا۔اسی لئے حسین مناظر اور دلکش مناظر کی ظاہری چمک دمک ہی سے اسکی تسکین ہو جاتی تھی۔''

(اقبالؔ بحیثیت شاعر۔ پروفیسر رفیع الدین ہاشمی ص ۱۷)

البتہ اقبال کے یورپ جانے کے پہلے کی شاعری میں فکر سے زیادہ حسن کی پیش کش ہے۔انھوں نے اپنی ابتدائی دور کی شاعری میں مناظرِ فطرت کی تصویر کشی اور حب الوطنی کے موضوع پیش کر کے اپنی شعری ذوق کی پیاس بجھانے کی

کوشش کی ہے۔لیکن چند ہی عرصے کے بعد فکر ونظر کو بھی پیش کرنا شروع کیا۔ان کی ابتدائی دور کی نظمیں گلِ رنگین اور خفتگانِ خاک سے استفسار سے فکری پہلو کا ظہور ہوتا ہے۔

کام مجھ کو دیدہء حکمت کے الجھیڑوں سے
دیدہء بلبل سے میں کرتا ہوں نظارہ ترا
تم بتادو راز جو اس گنبدِ گرداں میں ہے
موت اک چبھتا ہوا کانٹا دلِ انساں میں ہے

اقبال کی شعر و شاعری کی تخلیق میں ایک خاص مقصدیت پائی جاتی ہے۔اس لئے ان کا ذہن شروع سے ہی ایک خاص مقصدیت پر مائل تھا۔خود اقبال نے اپنی شاعری پر لکھا ہے۔

''شاعری محض محاورات اور اظہار و بیان کی صحت سے بڑھ کر کچھ اور بھی ہے۔میرے معیار تنقید نگاروں کے ادبی معیاروں سے مختلف ہیں۔میرے کلام میں شاعری محض ایک ثانوی حیثیت رکھتی ہے۔مجھے قطعاً یہ خواہش نہیں ہے کہ دورِ حاضر کے شعرا میں میرا بھی شمار ہو۔'' (خطوطِ اقبال مرتبہ رفیع الدین ہاشمی ص ۱۳۳)

انھوں نے شاعری کے ہر دور میں مقصد کا خیال رکھا۔اس کے مطالعے سے ہمیں اقبال کی شاعری کی عظمت،مزاج اور پیغام کی قدر و قیمت کا اندازہ بخوبی ملتا ہے۔خواہ وہ ان کی ابتدائی دور کی شاعری میں ہو یا بعد کی۔مثلاً وطنیت پر ان کی نظم تصویرِ درد کو لے لیجئے۔اس میں محض حب الوطنی کو ظاہر نہیں کیا بلکہ ایک مقصد لے کر پیغام پہنچایا ہے۔چنانچہ ہم یہ کہہ سکتے ہیں کہ ان کی شاعری میں پیغمبرانہ انداز دکھائی دیتا ہے۔

نہ سمجھو گے تو مٹ جاؤ گے اے ہندوستاں والو
تمھاری داستان تک بھی نہ ہوگی داستانوں میں

اقبالؔ ایک پیامی شاعر ہے۔ وہ کبھی اپنا پیغام ملّی شاعر بن کر، کبھی قومی شاعر بن کر اور کبھی آفاقی شاعر بن کر دیتے ہیں۔ ان کا پیغام مشرق و مغرب دونوں کو جگانے کا ہے۔ اسی وجہ سے وہ عمل اور حرکت کا پیغام دیکر قوم کو جگاتے ہیں۔ ؎

عمل سے زندگی بنتی ہے جنّت بھی جہنّم بھی
یہ خاکی اپنی فطرت میں نہ نوری ہے نہ ناری
مشرق سے ہوں بیزار نہ مغرب سے حذر ہو
فطرت کا اشارہ ہے ہر شب کو سحر کر
خودی کو کر بلند اتنا کہ ہر تقدیر سے پہلے
خدا بندے سے خود پوچھے بتا تیری رضا کیا ہے

اردو میں ظفر علی خان، محمد علی جوہر، حسرت موہانی اور اکبر الہ آبادی نے اصلاحی، سیاسی اور انقلابی نظموں کا ایک بڑا سرمایہ بہم پہنچا دیا ہے اور یہ بھی صحیح ہے کہ ایسی نظموں کے ساتھ غزل بھی اپنے روایتی مضامین کے دائرے کو توڑ کر سیاسی، سماجی اور انقلابی موضوعات، نئی زبان اور تازہ کار شعری رویّے اپناتی ہے۔ لیکن سچ یہ بھی ہے کہ اس شعری سرمایوں میں اکثر و بیشتر نظموں اور غزلوں کی شاعری صحافتی شاعری کہلانے پر مجبور ہو جاتی ہے۔ لیکن اقبال ایسے موضوعات پیش کرتے ہوئے صحافتی انداز سے دور رہے۔ مثلاً:

سبق پھر پڑھ، صداقت کا، عدالت کا، شجاعت کا
لیا جائے گا تجھ سے کام دنیا کی امامت کا

مسلماں کے لہو میں ہے سلیقہ دل نوازی کا
مروت حسنِ عالمگیر میں ہے مردانِ غازی کا
مری نوائے شوق سے شورِ حریمِ ذات میں
غلغلہ ہائے الاماں بتکدۂ صفات میں

شاعری کے دو پہلو ہیں۔ایک فنّی یعنی لفظوں کی ترتیب وموزونیت اور موسیقیت۔دوسرا پہلواس کی تخیلی یا شعوری ترتیب ہے،جس کے ذریعہ شعر میں جوش وولولہ اور گرمی پیدا کر دیتی ہے۔علامہ اقبال نے اس پہلو کو خونِ جگر سے تعبیر کیا ہے۔

نقش ہیں سب ناتمام خونِ جگر کے بغیر
نغمہ ہے سودائے خام خونِ جگر کے بغیر

اقبالؔ کی شاعری میں فنّی اور فکری دونوں پہلو پائے جاتے ہیں۔اگر بالِ جبرئیل میں شعریت کا رنگ غالب ہے تو ضربِ کلیم میں شعریت سے زیادہ فکر کو اہمیت دی ہے۔وہ ایک مفکر ہونے کے ساتھ ساتھ بڑے فنکار بھی ہیں۔ان کے کلام میں گہرے اور عمیق فلسفیانہ خیالات موجود ہیں اور فن کی خوب صورت ملاپ بھی۔بقول صوفی غلام مصطفیٰ تبسّم:

''اس کا سب سے بڑا کمال یہ نہیں ہے کہ وہ ایک فلسفی ہے اور اس نے دنیا کو نئی حکمتِ زندگی سے روشناس کرایا ہے بلکہ اس کی عظمت اس میں پوشیدہ ہے کہ وہ حکیمانہ افکار کو شعر کے حسین اور رنگین پیرائے سے آراستہ کرتا ہے۔''

(اقبالؔ بحیثیت شاعر۔پروفیسر رفیع الدین ہاشمی ص ص ۱۰۳-۱۰۴)

اقبال ایک فلسفی شاعر ہیں۔انھوں نے فلسفۂ خودی کو اپنی شاعری میں

پیش کیا ہے۔ان کے ہاں خودی کا مطلب ہے خود شناسی یا عرفانِ ذات کا۔ بالفاظِ دیگر خود(real self) کو پہچاننے کا ہے۔اس فلسفے کا خیال انھوں نے قرآن سے لیا ہے اور مغربی فلسفے سے بھی۔خودی کو انھوں نے سمندر سے تشبیہ دی ہے۔ان کی نظر میں خودی وصیع وعریض چیز ہے۔وہ اتنا ہے کہ خدائی بھی اس کے برابر ہوتی ہے۔

خودی کی زد میں ساری خدائی

ایک اور جگہ اقبال یوں رقم طراز ہیں۔ ؎

خودی وہ بحر ہے جس کا کوئی کنارہ نہیں
تو آب جو اسے سمجھنا اگر تو چارہ نہیں

اقبالؔ نے شاعری میں اپنے فکر ونظر کی پیش کش کے لئے کچھ اپنی اصطلاحات سے کام لیا ہے۔مثال کے طور پر 'شاہین'۔ کچھ الفاظ اقبال نے تو خود نئے بنائے یا انھیں الفاظ کو نئے معنوں میں استعمال کیا۔مثلاً خودی، مردِ مؤمن ،ذوقِ یقین، عقل وعشق وغیرہ۔ان نئے الفاظ اور اصطلاحات نے اقبال کی شاعری میں بھی ایک نیا انداز اور نیا فکر پیدا کیا۔ان کے کلام میں یہ اصطلاحات فکر کی پیش کش کو آسان کر دیا اور ساتھ ہی ساتھ شاعری کا حسن بڑھا دیا۔بقول سید صادق:

''ان کا تخلیق کردہ لسانی نظام ان کی فکر کی معنیاتی تہوں کو کھولتا ہوا نظر آتا ہے اور اس کی بھرپور نمائندگی کرتا ہے۔''

(فکر وتحقیق جولائی تا ستمبر ۲۰۰۵ ص ۱۴۰)

الغرض اقبال اپنی شعر وشاعری کے سفر میں مختلف رجحانات سے گزر کر اردو اور فارسی شاعری کے بلند درجے پر پہنچ گئے اور فارسی اور اردو ادب کو اپنی

شاعری اور فکر و نظر سے مالا مال کر دیا۔

کتابیات:

دانشورِ اقبال	:آل احمد سرور
اقبال بحیثیت شاعر	:پروفیسر رفیع الدین ہاشمی
اقبال اور عالمی ادب	:عبدالمغنی
شعر غیر شعر اور نثر	:شمس الرحمٰن فاروقی
فکر و تحقیق جولائی تا ستمبر ۲۰۰۵	
خطوطِ اقبال	:مرتبہ رفیع الدین ہاشمی

شاعری اور فکر و نظر سے مالا مال کر دیا۔

کتابیات:

دانشورِ اقبال :آل احمد سرور

اقبال بحیثیت شاعر :پروفیسر رفیع الدین ہاشمی

اقبال اور عالمی ادب :عبدالمغنی

شعر غیر شعر اور نثر :شمس الرحمٰن فاروقی

فکر و تحقیق جولائی تا ستمبر ۲۰۰۵

خطوطِ اقبال :مرتبہ رفیع الدین ہاشمی

Biological response of Eastern Arabian Sea during spring intermonsoon

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The Arabian Sea is one of the most productive regions in the world, characterized by eutrophic upwelling in the Summer Monsoon and oligotrophic stratified environments in the Spring inter monsoon (SIM). SIM season forms the intermediate season between two productive seasons, i.e., winter and summer monsoons. It is characterized by light winds and warm surface oligotrophic waters. The seasonal wind stress modifies mixed layer depth and nutrient status, which in turn determines the amount of nutrients available for phytoplankton growth. During SIM the EAS was characterized by weak winds (~3 m/s), warm SST (>29.6) and low SSS (<34.2), vertically stratified (MLD av.30m) well oxygenated (> 205μM) nutrient depleted (NO3 <0.1μM, PO4 <0.6) surface waters. Intense surface layer stratification and nutrient depletion resulted in low Chl a in the surface (av. 0.24 mg m^{-3}) and in the water column (av. 18.8 mgm^{-2}). Average primary production was also less in both surface (<3.2 mgC m-$3d^{-1}$) and water column (<190 mgC m-$2d^{-1}$). The phytoplankton abundance was generally low, and it was mainly contributed by *Trichodesmium erythraeum* (av. 2795 cells L^{-1}). High abundance of *Trichodesmium erythraeum* (14440 cells L^{-1}) generally considered as a biological response of strongly stratified tropical waters. Mesozooplankton biomass in the mixed layer was found to be higher (0.62 ml m^{-3}) as compared to the offshore (0.42 ml m^{-3}). Maximum zooplankton biomass (1.4 $ml.m^{-3}$) was observed in the mixed layer of 15°N and 17°N. In the thermocline layer the average biomass in the inshore and offshore stations was 0.27 $ml.m^{-3}$ and 0.20 ml m^{-3}, respectively. During this season the southern region, (8-13°N) recorded the minimum zooplankton biomass in the mixed layer and thermocline layers. Copepod was the most abundant mesozooplankton group (80%) both mixed layer and thermocline layer, followed by ostracods (8%) and chaetognaths (5%).The combination of a wide range of physico-chemical conditions during SIM resulted in variability in biological responses in the EAS. The intense stratification has caused low phytoplankton abundance, standing stock (Chl a) and productivity at various trophic levels.

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Variability of phytoplankton community structure in the Eastern Arabian Sea

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Phytoplankton communities play a crucial role in marine ecosystems, affecting nutrient cycling, structure and efficiency of the food web, and the flux of particles to deep waters.The ocean climate determines the composition and community structure of phytoplankton and modifies the global chemical budgets by a number of mechanisms. Although there is considerable information on the primary productivity in the eastern Arabian Sea, studies were comparatively less on phytoplankton community structure in oceanic waters. In this study, species composition, diversity and similarity patterns of phytoplankton community during spring inter-monsoon and different phases of summer monsoon were documented.A total of 177 species of phytoplankton were identified. They belong to six classes, namely Bacillariophyceae, Dinophyceae, Primensiophyceae, Dictyochophyceae, Prasinophyceae and Cyanophyceae. Among these, 104 species were diatoms, 67 species dinoflagellates, two species each of blue green algae and primnesiophyceae. Prasinophyceae and Dictyochophyceae were represented by single species each. Among diatoms at the genus level, *Rhizosolenia* presented the highest number of species (12 species), followed by *Coscinodiscus* (7 species) and *Nitzschia* (7 species). At the genus level, the best represented dinoflagellate was *Ceratium* (16 species), followed by *Protoperidinium* (10 species), *Goniaulax* (6 species) and *Prorocentrum* (6 species). Considerable temporal and spatial variability in the abundance of different species of phytoplankton was observed. Highest number of species (117 species) were found during late summer monsoon (LSM), followed by Peak Summer Monsoon (PSM) (112 species). Lowest number of species (62 species) was recorded during spring inter monsoon (SIM). These variations can be attributed to the shifts in nutrient regime influenced by the stratification during SIM and changing intensities of upwelling during from OSM to LSM through PSM.During all the seasons, diatoms were dominated. They constituted 73% during SIM and OSM, 58% during PSM and 59% during LSM.Relatively high percentage occurrence of dinoflagellate during PSM, which is characterized by the mature upwelling stage, is mainly due to the abundance of *Goniaulax polyedra* at 11.5°N. In view of the present analysis, it is assessed that the changing upwelling and stratified conditions in terms of physico-chemical variables may have roles in structuring the phytoplankton community and productivity.

A STUDY ON HUMAN WILDLIFE CONFLICT IN WAYANAD REGION, KERALA, INDIA

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ABSTRACT

Human wildlife conflict refers to the interaction between wild animals and people and the resultant negative impact on people or their resources or wild animals or their habitat. Recently human wildlife conflict has received much attention in scientific popular and social media, as it poses major threats to wildlife population, man and his crops in forest fringes and urban areas. An investigation on human wildlife conflict was done in three divisions of wayanad(north wayanad, south wayanad and Muthanga wildlife division) Kerala, India during January 2015 to June 2015. Survey method was opted for the study. A questionnaire including personal details, details of residence, rate and nature of conflict, mode of living and attitude of the authorities was prepared to conduct the survey. The sample size was 50. Different causes and solutions to mitigate human wildlife conflict were discussed. Agriculture was the major source of income for most of the respondents. The main type of conflict occurring is crop depredation. Elephant, deer and monkey were the animals that created more problems. Details of compensations provided were discussed. As a whole in Wayanad region human wildlife conflict has increased by an alarming rate and new measures to mitigate the same were also discussed.

Keywords: Conflict, Wildlife

INTRODUCTION

Wildlife traditionally refers to non-domesticated animal species, but has come to include all plants,fungi and other organisms which grow or live in wild in an area without being introduced by human beings. Human wildlife conflict is defined by the World Fund for Nature(WWF) as "any interaction between human beings and wildlife that results in negative impacts on human social ,economic or cultural life ,on the conservation of wildlife populations , or on the environment. The creating co-existence workshop at the 5th Annual World Parks Congress(8-17 September, 2003, Montreal) defined human wildlife in the context of human goals and animal needs as follows. Human wildlife conflict occurs when the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife.

The advent of farming and animal husbandry of the Neolithic revolution increased the scope of conflict between humans and animals. Large animals come into conflictwith humans by destroying crops, livestock or property or sometimes even by killing people. Some of the most common animals which are involved in the conflict are elephant, tiger, wild boar,gaur, deer, porcupine, monkey etc. There are different explanations and reasons behind

the conflict. Most of them are anthropogenic. Man slaughter is one of the dreadful impacts of human wildlife conflict.

Wild animals invade the human settlements due to reasons like habitat destruction, resource depletion etc. Ecological theory predicts that animals could tend to feed in a manner that maximizes their nutrients (energy, proteins, minerals etc) in the maximum possible time (reviewed by Pyke et.al 1977). A tiger should therefore hunt prey that will provide its sufficient meat with least effort. So it is easy to prey on a domestic animal which could fall easily for the tiger. A study on crop raiding by elephants showed that cultivated grasses like paddy and millet provide more protein, calcium and sodiumthan the wild grasses consumed during the corresponding season (Sukumar 1989-1990). So there are various reasons for conflict yet to be unveiled.

Conflict occurs with all animals. The biggest problem occurs when a bigger animal like tiger or a leopard etc. causes the problem.When a news of such an animal roaming around spreads, people gather and get scattered in and around the premises. The public surely will create problem for the authorities and the poor animal. So the efforts of the authorities to rescue the animal will be in vain, unless there is support of the public. Leopard - human conflict in Uttar Pradesh surged by almost 92 percent in the five year period between 2006 and 2011, when compared to figures between 2000 and 2005 (sanctuary Asia). These conflicts have many reasons and there are also measures to mitigate the conflict. But more than that when these situations occur rather than "no conflict'we should make new solutions to mitigate the conflict. In these cases crowd management is one main way. This is one of the biggest challenges the officials face in India.

The conflict between man and animal occurs due to many reasons. Out of this the invasion of the natural habitat of animals by man is a big reason. So we have to study whether the land areapeople reside are inside or outside the forest boundary and the land use pattern. Source of income of people living there is also important. Other causes include habitat loss, depletion of prey species and water resources inside the forest, climatic changes etc and there may be more reasons yet to be studied.

The government and wildlife management authorities should take appropriate measures to control the conflict. Methods like trenching, fencing and stone walls are now used to prevent the animals from entering into the residential areas. The extend ofits success varies in different areas. The authorities have to put forward more effective and innovative methods to stop or decrease the conflict. Government also provide compensation for loss of the people. But the transparency of this procedure should actually be studied.

Local people's involvement will have a lot to do in case of conflict. A general awareness about importance of wildlife, importance of conservation, role of human in conservation should be provided because most of the people dwelling near the forest may not be aware of these issues.

The conflict has been increased to an alarming rate unlike the olden days. Old people say that conflict was not this high even in those times when there were no much separation between town and forest. In the case of Wayanad 37 % of the total land area is forest,ie; 844.64 sq kms. Experts say that the reason of conflict in Wayanad is the lack of resources, huge plantation of trees inside the forest, invasion of exotic species, loss of greenery of wild etc. Last year 9 people died in the district due to animal attack. To add to all these problems monkey flu is the new villain of Wayanad. Many people have died due to monkey flu.

People living in and around the forest has livestocks and agriculture as a means of living. Other than this, collecting minor forest products is also a main source of income. Proper licence is needed for collecting MFP. Minor forest products include all products obtainable from the forest other than wood and thus comprise products of vegetable and animal origin. Some of the important forest products of nature are grasses, bamboos, canes, tans and dyes, oils, gums and resins, fibres,leaves,drugs ,spices, poisons, edible products, animal products etc.

METHODOLOGY

Man and wildlife conflict is oneof themajorissues that people and forest department of Wayanad are facing today. News and reports about the topic was frequently seen in news and details about the topic were more deeply studied from research papers, articles, journals like BNHS, Sanctuary Asia etc.

Survey method was selected to conduct the study. A questionnaire, including all the aspects like rate and nature of the conflict, causes of the conflict,mitigation measures, people's knowledge about conservation issues and strategies etc. The areas selected for the study were Chedleth range in South Wayanad division, Begur range in North Wayanad division and Muthanga range in Wildlife division.

Discussions were conducted with range officers of different wildlife divisions and withlocal leaders. Details of conflict and compensations provided were collected. The survey was conducted among all groups of people residing in the fringe areas of forest including all castes. After conducting the survey with a sample size of fifty the data was analyzed and various conclusions were made.

STUDY AREA

1. SOUTH WAYANAD

2. MUTHANGA WILDLIFE DIVISION

3. NORTH WAYANAD

RESULT AND DISCUSSION

People belonging to many castes (Kattunaikans, Mullukurumans, Chettis, Kurichians, Hindus, Muslims and Christians) are living together in and around the forests of Wayanad. Many of the people are educated up to primary level only and very few have completed graduation. People who are less educated are less aware of the conservation issues even though they know the basic aspects of conflict. Position of the houses from the forest boundaries was also considered. Fourteen percentage houses were inside the forest boundary, 52% were outside and 34% were on the boundary. The houses outside the boundary were mostly within 500ms and hence it is very easy for animals to reach there. Agriculture practices were present most on the boundaries andhence rate of conflict is more. As most of these people were living in the areasince birththey could tell clearly the changes in rate and nature of the conflict now and then. Peopleresiding herehad changed land for agriculturalpractices and construction works etc.

The mode of living of 48.6% is agriculture, 19.4% do livestock rearing,19.4% do daily wages and 12.5% do other jobs like government job, business etc. Although agriculture is the main source of income, many people have dropped agricultural practices due to the invasion of wild animals. Livestock rearing is also decreased due to cattle depredation. The main animals reared are cow (55.1%), buffalo (20.6%), goat(17.24%),poultry birds(3.44%) and other (3.44%). The main crops which are cultivated by them are paddy(32.92%), coffee(18.29%), ginger(12.19%), pepper(13.41%), banana(10.97%), tubers(3.65%), coconut(3.65%) and others(4.81%).

The most important part of the survey was to find out the rate and nature of human wildlife conflict. When considering the type of conflict occurring crop depredation (55.26%) is the highest followed by cattle lifting(15.78%) and others(28.94%)[table 1]. Others includedamage to houses, destruction of vehicles and causing disturbances in the daily activities of human beings due to the presence of wild animals. Even though there were many man lifting cases reported in Wayanad, none were included in the survey. There was an opinion that conflict is occuring on a daily basis.

CAUSES OF CONFLICT

1. Cattle grazing

2. Teak plantations

TABLE: 1- TABLE SHOWING THE TYPE OF HUMAN WILDLIFE CONFLICT.

	Crop depredation	Cattle lifting	Man lifting	Others	No conflict	Total
South Wayanad	13 (56.52%)	2 (8.69%)	_	8 (34.78%)	_	23
North wayanad	11 (45.83%)	5 (20.83%)	_	8 (33.33%)	_	24
MuthangaWildlife division	18 (62.06%)	5 (17.24%)	_	6 (20.68%)	_	29
Whole	42 (55.26%)	12 (15.78%)	_	22 (28.94%)	_	76

Elephants (24.19%), deer (21.50%), wild boar (19.89%), monkey (16.66%), tiger (6.45%), squirrel (3.22%), porcupine (0.53%), guar (0.53%), and others (12.5%) are the main animals causing conflict. The plants that are mostly destroyed are paddy (32.92%), coffee (18.29%), ginger (12.19%), pepper (13.41%), banana (10.97%), tubers (3.65%), coconut (3.65%) and others (4.87%). Elephants are the most problem causing animals. They invade the fields in herds. Even though tigers reported are few, they cause great terror among people which has reached its peak this year .The conflict between human and wildlife had become so severe since 15-20 years.

DESTRUCTIONS CAUSED BY WILD ANIMALS



Compensations are provided by the government for the losses caused by wild animals. On checking the details about the compensations given to people, there is hugedifferences as shown by authorities and victims. May be this had occurred because the respondents of this survey may not be included in the list of people who had received the compensation. The difficult and time consuming procedures keep people away from claiming the compensation.

The already provided preventive measures along the forest boundaries are trenching, fencing and stone walls. Among this stone walls are the most effective one. Unfortunately, construction of stone walls is difficult due to the cost of construction and lack of availability of stones. People complain about the lack of interest of authorities towards these problems.

MEASURES TO PREVENT THE ENTRY OF WILD ANIMALS

ELECTRIC FENCING

TRENCHING

Major causes of human wildlife conflict:

Although there are numerous causes for the conflict important one among them are

- Lack of naturalfoodandwater inside the forest due to depletion offorest, habitat loss, fragmentation, anthropogenic pressure etc.
- Increase in the population of wild animals.
- Strict enforcement of wildlife laws.
- Loss of bamboo forest.
- Change in the behaviour of animals (intelligence and laziness had increased).
- Increase of cattle grazing, plantations,agricultural practices etc in and around the forest.
- Easy access of animals into the villages due to improper maintenance of the already provided barriers and preventive measures.

Suggestions or methods to mitigate the conflict

Some of the suggestions to mitigate the conflict are:

- Implement rail fencing, stone walls along with electric fencing.
- Dilute the strictness of wildlife laws and give licence to farmers to possess guns to guard their crops.
- Decrease the wildlife population by sterilizing or any other population control measures.
- Maintenance of the barriers and promote strict night patrolling and separate forest from villages.
- Promote inter-planting and take measures to provide natural resources inside forest itself so that animals won't come out.
- Control tourism activities, cattle grazing and plantations inside forest.
- Provide awareness among people about wildlife conservation and related issues.

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Mesozooplankton abundance and distribution in the Andaman Sea during winter monsoon

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A study of the Andaman Sea, which is the least studied area of the Indian EEZ, was initiated for the biomass, distribution and abundance of major groups of zooplankton from the upper 1000m, during the winter monsoon (December 2003 - January 2004). Sampling was done at 24 hydrographic stations along 8°N, 10°N, 12°N and 13°50'N transects. Stratified samples were collected from five standard depths viz. 1000-500m, 500-300m, 300m-bottom of thermocline (BT), BT-top of thermocline (TT) and TT-surface (Mixed layer) using Multiple Plankton Net (MPN). A Sea Bird CTD was used to collect the temperature-salinity profiles. Surface meteorological parameters were collected at all stations and all along the ship's track by the ship - borne weather station. Water samples were collected using Rosette sampler fitted with Niskin water bottles from 14 standard depths and dissolved oxygen estimation was done by Winkler method. For measuring primary production and chlorophyll-a, water samples were collected from seven discrete depths (0, 10, 20, 50, and 75,100,120m). Primary productivity was measured using C14 technique by in situ method and chlorophyll-a (chl - a) using spectrophotometer.

The quantitative and qualitative abundance of zooplankton were found to be maximum in the mixed layer. The average zooplankton biomass in the mixed layer was 243 ml/1000m3,which is a high value for the season. Zooplankton abundance and standing stock showed general spatial and temporal variations. The average biomass was higher on the eastern side of the sea (318 ml/1000 m3) than on the western side (167ml/1000m3). Areas of high zooplankton standing stock were encountered in the 12°N latitude. The biomass showed a down sloping from the north to the south. Copepoda (84.5%) formed the dominant group, followed by chaetognaths (6.9%), ostracods (2.5%), decapods (1.9%) and copelates (1.6%). The least biomass valuesobservedin the mixed layer were along the northernmost transect (13°50'N). Distribution and abundance of zooplankton were influenced by various hydrographical characteristics. Comparatively higher values of dissolved oxygen, primary production and chlorophyll-a were noticed in the mixed layer on the western side of Andaman Islands.

MAN Vs WILD: A SCRUTINY ON HUMAN WILDLIFE CONFLICT IN WAYANAD REGION, KERALA, INDIA

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Abstract

Human wildlife conflict is the interaction between wild animals and people and the resultant negative impact on people or their resources or wild animals or their habitat. Recently human wildlife conflict has received much attention in scientific, popular and social media, as it poses major threats to wildlife population, man and his crops in forest fringes and urban areas. Man and wildlife conflict is one of the major issues that people and forest department of Wayanad are facing today. An investigation on human wildlife conflict was done in three divisions of wayanad (north wayanad, south wayanad and Muthanga wildlife division) Kerala, India during January 2015 to June 2015. A survey was conducted among all groups of people residing in the fringe areas of forest including all castes. A questionnaire including personal details, details of residence, rate and nature of conflict, mode of living and attitude of the authorities was prepared to conduct the survey. The sample size was 50. Different causes and solutions to mitigate human wildlife conflict were discussed. The main type of conflict occurring is crop depredation. Elephant, deer and monkey were the animals that created more problems. In recent times tigers are causing more terror among people. There is no barrier for animals to cross the boundary. So animals wander in the village more freely. Among many measures to control these problems, stone walls are the most effective one and rail fencing is also suggested. The major cause of conflict is said to be loss of habitat and natural forest cover and less availability of sufficient food for animals. Details of compensations provided were discussed. Through proper conservation strategies and methods only we can reduce the rate of human wildlife conflict. People should be given proper awareness about conservation of nature and various conservation issues happening around. A harmony between the wild and people must be developed and involvement of local people in conservation programmes is essential.

Keywords: *Conflict, Wildlife, South Wayanad and Muthanga.*

Introduction

Human wildlife conflict is defined by the World Fund for Nature (WWF) as "any interaction between human beings and wildlife that results in negative impacts on human, social, economic or cultural life, on the conservation of wildlife populations, or on the environment. The advent of farming and animal husbandry of the Neolithic revolution increased the scope of conflict between humans and animals. Large animals come into conflict with humans by destroying crops, livestock or property or sometimes even by killing people. Some of the most common animals involved in the conflict are elephant, tiger, wild boar, gaur, deer, porcupine, monkey etc.

Wild animals invade the human settlements due to reasons like habitat destruction, resource depletion etc. Ecological theory predicts that animals could tend to feed in a manner that maximizes their nutrients (energy, proteins, minerals etc) in the maximum possible time A study on crop raiding by elephants showed that cultivated grasses like paddy and millet provide more protein, calcium and sodium than the wild grasses consumed during the corresponding season [1]. So there are various reasons for conflict yet to be unveiled. Conflict occurs with all animals. The biggest problem occurs with the bigger animal like tiger or a leopard.

Numerous studies and research works have been conducted on forest and wildlife. [2] Treves *et. al.* conducted a study on Co-managing human wildlife conflicts. Conservationists recognize the need to work beyond protected areas if they are to sustain viable populations of wildlife. Traditionally humans respond by killing 'problem' wildlife and transforming wild habitats to prevent further losses. A work on the human dimensions of conflicts with wildlife around protected areas was studied by Treves [3]. Protected areas are credited with saving a number of wildlife populations from regional or range wide extinction, and they remain a corner stone of conservation.

Sukumar [4] published a paper on "The management of large mammals in relation to male strategies and conflict with people from Centre for ecological studies, Indian Institute of Science, Bangalore". The study says that many large mammals such as elephants, rhino and tiger often come into conflict with people by destroying agricultural crops and even killing people, thus providing a deterrent to conservation efforts. The males of these polygamous species have a greater variance in reproductive success than female leading to selection pressures favouring a high risk gain strategy for promoting reproductive success. This brings them into greater conflict with people. [5] Conducted a study on man wildlife conflict in Peppara wildlife sanctuary and adjacent areas. Thirty species of large mammals were recorded from the sanctuary and out of these five species were destructive to seventeen crops. Man slaughters were also recoded and tribes experience less conflict. Crop damage by wild animals in Kerala and evaluation of control measures was studied by [6]. Forty five species of crops was destroyed by wild animals and out of the total compensations claimed by the farmers only 8.2% was sanctioned by Kerala forest department. A study on Man and wildlife conflict in Wayanad Wildlife Sanctuary

was done by [7]. The study was conducted in 2174 houses to collect information on forest dependence, social and cultural activities and people's activities towards the management of forest and wildlife. Understanding the role of representations on human-leopard conflict in Mumbai through media content analysis was a study conducted by [8]. Better contact and understanding between conservation professionals and the mass media could be an important component of managing conflict.

The conflict has been increased to an alarming rate unlike the olden days. In the case of Wayanad 37% of the total land area is forest, i.e. 844.64 sq.kms. Experts say that the reason of conflict in Wayanad is the lack of resources, huge plantation of trees inside the forest, invasion of exotic species, loss of greenery etc. Last year 9 people died in the district due to animal attack. To add to all these problems monkey flu is the new villain of Wayanad. Many people have died due to monkey flu.

Materials and Methods

News and reports about Man and wildlife conflict was frequently seen in news and details about the topic were more deeply studied from research papers, articles, journals like BNHS, Sanctuary Asia etc. Survey method was selected to conduct the study. A questionnaire, including all the aspects like rate and nature of the conflict, causes of the conflict, mitigation measures, people's knowledge about conservation issues and strategies etc. The areas selected for the study were Chedleth range in South Wayanad division, Begur range in North Wayanad division and Muthanga range in Wildlife division. The period of study was Jan 2015- June 2015.

Discussions were conducted with range officers of different wildlife divisions and with local leaders. Details of conflict and compensations provided were collected. The survey was conducted among all groups of people residing in the fringe areas of forest including all castes. After conducting the survey with a sample size of fifty the data was analyzed and various conclusions were made.

Results and Discussion

People who are less educated are less aware of the conservation issues even though they know the basic aspects of conflict. Position of the houses from the forest boundaries was also considered. Fourteen percentage houses were inside the forest boundary, 52% were outside and 34% were on the boundary. The houses outside the boundary were mostly within 500ms and hence it is very easy for animals to reach there. Agriculture practices were present most on the boundaries and hence rate of conflict is more. As most of these people were living in the area since birth they could tell clearly the changes in rate and nature of the conflict now and then. People residing here had changed land for agricultural practices and construction works etc.

The mode of living of 48.6% is agriculture, 19.4% do livestock rearing, 19.4% do daily wages and 12.5% do other jobs like government job, business etc. Although agriculture is the main source of income, many people have dropped agricultural practices due to the invasion of wild animals. Livestock rearing is also decreased due to cattle depredation. The main animals reared are cow (55.1%), buffalo (20.6%), goat (17.24%), poultry birds (3.44%) and other (3.44%). The main crops which are cultivated by them are paddy(32.92%), coffee(18.29%), ginger(12.19%), pepper(13.41%), banana(10.97%), tubers(3.65%), coconut(3.65%) and others(4.81%). The most important part of the survey was to find out the rate and nature of human wildlife conflict which was shown in table 1.

Table.1: Type of Human Wildlife Conflict.

Division	Crop depredation	Cattle lifting	Man lifting	Others	No conflict	Total
South Wayanad	13 (56.52%)	2 (8.69%)	_	8(34.7%)	_	23
North wayanad	11 (45.83%)	5(20.83%)	_	8(33.3%)	_	24
MuthangaWildlife division	18 (62.06%)	5 (17.24%)	_	6(20.6%)	_	29
Total	42(55.26%)	12(15.78%)	_	22(28.%)	_	76

Causes of conflict

Elephants(24.19%), deer(21.50%), wild boar(19.89%), monkey(16.66%), tiger(6.45%), squirrel(3.22%), porcupine(0.53%), guar(0.53%), and others(12.5%) are the main animals causing conflict. The plants that are mostly destroyed are paddy(32.92%), coffee(18.29%), ginger(12.19%), pepper(13.41%), banana(10.97%), tubers(3.65%), coconut(3.65%) and others(4.87%). Elephants are the most problem causing animals. Even though tigers reported are few, they cause great terror among people which has reached its peak this year. The conflict between human and wildlife had become so severe since 15-20 years. There are seasonal effects on the rate of conflict. Conflict reaches its peak during fruiting seasons of jackfruits, mango etc. which occurs in summer season. Elephants come to paddy fields in the two harvesting seasons. Animals come to villages almost all the seasons.

breeding programmes. Captive-bred falcons are proving their worth for hunting; they produce strong and fast falcons well suited for desert life. The hybrids are more aerial and easily trained and managed than a purebred falcon. Hybrids are also less expensive than purebreds. Moreover hybrids possess hybrid vigour and are superior to the pure species in many aspects. Artificial insemination techniques have considerably improved production of hybrids from all three falcon species.

Falcon quarry

Quarry refers to prey species that are pursued by falcons. In Gulf countries, the Collared Dove *Streptopelia decaocto,* Turtle Dove *S. turtur*, Palm Dove *Streptopelia senegalensis*, Rock Dove *Columbia livia,* Quail *Coturnix coturnix*, Sand Patridge *Ammoperdix heyi*, Grey Francolin *Francolinus pandicerianus,* Chukar *Alectoris chukar* and Chestnut bellied Sand grouse *Pterocles exustus* are available in plenty. The major three species of quarry, which are traditionally pursued by Arab falconers, are the Houbara Bustard *Chlamydotis undulata macqueenii*, the Stone Curlew or Kairowan *Burhinus oedicnemus* and Arabian hare *Lepus capensis*. A successful hunt provides a delicious feast for the falconers in the desert. The overall aim of breeding the houbara in captivity is to provide a sustainable quarry resource for falcons in hunting season.

Training and Hunting

The objective of falconry is to hunt and catch quarry with trained falcons. Commonly female falcons are used for hunting. The falcon must be rewarded when her efforts are successful; therefore she is usually allowed to eat a portion of the quarry that she has caught, while the falconer usually retains the remainder. The falcon takes the advantage of height and stoops down over the prey and rakes it with talons. The targeted bird tries to escape from the attacker. Sometimes the falcon also tries to snatch other bird's booty. Falcons generally exhibit two types of hunting techniques: the high-speed stoop and the chase and grab. Saker flies low in 'search and chase' method of hunting, and catches mammals and birds. The Saker has long legs but lacks the extended, bird-catching toes of the Peregrine. At just about the time a falcon attempts to grab a houbara in flight, she will suddenly find herself going in the opposite direction of her intended meal. At the same time the houbara emits a thick slimy discharge 'taml'. This glues the wings of the falcon and helps the houbara to escape.

Each bird is trained by highly skilled trainers using live and dummy birds to perfect the hunting skills. High power radio transmitters having a range upto 50 kilometers are used to avoid losing the costly birds during training and hunting. The primary aim of training is to impart tameness and obedience. As falcons and quarry arrive in the Gulf at about the same time and will be available only for short period, Arab falconers at this time are under pressure to make the most of the situation. Until recently, it was difficult to retain a falcon from one season to the next. It was impractical for the nomadic falconer to keep falcons year-round in the hot season, because of the lack of food and suitable environment. Therefore, most falcons, except the best hunters are released at the end of a hunting season. When a falcon first comes into the hands of a trainer its eyes are usually 'sealed' by stitching the eyelids together using a thread. This procedure makes taming easier. Major progress in taming is achieved during the sealed period as the falcon comes to accept sounds and tactile sensations of its captive new world. At this stage the thread is removed, to restore the full sight. The sealing period may last less than a week, but the falcon is most likely to emerge from this short experience in a totally tame, yet unstressed state of mind. While molting, the falcons in captivity will revert and forget hunting techniques that were acquired during the training and hence, after molting, the trainer will have to re-train the bird for hunting, but this will be easier than acquiring a new bird.

Furniture

Furniture means the equipment necessarily used for the daily maintenance of falcons. Always there must be a means of restraining falcons, to prevent from flying off. The means of restraint is a strong, lightweight tether fitted to each ankle, these tethers or jesses, are known as *'subuq'*, made of leather. The free ends of these are then brought together and tied to a single cord. This piece is fastened to a brass or steel swivel, which is attached to another cord. This comprises a *'mursil'* leash components and a *'midwar'* swivel. The place on which a falcon stands is called a *'wakir'*. The traditional form of protection for a falconer's hand or arm is a leather glove or *'mangalah'*. As a security measure, the end of mursil can be fastened to the mangalah when it is not fastened to the wakir. The *'burqa'* or hood functions as a blindfold for the falcon. A falcon's world is mainly what is visualized, therefore this has the effect of psychologically removing the bird from any vision that would stimulate or upset it. The *burqa* assists in transforming a nervous, agitated or emotionally upset raptor into a pseudohypnotized bird. Another object is used to exercise the falcon during training, or retrieve the falcon after an unsuccessful flight, and is called the *'tilwah'*.

Falcon trapping

Falcons and their prey birds migrate from September to November across Arabia from Eastern Europe and Central Asia to their southern wintering areas. The shorter northern days and chill in the air signals the onset of migration and each cold snap sends a new wave of raptors on their great annual journey. 'Waiting for their arrival over Syria, Iran, Pakistan and Arabian Gulf will be the falcon trappers' [5]. The foremost method of capturing falcons is the luring method; pigeons are used as bait for this purpose. The second method is to offer a bird as bait with a noose frame attached. This device is thrown from a moving vehicle when a falcon is spotted.

Care should be taken to throw the pigeon opposite the falcon. The object of this is to conceal any association of the pigeon with the trapper; it should appear that the vehicle has struck the pigeon. The falcon, if all goes as planned, will alight on top of the pigeon, and while killing and eating the bait, it will ensnare its long toes in one or more of the nooses.

The third method is of 'little worth' to catch more valuable ones. A luggar falcon is retained for this purpose. Sealing is carried out to prevent the falcon from seeing the ground when it flies. A lightweight feather bait decoy is attached to the leg of 'bizzuar', the lesser falcon. In the west, the bizzuar is referred to as 'barak hawk'. When a desirable falcon is sighted, the bizzuar is thrown into the air. Since its downward vision is impaired, it cannot see the land and flies upward carrying its decoy. To another falcon the opportunity to rob the lesser one proves irresistible. In this instance, it is not the lesser falcon that is attacked but rather the decoy that it carries. When the larger falcon becomes ensnared, continued flight for either is impossible, and both flutter to the ground uninjured. The most intriguing method of catching a falcon is the 'hide', or 'dig in' approach, a method known to falconers worldwide. When a stationary falcon is sighted a good distance away, a hole is quickly dug in the sand, and a trapper is buried, except for his head and gloved hands. A basket or some such item is camouflaged with grass and placed over the man's head, so that the trapper can see out. A pigeon is tied to his wrist. He then repeatedly tosses the pigeon in the air to attract the attention of the falcon. When the falcon kills the pigeon and begins to eat it, the trapper stealthily catches the legs of the falcon. Once a falcon is caught, by whatever method, a head-cloth is quickly thrown over the excited and frustrated bird to prevent injury to it and the trappers. A hood is placed over the head. Finally, it is wrapped in an *'abba'*, a type of straightjacket.

Discussion

Falconry began as a supplement to the nomad's diet, but gradually evolved into a gentleman's sport over a long period of time. Arabs use falcons for hunting purposes. 'Baz' and 'Shaheen' are called falcons. The large expanse of the desert, its relative lack of protective cover and the demanding long-range flight of quarry such as the houbara bustard, desert hare and stone curlew all clearly favour the use of falcons. Shooting has been recently banned in several Arab countries, and there is growing interest in programmes to propagate houbara for release to the wild. The laws and regulations have assured the survival of the sport in the west and Arabia. The favourite prey of falcons is houbara bustard. The meat of houbara bustard is very tasty and is considered as of high medicinal value for which there is, however, no scientific evidence. It is also believed to be an aphrodisiac and energizer. Bahavudheen [6] gives the picture of the combat between falcon and houbara, the falcon's quick stoops on the houbara, leading to a struggle in the atmosphere which ends either in escape or defeat. 'The houbara species have suffered a massive decline in numbers during the present century and especially during the past 30 years as native grass lands have been increasingly converted to cash crops' [7]. Nowadays, fewer and fewer houbara visit the UAE, the reasons behind their fast decline needs to be well studied to know how to halt this decline before the houbara becomes extinct in the UAE. Predator and prey attack-escape performance is likely to be the outcome of an evolutionary arms race. 'Predatory birds are typically larger than their prey suggesting different flight performances' [8]. There are three idealized attack-escape situations between predatory and prey birds: climbing flight escape, horizontal speeding, and turning and escape by diving.

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Destruction caused by animals

Compensations are provided by the government for the losses caused by wild animals. On checking the details about the compensations given to people, there are huge differences as shown by authorities and victims. The difficult and time consuming procedures keep people away from claiming the compensation. The already provided preventive measures along the forest boundaries are trenching, fencing and stone walls. Among this stone walls are the most effective one. Unfortunately, construction of stone walls is difficult due to the cost of construction and lack of availability of stones. Fifty four percentages are aware of the conservation issues and 46% are unaware. Only 20% has opinion that humans are one of the causes of conflict while 10% opined, there may be role of man in conflict, but majority (70%) say that man is not at all a cause for this. Even though 96% suggested that conservation is important, many people have no knowledge about Gadgil and Kasthurirangan reports (88%). Only 18% opined that Gadgil report is better for conservation. Several measures are already implemented by the Kerala Forest Department and includes electric fencing and trenching.

Major causes of human wildlife conflict

Lack of natural food and water inside the forest due to depletion of forest, habitat loss, fragmentation, anthropogenic pressure etc., Increase in the population of wild animals; Strict enforcement of wildlife laws; Loss of bamboo forest; Change in the behaviour of animals (intelligence and laziness had increased); Increase of cattle grazing, plantations, agricultural practices etc in and around the forest; Easy access of animals into the villages due to improper maintenance of the already provided barriers and preventive measures.

Suggestions or methods to mitigate the conflict

Implement rail fencing, stone walls along with electric fencing; Dilute the strictness of wildlife laws and give licence to farmers to possess guns to guard their crops; Decrease the wildlife population by sterilizing or any other population control measures; Maintenance of the barriers and promote strict night patrolling and separate forest from villages; Promote inter-planting and take measures to provide natural resources inside forest itself so that animals won't come out; Control tourism activities, cattle grazing and plantations inside forest; Provide awareness among people about wildlife conservation and related issues.

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DIVERSITY OF COLEOPTERANS IN ALUKKAL VILLAGE OF AREEKODE, MALAPPURAM DISTRICT, KERALA

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ABSTRACT

Beetles(Order:Coleoptera) constitute a large quantity of total insect biodiversity and play a key role in trophic chains. They are well represented in all terrestrial habitats and are often used as indicators of environmental change because of their great habitat specificity. Diversity and abundance of coleoptera were studied and analyzed in two different habitats of Alukkal village of Areekode, Malappuran District, Kerala. The study was conducted during December 2014 to May 2015. For the study, the beetles were collected, preserved and identified. The collection methods include hand picking and sweeping. Beetles were preserved by pinning and keeping in 70% alcohol. The identification was done by experts and by comparing with pictures and descriptions. A total of 805 beetles belonging to eleven families were reported. Of these, 17 were identified up to the species level and 14 up to the genus level.The most abundant family was Chrysomelidae in both sites (70% and 64% in site 1 and site 2 respectively), in which *Aulacophorasp.,Oidesdorsosignata* Clark,1864 and *Altica sp.* were most abundant. Most beetle species are abundant, and they don't need to be especially conserved. But beetles that live in habitat that are getting changed could be in trouble and should be conserved.

KEY WORDS: Coleoptera, Beetles, Sorenson similarity index.

INTRODUCTION

The order coleoptera or beetles forms the largest order of insects(Borer et.al,1984) worldwide with about 3,90000 described species representing about 40% of the known insects. Every year approximately 2000 new species are described (Zoological record). They are distinctive with the hardening of their forewing into elytra. They occupy almost every available terrestrial and freshwater habitat and a few marginal marine habitats as well and have got adapted to life at all latitudes and in nearly every habitat to feeding on any substances of organic origin.

Order coleopteran is divided into four suborders viz. Polyphaga, Adephaga, Myxophaga and Archostemata. Polyphaga is the largest suborder containing 85% of the known species and Myxophaga is a small suborder whose members are minute with less than 100 known species. Archostemata contains several families of beetles most associated with wood and Adephaga includes most of the predacious beetles.

Beetles have a lot of ecosystem roles and some common species of them respond sensitively to the state of natural environment and may serve as convenient indicators of anthropogenic pollution. They have played an important part in the biological control of insect pests and noxious plant species. Most of them are beneficial as decomposers and recyclers of organic nutrients which contribute to soil fertility, like dung beetles which help to get rid of

waste, and those which eat wood help breakdown of dead trees. Tenebrionidae play an important role as primary decomposers (Henschel et.al., 2010). Larval forms of many beetles are also used as food in many countries.Many beetles are regarded as serious pests of agricultural crops, pasture plants, timber resources and stored products.

Alukkal village of Areekode lies in 11°4'N and 76°01'E with an altitude of 58m.The climate is generally mid hot and humid in nature and mean rainfall of the area is 3100mm and mean temperature ranges from 20°C to 35°C. The area is situated along the river Chaliyar and a major portion is comprised of agricultural lands. Main crops cultivated by agricultural practices include paddy and plantain. Other plantations like tapioca, cucumber, beans, okra etc... will also be there in some seasons The river side is shrubby and grassy with several kinds of shrubs and grasses and some kinds of agriculture too.

Most of the insect records available at present are the results of taxonomic studies carried out in the past, but in them estimation of abundance and diversity was not a major objective.A study on the diversity of coleoptera will not only help to assess the diversity of the area but also will help to carry out further studies to conserve the biodiversity over there. No work has been reported so far on Beetle's faunal diversity from Alukkal region.

MATERIALS AND METHODS

Coleoptera of Alukkal village were studied from December 2014 to May 2015. The study area was divided into two sampling sites, namely the area in the agricultural fields (Site1) and the area near to the river Chaliyar(Site2). Collections were made twice in a month from two sites in the morning (9.00 to 11.00), made by handpicking and sweeping with a proper net. The methods employed for preservation were Pinning and by keeping in 70% alcohol.Afield camera with 42X optical zoom and a 13 megapixel camera were used to take photographs of beetles.

A major portion of beetles were identified by experts, comparing with pictures anddescriptions. Population diversity was determined by using Simpson's index (Simpson, 1949) and the similarity between two sites using Sorenson's similarity index(1948).

RESULTS AND DISCUSSION

A total of 805 beetles represented by eleven families were recorded.Beetles represented by the families Chrysomelidae, Coccinellidae, Scarabaeidae, Cerambycidae, Curculionidae and Tenebrionidae were identified upto the genus or species level.Whereas,beetles represented by the families Elateridae,Lampyridae,Dytiscidae,Carabidae and Mordellidae were not identified upto the genus level (Table:1).

TABLE 1 : LIST OF COLEOPTERANS RECORDED FROM THE STUDY AREA

FAMILY	COMMON NAME	GENUS	SPECIES
Chrysomelidae	Leaf beetle	Oides	*Oidesdorsosignata*Clark,1864.
		Dicladispa	*Dicladispaarmigera*Olivier,1808.
		Platycorynus	*Platycorynusperegrinus*Herbst,1783.
		Cassida	*Cassidacircumdata*Herbst,1799.

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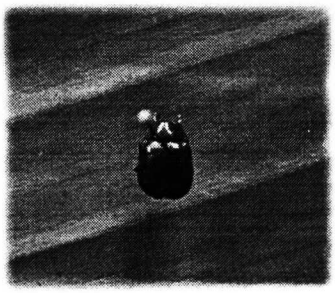
		Cassida	*Cassidacircumdata*Herbst,1799.

		Aulacophora	*Aulacophoracincta*Fabricius,1775.
		Aspidimorpha	*Aspidimorphamiliaris*Fabricius,1775.
		Coptocephala	
		Lilioceris	
		Altica	
		Monolepta	
		Aulacophora	
		Aspidimorpha	
		Chiridopsis	
		Aulacophora	
		Cassida	
Coccinellidae	Lady bird beetle	Coccinella	*Coccinellatransversalis*Fabricius,1781.
		Cheilomenes	*Cheilomenessexmaculata*Fabricius,1781.
		Epilachna	*Epilachnaseptima*Dieke.
		Epilachna	
Scarabaeidae	Scarabs/Lamellicorn beetle	Popilla	*Popillacomplanata*Newman,1838.
		Oryctes	*Oryctes rhinoceros* Linnaeus,1758.
		Chrysina	*Chrysinabayeri*Skinner.
		Apogonia	
		Copris	
Cerambycidae	Long horned beetle	Apomecyna	*Apomecynasaltator*Fabricius,1787.
		Nupserha	*Nupserhamadurensis*Pic,1926.
		Aeolesthes	*Aeolesthesholosericea*Fabricius,1787.
		Prionomma	*Prionommaatratum*Gmelin,1789.
Curculionidae	True weevil	Cosmopolites	*Cosmopolites sordidus*Germar,1824.
		Myllocerus	
Elateridae	Click beetle		
Tenebrionidae	Darkling beetle	Gonocephalum	
Lampyridae	Fireflies		
Dytiscidae	Predacious diving beetle		
Carabidae	Ground beetle		
Mordellidae	Tumbling flower beetle		

Oidesdorso signata

Dicladispa armigera



Platycorynus peregrines

Cassida circumdata

Aulacophora cincta

Aspidi morphamiliaris

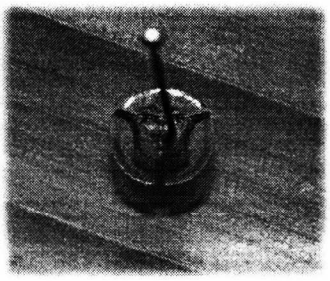
Coptocephala sp.

Lilioceris sp.

Altica sp.

Monolepta sp.

Aulacophora sp.

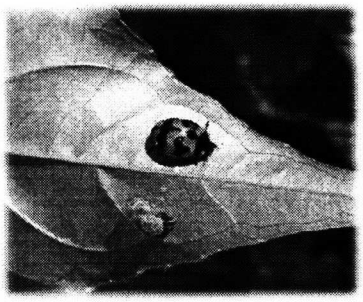


Aspidimorpha sp.

Chiridopsis sp.

Aulacophora sp.

Cassida sp.

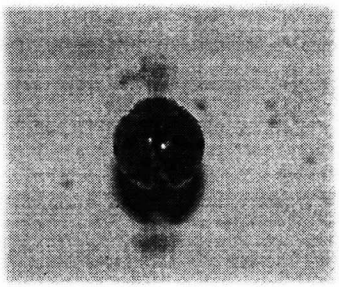


Coccinella transversalis

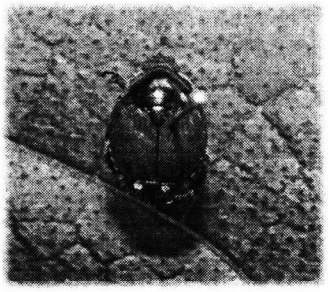
Cheilomenessex maculate

Epilachna septima

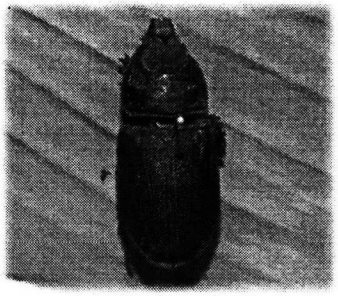
Epilachna sp.



Epilachna sp.



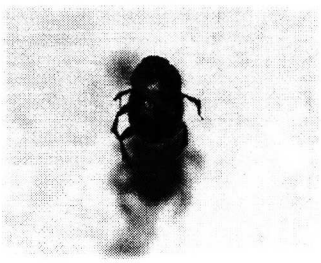
Popilla complanata



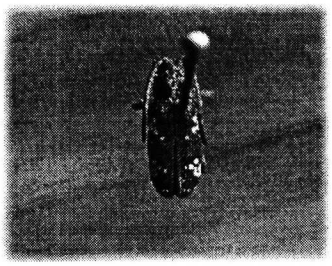
Oryctes rhinoceros

Chrysina bayeri

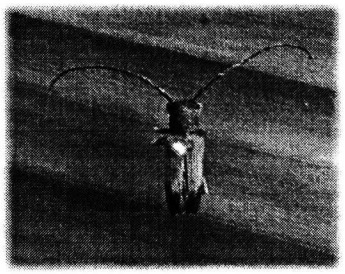
Apogonia sp.



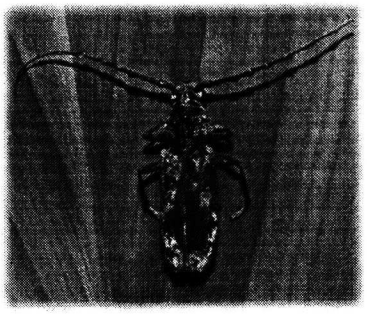
Copris sp.



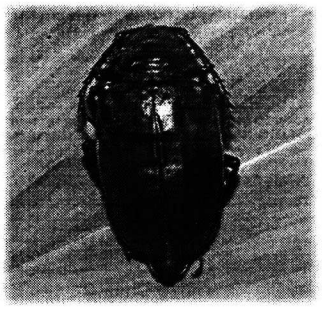
Apomecyna saltator



Nupserha madurensis



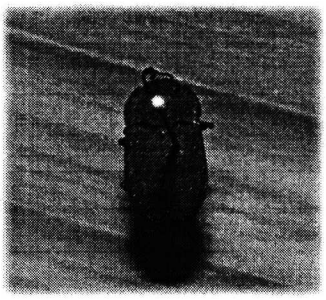
Aeolesthes holosericea



Prionomma atratum

Cosmopolites sordidus

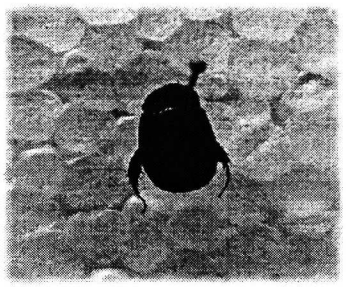
Myllocerus sp.



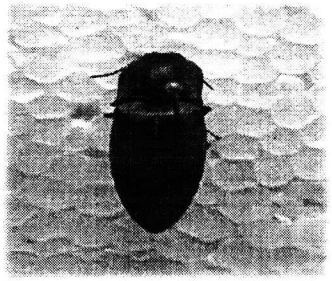
Gonocephalum sp.

Family:Carabidae

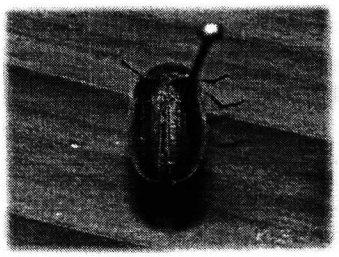
Family:Curculionidae



Family:Dytiscidae



Family:Elateridae



Family:Lampyridae

Family:Mordellidae

The agricultural field area (site 1) showed higher number of beetles with a total of ten families than the river side area (site 2). Among the collected eleven families of beetles, ten were reported from site 1 and seven were reported from site 2.The most abundant family was Chrysomelidae in both sites.Since the area comprised of different kinds of plantations and high vegetation,it provides a suitable habitat for leaf beetles. So, this study concurs with a similar study in different habitats (Ohsawa and Nagaike, 2006) in terms of the influence of vegetation composition and vegetation cover on chrysomelidae communities. Also, the area contained agricultural practices which favored a variety of pest species too (like *Dicladispaarmigera, Epilachna sp. etc...).*These may be the main reasons for their abundance Many environmental factors affect diversity of species (Rosenzweig, 1995).

There is always correlation between structural complexities of habitats and diversity of species (Hawksworth and Kalin Arroyo, 1995). More diversity is observed at the region with availability of variety of habitats (Ried and Miller, 1989). Likewise, Uetz in 1991 stated that good beetle diversity is seen on structurally complex shrubs. So, site 2 may have a variety of habitats which favored a high diversity there than site 1. In site 1, *Oidesdorsosignata* with a value of 0.0343(Simpson index) was the dominant species. In site 2, *Aulacophora sp.* with a value of 0.0481(Simpson index) was the dominant one. Forty percentage of similarity was recorded between the two study area in their beetle species composition (Fig:1).

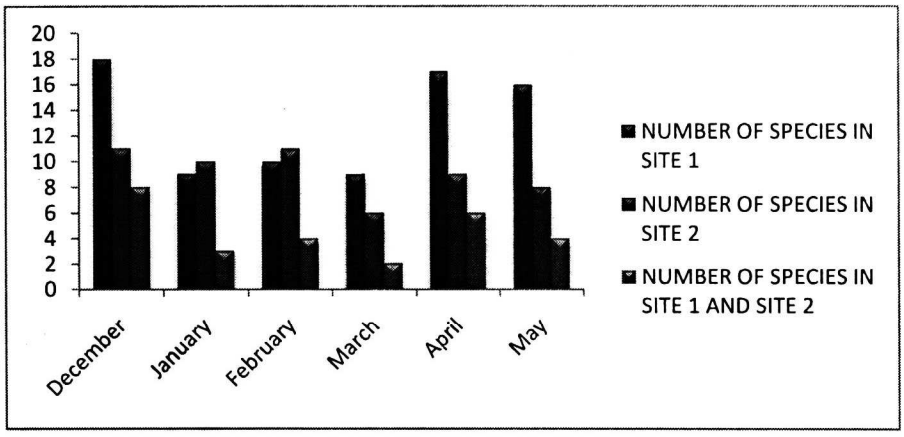


Fig: 1. NUMBER OF BEETLE SPECIES RECORDED IN EACH MONTH.

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WOSC/TS-5/ME/PP/16

Distribution of *Pleuromamma* (Copepoda) in the Andaman Sea during fall inter monsoon

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Distribution and diversity of the copepod *Pleuromamma* (Copepoda) in relation with hydrography and meso-zooplankton community structure were studied in the Andaman waters during inter-monsoon fall of 2002. Samples were collected from five stratified layers of Andaman waters from 1000m to surface depth by using a Multiple Plankton Net (MPN) onboard FORV SagarSampada. Salinity was 34.89± 0.84 psu and average DO observed is 5.7ml/l during the present study. Zooplankton biomass varied from 4- 233ml/1000m-3. Copepod formed the bulk of zooplankton (67-88%), followed by Ostracods and Chaetognaths. A total of 200 copepod species obtained belonging to 19 families of which 21 were reported for the first time from this area. *Pleuromamma abdominalis, P. indica, P. gracilis, P. piseki, P. quadrangulata* and *P. xiphias* were formed nearly 11% of the total copepod composition. The distribution of these species in the Andaman waters reveals that their abundance was inversely correlated with depth. *Pleuromamma* which play a vital role in the food chain of many economically important fishes exhibited diel vertical migration. The hydrographical factors which controlling their distribution in the Andaman waters is a good indicator of the ecologyof the region. Many mesopelagic and bathypelagic species such as *Bradycalanus typicus, Disseta palumboi, D. scapularis, Gaussia princeps* and *G. sewelli* were recorded from the mixed layer during the study period from Andaman waters. Diversity indices such as species richness (d), Shannon index (H'log2), evenness and dominance were calculated. Highest species richness and species diversity were recorded from the station in the eastern side of the island arc at 10º Channel, through which the eastern and western parts of the Andaman waters is connected.

A PRELIMINARY STUDY ON THE DIVERSITY OF BUTTERFLY POLLINATORS IN FAROOK COLLEGE CAMPUS, KOZHIKODE, KERALA

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ABSTRACT

Butterflies are cute and marvellous creatures of nature. They are the wonders of nature with diverse color, habitat, size and form with an immense aesthetic value. They belong to the Class Insect of Order Lepidoptera. The present study was conducted regarding the different flowering plants (garden, cultivated, semi-cultivated and wild) visited by butterflies as pollinators, their foraging activity and host preference in Farook College Campus. During the present study 17 species of butterflies were collected as flower visiting pollinators on 14 species of plants. Family Nymphalidae was found dominated in all the study areas (10 species), followed by Pieridae (4 species), Papilionidae (2 species) and Hesperidae (1 species). The most visited plant by butterflies was *Lantana camera*, a wild herbaceous plant which was flowering throughout the year. Visits of butterflies were frequent to flowers of herbs and shrubs rather than to flowers of trees.

Key words: Butterflies, Pollinators, Flowering plants, Nymphalidae, Pieridae, Papilionidae, Hesperidae

INTRODUCTION

Butterflies are abundant and diverse group of organisms and a conspicuous part of virtually all the world's terrestrial ecosystems. They belong to the class Insecta of order 'Lepidoptera. 'They are sensitive biota which gets severely affected by environmental variations and changes in forest structure. They form an important part of the food chain of birds, reptiles, amphibians, spiders and predatory insects. They exhibit polymorphism and mimicry. Some butterflies have evolved symbiotic and parasitic relationship with social insects such as ants. Some species are pests. Butterflies are attracted to flowers with abundant nectar supplies and tend to visit bright coloured flowers, especially red, orange and purple. They are active during day and tend to visit a great number of flowers. They have long, thin legs and use them to perch on the sides of flowers and simply probe for nectar with their long proboscis. However they are not effective as some insects, and are therefore not considered being major pollinator. The main reason for this is that butterflies have limited contact with the pollen and therefore do not transfer large amount of pollen from flower to flower. But they can pollinate a limited extent. India has around 1501 species of butterflies, out of which 334 species are reported from the Western Ghats and 37 species are endemic to Western Ghats. Of the 334 species of butterflies of Western Ghats 316 species are reported from Kerala alone. Studies on butterflies in India were initiated by Fabricius and Cramer (1775). Some of the important group of butterfly pollinators were mentioned by Faegri and Vanderpijl (1979) in his book "The principles of pollination ecology Sihag(1995) reviewed some important insect pollinators and described the role and adaptation of various environmental factors in pollination biology. Nimbalkar and Chandekar (2010) carried out a study on butterfly diversity in relation with nectar food plants from Bhor

Tahsil of Maharashtra and they identified a total of 19 nectar food plants and maximum species recorded in Nymphalidae. Various studies on butterfly diversity in the Farook college campus were already conducted and reported a total of 60 species. But there are limited studies and reports on pollinating butterflies and their role in pollination. In this regard the present investigation is to make awareness about pollinating butterfly diversity, importance of pollination and their foraging activity and habitat preference in the Farook College Campus

METHODOLOGY

We chose Farook college campus as our study area and the campus is well habitated by different variety of plants. We selected the 3 main gardens situated within the campus for the survey of butterflies. The random method of observation was used to observe pollinating butterflies and their host plant. Total 17 species of host plants were selected. The period of observation was from October 2013- January 2014. Observation was done twice in a day especially in morning from 8-9 am and evening 3-4 pm. The selected study area were partitioned named as A, B and C

Site-A: Situated in front of the main block of the campus (Plate1- fig:1)

Site-B: Situated near the Botany department (Plate1-fig: 2)

Site-C: Situated in front of the Dept. of Zoology (Plate1-fig: 3)

Most important flowering plants observed in different sites are as follows:

Site A - *Allamanda cathartica, Mimosa pudica, Ixora javanica,* Waterlilly, *Lantana camara, Cassia fistula,* Grass etc.

Site B – *Hamalia patens, Ixora javanica ,Bauhima parpurea, Calotropis gigantean, Sida acuta, Ceasalpinia pulcherima, Clerodendrom viscosum, Pongamia pinnata, Acavvia auriculeformis, Mimosa pudica* etc.

Site C – Grasses, *Hibiscus rosasinensis, Mimosa pudica, Ravolfia sarpentina, Lantena camera and Mussenda frondosa* (plate-1)

The observed butterflies were photographed from the site itself. They were identified by using literature available from Farook college library and conformation was done by the guidance of Mr. Jaffar pallot Scientist (ZSI). Following plants from the campus was identified with the help of Dr. Kishore Kumar Assistant professor of Botany department, Farook College. The host plant preference for pollinating butterflies was also noted during the study period by observing their frequent foraging on different host plants.

Plate-1

Figure 1 Site-A

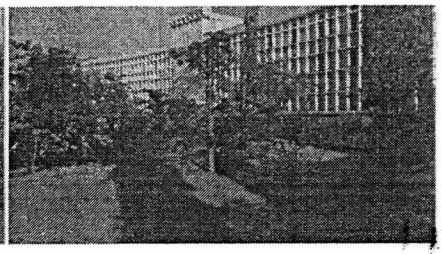


Figure 2 Site-B

Figure 3 Site-C

RESULTS AND DISCUSSION

Present studies were conducted regarding the diversity of butterfly pollinators on different flowering plants (garden, cultivated, semi wild and wild), visited for their foraging activity. During the course of study a total of 17 species of butterflies were collected as flower visitors from the Farook college campus which belonging to 4 families. Out of 17 species 10 belongs to family Nymphalidae, 4 to Pieridae, 2 to Papilionidae and 1 to Hesperidae (Fig- 4).

Species belonging to Nymphalidae were most dominant family during the observation (56%) followed by Pieridae (23%), Papilionidae (16%) and Hesperidae (5%) (Fig-5). The butterflies foraging for nectar included 17 species representing 4 families on 14 species of plants representing 12 families. 3 of them were Semi wild, 8 were Wild, and 3 were Cultivated. So the dominated ones were wild plants (Table 1).

The status of recording was as follows, C-common (30-50 sightings), U.C-uncommon (10-30 sightings) and R-Rare (5-10 sightings). Among the 17 species 9 were found common, 7 uncommon and 1 species was found as rare. Out of 17 species 4 were recorded from site A, the garden in front of Farook college campus. In these areas 5 plants from 5 families were used by butterflies as nectar food plants. The recorded plant families were Verbanaceae, Caesalpineae, Luneaceae, Aracaceae and Rubiaceae (Table 2). The most frequently visited plant by butterflies in this site was *Lantana camara* , and frequent foraging activity exhibited by Nymphalidae butterflies.

10 species of butterflies were observed in the Botanical garden of Farook college campus (Site B). This site has more plants compared to other two sites. Altogether 8 plants from7 families were recorded. Fabaceae, Caesalpinaceae,Verbanaceae, Lumiaceae, Poaceae, Asdapiadaceae, Asoletiadaceae etc. were recorded families in site B (Table 3). Butterflies were more frequently visited by the plants viz. *Lantana camara* , *Bauhimea purpureae* and *Clotropis gigantean* in site B. Nymphalids and Pierids butterflies was more frequently visited in the above host plants for foraging.

Only 4 species of butterflies visited in site C, the garden of Zoology department of Farook College. Butterflies on 4 species of plants from 3 families viz. Sterculiaceae, Malvaceae and Rubiacea (Table 4). In this site the visit of butterflies were not frequent due to scarcity of flowering plantation.

Butterflies are scaled wing insects belong to the order Lepidoptera of class Insecta. There is an intimate association of butterflies and plants and their lives are exceptionally interlinked (Feltwell, 1986). The present study revealed that butterflies visit a wide variety of plants (garden, cultivated, semi wild and wild) and most of them are considered as opportunistic foragers. The same observations were made by Courtney (1986) also.

However studies conducted to date, indicate that butterfly species show distinct flower preferences (Erhardt and Thomas, 1991). In the present study the most preferred plant was *Lantana camara,* a wild plant flowering throughout the year which was abundantly recorded in the two study sites. The preference of specific host plants may be due to certain floral nectars with a specific chemical composition and other factors like floral color, shape, size, position and arrangement in inflorescence etc. The floral features such as large, red or blue, narrow, tubular flower with deep nectaries are important for butterfly visitation. (Larson, 2001). In the present study visits of butterflies were more frequent to flowers of herbs and shrubs than to flowers of trees.Studies on Nimbalkar *et al* (2011) also supported this observation.

The present study revealed that Nymphalidae butterflies were the dominant one compared to the others at the flowers throughout the flowering season. Similar observations were also found in many previous studies done in Kerala. Studies on butterflies of Silent valley National park carried out by George Mathew and Rahmathulla (1993) and they observed that Nymphalidae and Pieridae contain maximum number. Another study done by Sudheendrakumar *et al*., (2000) showed that Nymphalidae is the predominant family. So most of studies done in Kerala till now shows that population of butterfly family Nymphalidae are predominant. This may be attributed to the climatic conditions of Kerala especially the sustained monsoon seasons of the year.

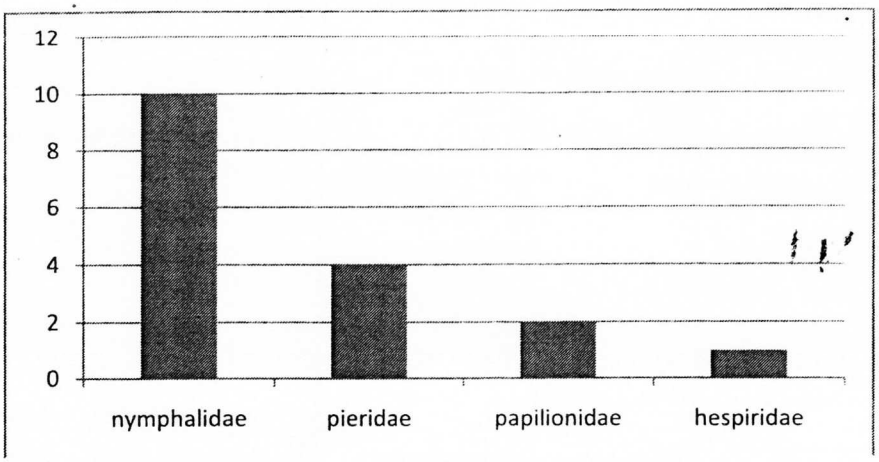


Figure 4- Dominanant Butterfly diversity during the present study

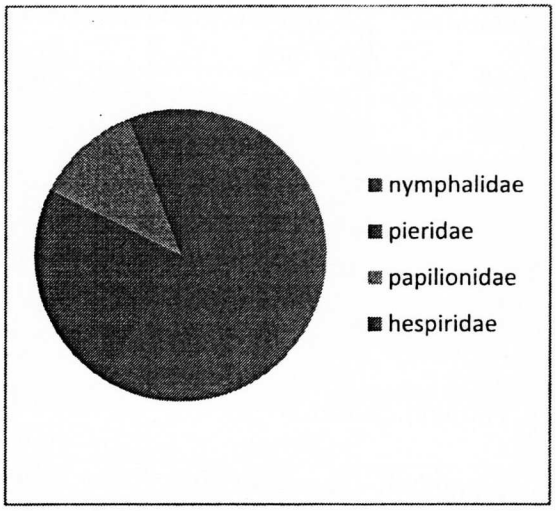


Figure 5- Pollinating Butterfly diversity of Farook College campus

Table 1-Different butterfly fauna and floral composition of Farook College Campus

Flora				Fauna		
Sl No	**Species**	**Scientific Name**	**Family**	**Species**	**Family**	**Remark**
1	Common emigrant	Catopsilia pomona	Pieridae	Cassia fistulaLantana camera	CaesalpinaceaeVerbenaceae	Semi wildWild

2	Tailed jay	Grphium agamemon	Papilionidae	Lantana camera	Verbenaceae	Wild
3	Common crow	Euploea core	Nymphalidae	Crotalaria pallida	Fabaceae	Wild
4	Striped tiger	Danaus genutia	Nymphalidae	Lantana cameraCrotalaria pallidLeucas aspera	VerbenaceaeFabaceaeLumeaceae	WildWildWild
5	Commonbush brown	Mycalesis perseus	Nymphalidae	Cynadon dactylon	Poaceae	Wild
6	Common grass yellow	Eurema hecabe	Nymphalidae	Cassia fistula	Caesalpinaceae	Semi wild
7	Psyche	Lepto sianina	Pieridae	Leucas aspera	Lumeaceae	Wild
8	Common jezibel	Delias eucharis	Pieridae	Bauhinea purpurea	Caesalpinaceae	Cultivated
9	Glassy tiger	Parantica algea	Pieridae	Calotropis gigantea	Asdepiadaceae	Wild
10	Common palm fly	Elymnias hypermnestra	Nymphalidae	Ixora javanicaCynadon dactylon	RubeaceaePoaceae	Wild
11	Black rajah	Charaxes solon	Nymphalidae	Bauhinia racemosa	Caesalpinaceae	Semi wild
12	Commander	Moduza procris	Nymphalidae	Mussaenda frondosa	Rubeaceae	Semiwild
13	Blue morman	Papilio polymnster	Nymphalidae	Clerodendron viscosum	Verbanaceae	Wild
14	Plain tiger	Panavs chrysippas	Papilionidae	Calotropis gigantea	Asdepiadaceae	Wild
15	Common sailer	Neptis hylas	Nymphalidae	Helecters isora	Sterculiaceae	Wild
16	Great egg fly	Hypolimnas bolina	Nymphalidae	Hibiscus rosasinensisSida rhombifolia	Malvaceae	Cultivated
17	Indian palmbob	Suastus germius	Hespiridae	Lantana camera	Verbenaceae	Wild

Table II-Site A-Distribution and diversity of butterflies-

Fauna					Flora	
Sl No	Common name	Scientific name	Family	Status of recording	Plant species	Fmily
1	Common emigrant	*Catopsilia pomona*	Pieridae	C	*L.camera* *C.fistula*	Verbenaceae Caesalpinaceae
2	Tailed jay	*Graphium agamemnon*	Ppilionidae	C	*L.camera*	Verbenaceae

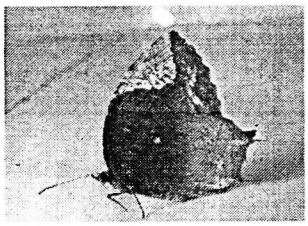
3	Psyche	*Hepto* sianima	Pieridae	C	*L.aspera*	Lumeaceae
4	Common palm fly	*Elymnias hyperministra*	Nymphalidae	C	*Ixora javanica C.dactylon*	Rubeaceae Poaceae

Table III-Site B--Distribution and diversity of butterflies

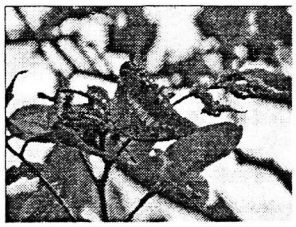
Flora				Fauna		
SlNo	Common name	Scientific name	Family	Status of recording	Species	family
1	Common crow	*Euploea care*	Nymphalidae	UC	C.pallida Delonix regia	Fabaceae Caesalpinaceae
2	Striped tiger	*Danus genutia*	Nymphalidae	C	*L.camera C.pallid, L.aspera*	Verbanaceae Fbaceae Lumeaceae
3	Common bushbrown	*Mycalesis perseus*	Nymphalidae	C	*M.frondosa Cynodon dactylon*	Rubeceae Poaceae
4	Common grass yellow	*Eurema hecabe*	Pieridae	UC	*C.fistula*	Caesalpinaceae
5	Common jezbel	*Delias eucharis*	Pieridae	C	*C.gigantea*	Caesalpinaceae
6	Glassy tiger	*Parantica aglea*	Nymphalidae	C	*B.purpurea*	Asodopiadaceae
7	Black rajah	*Charaxes solon*	Nymphalidae	UC	*B.recemosa*	Caesalpinaceae
8	Plain tiger	*Danaus chrysippus*	Nymphalidae	UC	*C.gigantea*	Asodopiadaceae
9	Common emigrant	*Catopsilla Pomona*	Pieridae	C	*L. camer C.fistula*	Verbanaceae Caesalpinaceae
10	Blue mormon	*Papillo poymnster*	Papilionidae	C	*L.camera*	Verbanaceae

Table VI Site C--Distribution and diversity of butterflies

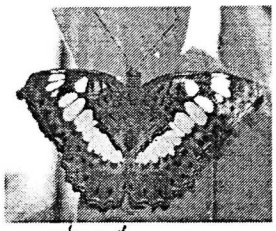
Flora				Fauna		
Sl No	Common name	Scientific name	Family	Status of recording	Plant species	Family
1	Commander	*Moduza procris*	Nymphalidae	UC	*M.frondosa*	Rubeaceae
2	Common sailer	*Neptis hylas*	Nymphalidae	UC	*Helecteres isora*	Sterculeaceae
3	Great eggfly	*Hypolimnas boloina*	Nymphalidae	UC	*H.roassinensis*	Malvaceae
4	Indian palmbob	*Suastis germius*	Hespiridae	UC	*L.camera*	Vreenaceaeb



Common palmfly

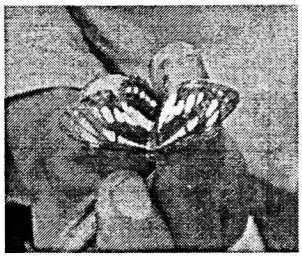


Black Rajah

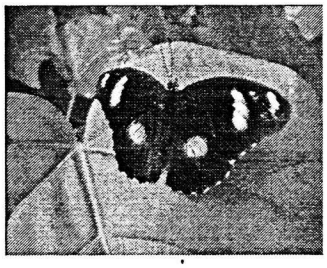


Commander

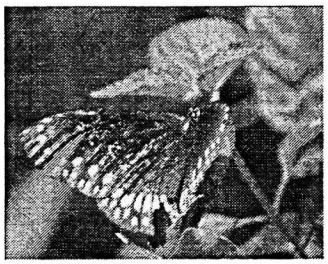
Plate 2: Family Nymphalidae



Common sailor

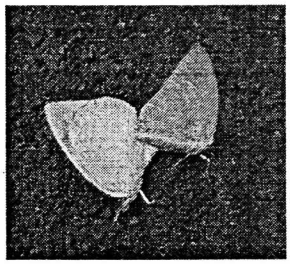


Great egg fly



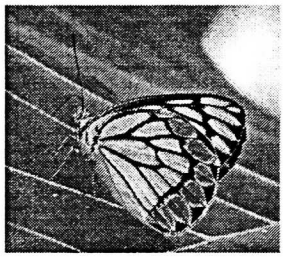
Common Indian crow

Plate 3: Family Pieridae



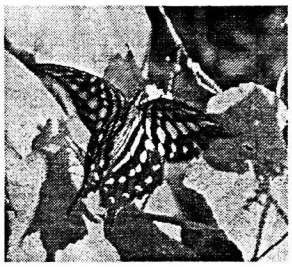
Common Emigrant

Common Grass yellow

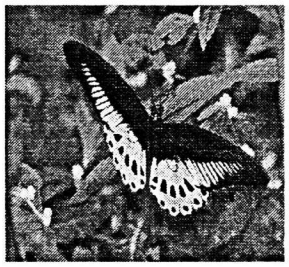


Common Gesbel

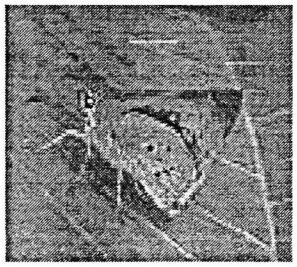
Plate 4: Family Papilionidae



Tailed jay



Bluemormon



Palmbob

Plate 5: Family Hespiridae

CONCLUSION

The present study of butterfly diversity in Farook college campus reveals a moderate diversity of butterflies due to the average level of vegetation and temperature which will enhance the butterfly growth. Our findings are important with respect to monitoring

pollinating butterfly and plant diversity defining conservation strategies in this aspect. Although the study was limitted to short time, it helps to continue a little to biodiversity in the study area, a base line about the relationship between the butterfly and host plant.

In the last few decades a notable decline in the number of butterflies has been recorded all over the world, many species becoming rare or vanishing completely. This decline as well as decline among other groups of animal is connected with the well being of our eco system. Thus it is our duty to protect our nature if we want the human society to endure not for just another century but for thousands and thousand years to come. For this green lungs of the world must be maintained, otherwise the battle for protection and preservation of environment, there will be a victor but we all end up as losers.

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A PRELIMINARY STUDY ON STATUS, THREATS AND CONSERVATION STRATEGIES OF AVIAN FAUNA IN THIRUNNAVAYA WETLAND, MALAPPURAM, KERALA, INDIA

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Abstract

Wetlands are one of the most productive ecosystems in the world, which act as an important indicator of varied flora and fauna. Thirunnavaya wetlands situated in Malappuram district, Kerala, India has recorded 67 species of water birds belonging to 57 genera, 31 families and 16 orders in the month of July 2014 to June 2015. Out of 67 species, 49 were Resident, 12 were Winter Visitors and 6 were Resident Migratory. The orders Ciconiiformes and Passeriformes represented by 15 species each were dominated, Charadriformes by 10, Coraciformes by 6 and the remaining orders represented by 3/2/1 species. The avian fauna suffer severe habitat destruction in the study area largely by anthropogenic effects such as filling up the aquatic habitats, clay mining, pollution, improper waste management and invasion of exotic flora and fauna. So appropriate conservation strategies mainly by protection and restoration of wetland habitats should be implemented for the existence of avian fauna.

***Key words**: Thirunnavaya wetland, water birds, habitat destruction, anthropogenic effects, habitat restoration.*

Introduction

Wetlands are one of the most productive ecosystems in the world and it provide suitable habitat for thousands of aquatic flora and fauna. The bird population evaluation has become an important tool in biodiversity conservation. More over seasonal monitoring is equally important to trace the dynamic movement of birds in such habitat. So birds are good bio-indicators and very useful models for studying variety environmental problems [1].The permanent and temporary sources of water in wetland provides good foraging sites for a variety of bird species, with small fish, tadpoles, frogs, insect larvae, other invertebrates and edible aquatic plants. But now wetlands are deteriorating rapidly. Thirunavaya wetlands have long been known to support a large number of resident and migratory birds.

Indian subcontinent is known for diverse and rich bird species, whose taxonomy, distribution and their general habitat characters are well documented in India. A study was conducted by [2] on the birds of Thrissure Kole wetlands and they also discussed the importance conserving Kole wetlands. [3] prepared a check list of avifauna in Bharatha puzha river basin in the year 2006. Recently [4)].studied the status and threats of water birds in West Bengal.

It was a preliminary study in Thirunnavaya wetland, with main objectives to document the species composition and structure of water birds, to find out major threats and to point out proper conservation strategies.

Materials and Methods

Thirunnavaya wetland is located in Tirur taluk, Malappuram district, Kerala state, India with latitude 10°8'49" and 11°00'01" N and longitude 75°98'13" and 75°99'11" E. The area encompasses an area of 80 acre land with varied habitat. Usually this wetland receives average annual rainfall of 170- 200 mm and average annual temperature of 30.5 C. The vegetation is dominated by *Nelumbo nucifera, Nymphaea nonchalli, Vallisnaria species, Hydrilla and Ipomea Carnea.* In addition paddy cultivation is also practiced. Observations were made in two times in a day, between the months of of July 2014 to June 2015 by direct observation method[(5]. The survey was conducted from 7 to 10 am and from 3 to 6.30 pm twice in a week. Total count method and line transecting method [6] was adopted for counting for avian fauna. At each sights of bird was identified and counted using binocular (Olympus,7x50) and field guides of [7] and (8). In case of doubtful identification, photographs were taken and the species were identified later by consulting with experts.

Results and Discussion

Checklist of birds in Thirunnavaya Weland with status, abundance and habitat type were provided in Table 1. A total of 7300 individual birds representing 67 species, 57 genera, 31 families and 16 orders were observed from study area. Among these, 49 (73%) were Resident, 12 (18%) were Winter Visitors and 6 (9%) were Resident Migratory (FIG 1). In the case of Resident Little cormorant, Indian Pond Heron, Cattle Egret, Lesser Whistling Teal, Purple Moorhen, Bronze Winged Jacana, White Breasted Kingfisher, House Crow and Common Myna were common, in Winter Visitors Marsh Sandpiper, Common Sandpiper and Paddy Field Warbler were common., Purple Heron and Open Asian Bill were common species in Resident Migratory. Peak of winter population of migrant was observed during the month of October to middle of February. In present study, the highest bird population was recorded in winter, lowest in monsoon.[12] also reported that during July the birds moved away to avoid heavy rainfall and the whole wetland area lay undated and the availability of

food was also low. Among the bird species recorded, Oriental White Ibis (*Threskiornis melanocephalus*) and Oriental Darter (*Anhingarufa melanogaster*) were listed as Near Threatened category on Red List by IUCN increases suitability of these wetland ecosystem. As vegetation changes along complex geographical and environmental gradients, a particular bird species may appear increases or decreases in number and disappear as habitat changes[(9].

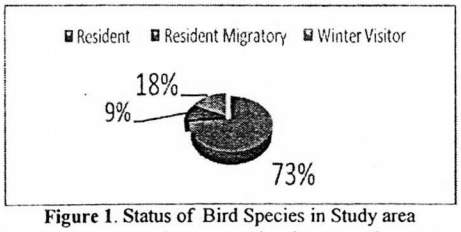

Figure 1. Status of Bird Species in Study area

Wetland birds in Thirunnavaya faced several anthropogenic threats; these are adversely affect natural habitats and will decrease the numbers of birds. Water pollution, usage of pesticides, wetland reclamation, harmful fishing and uncontrolled growth of invasive plants was the threats we were observed. The uncontrolled use of toxic chemicals, insecticides and pesticides in Loktak lake aldo, the discharge of effluents, sewage, garbage etc lead to water and soil pollution and it endangering the aquatic fauna and flora [10]. Water level drawsdown or drainage of wetlands can produce major changes in soil physical, chemical and biological properties. And the infestation of the exotic water weeds like *Eichhonia, Salvinia molesta* were causing serious harms to the water birds was documented by [11]

For proper wetland management, following strategies should be initiated. Bring the local people to protect the wetland, enhancing the usage of bio fertilizers, prevent the habitat destruction by protecting land from reclamation process, completely avoid the introduction invasive fauna and flora to wetland or Proper removal of water weeds from wetlands, prevent the fish catching practices by using gill nets or the nets which is harmful to the reproduction or survival of native fishes.

Birds are abundant and wide spread species in world and they constitute one of the important components in global biodiversity. During the study period, a total of 67 species were recorded in Thirunnavaya wetlands. Many threats were noticed from the study areas. And it can directly impact on avian fauna survival. Habitat restoration and other effective conservation strategies should be initiated on these ongoing issues for the protection of avian fauna.

Table 1. Check List Of Avian Fauna In Thirunavaya Wetland.

Sl No	Family	Common name	Scientific Name	Residential Status	Abundance	Habitat
1	Podicipitidae	Little Grebe	*Trachybaptus ruficollis*	R	C	H3,H4
2	Phalacrocoracidae	Indian Shag	*Phalacrocorax fuscicollis*	R	Rr	H5
3		Little Cormorant	*Phalacrocorax niger*	R	VC	H2,H3,H4,H5
4	Anhingidae	Oriental Darter	*Anhinga rufa melanogaster*	RM	FC	H3,H4,H5
5	Ardeidae	Grey Heron	*Ardea cineria*	WV	FC	H1,H2
6		Purple Heron	*Ardea purpurea*	R	C	H1, H2,H3
7		Large Egret	*Casmerodius albus*	RM	C	H1,H2
8		Little Green Heron	*Butorides striatus*	R	FC	H1,H3LKLKL
9		Indian Pond Heron	*Ardeola grayii*	R	VC	H1,H2,H3,H4
10		Cattle Egret	*Bubulcus ibis*	R	VC	H1,H2,H3,H4
11		Median Egret	*Egreta intermedia*	R	C	H1,H2
12		Little Egret	*Egreta garzetta*	R	C	H1,H2,H3,H4
13		Black Crowned Night Heron	*Nycticorax nycticorax*	R	Rr	H1,H2
14		Yellow bittern	*Ixobrychus sinensis*	RM	Rr	H4,
15	Ciconidae	Asian open bill Stork	*Anastomus oscitans*	RM	C	H1,H2
16		White necked Stork	*Ciconia episcopus*	RM	FC	H1, H2
17		European white Stork	*Ciconia ciconia*	WV	FC	H1, H2
18	Threskiornithdae	Oriental white Ibis	*Threskiornis melanocephalus*	R	C	H1, H2
19		Glossy Ibis	*Plegadis falcinellus*	WV	Rr	H1, H2
20	Anatidae	Lesser whistling teal	*Dendrocygna javanica*	R	VC	H3,H4
21	Accipitridae	Black kite	*Milvus migrance*	R	FC	H7,H8
22		Brahminy kite	*Haliastur Indus*	R	FC	H7,H8
23		Shikra	*Accipiter badius*	R	Rr	H7
24	Phasianidae	Indian Peafowl	*Pavo cristatus*	R	FC	H2,H6,H7
25	Rallidae	White breasted water hen	*Amaurornis phoenicurus*	R	C	H2,H3,H4,H6
26		Common moor hen	*Gallinula chloropus*	RM	FC	H3,H4
27		Purple moor hen	*Porphyrio porphyrio*	R	VC	H2,H3,H4
28	Jacanidae	Pheasent tailed Jacana	*Hydrophasianus chirurgus*	R	Rr	H3,H4
29		Bronze winged Jacana	*Metopidius indicus*	R	VC	H3,H4
30	Charadridae	Red wattled lapwing	*Vanillus indicus*	R	VC	H1,H2,H6
31		Marsh sandpiper	*Tringa stagnatilis*	WV	FC	H1,H2
32		Common Green shank	*Actitis hypoleucos*	WV	Rr	H1,H2
33		Wood Sandpiper	*Tringa nebularia*	WV	FC	H1,H2
34		Common sand piper	*Tringa glareola*	WV	Rr	H1, H2

35		Little stint	*Calidris alpine*	WV	Rr	H1, H2
36	Laridae	River Tern	*Sterna aurantia*	R	Rr	H1, H2
37		Whiskered Tern	*Chlidonias hybridus*	WV	Rr	H1, H2
38	Columbidae	Blue rock Pigeon	*Columba livia*	R	C	H2,H7
39		Spotted Dove	*Streptopelia chinensis*	R	FC	H2,H7
40	Psittacidae	Rose ringed parakeet	*Psittacula krameri*	R	C	H2,H7
41	Cuculidae	Asian koel	*Eudynamys scolopacea*	R	FC	H7
42		Greater coucal	*Centropus sinensis*	R	FC	H6,H7
43	Strigidae	Barn owl	*Tyto alba*	R	Rr	H7
44	Apodidae	Asian palm swift	*Cypsiurus balasiensis*	R	FC	H8
45	Alcidinidae	Lesser pied kingfisher	*Ceryle rudis*	R	FC	H1,H3,H4,H5
46		Small blue kingfisher	*Alcedo atthis*	R	C	H1, H3,H4,H5
47		Stork billed kingfisher	*Pelargopsis capensis*	R	FC	H1, H3,H4,H5
48		White breasted kingfisher	*Halcyon smyrensis*	R	VC	H1,H2, H3,H4,H5
49	Meropidae	Small Bee-eater	*Meropus orientalis*	R	C	H7,H8
50	Coracidae	Indian Roller	*Coracias benghalensis*	R	FC	H7,H8
51	Capitonidae	White Cheeked Barbet	*Megalaima viridis*	R	FC	H7
52	Picidae	Lesser golden-Backed Wood pecker	*Dinopium benghalense*	R	FC	H7
53	Oriolidae	Eurasian Golden Oriole	*Oriolus oriolus*	WV	FC	H7
54	Dicruridae	Black Drongo	*Dicrurus smacrocerus*	R	C	H2,H3,H6,H7
55		Racket tailed Drongo	*Dicrurus paradiseus*	R	FC	H7
56	Sturnidae	Common myna	*Acridotheres tristis*	R	VC	H6,H7
57	Corvidae	Indian tree pie	*Dendrocitta vagabunda*	R	FC	H7
58		House Crow	*Corvus splendens*	R	C	H6,H7
59		Jungle Crow	*Corvus macrorhynchos*	R	C	H6,H7
60	Pycnonotidae	Red whiskered Bulbul	*Pycnonotus jocosus*	R	FC	H7
61	Muscicapidae	Jungle Babbler	*Turdoides affinis*	R	FC	H7
62		Blyth's Reed warbler	*Acrocephalus dumetorum*	WV	FC	H2,H3
63		Paddy field Warbler	*Acrocephalus Agricola*	WV	FC	H2,H3
64		Oriental Magpie Robin	*Motacilla maderaspatensis*	R	FC	H7
65	Motacillidae	White browed wagtail	*Copsychus saularis*	R	FC	H1,H2
66	Nectarinidae	Purple-Rumped sunbird	*Nectarinia zeylonica*	R	FC	H7
67		Loten's Sunbird	*Nectarinia lotenia*	R	FC	H7

R=Resident, RM= Resident Migrant, WV= Winter Visitors, C=Common, FC=Fairley Common, VC=Very Common, H1= shallow marshy area, H2= Paddy field, H3=Areas of submerged vegetation and floating vegetation, H4=reed beds, H5=Open water area, H6=Grass lands and grazing lands, H7=Trees and bushes standing near the water bodies ,H8= flying over and around water bodies.

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