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# CUSTOMER RELATIONSHIP MANAGEMENT – THE NEW MARKETING MANTRA IN BANKS: A COMPARATIVE STUDY OF NEW GENERATION PRIVATE SECTOR BANKS AND OLD PRIVATE SECTOR BANKS IN KERALA

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## Abstract

Today, many businesses such as banks, insurance companies, and other service providers realize the importance of Customer Relationship Management (CRM) and its potential to help them acquire new customers retaining existing ones and maximize their lifetime value. At this point, close relationship with customers will require a strong coordination between IT and marketing departments to provide a long-term retention of selected customers. CRM is a sound business strategy to identify the bank's most profitable customers and prospects, and devotes time and attention for expanding account relationships with those customers through individualized marketing, re-pricing, discretionary decision making and customized service-all delivered through the various sales channels that the bank uses. In the ongoing era of financial sector deregulation in India, CRM as a competitive strategy has become an imperative rather than an option. In this context, this paper seeks to make an empirical study of the CRM initiatives of private sector banks in the state of Kerala. Both Old Generation Private Sector Banks (OPBs) and New generation Private Sector Banks (NPBs) have been included in the study. Accordingly, the study seeks to make a comparative analysis of the CRM practices between these two broad categories of private sector banks. NPBs which have started functioning in the reforms era have been observed to have scored better in the CRM front than OPBs. Based on the findings of the study, the paper makes a few strategies for more effective adoption of CRM for superior performance of banks.

**Key Words**: Information and Communication Technology (ICT), Banking Technology**,** Bank Marketing, CRM

## Introduction

Today, many businesses such as banks, insurance companies, and other service providers realize the importance of Customer Relationship Management (CRM) and its potential to help them acquire new customers retain existing ones and maximize their lifetime value. At this point, close relationship with customers will require a strong coordination between IT and marketing departments to provide a long-term retention of selected customers. In this context, the proposed research seeks to study the CRM initiatives of private sector banks based in the state of Kerala. CRM is a sound business strategy to identify the bank's most profitable customers and prospects, and devotes time and attention to expand account relationships with those customers through individualized marketing, re-pricing, discretionary decision making, and customized service-all delivered through the various sales channels that the bank uses.

## Objectives of the study

(i) To study the concept of CRM, its process and benefits in the present day deregulated business environment, with a focus on its applications in the banking sector.

(ii) To make an empirical study of the CRM initiatives of private sector banks functioning in the state of Kerala, and to compare the performance in CRM effectiveness between the two broad categories of private sector banks viz. Old Generation Private Sector Banks (OPBs) and New generation Private Sector Banks (NPBs);

(iii) To make broad suggestions for effective use of CRM for enhanced operational efficiency and competitiveness of private sector banks functioning in the state of Kerala, based on the findings of this study.

## Hypotheses of the Study

(a) To be tested on OPBs (Old Private sector Banks):

H1: There exists a significant difference among the level of customer satisfaction and CRM practice in the public sector banks.

(b) To be tested on NPBs (New generation Private sector Banks):

H2: There exists a significant difference among the level of customer satisfaction and CRM practice in the private sector banks.

(c) To be tested on comparison of OPBs and NPBs:

H3: There exists a significant difference in the level of customer satisfaction and CRM practice between OPBs and NPBs.

## Methodology

Kerala's history of banking is rather enviable. Kerala had to its credit a very conducive climate for banking development right from historical times. This research deals with CRM in Old Generation Private Sector Banks and New Generation Private Sector Banks in Kerala. The Kerala based Old Generation Private Sector banks taken for the study are a) Catholic Syrian Bank b) South Indian Bank. c) Dhanalakshmi Bank. and d) Federal Bank. The New Generation Private Sector Banks taken for the study are: a) ICICI Bank b) HDFC Bank c) Axis Bank and d) Yes Bank

A sample of 100 respondents has been drawn from the various socio-economic strata, at different designations and having different educational qualification and belonging to different age groups. Among the 100 respondents 50 are from Old Generation Private Sector banks and the other 50 are from New Generation Private Sector banks.

A structured questionnaire was designed to collect the primary data. Convenience sampling method is used for collecting the data and the data was collected by conducting personal interview with the customers. The views of the customers regarding their satisfaction/dissatisfaction towards CRM practices of the concerned banks have been qualified on the basis of Likert scale having five points. These five points and their respective score values in the scale are given as under:

**Table 1 Five-Point Scale (Likert's Scale) used for Data Analysis**

| Points of Scale | Assigned Score |
|---|---|
| Very Satisfied | 5 |
| Satisfied | 4 |
| Neither satisfied nor dissatisfied | 3 |
| Dissatisfied | 2 |
| Very dissatisfied | 1 |

A high score in the corresponding dimension indicates a very high satisfaction of the customers. Score in the low range indicates conversely low

satisfaction of the customers. Since the questionnaire was a survey, the dimensions selected for measuring customers' satisfaction have been selected as below:

(i) Ability to Resolve Complaints
(ii) Responsiveness of the Banks Staff to Customer Query
(iii) Banking Services
(iv) Counter Services
(v) Accounts and Deposits of the Banks

***Techniques of Data analysis***

The following techniques were used to study the objectives:

(i) Mean
(ii) Standard Deviation
(iii) Z-test

***Customer Relationship Management: The Concept***

In literature, many definitions are given to describe CRM. The main difference among these definitions is relating to the technological and relationship aspects of CRM. Some authors with marketing background emphasize technological side of CRM while some others consider IT perspective of CRM. From marketing aspect, CRM is defined by [Couldwell 1998] as "A combination of business process and technology that seeks to understand a company's customers from the perspective of who they are, what they do, and what they are like". From a technological perspective, CRM initiatives are those activities that result in the market place of the future to undergo a technology-driven metamorphosis" [Peppers and Rogers 1995]. Consequently, IT and marketing departments must work closely to implement CRM efficiently. Meanwhile, implementation of CRM in banking sector was considered by [Mihelis et al. 2001]. They focused on the evaluation of the critical satisfaction dimensions and the determination of customer groups with distinctive preferences and expectations in the private bank sector.

Customer Relationship Management (CRM) is the process of managing detailed information about individual customers and carefully managing all customer "touch points" to maximize customer loyalty. A *customer touch point* is any occasion on which the customer encounters the brand and product – from

actual experience to personal or mass communications to causal observation (Kotler, 2007). Customer Relationship Management (CRM) has become immensely popular because of the promise it holds for organizations. "CRM is a business strategy to acquire and retain the most valuable relationships. CRM requires a customer centric business philosophy and culture to support effective marketing, sales and service processes. CRM applications can enable effective customer relationship management, provided that an enterprise has right leadership, strategy and culture". (CRMGuru.com, Jan 2003).

### *CRM Objectives in the Banking Sector*

The idea of CRM is that it helps businesses use technology and human resources gain insight into the behavior of customers and the value of those customers. If it works as hoped, a business can: provide better customer service, make call centers more efficient, cross sell products more effectively, help sales staff close deals faster, simplify marketing and sales processes, discover new customers, and increase customer revenues. It doesn't happen by simply buying software and installing it. For CRM to be truly effective, an organization must first decide what kind of customer information it is looking for and it must decide what it intends to do with that information. For example, many financial institutions keep track of customers' life stages in order to market appropriate banking products like mortgages or IRAs to them at the right time to fit their needs. Next, the organization must look into all of the different ways information about customers comes into a business, where and how this data is stored and how it is currently used. One company, for instance, may interact with customers in a myriad of different ways including mail campaigns, Web sites, brick-and-mortar stores, call centers, mobile sales force staff and marketing and advertising efforts. Solid CRM systems link up each of these points. This collected data flows between operational systems (like sales and inventory systems) and analytical systems that can help sort through these records for patterns. Company analysts then comb through the data to obtain a holistic view of each customer and pinpoint areas where better services are needed.

The following data are collected in CRM projects to run process engine: 1) Responses to campaigns, 2) Shipping and fulfillment dates, 3) Sales and purchase data, 4) Account information, 5) Web registration data, 6) Service and support records, 7) Demographic data, 8) Web sales data.

The use of CRM in banking has gained importance with the aggressive strategies for customer acquisition and retention being adopted by the banks in today's competitive era. This has resulted in the adoption of various CRM initiatives by these banks to enable them to achieve their objectives. The steps that banks follow can be as follows:

a) Identifying CRM initiatives with reference to the objectives to be attained (such as increased number of customers, enhanced per-customer profitability, etc.)

b) Setting measurable targets for each initiative in terms of growth in profits, number of customers, etc.

c) Evaluating and choosing the appropriate CRM package that will help the company achieve its CRM goals (a comparison of payoffs against investments could be carried out during the evaluation exercise).

***Process of CRM in Banking***

CRM process includes customers' demographic data, product ownership data and transaction data or, more generally product usage data as well as risk and profitability data. The importance of the Data Warehouse stems from the analysis of Figure I. As a result of strategic decisions customer analysis is carried out by using data continuously updated as well the analytical methods and tools to be described later on. The CRM group analyzes results obtained and designs action plans, such as campaigns, promotions, special marketing initiatives, etc. Plans developed are then implemented by means of the several channels used by the bank to reach customers.

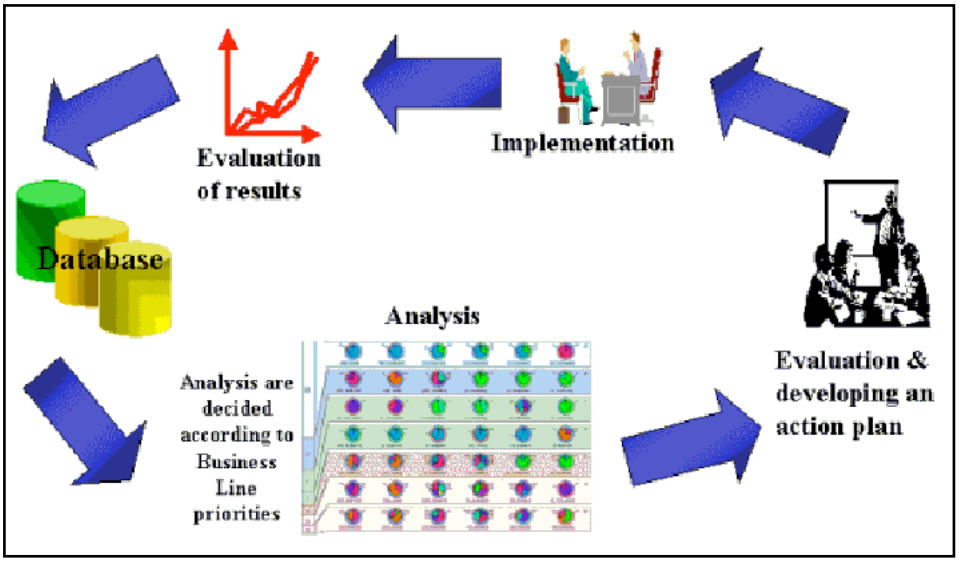


**Figure 1 The process of Relational Marketing**

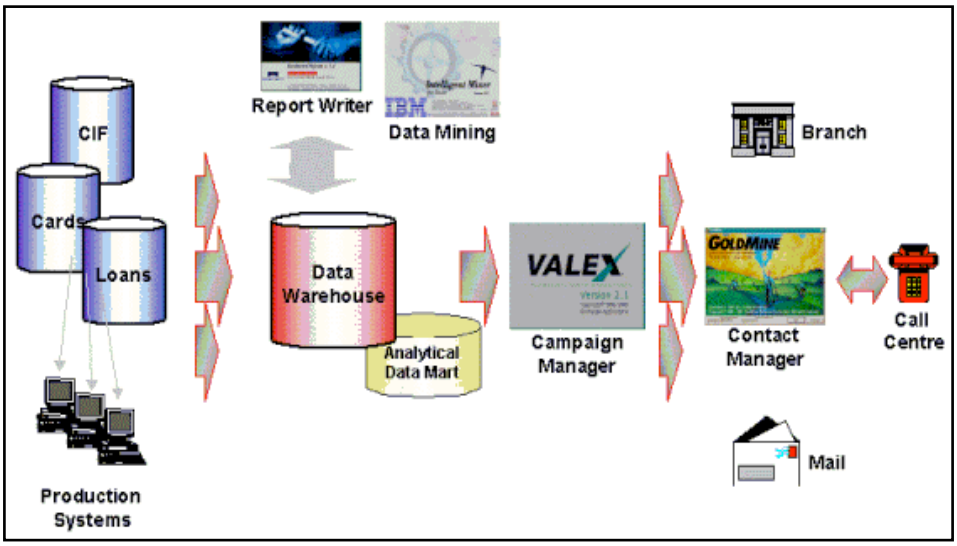


**Figure 2 The General Structure of Relational Marketing Activity**

Figure 2 shows general structure of Relational Marketing Activity. Accordingly, the Relational Marketing process is supported by a computing infrastructure where many software packages are integrated with the bank's information system. Figure 3 shows the marketing campaign process and the software supporting it.

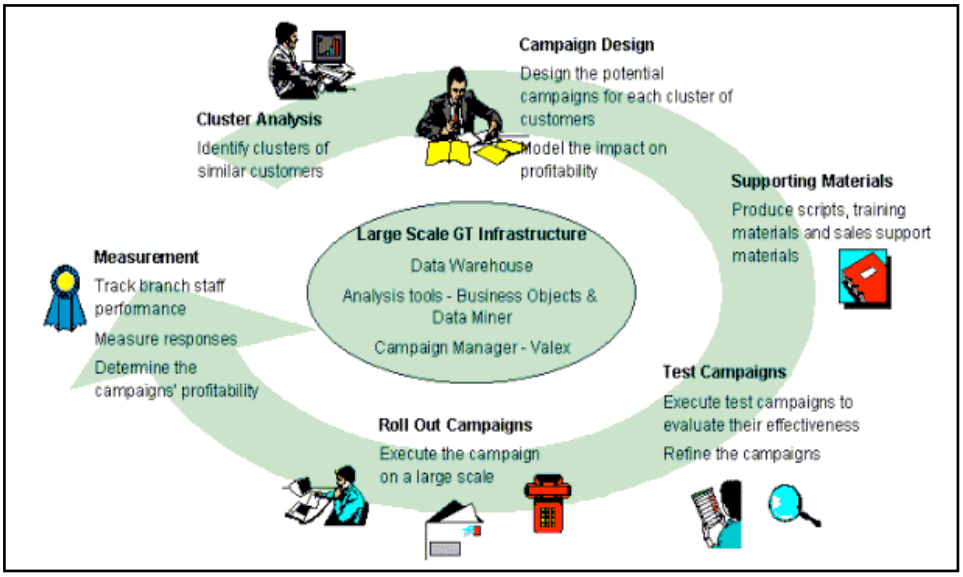


**Figure 3 The marketing Campaign Process and the Software Supporting it.**

***The Benefits of CRM***

The benefits deriving out of adoption of CRM practices, particularly in the banking parlance are many. Primarily CRM initiatives enable the banks to attract new customers while at the same time retaining the existing ones. This in turn translates into higher business volumes and profitability. Some of the most important benefits include:

- Gaining Sales momentum
- Increasing acquisition of new customers
- Improving retention of existing customers
- Increasing the profitability of customer relationships
- Improving distribution and channel management
- Maximizing the value of past CRM investments

***CRM Initiatives of Private Sector Banks in Kerala: An Analysis***

Banks aim at developing life long relationships with customers through CRM. CRM advocates that organizations must shift from the constant customer acquiring mode to customer retention mode by developing a mutually profitable life long relationship and then maximize the life time value of this relationship by ensuring that customers spend more on the services offered by banks. Thus, the revenues improve only when needs of the customers are well understood and

fulfill those needs effectively by offering suitable services. CRM has to continuously evolve to meet future customer needs and expectations. Simply stated, CRM is for enhanced competitiveness i.e., CRM is going to be a-never ending journey for the banks.

The private sectors banks in Kerala have been growingly adopting CRM in the ongoing reforms era. The added thrust on CRM is reflected in higher investments in the following:

- ATMs
- E-banking
- Mobile alerts like salary credit account debit/credit, cheque bounce etc.
- Bill payments through internet
- Free of cost SMS for queries on Banking, Cards and Demat a/c.

***Limitations of the Study***

(i) Reluctance of some respondents in sharing of data.
(ii) Time constraint.
(iii) Limitations of convenience sampling may be there.

## Data Analysis and Interpretation

***Ability to Resolve Complaints***

One of the important dimensions of CRM influencing customers' satisfaction is the ability to resolve Customers' Complaint. The basic success for all the banks would be to view complaints of customers as a great opportunity to do better by turning a discontented customer into a satisfied one. Variables like, outcome of complaints and handling of complaints are the important ingredients of measuring customers' satisfaction. The views of customer about this dimension under study are exhibited in Table 2.

Table 2 reveals that New Generation Private sector banks provides the highest satisfaction to its customers, as the combined mean score of two variables which determine the satisfaction of the customers on the basis of the ability to resolve complaints which is represented by the combined mean score is 4.10. This score is in between very satisfied and satisfied. The views expressed by the customers are consistent as the standard deviation is 0.98.

The customers of the Old Generation private sector banks express their level of satisfaction below very satisfied mean value being 3.94. However, the score of standard deviation show some inconsistent views of customers in case of the Old Generation private sector banks.

Further analysis of Table 2 indicates that in case of New Generation Private Sector banks and Old Generation Private Sector Banks, the outcome of complaints and handling of complaints are the highly contributing factors towards the satisfaction of customers by the New Generation Private Sector Banks. This was due to the fact that customers of New Generation Private Sector Banks are more satisfied than Old Generation Private Sector Banks or a few customers made complaints to their banks.

**Table 2 Customers' Satisfaction with Ability to Resolve Complaints**

| No. | Variables | New Generation Private Sector Banks | | Old Generation Private Sector Banks | |
|---|---|---|---|---|---|
| | | **Mean** | **SD** | **Mean** | **SD** |
| 1 | Outcome of Complaints | 4.90 | 0.756 | 4.28 | 0.845 |
| 2 | Handling of complaints | 3.50 | 1.203 | 3.26 | 1.163 |
| | Combined Mean/SD | 4.10 | 0.98 | 3.94 | 1.00 |

***Responsiveness of the Bank Staff***

Customers' satisfaction towards the CRM practice of bank staff refers to the willingness of the bank employees to help customers and provide prompt services to its customers. Customers' of a bank have a minimum expectation that the employees would attend them rather than chitchat amongst themselves.

This factor is linked to several minor ingredients of the satisfaction experienced by the customers such as courtesy of the staff; banks employees' willingness in helping customers; knowledge to perform the service; information delivery; quality of information received and attitude of bank staff. The politeness, respect, consideration and friendliness of the service providers can be bundled into the term courtesy. Information delivery refers to keeping the customers informed in the language they can understand. The attitude of the staff

is referring to the behaviour of officers and other employees of the respective bank towards the customers. The response of the staff of the bank under study is exhibited in Table 3.

An investigation of Table 3 reveals that New Generation Private Sector Banks provides the highest satisfaction to its customers, as the combined mean score of different variables which determine the satisfaction of the customers on the basis of the Responsiveness of the Bank Staff which is represented by the combined mean 2.98. The mean score of the New Generation Private Sector Banks lies in between satisfied or very satisfied. The views expressed by the customers of the New Generation Private Sector Banks banks are inconsistent as the standard deviation is 1.31.

In New Generation Private Sector Banks, 'the knowledge of the bank staff, helpfulness of banks 'staff and courtesy of the banks staff is the highly contributed CRM factors towards satisfaction of the customers.

In Old Generation Private Sector Banks banks, courtesy of the staff is the highly contributed CRM factor towards satisfaction of the customers of the Banks and helpfulness of the bank staff and quality of information received is the highly contributed factor towards satisfaction of the customers of the Old Generation Private Sector Banks.

**Table 3 Customers' Satisfaction regarding Responsiveness of the Bank Staff**

| No. | Variables | New Generation Private Sector Banks | | Old Generation Private Sector Banks | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| 1. | Courtesy of the banks staff | 3.06 | 1.208 | 3.76 | 1.211 |
| 2. | Helpfulness of the bank staff | 3.78 | 1.587 | 3.46 | 1.451 |
| 3. | Knowledge of the banks staff | 3.16 | 1.209 | 3.12 | 1.204 |
| 4. | Bank information delivery to customers | 2.54 | 1.431 | 2.04 | 1.197 |
| 5. | Quality of information received | 3.10 | 1.367 | 3.08 | 1.321 |
| 6. | Attitude of the banks staff | 2.46 | 1.202 | 2.14 | 1.179 |
| | Combined Mean/SD | 2.98 | 1.31 | 2.95 | 1.29 |

***Banking Services***

The variety of the product and services sold by the bank is a dominant factor for the success of any bank. The prime aim of every bank is to provide excellent service to their customers. The services like, ATMs card; Demand draft; cheque book; Net banking, Mobile banking are the important ingredients of measuring CRM practices and customers' satisfactions. Customers' satisfaction with Banking Services refers to the satisfaction level of customers with quality of service providing by the bank. Banking services provided by the banks under study are exhibited in Table 4.

The analysis of table 4 indicates that the New Generation Private Sector Banks provides the highest satisfaction to its customers as the combined mean score of different variables which determine the satisfaction of the customers on the basis of the Banking Services which is represented by the combined mean 3.36. The mean score of the banks lies in between satisfied or very satisfied. The views expressed by the customers of the New Generation Private Sector Banks are consistent as the standard deviation is insignificant 1.19.

**Table 4 Customers' Satisfaction with banking services**

| No. | Variables | New Generation Private Sector Banks | | Old Generation Private Sector Banks | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| 1. | ATM cards | 4.12 | 1.094 | 4.16 | 1.218 |
| 2. | Demand Drafts | 3.04 | 1.046 | 3.02 | .927 |
| 3. | Cheque Book | 3.20 | 1.470 | 3.24 | 1.523 |
| 4. | Net Banking | 3.10 | 1.235 | 3.08 | 1.189 |
| | Combined Mean/SD | 3.36 | 1.19 | 3.40 | 1.18 |

In Old Generation Private Sector, ATM cards service is the highly contributed factor towards satisfaction of the customers of the Banks and Cheque book service and net banking is the highly contributed factor towards satisfaction of the customers of the Old Generation Private Sector.

***Speed of Counter Services***

Customers' satisfaction with Counter Service refers to customers' satisfaction with the time taken for deposit cash and speed of withdrawal of cash

from the bank, issue a draft and speedily collection of customers' cheques. All have an important role to play in determining the satisfaction of the customers pertaining to the CRM practices and efficiency of the bank. The perceptual views of customers regarding this dimension are presented in Table 5.

Analysis of Table 5 indicates that the highest satisfaction of customers is provided by the New Generation Private Sector Bank as the combined mean score of different variables which determine the satisfaction of the customers on the basis of the Speed of Counter Services which is represented by the combined mean 3.66. The mean score of the New Generation Private Sector Bank lies in between neither satisfied, nor dissatisfied, and satisfied. The views expressed by the customers of the New Generation Private Sector banks are inconsistent as the standard deviation is 1.185.

**Table 5 Customers' Satisfaction regarding Speed of Counter services**

| Sl. No. | Variables | New Generation Private Sector Banks | | Old Generation Private Sector Banks | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| 1. | Cash Deposits | 4.50 | 0.787 | 4.12 | 1.113 |
| 2. | Cash Payment | 3.02 | 1.380 | 3.54 | 1.237 |
| 3. | Issue a draft | 3.40 | 1.054 | 3.36 | 1.059 |
| 4. | Cheque payments | 3.68 | 1.347 | 3.76 | 1.445 |
| 5. | Cheque deposits | 3.56 | 1.353 | 3.40 | 1.387 |
| | Combined Mean/SD | 3.66 | 1.185 | 3.64 | 1.251 |

The satisfaction of customers of the Old Generation Private Sector banks lies in between dissatisfied and neither satisfied, nor dissatisfied, mean value being 3.64. The views expressed by the customers of Old Generation private sector banks are inconsistent as the standard deviation is 1.251. Further analysis of the above table indicates that in all the banks viz. public and private, the speed of cash deposits and cheque payment are the highly contributed factors towards the satisfaction of the customers.

***Accounts and Deposit of the Bank***

Accounts and Deposit of the bank Customers' satisfaction with Bank Accounts and Deposits refers to the satisfaction of customers with saving account, current account and fixed deposits of the bank. The views of customers regarding this dimension under study are presented in Table 6.

Analysis of Table 6 indicates that the highest satisfaction of customers is provided by the Old Generation Private Sector bank, as the combined mean score of different variables which determine the satisfaction of the customers on the basis of the Accounts and Deposit of the Bank which is represented by the combined mean 3.38. The mean score of the banks lies in between satisfied or very satisfied. The views expressed by the customers of the banks are consistent as the standard deviation is insignificant 1.269.

**Table 6 Customers' Satisfaction regarding Accounts and Deposit of the Banks**

| Sl. No. | Variables | New Generation Private Sector Banks | | Old Generation Private Sector Banks | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| 1. | Savings A/C | 2.95 | 1.415 | 3.00 | 1.433 |
| 2. | Current A/C | 3.18 | 1.192 | 3.22 | 1.229 |
| 3. | Fixed Deposits A/C | 3.69 | 1.261 | 3.65 | 1.141 |
| | Combined Mean/SD | 3.26 | 1.291 | 3.38 | 1.269 |

The satisfaction level of customers of the New Generation Private Sector Banks, the banks is in between satisfied or very satisfied as mean score is 3.26. However, the score of standard deviation of the banks shows some inconsistent views of customers. As the standard deviation score is 1.291 for the New Generation Private Sector.

The findings of present study reveal that customers have the highest satisfaction with savings accounts of both sector followed by fixed deposit in New Generation Private Sector and current account in Old Generation Private Sector highlighted by the respondents. Customers have maximum satisfaction with savings accounts of the both sector banks.

***Overall Customers' Satisfaction***

The overall satisfaction of the customers towards CRM practices in public and private sector commercial banks in Kerala which has been summed up in the Table 6 reveals that in all the banks the satisfaction level ranges between satisfied, and neither satisfied, nor dissatisfied. As the overall customers' satisfaction score in New and Old private sector banks are 8.97 and 8.61 respectively (Table 7). A comparison of two sector viz. New and Old

Generation private reveals that the customers in both the banks are somewhat close to each other. The calculated Z-value regarding responsiveness of the staff (0.927), banking services (-0.13) and Accounts and deposits (-0.29) is less than the table value of Z-test at 5% level of significance. Thus, the alternative hypothesis that there exists a significant difference among the level of customers' satisfaction in the public and private sector banks is rejected in favour of null hypothesis. This shows that the customers of both banks hold the similar views. However, the calculated Z-value regarding ability to resolving complaints (2.033) and Counter service (3.491) is greater than the critical value of Z-test that is $\pm$ 1.96 at 5% level of significance. Thus, the alternative hypothesis is correct and hence accepted.

**Table 7 Hypothesis Testing**

| Sl. No. | Variables | New Generation Private Sector Banks | | Old Generation Private Sector Banks | | 'Z' Value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| 1. | Ability to resolve complaints | 8.40 | 1.363 | 7.54 | 1.427 | 2.033 |
| 2. | Responsiveness of the bank's staff | 18.10 | 3.197 | 17.60 | 2.513 | 0.927 |
| 3. | Banking Services | 13.46 | 1.061 | 16.90 | 1.203 | -0.13 |
| 4. | Counter Services | 18.16 | 0.789 | 18.18 | 1.110 | 3.491 |
| 5. | Accounts and Deposits in the Banks | 9.82 | 1.941 | 9.87 | 1.865 | -0.29 |
| | Combined Mean/SD | 8.97 | 1.731 | 8.61 | 1.691 | 1.815 |

As far as comparison of New Generation Private Sector banks and Old Generation Private Sector sector banks is concerned, the calculated Z-value between the mean score of New Generation Private Sector banks and Old Generation Private Sector banks is greater than the critical value of Z-test that is $\pm$1.96 at 5% level of significance with respect to ability to resolve complaints, thus the alternative hypothesis that there exists a significant difference among the level of customers' satisfaction in New and Old private sector banks is accepted. However, with respect to other dimensions of customers' satisfaction, the calculated Z-value is greater than the table value of Z-test at 5% level of satisfaction. Thus, the alternative hypothesis is Correct and hence accepted. This suggests that the customers of New Generation Private Sector and Old

Generation Private Sector banks do not hold similar view towards the CRM practices viz., responsiveness of the bank staff, banking services, counter services and accounts and deposits.

## Findings of the Study

The banking sector in India is undergoing major changes due to competition and the advent of technology. The customer is looking for quality services which can provide him/her satisfaction. This study reveals the CRM practices and customers' satisfaction level of New Generation Private Sector and Old Generation Private Sector banks and their comparison. The analysis of data brings out the following findings:

- From the study, it is evident that New Generation Private Sector banks are more sincere in solving and handling of customers' complaints.
- It is found that the employees of the New Generation Private Sector bank have maximum courtesy with their customers, more willing to help customers, more knowledgeable in answering customers' questions, and excellent in giving information to their customers.
- In New Generation Private Sector banks, the knowledge of the banks staff, helpfulness nature of bank staff and courtesy of the bank staff are the highly practiced CRM factors towards satisfaction of the customers.
- The study reveals that the employees of New Generation Private Sector banks are very attentive towards its customers as compared to Old Generation Private Sector banks.
- ATM cards and cheque book services are the highly contributed factors towards the satisfaction of customers in New Generation Private Sector banks.
- In Old Generation Private Sector sector banks, ATM cards service and Net Banking Services are the highly contributed factors towards satisfaction of the customers.
- Finally, the study found that customers of New Generation Private Sector banks are more satisfied with their accounts and deposits of the banks than Old Generation Private Sector banks.

## Major Suggestions for Enhanced Performance of Banks through CRM

Banks are realizing that the magical formula for attaining success in such a competitive environment is to focus on maintaining relationship with

customers leading to customer loyalty and retention. Based on the findings, a set of suggestions are made so as to pinpoint how CRM is Used as Marketing Mantra and can be used to secure competitiveness, which are given below:

- Implement a Customer Centric Process in Banks.
- New Generation Private Sector need to improve their counter services.
- Customers' complaints should be handled speedily and customers' satisfaction should always be on the top priority.
- Employees should be given training to improve their attitude.
- It is advisable for all the banks under study to keep a separate complaint-cum-suggestion box / book to enable customers to offer suggestions and complaints.
- The working hours of the banks must be as flexible as possible. The operating hours of banks must be extended depending upon the needs and desires of customers.
- Provision for separate inquiry counter at all the banks would be very useful especially to the illiterate customers. Efficient, knowledgeable, customers, competent and versatile front-line staff is the prime requirement for all the banks surveyed.
- As so many customers still using ATM cards, so there should be required more ATM machines for the convenience of the customers.
- The banks must try to find out the specific needs of different customers, so that suitable package of services can be made available to them.

It is believed that the suggestions as above, if properly implemented, will ensure more meaningful implementation of CRM, thus ensuring better Customers' Satisfaction. This in turn would enable them to stay ahead of the changes and withstand the pressures of competition.

## Concluding Remarks

CRM has got very high potential for bringing about radical improvements in the performance of banks, by ensuring enhanced business volumes by attracting new customers and retaining the existing ones. While NPBs could meaningfully utilize CRM for superior performance to a large extent, OPBs (and of course, Public Sector Banks) have to adopt the CRM philosophy still further

in order to survive and prosper, in view of the fierce competition in the banking industry in India in the ongoing reforms era.

## Rreferences


[1]. Philip Kotler, Kevin Lane Keller, Abraham Koshy, Mithileshwar Jha, Marketing Management A South Asian Perspective, 12th Edition, 2007.

[2]. Bhattacharya (2005), *Services Marketing,* Excel Books, New Delhi, India.

[3]. Beckett-Camarata, E.J., Camarata, M.R., Barker, R.T., "*Integrating Internal and External Customer Relationships Through Relationship Management: A Strategic Response to a Changing Global Environment",* Journal of Business Research, 1998, 41, 71-81.

[4]. Berry, M.J.A. & Linoff G.S., *Mastering Data Mining: The Art and Science of Customer Relationship Management*, John Wiley & Sons, Inc., 2000.

[5]. Albin D. Robert, "*Customer Focus in banking Service*", Journal of Indian Marketing, 2004 pp 17-18.

[6]. Amuthan R, "*A Study on Retail Banking Strategies in Private Sector Banks with special reference to HDFC Bank and ICICI Bank ltd*." Journal of Indian Marketing, 2004, pp 31-34.

[7]. Jham, Vimi, and Khan, Kaleem, Mohd, "*Customers' Satisfaction in the Indian Banking sector: A Study*", Journal of Marketing, 2008, pp 84-93.

[8]. Levesque, T. And McDougall, G H "*Determination of Customers' Satisfaction in Retail banking"*, International Journal of Marketing, 1996, Vol. 14, No.7, pp12-20.

[9]. Arjunan and E. Shirley Elizabeth, *A Study on Service Quality Perceptions of Publi and Private Sector Banks in Erode District,* SAJOSPS, ISSN 0972-4613 Vol. 11 No.2, 2011, PP 80-84.

[10]. Bhisham Ramkelawon , "*Customer Relationship Management as an Integrated Approach in the Banking Sector - A Case Study of a local bank in Mauritius*", Proceedings of the International Research Symposium in Service Management, 24-27 Aug. 2010.

[11]. Kothari, C R , *Research Methodology: Methods & Techniques*, New Age International (P) Limited, Publishers, New Delhi, 2005.

[12]. Mylonakis, J., *Customer relationship management functions: A survey of Greek bank customer satisfaction perceptions.* The Icfai University Journal of Bank Management, 2009, VIII(2), 7-31.

# ORGANIC MARKET - NEED OF THE FUTURE

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## Abstract

Organic market is a sustainable market which has started to gain its popularity worldwide. People have started to understand the ill effects of using conventional foods which contain lots of chemical residues. It not only affect the consumers but also the farmers who are cultivating it, the evidence of it can be found, not only in Punjab and Kerala but also from all over India. It is critical that the Indian Government comprehend the ramifications of conventional farming and embraces the organic market as its future.

## Introduction

The origin of organic farming goes back, in its recent history, to 1940s. During this period, the path breaking literature on the subject published by J.I. Rodale in the United States, Lady Balfour in England and Sir Albert Howard in India contributed to the cause of organic farming (Narayanan, 2005).

The World War II (1939-1945) brought with it the technologies that were useful to agricultural production. For example, ammonium nitrate used for munitions during the war evolved into ammonium nitrate fertilizer; organophosphate nerve gas production led to the development of powerful insecticides. These technical advances since World War II have resulted in significant economic benefits as well as environmental and social detriments.

Organic agriculture seeks to use those advances that consistently yield benefits, such as new varieties of crops, precision agriculture technologies, and more efficient machinery, while discarding those methods that have led to negative impacts on society and the environment, such as pesticide pollution (Delate, 2003).

Twentieth century witnessed the technological revolution leading to widespread use of chemical fertilizers without any concern of environmental measure for economical reasons. With the passage of time, society understood the impact of industrialized agriculture and demanded for regional and seasonal products with the respect of environment, health and social welfare of the region, thus the demand for organic agriculture became relevant (Mutlu, 2007).

There are several definitions of organic farming and the one given by the US Department of Agriculture (USDA) is considered the most coherent and stringent. It is defined as 'a system that is designed and maintained to produce agricultural products by the use of methods and substances that maintain the integrity of organic agricultural products until they reach the consumer'. This is accomplished by using substances, to fulfill any specific fluctuation within the system so as to maintain long term soil biological activity, ensure effective peak management, recycle wastes to return nutrients to the land, provide attentive care for farm animals and handle the agricultural products without the use of extraneous synthetic additives or processing in accordance with the act and the regulations in this part. Thus sustainability and organic farming are closely linked (Lampkin, 1999).

***Organic vs. Conventional***

Intensive-type farming, through the application of high-input systems that offer an increased yield, is known as conventional agriculture. It is the chemical age which uses fertilizers to increase crop yields, pesticides to protect crops, and antibiotics and hormones to increase productive efficiency of livestock. The World Health Organisation estimates that long term exposure to pesticides and toxins which are used in conventional farming might cause Parkinson's disease among others in old age. High concentrations of organophosphates and Lindane (both extremely toxic) are found in non-organic fruit and vegetables, especially pears, carrots and lettuce. Many pesticides are known endocrine disrupters—chemicals that lead to an increase in birth defects, sexual abnormalities and reproductive failure (Athanasios et al. 2012).

According to International Federation of Organic Agriculture Movements (IFOAM) survey, organic produce have consistently been rated for better flavor and texture than non-organic produce. They also have low water content helping it to reserve high nutrient.

There are more than 500 additives permitted in conventional food processing, some of which have negative human health effects (IFOAM, 2006). Train No: 339 from Bathinda to Bikaner which has been called by the locals using a chilling name 'The Cancer Train' shows the ill effects of conventional farming. It routinely carries at least 60 cancer patients who make the overnight journey with their families to the town of Bikaner for treatment at the government's regional cancer center. Research by one of the most respected medical institutes in India recently found that farming villages using large amounts of pesticides have significantly higher rates of cancer than villages that use less of the chemicals (Zwerdling, 2009).

Kerala is also not spared from the ramifications of conventional farming. Use of Endosulfan, a deadly pesticide sprayed in the Kasaragod district brought deadly diseases along with physical disfiguration among the new born. The United Nations Organization (UNO) classifies Endosulfan as a highly dangerous insect killer and is banned in 62 countries. From 1995 about 500 deaths have been officially acknowledged, as a result of spraying Endosulfan while unofficial estimates put the total number of deaths since the late seventies around 4000. Even though Endosulfan has been banned for 2 years in Kerala, Kerala Government is discussing the revoking of the ban (Kalanad, 2011).

Governments who wish to improve the health of their population and reduce health care costs should encourage organic agriculture and engage in procurement of organic products. Consumers, who wish to reduce their exposure to harmful pesticides, drug residues, GMOs (Genetically Modified Organism) and additives, should support the organic movement and chose organic food. Farmers who wish to protect their own and their workers' health, and improve the quality of their produce, should grow organic (IFOAM, 2006).

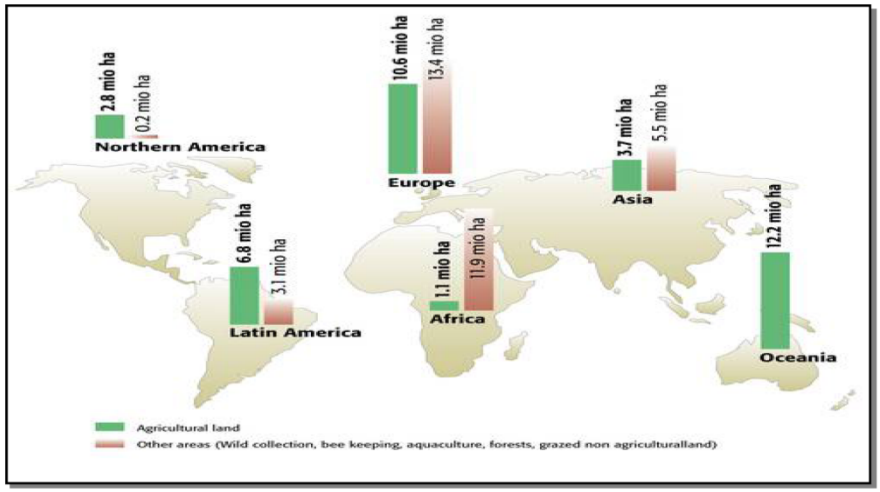
### *Organic agriculture around the world*

The relevance and need for an eco-friendly alternative farming system arose from the ill effects of the chemical farming practices adopted worldwide during the second half of the last century. The methods of farming evolved and adopted by our forefathers for centuries were less injurious to the environment. People began to think of various alternative farming systems based on the protection of environment which in turn would increase the welfare of the humankind. Many systems of farming came out of the efforts of many experts

and laymen. However, organic farming is considered to be the best among all of them because of its scientific approach and wider acceptance all over the world (Narayanan, 2005).

Today nearly 162 countries in the world are practicing organic farming and number of farms and agricultural land are increasing day by day. According to the latest Research Institute of Organic Agriculture- International Federation of Organic Agriculture Movements (FiBL-IFOAM) Survey on organic agriculture, there are 37.2 million hectares of organic agricultural land (including in-conversion areas).

The regions with the largest areas of organic agricultural land are Oceania (12.2 million hectares, 33 percent of the world's organic agricultural land) and Europe (10.6 million hectares, 29 percent). Latin America has 6.8 million hectares (18.4 percent) followed by Asia (3.7 million hectares, 10 percent), North America (2.8 million hectares, 7.5 percent) and Africa (1.1 million hectares, 3 percent).

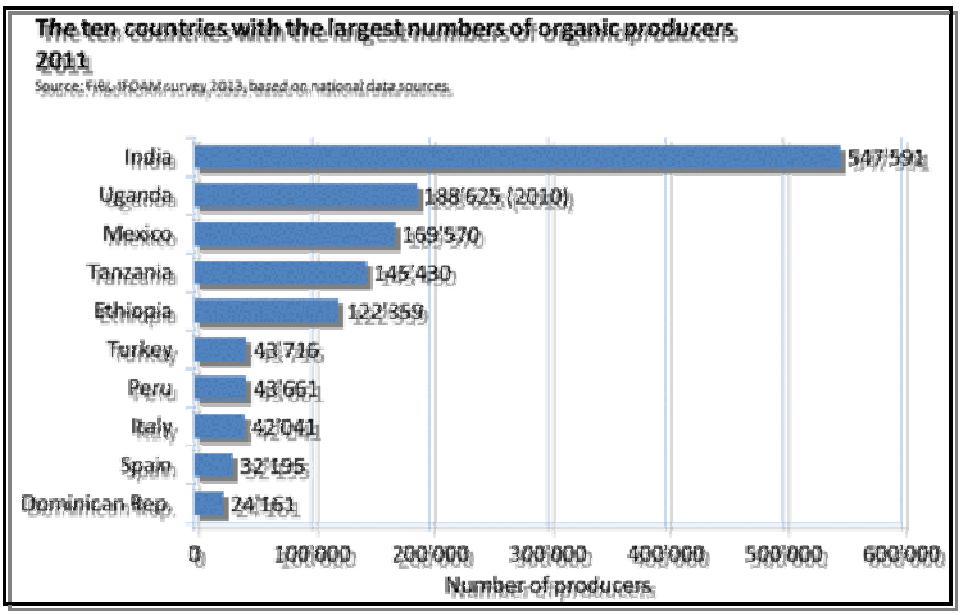



*Source: FiBL- IFOAM Survey 2013*

**Figure 1: Organic agricultural land and other areas 2011**

The countries with the most organic agricultural land are Australia (12 million hectares), Argentina (3.8 million hectares), and the United States (1.9 million hectares). The leading countries by area in Asia are China (510'000 hectares) and India (304'266 hectares). There were 1.8 million producers in

2011. Thirty-four percent of the world's organic producers are in Asia, followed by Africa (30 percent), and Europe (16 percent). The countries with the most producers are India (547'591), Uganda (188'625, 2010), and Mexico (169'570) (Willer, Helga and Kilcher, Lukas (Eds.) 2013).



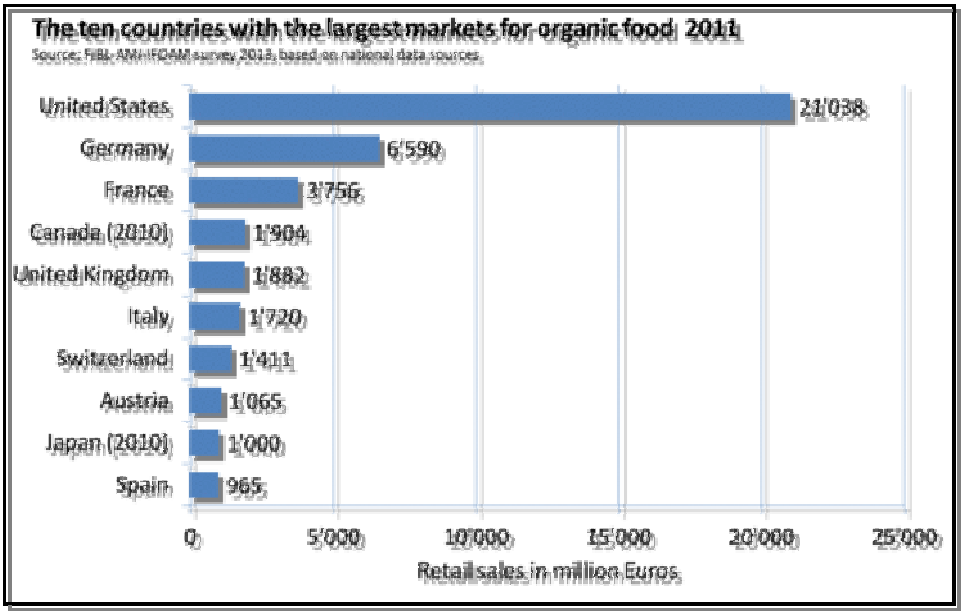

*Source: FiBL- IFOAM Survey 2013*

**Figure 2: The ten countries with the largest numbers of organic producers 2011**

### *Market for Organic Foods*

Global sales of organic food & drink reached 63 billion US dollars in 2011. The market has expanded over three-fold in ten years (2000: 17.9 billion US dollars). Although growth has slowed since the financial crisis started in 2008, sales have continued to increase at a healthy pace. Demand for organic products is concentrated in two regions; North America and Europe comprise 90 percent of global revenues.

In 2011, the countries with the largest organic markets were the United States, Germany, and France. The largest single market was the United States. The highest per capita consumptions were in Switzerland, Denmark, and Luxemburg. The highest market shares were reached in Denmark, Switzerland and Austria (Willer, Helga and Kilcher, Lukas (Eds.) 2013).




*Source: FiBL-AMI-IFOAM survey 2013*

Figure 3: The ten countries with the largest markets for organic food 2011

***Organic Agriculture and Marketing in India***

The inability of Indian agriculture to meet the country's demand for food, during the two and half decades immediately after independence had been a matter of concern. The system of agriculture based on the traditional knowledge and practices handed down from generation to generation could not produce enough, to feed the increasing population. The ignominy of our dependence for food on the western developed nations and the politics of food aid practiced by them added to our determination to be self-sufficient in food production by modernising agriculture. The green revolution fulfilled our aspirations by changing India from a food importing to a food exporting nation.

However, the achievement was at the expense of damaging the well being of the people along with ecological and environmental detriment. The agriculture system adopted from the west has started showing increasing unsustainablility and once again the need for an appropriate method suitable to our requirements is being felt (Narayanan, 2005).

According to Agricultural and Processed Food Products Export Development Authority (APEDA), India ranks 33rd in terms of total land under

organic cultivation and 88th position for agriculture land under organic crops to total farming area. The cultivated land under farming is around 1.1 million Ha (2010-11). With the phenomenal growth in area under organic management and growing demand for wild harvest products, India has emerged as the single largest country with highest arable cultivated land under organic management. India has also achieved the status of the single largest country in terms of total area under certified organic wild harvest collection.

India produced around 3.88 million MT of certified organic products and exported 86 items in the year 2010-11 with the total volume of 2.05 million MT. India is best known as an exporter of organic tea and also has great export potential for many other products. Other organic products for which India has a niche market are spices and fruits.

There is also good response for organic rice, vegetable, coffee, cashew, oil seed, wheat and pulses. Among the fruit crops bananas, mangos and oranges are the most preferred organic products. The export realization was around 178.47 million US $ registering a 33% growth in the year 2011. Organic products are mainly exported to EU, US, Australia, Canada, Japan, Switzerland, South Africa and Middle East (APEDA).

Madhya Pradesh has the largest area under organic farming (4.40 ha 52%) followed by Maharashtra (1.50 ha 33.6%) and Orissa (0.95 ha 9.7%) in the second and third place respectively. The least areas under organic farming are in the states of Jharkhand, Tripura, Himachal Pradesh and Jammu & Kashmir (Ref. Table 1).

**Table 1. Organic Certification area and Production Statistics Year 2009-10**

| Area Under Organic Certification process and Number of farmers registered (2009-10) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total Area In ha | | | Total No. of farmers | | |
| S. No. | States | Organic | In-Conversion | Total | Organic | In Conversion | Total |
| 1 | Andhra Pradesh | 10129.11 | 20838.12 | 30967.23 | 9046 | 22458 | 31504 |
| 2 | Arunachal Pradesh | 523.17 | 1374.33 | 1897.5 | 116 | 590 | 706 |
| 3 | Assam | 1598.18 | 3510.74 | 5108.92 | 479 | 2768 | 3247 |
| 4 | Bihar | 0 | 1096.3 | 1096.3 | 0 | 2111 | 2111 |
| 5 | Chhattisgarh | 332.06 | 112.241 | 444.301 | 3 | 116 | 119 |
| 6 | Delhi | 77.3 | 190.4 | 267.7 | 4 | 66 | 70 |
| 7 | Goa | 5947.1 | 1443.67 | 7390.77 | 620 | 203 | 823 |
| 8 | Gujarat | 53596.95 | 16941.91 | 70538.86 | 19353 | 10213 | 29566 |
| 9 | Haryana | 3585.16 | 5387.59 | 8972.75 | 1794 | 3473 | 5267 |
| 10 | Himachal Pradesh | 437.09 | 139.01 | 576.1 | 346 | 833 | 1179 |
| 11 | J & K | 430.63 | 182.44 | 613.07 | 132 | 68 | 200 |
| 12 | Jharkhand | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | Karnataka | 16099.06 | 35369.398 | 51468.458 | 6061 | 26163 | 32224 |
| 14 | Kerala | 7352.67 | 7516.67 | 14869.34 | 6215 | 8857 | 15072 |
| 15 | Manipur | 1247.16 | 1924.15 | 3171.31 | 2066 | 2901 | 4967 |
| 16 | Maharashtra | 105172.6 | 45295.12 | 150467.74 | 44551 | 21098 | 65649 |
| 17 | Madhya Pradesh | 378572.2 | 61952.74 | 440525 | 151953 | 25072 | 177025 |
| 18 | Mizoram | 18002.27 | 9857.55 | 27859.82 | 14177 | 13878 | 28055 |
| 19 | Meghalaya | 1366.01 | 1677.1 | 3043.11 | 823 | 2685 | 3508 |
| 20 | Nagaland | 3091.3 | 6554.39 | 9645.69 | 3459 | 15639 | 19098 |
| 21 | Orissa | 79086.99 | 16653.92 | 95740.91 | 49523 | 12605 | 62128 |
| 22 | Punjab | 379.84 | 4883.77 | 5263.61 | 85 | 2992 | 3077 |
| 23 | Rajasthan | 29969.93 | 11157.99 | 41127.92 | 10204 | 7603 | 17807 |
| 24 | Sikkim | 2872.73 | 4521.49 | 7394.22 | 3130 | 4697 | 7827 |
| 25 | Tripura | 203.56 | 77.5 | 281.06 | 1 | 295 | 296 |
| 26 | Tamil Nadu | 3199.44 | 3543.44 | 6742.88 | 206 | 3465 | 3671 |
| 27 | Uttar Pradesh | 8665.35 | 44879.88 | 53545.23 | 5518 | 26458 | 31976 |
| 28 | Uttarakhand | 16158.86 | 14906.75 | 31065.61 | 20695 | 26484 | 47179 |
| 29 | West Bengal | 9881.91 | 5681.14 | 15563.05 | 737 | 2785 | 3522 |
| 30 | Other | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total** | **757978.7** | **327669.74** | **1085648.45** | **351297** | **246576** | **597873** |

*Source: Ministry of Agriculture*

Out of the 3.88 million MT of organic food produced by India, fruits/vegetables contribution plays a major role, followed by cotton, spices, wheat, tea/coffee etc.

**Table 2 Production of important commodities under organic management (Year 2009-10)**

| S.No | Commodities | Area (ha) | Quantity(MT) |
|---|---|---|---|
| 1 | Rice | 11292.272 | 17762.454 |
| 2 | Wheat | 31444.258 | 113570.624 |
| 3 | Other cereals/millets | 106627.904 | 271042.755 |
| 4 | Pulses | 37058.669 | 53227.097 |
| 5 | Oil seeds | 179904.1002 | 315067.737 |
| 6 | Tea/Coffee | 48841.233 | 40614.611 |
| 7 | Spices | 44770.211 | 168507.901 |
| 8 | Fruits/Vegetables | 143239.243 | 889844.335 |
| 9 | Herbal/Medicinal | 46460.041 | 189193.241 |
| 10 | Cotton | 447521.278 | 837293.435 |
| 11 | Other miscellaneous crops | 41855.189 | 24661.381 |

*Source: Compiled from the website of Ministry of Agriculture*

According to the latest FiBL-IFOAM Survey on organic agriculture, India is the major producer of organic food. However, Indian organic market is almost export oriented. To regulate the export of organic products, the Director General of Foreign Trade, Government of India has issued a public notice according to which no organic products may be exported unless they are certified by an inspection and certifying agency duly accredited by one of the accreditation agencies designated by the Government of India.

In India, there are, at present, six accreditation agencies approved by the central government's Ministry of Commerce (MoC). They are the Agricultural and Processed Food Products Export Development Authority (APEDA), Coffee Board, Spice Board, Tea Board, Coconut Development Board and Cocoa & Cashew nut Board (Garibay and Katke, 2003). Indocert, based in Kerala, is among the accredited domestic agencies (Muthukumaran, 2006).

Exporters face difficulties to get certified, due to the lack of expert knowledge in production and certification. High certification costs and no standardization in terms of regulation are barriers for exporters. Moreover, local governments in most developed countries are setting high standards, which cause more constraints for exporter countries. Although market, product information, and finance are barriers for developing countries in organic agricultural sector, building cooperativeness can be one good solution for better world market (Kortbech, 2000 and Rehber et al., 2002).

In the national market, high price and lack of promotional efforts can be attributed as major reasons for the unsold stock of organic products. Surabhi Singh (2013) stated that most severe problems faced by the farmers related to marketing of organic products in the domestic market are high production cost, lack of awareness among consumers about organic farming merits, inadequate transport and storage in the rural area, poor price fetched by the organic produce in the local market, availability of cheaper alternative food items, unavailability of a separate market area for selling of organic products and unavailability of any proper marketing network.

Direct marketing of organic produce, the most commonly followed system of selling practiced in this regard, limits the reach of organic produce to a larger market. Selling through middlemen in the village level markets, fairs, mandis (it is the place for marketing of vegetables and grains exclusively where retailers, middlemen, wholesalers and money lenders are present) and cooperative societies do not bring in adequate returns for the farmers unless they are also actively involved in marketing their produce.

## Conclusion and Suggestions

As per the 2011 population census, by 2030 India is going to become the biggest market for the whole world with the current population growth rate 1.58%. It is predicted to have more than 1.53 billion people as compared to 1.22 billon people at present. More and more people are getting aware of the ill effects of conventional food and the consumers are looking for an alternative. Promotion of organic farming and marketing of the produce may be taken up with missionary zeal. The following measures/programmes can bring in results.

- Create awareness regarding the benefits of organic food.
- Promote organic farming at the house hold and group levels.
- Increase in production levels can bring down price which can help in decreasing the usually high price of organic food.
- Unavailability seems to be a deterrent in consuming organic food by the consumers which calls for increasing the number of outlets for the organic products.
- Separate racks in the supermarket/departmental stores for organic food will increase its availability for the urban consumers, thereby increasing the consumption of organic foods.

- Forming of organic farmers association can help them to unify their efforts and can improve their marketing efforts in creating greater demand thus enhancing their returns.

If the Government, NGOs and distributers join hands to promote organic products, the hazards due to the consumption of conventional farming foods can be minimized to the benefit of the population.

## References

[1]. Athanasios Theocharopoulos, Stamatis Aggelopoulos, Panoraia Papanagiotou, Katerina Melfou and Evangelos Papanagiotou**,** *Sustainable Development – Education, Business and Management – Architecture and Building Construction – Agriculture and Food Security*, 2012.

[2]. Delate, Kathleen, *Fundamentals of Organic Agriculture*, Iowa State University, PM 1880 May, 2003.

[3]. Garibay, Salvadore V. and Katke, Jyoti, *Market Opportunities and challenges for Indian Organic Products*, Research Institute of Organic Agriculture (FiBL) and ACNielsen ORG-MARG, February, 2003.

[4]. Kalanad, Sag**,** *Endosulfan Tragedy in Kerala***,** http://godsowncountrys. wordpress.com /endosulfan- tragedy-in-kerala/. 2011.

[5]. Kortbech-Olesen, Rudy, *Organic Food and Beverages: World Supply and Major European Markets*. In: Lockeretz, Willie and Bernward Geier (editors) (2000): Quality and Communication for the Organic Market. IFOAM, Germany.

[6]. Lampkin, N H, Organic Farming and Agricultural Sustainability. In: Turner, S D and Alford, D (Eds.) *Agriculture and the Environment: Challenges and conflicts for the new millenium***,** ADAS, Wolverhampton, 1999, pp. 146-154.

[7]. Muthukumaran, K, *Organic Agriculture and Food Industry: Trends, Challenges and Opportunities***,** CAB CALLING**,** , 2006, October-December.

[8]. Mutlu, Nihan, *Consumer Attitude and Behavior towards Organic Food: Cross-Culture Study of Turkey and Germany,* Institution of agricultural policy and market, 2007.

[9]. Narayanan, S, *Organic Farming in India: Relevance, Problems and Constraints*, National Bank for Agriculture & Rural Development, Department of Economic Analysis & Research, 2005.

[10]. Rehber, E. and Turhan, S, *Prospects and Challenges for developing Countries in trade and production of organic food and fibers- the case of Turkey*, British Food Journal, 2002,Vol.104 No: 3/4/5.

[11]. Singh, Surabhi, *Organic Products: Marketing Practices and Problems in the Plainss and Hilly Regions of Uttrakhand*, Indian Journal of Marketing, Vol.43 No:2 February, 2013, ISSN 0973-8703, pp. 37- 49.

[12]. Willer, Helga and Kilcher, Lukas (Eds.), *The World of Organic Agriculture - Statistics and Emerging Trends 2012.* Research Institute of Organic Agriculture (FiBL), Frick, and International Federation of Organic Agriculture Movements (IFOAM), Bonn V 2., 2013.

[13]. Yussefi, Minou and Willer, Helga *Organic Agriculture Worldwide 2002– Statistics and Future Prospects,* IFOAM, Germany , 2002.

[14]. Zwerdling, Daniel, *In Punjab, Crowding onto the Cancer Train,* National Public Radio, http://www.npr.org/templates/ story/ story.php? storyId= 103569390, 2009.

[15]. *Organic Agriculture and Human Health,* IFOAM, http://www.ifoam.org/growing_organic/3_advocacy_lobbying/eng_leaflet_PDF/Human_Health.pdf. 2006.

# USING NEURAL NETWORK CLASSIFIERS KNN AND K * FOR PREDICTING THE MELTING POINT OF DRUG - LIKE COMPOUNDS

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## Abstract

A K–nearest neighbor (KNN) model and K Star model was used to study quantitative structure property/activity relationships to predict the melting point of drugs like compounds in terms of Topological descriptors, Topological charge indices, connectivity indices and 2D auto correlations. KNN and K star were trained using training data set and it was found that the best method among this is KNN. It offers accuracy and improves the computation time.

## Introduction

Drug design is the process of identifying new medicines. Drug is an organic molecule which inhibits or activates the function of a bimolecule and gives therapeutic benefits to the patients. Different compounds are used to make a particular drug. So it is important to know about the physical properties of such compounds like solubility, viscosity, Melting Point etc.

Melting Point is a fundamental physical property used for screening and purity analysis. Since Melting Point affects Solubility, Viscosity and Toxicity of a compound, it is used as a descriptor for predicting these properties [1]. So the compound has to be synthesized and melting point has to be determined experimentally before predicting such properties. Here comes the importance of a computational model for predicting the Melting Point which is very much economical. Melting Point is calculated in laboratories very fast and straight forward but sometimes compounds used for this process may be hazardous, toxic, and expensive and may lead to the wastage of time and chemicals. So a computational model for predicting the Melting Point is desirable.

Data Mining is the process of discovering patterns and establishing relationships automatically or semi automatically to predict the future behaviour using machine learning techniques [2]. Machine Learning is the ability of a machine to automatically learn to recognize patterns by using Artificial Intelligence and make intelligent decisions based on the pattern. Many methods like Classification, Association and Clustering have been used for Machine Learning [2][3][4][5].

Molecular descriptors are molecular properties used to characterize the molecule. They are the result of logical and mathematical procedures which transforms chemical information in symbolic representation into the result of standard experiment. Molecular descriptors [6] helps to predict the activity and properties of molecules in complex experiments and play an important role in scientific growth [7].The molecular descriptors are distinguished by their physico chemical meaning or specific mathematical tools used for calculating molecular descriptors. QSAR/QSPR is based on the assumption that compounds from same chemical domain behave similarly. The general idea behind this is to get the physical property of the compound using a predictive model with the use of a database of values obtained from the previous laboratory experiments.

## Data and Methodology

The methodology was to calculate the descriptors and to select the appropriate descriptors. Molecular descriptor means molecular property to characterize the molecule. That is the result of logic and mathematical procedure which transforms chemical information in symbolic representation into the result of standard experiment. Melting point data of 100 drugs like compounds were taken from the dataset compiled by Bergestrom [8], the data set contains compounds with their melting points which was experimentally determined and a SMILES description of the compounds, which is used for calculating descriptors. We then use the E-Dragon software [9] to calculate the theoretical descriptors. With the use of dragon software a total of 250 descriptors were calculated and using Topological descriptors, Topological charge indices, connectivity indices and 2D auto correlations. All the 2D descriptors are converted to 3D using CORNIA in E-Dragon software. After that the descriptors that have the value 0 is eliminated.

We then used the WEKA workbench [10], which is a powerful data mining tool to find the correlations between these descriptors and eliminate highly correlated descriptors. For selecting the attributes the attribute evaluator CfsSubsetEval is used which evaluates the worth of a subset of attributes by considering the individual predictive ability of each feature along with the degree of redundancy between them and Best first search method which searches the space of attribute subsets by greedy hill climbing augmented with a backtracking facility. Finally nine descriptors are selected. They are PW2, X1A, X3A X5A, X0Av, MATS6m, MATS1p, MATS8p, and GATS4p. Figure 1 summarizes the correlation between the 9 descriptors.

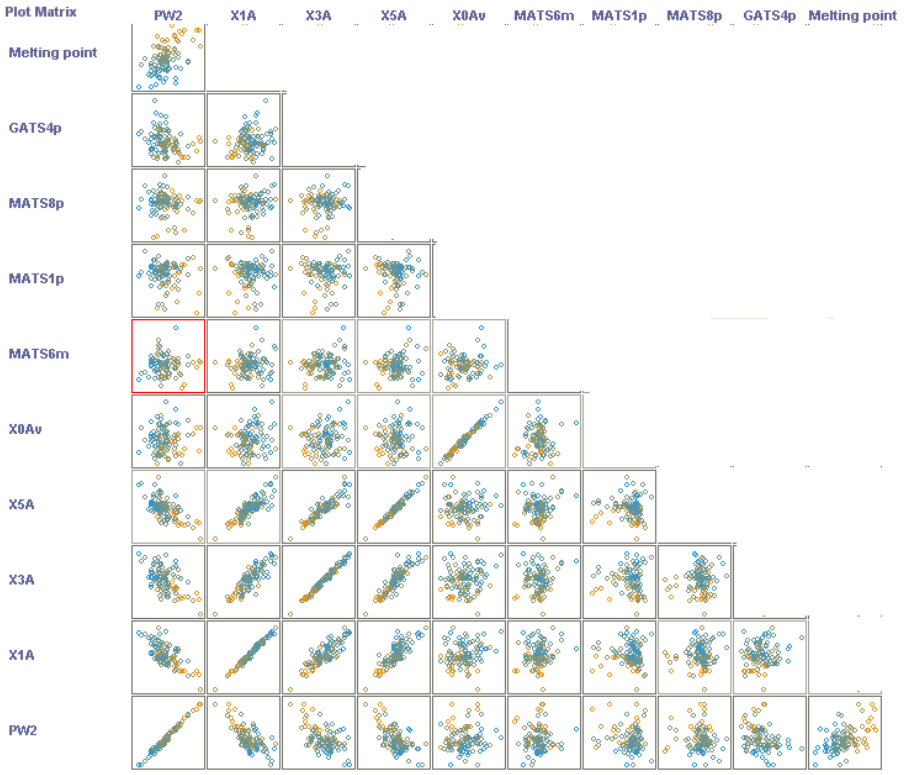


**Figure 1 Half –matrix scatter plot of the correlations between the descriptors.**

***Model building***

After selecting the descriptors, we split the data set into a training set and a test set, setting aside 66% of the data into the training set and the remaining into the test set. The split was used to evaluate the performance of the classifiers. The Lazy learners k – nearest neighbor (KNN) and K star models were designed and trained to predict the melting point of drug like compounds. The results are compared in the last section.

We used the Weka work bench to build the models, K-nearest neighbors and Kstar[10]. These are lazy learners which provide an instance based learning, in which each new instance is compared with existing one using a distance matric and closest existing instance is used to assign the class to the new one. This is called nearest neighbor classification method. Sometimes more than one nearest neighbors are used and majority class of the closest K neighbors is assigned to the new instance it is known as KNN. The model normalizes attributes by default and can select appropriate value of K based on cross-validation. If several instances found then it chooses the first one. Finally a model with 9 KNN (which is the number of neighbors to use for training) was selected and trained to predict the physical property.

The model could predict the melting point with a mean absolute error 27.5268 and Root mean squared error 39.699 also this is the best performance obtained among various KNN neighbors.

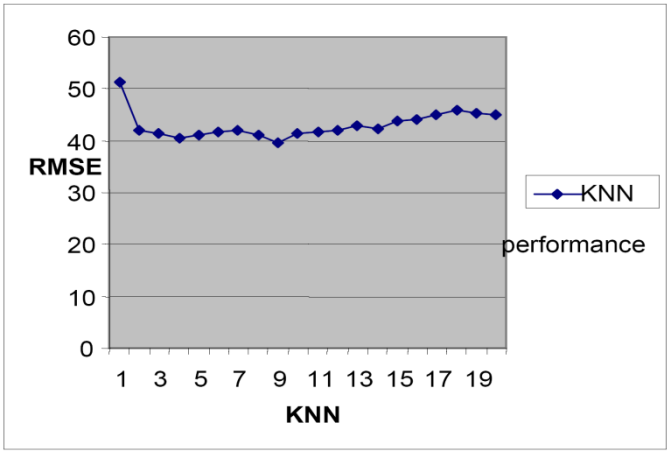


**Figure2. KNN performance for various neighbors**

A K star model is then used on the same data and its performance was evaluated. K* is an instance-based classifier, meaning that it classifies a test instance by finding the training instances that most resemble it. It belongs to the class of k-nearest neighbor classifiers because it classifies each instance by looking at the nearest k data points and determining the class by the one which is most common in the nearest k data points. A K star model with 80 global blend (values are restricted to [0,100]) is found most optimal for the problem. The predicted output showed a mean absolute error of 30.4099 and a Root mean squared error 43.9979

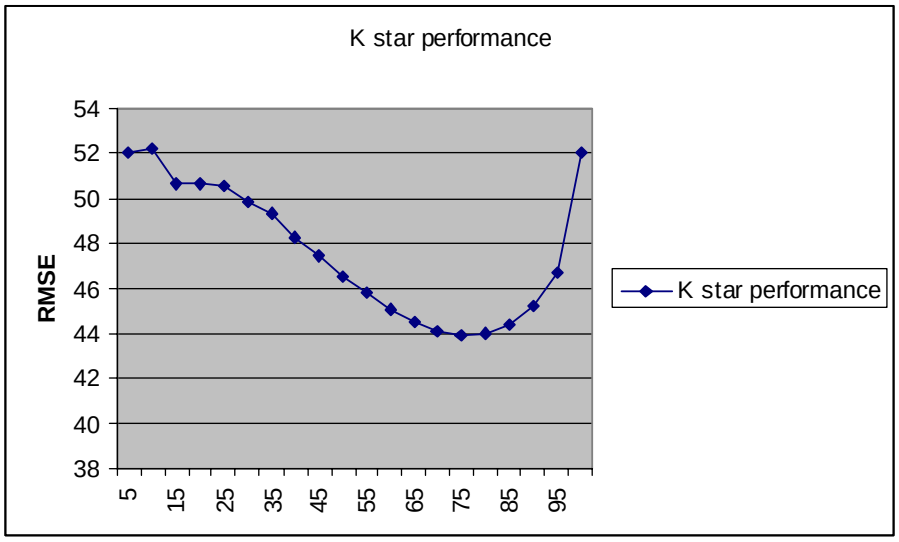


**Figure 3 : K star Performance for various parameters for global blending.**

The Table shows actual melting point, melting points predicted by KStar and KNN models and relative error. After calculating the relative error only a few molecules showed higher relative error.

**Table1. Experimental and predicted values of melting point with Relative error of prediction.**

| Name | Melting point | Value predicted by Kstar | RE % | Value predicted by IBk' | RE % |
|---|---|---|---|---|---|
| Haloperidol | 148 | 158.275915 | -6.94319 | 146.944444 | 0.713214 |
| Alclofenac | 92 | 129.086615 | -40.3115 | 126.322222 | -37.3068 |
| Benzarone | 124.3 | 154.638877 | -24.4078 | 149.611111 | -20.3629 |
| Clebopride | 194 | 170.680839 | 12.02019 | 172.444444 | 11.11111 |
| Caroxazone | 203 | 153.442493 | 24.41257 | 160.833333 | 20.77176 |
| Alibendol | 95 | 142.101028 | -49.58 | 142.777778 | -50.2924 |
| Acedapsone | 289 | 173.605572 | 39.92887 | 174.277778 | 39.69627 |
| Febantel | 129 | 130.778333 | -1.37855 | 133.944444 | -3.8329 |
| Fenpiprane | 41 | 144.065522 | -251.379 | 120.5 | -193.902 |
| Bupivacaine | 107 | 117.411021 | -9.72993 | 112.755556 | -5.37902 |
| Atenolol | 146 | 135.939861 | 6.890506 | 144.777778 | 0.837138 |
| Celiprolol | 110 | 147.323434 | -33.9304 | 153 | -39.0909 |
| Acyclovir | 255 | 156.47872 | 38.6358 | 177.555556 | 30.37037 |
| Adrafinil | 159 | 131.562698 | 17.25616 | 127.988889 | 19.50384 |
| Clometacin | 242 | 155.433067 | 35.77146 | 164.777778 | 31.91001 |
| Benperidol | 170 | 154.02976 | 9.394259 | 153.388889 | 9.771242 |
| Amisometradine | 175 | 153.301151 | 12.39934 | 167.5 | 4.285714 |
| Cimetidine | 141 | 122.465233 | 13.14522 | 132.222222 | 6.225374 |
| Azacyclonol | 160 | 130.057997 | 18.71375 | 118.255556 | 26.09028 |
| Benzoic acid | 122.4 | 124.306289 | -1.55743 | 121.088889 | 1.071169 |
| Aceclofenac | 149 | 142.84349 | 4.131886 | 144.777778 | 2.833706 |
| Antazoline | 120 | 123.61637 | -3.01364 | 139.533333 | -16.2778 |
| Acetaminosalol | 187 | 133.216353 | 28.76131 | 124.933333 | 33.19073 |
| Felodipine | 145 | 145.379986 | -0.26206 | 151.111111 | -4.21456 |
| Haloxazolam | 185 | 175.598985 | 5.08163 | 185.777778 | -0.42042 |
| Glyburide | 169 | 172.712572 | -2.19679 | 171.666667 | -1.57791 |
| Hydrochlorothiazide | 267 | 180.878084 | 32.2554 | 202.333333 | 24.21973 |
| Abecarnil | 150 | 151.447306 | -0.96487 | 154.555556 | -3.03704 |
| Amidephrine | 159 | 158.524831 | 0.298848 | 156.888889 | 1.327743 |
| Clotrimazole | 147 | 152.328255 | -3.62466 | 155.111111 | -5.51776 |
| Carbutamide | 144 | 155.753245 | -8.16198 | 160.111111 | -11.1883 |
| Chlophedianol | 120 | 134.491094 | -12.0759 | 120.166667 | -0.13889 |
| Anileridine | 83 | 117.382919 | -41.4252 | 118.533333 | -42.8112 |
| Atropine | 114 | 140.595405 | -23.3293 | 133.655556 | -17.2417 |

## Results

It was found that a KNN model is best for predicting the melting points of drug like compounds when compared with K * and shows the advantage of instance based models. For the prediction of 34 drugs like compounds based on a training set of 100, it is found that compounds with high melting point cannot be predicted accurately and compounds with low melting point are predicted on the higher side and these are due to the limited number of compounds. So we claim that KNN models are promising candidates for QSPR/QSAR studies. Also the study emphasized the need for more investigation to find out suitable descriptors to model the physical properties of compounds and the use of more accurate descriptors will improve the performance.

## References

[1] C.A.S. Bergstrom, U. Norinder, K. Luthman and P. Artursson, "*Molecular descriptors influencing melting point and their role in classification of solid drugs*", J. Chem. Inf. Comput. Sci, 2003, **43**(4), pp.1177-1185

[2] I. H. Witten and E. Frank, "*Data mining: practical machine learning tools and techniques*", 2nd Edition, Morgan Kaufmann, San Francisco, 2005.

[3] Du QS, R.B. Huang and K.C. Chou, "*Recent advances in QSAR and their applications in predicting the activities of chemical molecules, peptides and proteins for drug design*", Guangxi University, Key Laboratory of Subtropical Bioresource Conservation and Utilization of Guangxi, Nanning, Guangxi, 530004, China.

[4] H. Liu, X. Yao and P. Gramatica, "*The applications of machine algorithms in the modeling of Estrogen like chemicals*", School of Pharmacy, Lanzhou University, Lanzhou 730000, China.

[5] Laura D.Hughes, David S Palmer,Florian Nigsch and John B.O Mitchell, "*Why are some properties difficult to predict than others ? A study of QSPR models of solubility, melting point and log P*",Journal of chemical information and modelling,.

[6] Pang Ning Tan, Michael Steinbach and Vipin Kumar, "*Introduction To Data Mining*". Amazon.

[7] Roberto Todeschini and Viviana Consonni, “Handbook of molecular descriptors, Wiley – VCH, 2000.

[8] Bergstrom, C. A. S.; Norinder, U.; Luthman, K.; Artursson, P. *Molecular Descriptors Influencing Melting Point and Their Role in Classification of Solid Drugs*. J. Chem. Inf. Comput. Sci.; (Article); 2003; **43**(4); 1177-1185.

[9] Tetko, I. V.; Gasteiger, J.; Todeschini, R.; Mauri, A.; Livingstone, D.; Ertl, P.; Palyulin, V. A.; Radchenko, E. V.; Zefirov, N. S.; Makarenko, A. S.; Tanchuk, V. Y.; Prokopenko, V. V. *Virtual computational chemistry laboratory - design and description*, J. Comput. Aid. Mol. Des., 2005, 19, 453-63.

[10] Ian H. Witten and Eibe Frank (2005) "*Data Mining: Practical machine learning tools and techniques*", 2nd Edition, Morgan Kaufmann, San Francisco, 2005.

# *IN-VITRO* ANTIBACTERIAL ACTIVITY AND EFFECT OF INTERACTIONS BETWEEN ANTIBIOTICS AND ETHANOLIC EXTRACTS OF *COLEUS AMBOINICUS*

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## Abstract

Drugs are essential in our life to cure diseases. These drugs cause various side effects and development of resistant bacterial strains. Researches are conducted to produce drugs from plants that are devoid of side effects. The objective of the present study is to find the in-vitro interaction of three clinically important drugs and *Coleus amboinicus* extract. Plants were collected and extract taken from them by soxhlet extraction method. Discs are prepared by using these extracts and the drugs such as Ampicillin, Gentamycin and Chloramphenicol. Antibiotic sensitivity tests are done against seven bacteria, in different concentration. Results are analyzed for the synergistic, antagonistic and additive effects of the combinations against seven bacteria in different concentrations. Ethanolic extract of *Coleus amboinicus* have antibacterial activity and some synergic activity against gram positive bacteria like *Bacillus* species and *Streptococcus* species. They also have an antagonistic activity against gram negative bacteria like *E.coli* and *Klebseilla* species.

**Keywords:** *Coleus amboinicus*, Ampicillin, Gentamycin, Chloramphenicol, Synergy, Antagonism

## Introduction

The use of traditional medicines and medicinal plants is given much importance now-a-days. The traditionally used rural herbal remedies have been found to be effective against micro organisms. In recent times, due to increasing realization of health hazards and toxicity caused by drugs thought the world, the use of medicinal herbs as drugs by the people increased. This has lead to utilization of eco-friendly and bio-friendly plant based product for prevention and cure of various human ailments.

Antibiotic is an extremely important research tool. Different antibiotics exercise their inhibitory activity on various pathogenic organisms. The effect of antibiotic on a pathogen is specific and is different from pathogen to pathogen. It is either by killing or by arresting the growth of the microorganism. Studies for drug combinations grew steadily. Laboratory studies showed that these combinations have enhanced killing power. . Drug synergy occurs when drugs can interact in ways that enhance or magnify one or more effect or side effects of those drugs. *Coleus ambonicus* is the plant that used for the extract. This is included in the family Lamiaceae. The antimicrobial activity of plant extract in combination with antibiotics may show synergistic or antagonistic activity. The synergistic effect from the combination of antibiotics with plant extracts against resistant bacteria leads to new ways for the treatment of infectious diseases.

The use of synergistic combination in antimicrobial chemotherapy is often used commercially for the treatment of various infections. In synergism one drug greatly enhances the antibacterial activity of another. In view of resistance pattern of pathogenic bacteria against the agents, the agent from plant material is essential. The use of combination of antibiotic is very common now a days, the synergistic effect of which surpasses their individual inhibitory activity[1].

Antagonism is an effect which nullifies the action of another. Any combined effect of two drugs that is smaller than the sum of the effect of each single drug present in the mixture may be termed antagonism. Usually the antagonistic drugs are inhibitors of protein synthesis. Some plant extracts shows antagonism against antibiotics.

## Materials and Methods

***Plant Material and Preparation of extract***: Leaves of *Coleus amboinicus* were collected from Kothamangalam area and identified by a Botanist from Mar Athanasius College, Kothamangalam. Fresh plant materials were collected and washed under tap water and then distilled water. Fresh leaves, oven dried leaves and shade dried leaves were used for further study. The extracts of *Coleus ambonicus* was prepared by soxhlet extraction in ethanolic medium for 72 hours till the extraction was completed. The filtrate was obtained by the solvent evaporation.

***Bacterial Strains and Antibiotics used***: Different samples of bacterial strains were collected from MBMM Hospital, Kothamangalam and were identified by

different methods such as Gram staining[3], Hanging Drop Method[4] and biochemical tests[5]. The different bacterial strains used for the study are *E.coli, Bacillus* sp*, Streptococcus* sp*, S.aureus, Pseudomonas* sp*., Vibrio sp.* and *Klebsiella sp.* These organisms were further used to study its interaction between antibiotics and extracts. Antibiotics used are Ampicillin, Chloramphenicol and Gentamycin

***Antimicrobial Sensitivity Testing:*** This test is performed in Nutrient agar plates using Kirby Bauer method[6]. Mcfarland standards'[7] of culture were prepared. Antibiotic disc were prepared[8] using Whatman filter paper. Antibiotic powder and extract (Ampicillin, Chloramphenicol, Gentamycin, extracts of fresh, oven dried and shade dried leaves) were then placed under sterile conditions. The plates were incubated overnight at $37^0$c. Following incubation, the diameters of zone of inhibition of the growth including the disc diameter were measured. The diameter of zone was measured in millimeter and compared with the antibiogram.

***Synergistic and Antagonistic Activity[2]*:** The synergistic activity study was calculated by combining with the standard antibiotics Ampicillin, Gentamycin and Chloramphenicol by means of Kirbythese, Bauer technique. The plates were incubated overnight at $37^0$c. Following incubation, the diameters of zone of inhibition of the growth including the disc diameter were measured.

## Results

Antibacterial assay was tested against seven bacteria by Disc Diffusion Method. This indicates the sensitivity or resistance of bacteria towards the antibiotics and plant extracts at a particular concentration per milliliter. Synergistic effect of antibiotics with plant extracts were tested against seven bacteria at a ratio of 1:1. The antibiotics Ampicillin, Gentamicin and Chloramphenicol were taken at a concentration of 40mg/ml and plant extracts were taken at a concentration of 100mg/ml. Of these, *Streptococcal* species showed synergism in combination with fresh leaf extract and ampicillin. It also showed an additive effect in combinations of shade leaf extract and chloramphenicol, oven dried and Ampicillin. The other six bacteria *E.coli , S. aureus, Klebsiella* sp*., Bacillus* sp*., Pseudomonas* sp*., and Vibrio* sp. showed antagonism at this concentration. Synergistic effect of antibiotics with plant extracts were tested against seven bacteria at a ratio of 75:25. *Streptococcal* species showed synergism except the combinations of fresh and shade

leaf extract with Gentamicin, while *Pseudomonas* sp. showed synergism in this combination. *Vibrio* species showed synergism except the combinations of fresh leaf extract and ampicillin, shade dried leaf extract and chloramphenicol. *Bacillus* sp. also showed synergism except the combinations of fresh and shade extract with ampicillin, oven dried with gentamycin and chloramphenicol. *S.aureus* showed antagonism except the shade and gentamycin combination. *E.coli* and *Klebsiella* sp. were completely antagonistic. Synergistic effect of antibiotics with plant extracts were tested against seven bacteria at a ratio of 25:75. *Streptococcal* species and *Bacillus* species were completely synergistic at 25:75 ratios. *E.coli* and *Klebseilla* species were completely antagonistic. *S.aureus* showed synergism in combination with gentamycin and chloramphenicol only. *Pseudomonas* species showed synergism with gentamycin. *Vibrio* sp. showed antagonism with chloramphenicol and synergism with ampicillin.

**Table 1. bacterial identification**

| **Test** | **Bacterial strain** | | | | | | |
|---|---|---|---|---|---|---|---|
| | ***E.coli*** | ***Klebsiella* sp** | ***Pseudomonas* sp** | ***S. aureus*** | ***Streptococcus* sp** | ***Bacillus* sp** | ***Vibrio* sp** |
| **Grams Staining** | - | - | - | + | + | + | - |
| **Motility test** | M | NM | M | NM | NM | M | M |
| **Glucose** | AG | AG | A | A | A | A | A |
| **Lactose** | G | G | - | A | A | A | A |
| **Sucrose** | G | G | - | A | A | - | - |
| **IMViC** | ++-- | --++ | ---+ | -++- | ---- | --+- | ---- |
| **Urease** | - | - | + | - | - | - | - |
| **Nitrate** | + | + | + | + | + | + | + |
| **Coagulase** | - | - | - | + | - | - | - |
| **Oxidase** | - | - | + | | - | - | - |
| **Catalase** | + | + | + | + | + | + | + |
| **TSI** | A/A G+, $H_2S$- | A/A,G+, $H_2S$- | K/K,G-, $H_2S$- | A/A, G-, $H_2S$- | A/A, G-, $H_2S$- | A/A, G-, $H_2S$- | A/A, G-, $H_2S$- |

a-acid, g – gas, M –motile, NM –non motile, +positive, -negative

**Table 2. Antibacterial Assay of antibiotics and extracts.**

| Name of Organisms | DIAMETER OF ZONE OF INHIBITION(mm) +/- SD | | | | | |
|---|---|---|---|---|---|---|
| | Ethanolic Extract of *Coleus amboinicus* (100mg/1ml) | | | Antibiotics(40mg/ml) | | |
| | F | S | O | A | G | C |
| ***E.coli*** | 7.66±1.24 | 9.33±1.76 | 6±0 | 41.33±1.33 | 6.33±2.4 | 33.66±1.33 |
| ***Klebsiella sp.*** | 7.66±2.11 | 12±0.812 | 6±0.81 | 28.6±2.52 | 27.6±1.34 | 29±1.15 |
| ***S.aureus*** | 5.6±0.67 | 6±0 | 5.6±0.67 | 16.6±0.92 | 16.6±1.34 | 23.6±1.34 |
| ***Streptococcus* sp.** | 5.6±2.1 | 6±0 | 5.6±2.1 | 51.33±1.05 | 22±1.15 | 4±0 |
| ***Bacillus* sp.** | 7.3±0.66 | 7.3±0.66 | 7±0.81 | 14.5±1.23 | 18±0 | 29.3±1.33 |
| ***Pseudomonas* sp.** | 5.6±-2.1 | 6.6±2.1 | 6±2.4 | 6.36.3±2 | 14.3±3.9 | 6±0 |
| ***Vibrio* sp.** | 5±0 | 5.6±2.1 | 5±0 | 12.6±6.1 | 18±3.6 | 23.6±-2.1 |

F = fresh leaf extract, S = shade dried leaves, O = oven dried leaves, A = Ampicillin, G = Gentamycin, C = Chloramphenicol,

**Table 3. Synergistic Assay in of Antibiotics and Ethanolic Extracts of *Coleus amboinicus* 1:1 concentration**

| Name of Organisms | DIAMETER OF ZONE OF INHIBITION(mm)+/- SD | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Combinations of Antibiotics & Plant Extract( 1:1 Concentration) | | | | | | | | |
| | F+A | F+G | F+C | S+A | S+G | S+C | O+A | O+G | O+C |
| ***E.coli*** | 8±0 | 25±0 | 12±0 | 16.5±2.25 | 16±0 | 17±0 | 9±0 | 15±0 | 12±0 |
| ***Klebsiella* sp.** | 8±-0 | 9±-0 | 8±0 | 7±0 | 6±0 | 5±0 | 8±0 | 7±0 | 7±0 |
| ***S.aureus*** | 9±0 | 7±0 | 8±0 | 16.5±2.25 | 10±0 | 9.5±2.5 | 12.5±6.25 | 11.5±2.5 | 10±0 |
| ***Sreptococcus* sp.** | 12±0 | 22±0 | 7±0 | 7±0 | 25±0 | 10±0 | 10±0 | 15±0 | 8±0 |
| ***Bacillus sp.*** | - | 20±0 | 25±0 | 12±0 | 20±0 | 25±0 | - | 13±8 | 15±0 |
| ***Pseudomonas* sp.** | 8±0 | 19±0 | 7±0 | 8±0 | 13±0 | 10.5±2.5 | 80±0 | 9.5±2.5 | 10±0 |
| ***Vibrio* sp.** | 8±0 | 19±0 | 20±0 | 16±0 | 22±0 | 15±0 | 11.5±2.25 | 17±0 | 11±0 |

**Table 4. Synergistic Assay of Combinations of Antibiotics and Ethanolic Extracts of *Coleus amboinicus* in 75:25 concentrations**

| Name of Organisms | Diameter of Zone Of Inhibition(mm)+/- SD | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Combinations Of Antibiotics And Plant Extract(75:25 Concentration) | | | | | | | | |
| | F+A | F+G | F+C | S+A | S+G | S+C | O+A | O+G | O+C |
| *E.coli* | 7±0 | 10±0 | 21±0 | 7±0 | 20±0 | 22±0 | 6±0 | 21±1 | 20±0 |
| *Klebsiella* sp. | 6±0 | 8±0 | 7±0 | 6±0 | 7±0 | 6±0 | 6±0 | 7±0 | 6±0 |
| *S.aureus* | 7±1 | 6±0 | 5±0 | 8.5±2.25 | 29±1 | 13±1 | 8.5±2.25 | 20±0 | 15±0 |
| *Streptococcus* sp. | 30±0 | 20±0 | 25±0 | 25±0 | 21.5±2.25 | 25±0 | 22±0 | 27.5±2.25 | 24±1 |
| *Bacillus* sp. | 15±0 | 21.5±2.25 | 33.5±2.25 | 18±0 | 27±1 | 36±1 | 21±1 | 24±1 | 30±0 |
| *Pseudomonas* sp. | 8±0 | 24±0 | 10±0 | 9±1 | 26.5±1 | 11±1 | 6±1 | 20±0 | 6±1 |
| *Vibrio* sp. | 20±0 | 25±0 | 30±0 | 25±0 | 30±0 | 20±0 | 30±0 | 30±0 | 30±0 |

**Table 5. Synergistic Assay of Combinations of Antibiotics and Ethanolic Extracts of *Coleus amboinicus* in 25:75 concentrations**

| Name of Organisms | Diameter of Zone Of Inhibition(mm)+/- SD | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Combinations Of Antibiotics and Leaf Extract (25:75 CONCENTRATION) | | | | | | | | |
| | F+A | F+G | F+C | S+A | S+G | S+C | O+A | O+G | O+C |
| *E.coli* | 15±0 | 10± | 23±0 | 20±0 | 21±0 | 11.5±1 | 22±0 | 19±1 | 24±1 |
| *Klebsiella* sp. | 6±0 | 8±0 | 7±0 | 5.5±2.5 | 7±1 | 6±0 | 6±0 | 7±0 | 6±0 |
| *S.aureus* | 20±0 | 24±0 | 28±0 | 25±0 | 30±0 | 21±1 | 20±0 | 30±0 | 30±0 |
| *Streptococcus* sp. | 25±2 | 27.5±6.25 | 24±1 | 25±0 | 28.5±1 | 30±0 | 21±0 | 31±1 | 15.5±1 |
| *Bacillus* sp. | 36±0 | 21±1 | 36±0 | 36±0 | 23±0 | 35±0 | 35±0 | 28±0 | 35±0 |
| *Pseudomonas* sp. | 8±0 | 21±0 | 8±0 | 7.5±6.25 | 25±0 | 11.5±1 | 6.5±1 | 22±0 | 6±1 |
| *Vibrio* sp. | 30±0 | 26±0 | 25±0 | 25±0 | 15±0 | 25±0 | 23±0 | 30±0 | 25±0 |

**Fig 1. Coleus amboinicus**

(25:75) 75:25 (1:1)

**Fig 2. Interactions of Antibiotics and Ethanolic Extracts of *Coleus amboinicus* against *Bacillus* sp**

## Conclusion

Leaves of the herbal plant *Coleus amboinicus* was used for the evaluation of the antibacterial activity and effect of interactions between antibiotics and ethanolic extracts of *Coleus amboinicus*. Leaves were dried in shade and in oven. Fresh leaves, shade dried and oven dried leaves were subjected to alcoholic extraction using soxhlet extractor.

These extracts were dissolved in DMSO and are used for the preparation of appropriate discs. Three antibiotics, namely ampicillin, gentamycin and chloramphenicol were also dissolved in DMSO and are used for the preparation of antibiotic discs.

Seven bacterial strains were used in this study, *E.coli, Klebseilla* species, *Pseudomonas* species, *S.aureus, Bacillus* species, *Streptococcus* species and *Vibrio* species. Combinations of antibiotics and extract were prepared in different concentration, were used to study various interactions of antibiotics and extract towards the seven microorganisms.

*Streptococcus* species were more susceptible and showed synergism. Fresh, shade and oven dried leaf extracts with gentamycin combinations showed synergistic effect on all the seven organisms in all ratios. *E.coli* and *Klebseilla* species were antagonistic completely. Out of seven bacteria, *Streptococcus* species were more susceptible to extracts.

Fresh, Shade dried and oven dried extracts with gentamycin combinations showed synergistic effects against seven organisms in three different concentrations.

## Reference


[1]. Gislene G .F, Nascimento, Julian Locatelli,Paulo C Freitas, Giuliana L Silva: *Antibacterial activity of plant extracts and phytochemicals on antibiotic resistant bacteria*, Brazilian Journal of Microbiology ,2000 31:247-256

[2]. Arthanari Saravana Kumar, K.Venkateshwaran, J .Vanitha, G.S. Saravanan, M.Ganesh, M.Vasudevan, T.Sivakumar. *Synergistic activity of methanolic extract of Thespesia populnea (Malvaceae) flowers with oxytetracycline*, Journal of the Bangladesh pharmacological society (BDPS) 2009;4:13-16

[3]. James G Cappuccino, Natalie Sherman, Microbiology A Laboratory Manual, 7th edition, 2005, p.37-73

[4]. James G Cappuccino, Natalie Sherman, Microbiology A Laboratory Manual, 7th edition, 2005, p.71-38

[5]. James G Cappuccino, Natalie Sherman, Microbiology A Laboratory Manual, 7th edition, 2005,p.151-193

[6]. Navarro V, Villareal M L, Rojas G, Lozoya X: *Antimicrobial activity evaluation of some plants used in medicine for the treatment of infectious disease.* J Ethanopharmacol,1996, 53:143-147

[7]. J.G.Collee. A.G Fraser, B.P Marmion, A.Simmons, Mackie & McCartney practical medical Microbiology, 14th edition, Elsevier, 2006, p.851-852

[8]. Prakash M, Ananda Kumar S, Karmegam N :*Synergistic effect of selected medicinal plants extract s against certain bacteria* .Indian Journal of Applied Microbiology (2006a) 6, 52-53.

# SPECIES SUITABILITY OF SMALL NUTRIENT DENSE FISHES FOR BACKYARD POND CULTURE

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## Abstract

Four species of small indigenous fishes *Etroplus maculatus*, *Puntius ticto*, *Danio malabaricus*, and *Labuca dadybujori* were tried for their suitability in backyard pond culture. The fishes from natural systems were used to compare the health conditions of the reared samples. To determine the condition of fishes the length-weight relationship [LWR] was determined using the equation W = aLb. In order to determine the relative robustness or degree of well-being of this fish in wild and in culture systems, the coefficient of condition was calculated using the formula K= 100000L/W3

## Introduction

Kerala is an exceptional hot spot of fresh water fish diversity[1] with a high degree of endemism[2]. Streams and rivers originating from Western Ghats biodiversity hotspot in Kerala, South India, has become the geographic focus of attention of ichthyologists, conservation biologists and fish hobbyists[3]. Fish production in 2006 was reported to be 51.7 million tones with a value of US$ 78.8 billion, representing an annual growth rate of nearly 7%. World aquaculture is heavily dominated by the Asia-Pacific region, which accounts for 89% of production in terms of quantity and 77% in terms of value. This dominance is mainly due to China's enormous production, which accounts for 67% of global production in terms of quantity and 49% of global value. China produces 77% of all carps (cyprinids) and 82% of the global supply of oysters. The Asia-Pacific region accounts for 98% of carp, 95% of oyster production and 88% of shrimps and prawns (penaeids). However, growth rates for aquaculture production are slowing, partly owing to the public concern about aquaculture practices and fish

quality. Genetically Modified Organisms (GMOs) remain a controversial issue. In response to these concerns, integrated multitrophic aquaculture and organic aquaculture are on the rise. Kerala is blessed with an immense measure of fresh water fishery resource as well. The state's 44 rivers (85,000 ha), 53 reservoirs (42890 ha), and 53 backwaters and other brackish water bodies (65213 ha) endow it with a multitude of fisheries. Besides the marine life bestowed by the sea, these inland water resources contribute significantly to the growth of the fishing industry in the state. This is substantiated by the fact that the inland fish yield level of the state is currently at about 75036 tonnes a year. The riverine fishery of Kerala is highly diverse and is contributed by around 207 species[4]. Kerala is the most fertile region of the Arabian Sea, as far as fisheries are concerned. The potential of the state in terms of marine fisheries is believed to be about 5.17 lakh tones. Not only do the fisheries contribute to about 3 percent of the economy of Kerala they also earn the state a great deal of foreign exchange and goodwill. The fisheries of the state are famous all over the world and are exported to Europe and America among other parts of the globe. Besides the marine life bestowed by the sea, these inland water resources contribute significantly to the growth of the fishing industry of the state. This is substantiated by the fact that the inland fish yield level of the state is currently at about 75036 tonnes a year. The total populace of fisher folk residing in the state of Kerala is an estimated 10.85 lakhs. Among these, the number of fishermen who have taken up marine fishing as their occupation is believed to be about 2.2 lakhs. They and their families have taken up domicile in the coastal areas of the state and built up hamlets of hutments in these regions. The inland fishing sector engages about 50 thousand fishermen in active fishing. In the state of Kerala, about 165 thousand people are engaged in allied activities of the fishery sector. The workers of units involved in drying, preserving, packaging, transporting and exporting the fishes and seafood are included in this count (www.ifp.co.in). Geographically, the inland fisheries have great scope in the State. An inimitable feature of the State is the occurrence of 49 interconnected backwaters (Kayals) with an area of 46129 ha. The total brackish water resources of the State are estimated as 143,696 ha. The State is endowed with a total area of about 2, 26,274 ha of fresh water resources consisting of rivers, fresh water lakes, reservoirs, minor irrigation tanks, ponds *etc.,* Of these about 1,30,000 ha area is ideally suited for fresh water fish culture (www.ifp.co.in). In Kerala the total brackish water resources covers a total area of about 1,43,696ha, which includes

the lower reaches of rivers, the brackish water lakes, the backwaters and the adjacent low lying fields & prawn filtration fields, mangrove swamps etc. It was estimated that Kerala had a total area of about 65000ha of brackish water area available for effective use of brackishwater aquaculture (www.ifp.co.in). There is ample scope for the development of freshwater fish culture in Kerala. The extensive polders and low lying paddy fields of Kuttanadu and Kole lands of Thrissur and Malappuram district can be utilized for rotational fish farming after paddy. Pokkali fields in Ernakulam district can also be well utilized for fish farming. Even though several FFDA's functions in 14 districts of the State, it is disappointing to note that fresh water fish farming has remained largely unrecognized? Even though local fish farmers are available in the state for the prosperity of fresh water fish culture, at present the culturing of Indian Major Carps is a synonym to fresh water fish culture in Kerala.

As small dense fishes are encountered as by catches in the inland sector, the nutrients are unutilized in the state due to lack of knowledge. These fishes are not excellent table fishes because of the lean and flat body. Through these data, small fishes are proved to be the best option for a balanced diet. Till date, there has been a lacuna in research to undertake the culture of these small dense fishes in the backyard ponds as well as in paddy fields are of significance since it will contribute to the daily diet to the fisher family who face the problems of mineral and vitamin deficiencies which in turn lead to under nutrition. The study look forward to formulate effective culture systems that can make these fishes available for their consumption all through the year irrespective of season. Species that are favorable for culture in the study area are listed through culture of four commonly available species in a pond and their condition factors were studied.

## Materials and Methods

Commonly available and locally consumed small dense fishes were reared in cultured pond. Fishes of four different genera were collected from two main rivers of Kerala, Periyar and Muvattuppuzha. Periyar is the longest river in the state of Kerala, India with a length of 244km. It is one of the perennial rivers in the region. Orange chromide (*Etroplus maculatus*) was collected from Pizhala where Periyar join Cochin backwaters. *Puntius ticto, Danio malabaricus,* and *Labuca dadybujori* were collected from Muvattupuzha river.

Culture pond was constructed by digging an area of 5×3×1 at the backyard area. It was then lined with polythene sheets. An outlet to prevent overflow of water was made by connecting a PVC pipe, whose mouth was guarded with small meshed net to avoid the loss of fishes. The pond was then filled with rain water. After a few days cow dung was added as fertilizer. The pond was left intact for two weeks. The appearance of a greenish tinge in the water indicates that the pond is ready to stock.

The orange chromides were caught using ring net with the help of local fishers and other species with scoopnets and mosquito net. The collected specimens were transported in oxygen packed polythene bags by late evenings. A total of 70 specimens were stocked. During the culture period a mortality rate of 2-3 were found in a fortnight. After 3 months (Culture period was from Feb 2011 to May 2011) they were harvested using scoop nets and the pond was drained. Length and weight of the samples were noted for length-weight analysis and analyzing the condition factor.

The fishes from natural systems were used to compare the health conditions of the reared samples. To determine the condition of fishes, the length-weight relationship [LWR] was determined using the equation $W = aLb^5$ and logarithmically transformed into log W = log a + b log L where W is the weight of the fish in gram and L is the total length of the fish measured in millimeter. The parameters 'a' (proportionality constant) and 'b' (exponent) of the LWR were estimated by least square regression[6]. Also, in order to determine the relative robustness or degree of well-being of this fish in wild and in culture systems, the coefficient of condition was calculated using the formula K= 100000L/W3[7].

## Results

Based on $T_L$, the length weight relationship of *L. dadybujori* in culture systems was $W = 1.802T_L^{0.808}$ and for the log log plot (Fig. 1) the relationship was l Log W = 0.808Log L - 1.802 ($R^2 = 0.41$) shows that the fish doesn't have isometric growth. Based on $T_L$, the length weight relationship of *L. dadybujori* in wild is $W = 1.950T_L^{2.833}$ and for the log plot (Fig. 2) the relationship was Log W= 2.833 Log TL- 1.950 ($R^2 = 0.586$) shows that the fish does not have isometric growth. The coefficient of Condition calculated shows a value of 0.76 with a standard deviation of 0.18 in culture systems versus 0.98 with a standard deviation of .30 shows that the species is not doing well in the culture systems and cannot be considered as an ideal species for small dense fish culture.

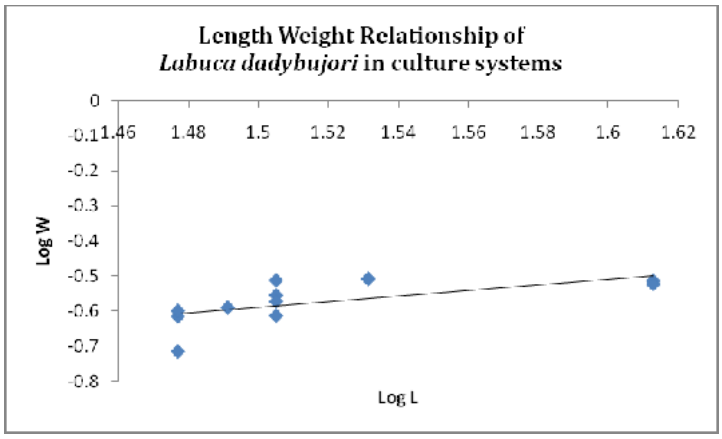


**Fig.1. Length Weight Relationship of *Labuca dadybujori* in culture system**

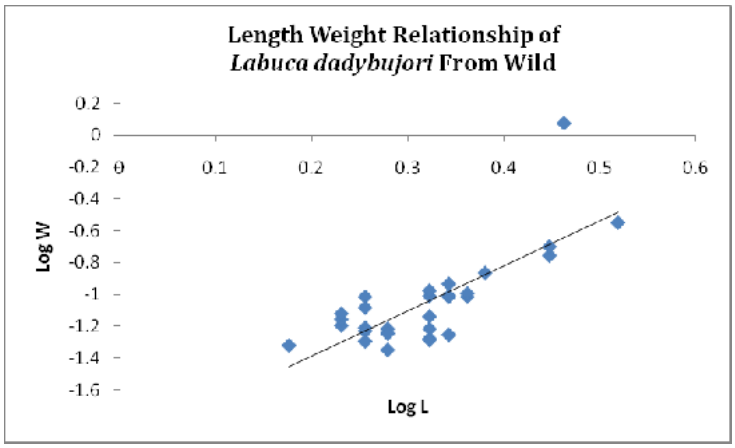


**Fig.2. Length Weight Relationship of *Labuca dadybujori* from Wild**

Based on $T_L$, the length weight relationship of *D. malabarcius* in culture systems is $W = 2.794T_L^{3.691}$ and for the log log plot (Fig. 3) the relationship was Log W = 3.691 Log L- 2.794 ($R^2$ = 0.968) shows that the fish have isometric growth. Based on $T_L$, the length weight relationship of *D. malabaricus* in the wild is $W = 2.077T_L^{3.059}$ and for the log log plot (Fig. 4) the relationship was Log W = 3.059Log L - 2.077 ($R^2$ = 0.959) shows that the fish has isometric growth. The coefficient of Condition calculated shows a value of 0.60 with a standard deviation of 0.08 in culture systems versus 0.94 with a standard deviation of .15. The length weight analysis shows that the species is doing well in the culture systems and can be considered as an ideal species for small dense fish culture.

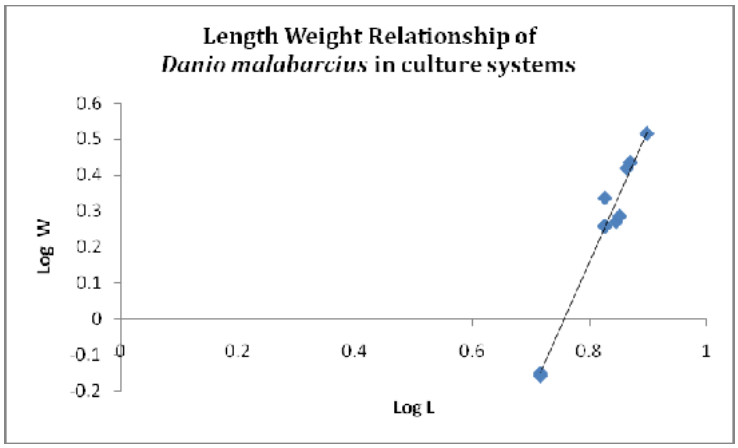


**Fig.3. Length Weight Relationship of *Danio malabaricus* in culture system**

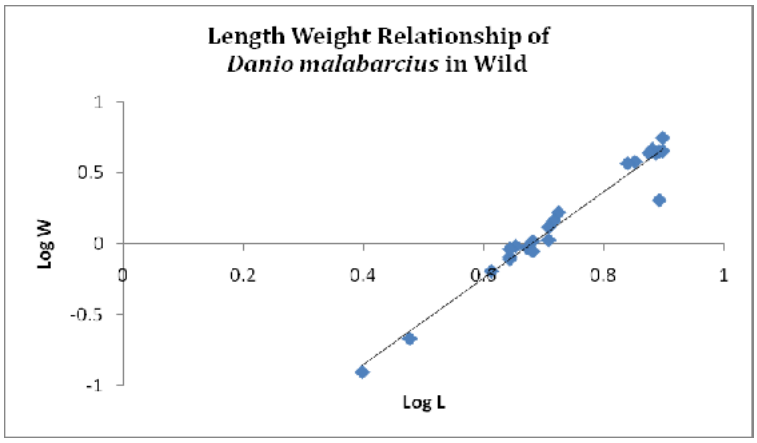


**Fig.4. Length Weight Relationship of *Danio malabaricus* in wild**

Based on $T_L$, the length weight relationship of *E. maculates* in culture systems is $W = 5.002T_L^{3.091}$ and for the log log plot (Fig. 5) the relationship was Log W = 3.091Log L - 5.002 ($R^2 = 0.936$) shows that the fish has isometric growth. Based on $T_L$, the length weight relationship of in wild *E. maculatus* is $W = 1.7T_L^{3.034}$ and for the log plot (Fig. 6) the relationship was Log W= 3.034Log L- 1.7 ($R^2 = 0.967$) shows that the fish have isometric growth. The coefficient of Condition calculated shows a value of 1.27 with a standard deviation of 0.29 in culture systems versus 2.12 with a standard deviation of 0.18. The length weight analysis shows isometric growth and coefficient of conditioning shows a value greater than 1 indicates that the species is doing well in the culture systems and ideal species for small dense fish culture.

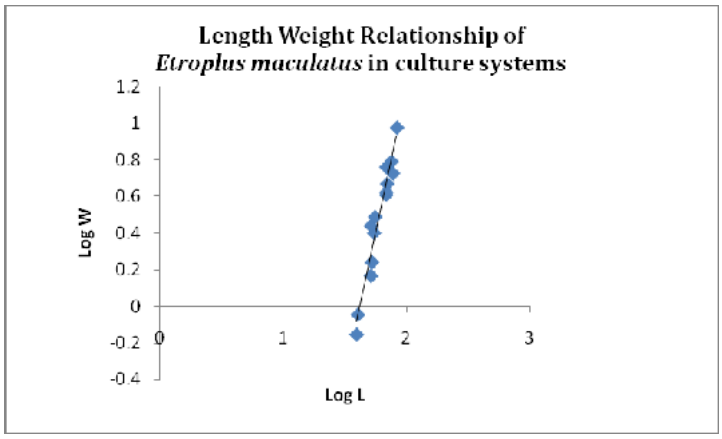


**Fig.5. Length Weight Relationship of *Etroplus maculatus* in culture systems**

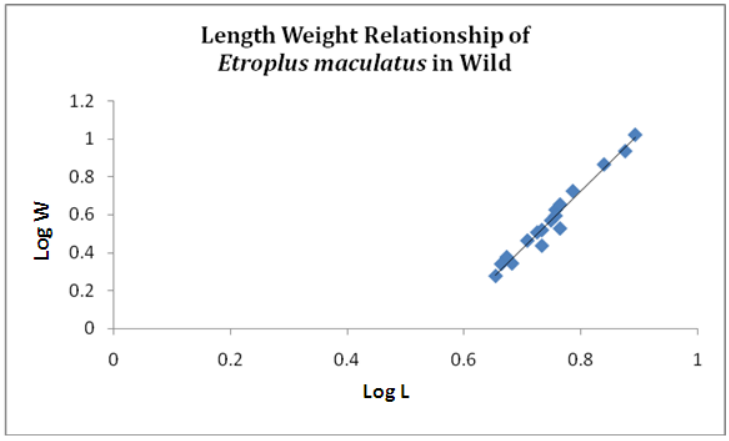


**Fig.6. Length Weight Relationship of *Etroplus maculatus* in wild**

Based on $T_L$, the length weight relationship of *P. ticto* in culture systems is $W = 1.348 T_L^{0.944}$ and for the log log plot (Fig.7) the relationship was Log W = 0.944Log L - 1.348 ($R^2$= 0.066) shows that the fish have isometric growth and a weak correlation coefficient. Based on $T_L$, the length weight relationship of *P. Ticto* in wild is $W = 1.838\ T_L^{2.856}$ and for the log log plot (Fig. 8) the relationship was Log W= 2.856 Log L- 1.838 ($R^2$ = 0.981) shows that the fish does not have isometric growth. The coefficient of Condition calculated shows a value of 1.21 with a standard deviation of 0.21 in culture systems versus 1.17 with a standard deviation of 0.14. The length weight analysis did not show isometric growth which might be due to small sample size and coefficient of

conditioning which is an effective tool with specimens with low sample size shows a value greater than 1 indicates that the species is doing well in the culture system and might be an ideal species for small dense fish culture.

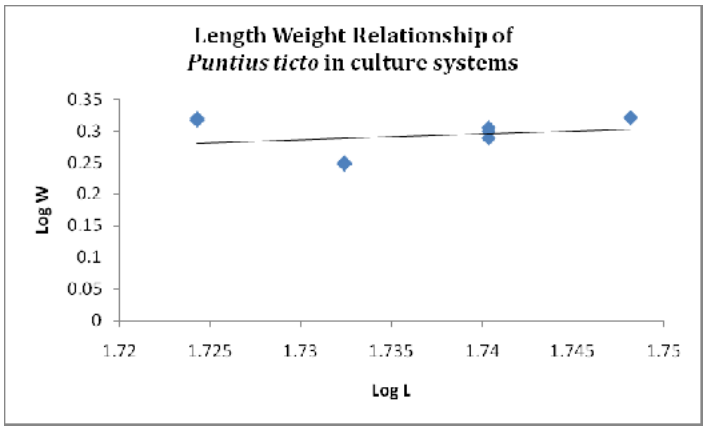


**Fig.7. Length Weight relationship of *Puntius ticto* in culture systems**

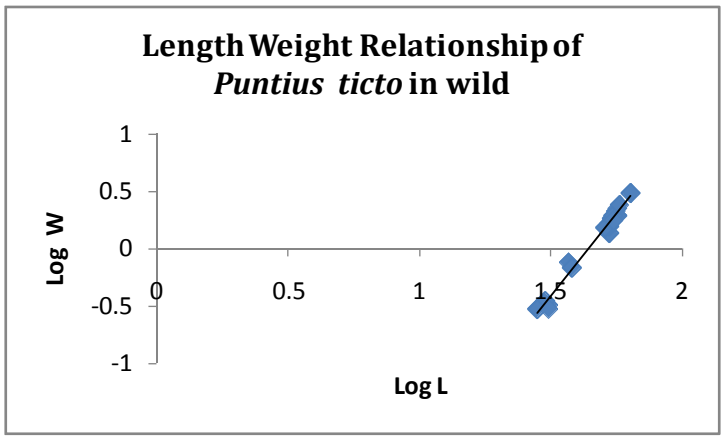


**Fig.8. Length Weight Relationship of *Puntius ticto* in wild**

Based on $T_L$, the length weight relationship of *P. fasciatus* in culture systems is W =5.259 $T_L^{3.23}$ and for the log log plot (Fig. 9) the relationship was Log W = 3.230Log L - 5.259 ($R^2$= 0.979) shows that the fish have isometric growth and a weak correlation coefficient. The coefficient of Condition calculated shows a value of 1.17 with a standard deviation of 0.09 in culture. The length weight analysis show isometric growth and coefficient of conditioning which is an effective tool with specimens with low sample size shows a value greater than 1

indicates that the species is doing well in the culture systems is an ideal species for small dense fish culture.

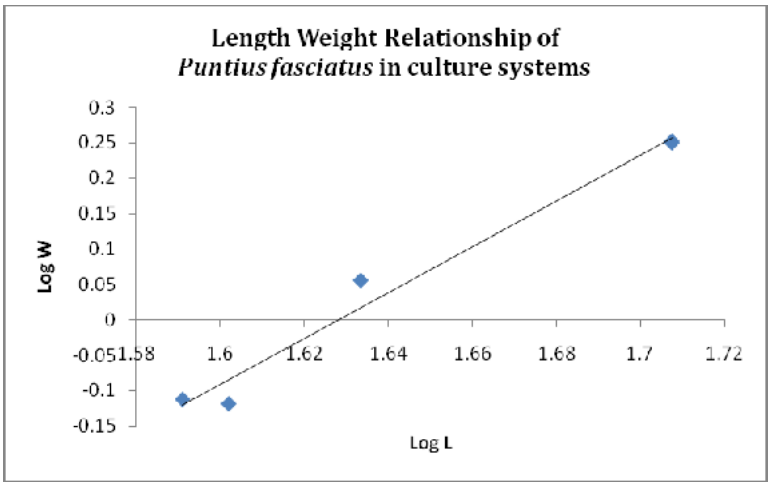


**Fig.9. Length Weight Relationship of *Puntius fasciatus* in culture system**

**Discussion**

The importance of fish as a rich source of animal protein is well established and this is frequently used to justify fish as a valuable food, whereas very little attention has been given to the role of fish in supplying vitamin A and minerals in the diet. Floodplain fisheries are still the main source of fish eaten by rural people, with SIS contributing the most. However, with the present trends of decreasing floodplain fisheries and increasing aquaculture, the total fish intake may fall and a larger proportion of SIS in the diet will be substituted by bigger fishes. This will have a negative impact on the nutritional contribution from fish, especially because the content of vitamin A and calcium is very much less in big species than in SIS. To maintain and enhance SIS intake, sustainable management and restoration of floodplain fisheries must be given high priority. However, the drainage of floodplains and the increasing population limit the scope. Rather, incorporating nutrient-dense fish species in the production systems used in the continued expansion of aquaculture is a means of abating the above trends. Mazumder and Lorenzen[8] reported that due to pollution and habitat alteration, small native fish stocks are declining and including them in integrate farming can save them. Similarly a country like India with the largest number of biodiversity in fresh water fishes has to seek measures to

conserve such species in an integrated manner so that effective conservation can be implemented. Kerala, the land of rivers is blessed with high value species and many fishes are facing threats due to various anthropogenic stressors.

The present study throw light to a section we haven't looked and the results of the study will be useful for sustaining the livelihood of fisher folks as well as solving the nutrient deficiency faced by the state especially, in the case of women during pregnancy. Fish is an integral part of the diet of Keralites. Linking human nutrition to fisheries in Bangladesh to address public health problems by documenting and disseminating data on the importance of small indigenous fish species as a commonly consumed, nutrient-dense food in the everyday diet of the poor rural Bangladeshi population is well established[9]. Ahmed et al., [10] based on their studies on the polyculture of small indigenous fishes found that the indigenous fishes are nutritionally superior than large food fishes such as carps and also found that they are suitable species for polyculture. Our data can be used by decision makers at many different levels in Kerala so that the idea of including small indigenous fish species can play an important role in combating micronutrient deficiencies especially among women in Kerala. In poor rural households we found that small indigenous fish species can contribute to the total recommended intakes of vitamin A and calcium, respectively, at the household level in the peak production season. A committed team of researchers and practitioners is needed to use this information to develop and implement SIS pond polyculture systems in the flood plains of Kerala. We have documented that these SIS can perform well in controlled conditions; so including them in polyculture improves the nutritional quality of the fish production without having a negative impact on total fish production. This production system offers a great potential for providing essential limiting micronutrients for the people in Kerala without added cost as all SIS are comparatively cheap. It is commonly agreed that some of the SIS are popular and well-liked fish species, and interest in its health and nutritional benefits awakened as a result of the study will substantiate the perception that SIS is good for or protects the eyes was corroborated by its high contents of vitamin A compounds by HPLC analysis. The high calcium content in SIS is more than that in milk, commonly regarded as the best source of calcium. At the same time, it was recognized that small indigenous fish species could not be prevented from

being part of the pond polyculture, since the pond is not a closed system and small indigenous fish species also enter the pond with duckweed. All SIS reproduces in ponds during the production season led to our recommendation that partial harvesting of small amounts could be done biweekly or weekly, favoring household consumption making it a cost free mechanism. In contrast, it became more evident that harvesting of carps, which were often harvested all at once and sold immediately to a wholesaler, did not favor household consumption and have low market value in Kerala, lower than SIS (@ 40Rs/Kg Vs. 60 Rs/Kg). Further studies on the effect of processing and cooking on nutrient contents as well as nutrient bioavailability will provide better quantification of the nutritional value of the fish. The small indigenous fish species are no longer referred to as "trash" or "weed" fish. More attention is to be paid in monitoring and documenting the changes in capture fisheries and more research on small indigenous fish species should be conducted.

## References

[1]. Kottelat, M. and Whitten, T. *Freshwater biodiversity in Asia, with special reference to fish.* World Bank Technical Paper No. 343, 1996.

[2]. Dahanukar, N., R. Raut & A. Bhat , Distribution, endemism and threat status of freshwater fishes in the Western Ghats of India. *Journal of Biogeography* 2004,31: 123–136.

[3]. Rajeev Raghavan , G. Prasad , P. H. Anvar Ali , Benno Pereira, *Fish fauna of Chalakudy River, part of Western Ghats biodiversity hotspot, Kerala, India: patterns of distribution, threats and conservation needs*. Biodiversity and Conservation 2008, Vol 17, 13:3119-3131.

[4]. Gopi, K.C. , Freshwater fishes of Kerala State, pp. 57–76. In: Ponniah, A.G. & A. Gopalakrishnan (eds.). *Endemic Fish Diversity of Western Ghats*. NBFGR/NATP Publication, 2000, 1: 347pp.

[5]. Pauly D, *Some simple methods for the assessment of tropical fish stocks.* FAO.Fisheries Techn.Pap. 1984, (234) FAO, Rome.

[6]. Zar, J.H., *Biostatistical Analysis*.Fourth edition. Pearson Education, India, 1999, 929pp.

[7]. Mazumder and Lorenzen, *Developing Aquaculture of small Native Species (SNS) in Bangladesh: Village level Agroeconomical change and the availability of SNS*. The Iclarm Quarterly, 1999, Vol.22 (3): 20-23.

[8]. Roos N, Islam M., Thilsted S.H., Small fish is an important dietary source of vitamin A and calcium in rural Bangladesh. Int. J. Food Sci. Nutr. ; 2003 54:329-339.

[9]. Ahmed Shahim, A.F.M. Arifur Rahman, Md. Ghulam Musthafa, M. Bilal Hossain and Nazmun Nahar, *Nutrient Composition of Indigenous and Exotic Fishes of Rainfed Waterlogged Paddy Fields in Lakshmipur, Bangladesh,* World Journal of Zoology 2012, 7 (2): 135-140.

# CAMPHOR SULPHONIC ACID DOPED POLYANILINE-GRAPHENE HYBRID FOR OPTICAL LIMITING

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## Abstract

We have covalently functionalized reduced graphene oxide with camphor sulphonic acid doped polyaniline using phenylene diamine as a linker and the hybrid was characterized by Fourier Transform infrared spectroscopy, X-ray diffraction analysis, X-ray photoelectron spectroscopy, UV-Visible spectroscopy and Scanning electron microscopy. Nonlinear optical properties of the hybrid, graphite oxide and the pristine polyaniline were investigated by open aperture Z-scan technique at 532 nm. At the same mass concentration (0.2 g/l), the hybrid exhibited improved limiting compared to the graphene oxide (GO) and pristine polyaniline due to the synergic combination of nonlinear mechanisms of polyaniline and reduced graphene oxide.

## Introduction

Graphene, the thinnest material in our universe is a single atom-thick sheet of hexagonally arrayed $sp^2$ bonded carbon atoms [1] and it promises many potential applications [2] due to its fascinating properties [3]. But as a result of high cohesive van der Waals energy [4] between the sheets, the practical applications of graphene are limited, just as with other allotropes of carbon. Functionalization at the carbon basal planes and edge sites will overcome this limitation and recently graphene based hybrids of conjugated polymers with dramatic improvement in properties are reported [5].

Following the demonstration of the first functioning laser [6], nonlinear optical limiting materials were thoroughly investigated. As the power of laser increases, demand for the protection from lasers becomes greater. Various materials including organic dyes, organometallics, fullerenes, semiconductors

etc. were studied for optical limiting applications [7], [8], [9], [10]. However no single material or limiting mechanism can meet the practical application requirements.

Among conjugated polymers, polyaniline emerged as a widely studied group of NLO materials [11], because of its ultrafast response, high damage threshold, architectural flexibility and relative ease of processing. Although hybrids of polyaniline covalently grafted on graphene sheets were very recently studied aiming supercapacitor applications [12], [13], its optical limiting applications are largely unexplored.

Encouraged by these considerations, we have decorated reduced graphene oxide with camphor sulphonic acid doped polyaniline using phenylene diamine as a linker. The hybrid was characterized by various microscopic and spectroscopic techniques. Graphite oxide (GO) synthesized by simplifying the modified Hummers method was first activated by acyl chlorination, then functionalized with Phenylene diamine and subsequently polymerized along with aniline monomer, yielding the hybrid. Nonlinear optical (NLO) properties of the samples were investigated by open aperture Z-scan technique at 532 nm. At the same mass concentration (0.2 g/l), the hybrid exhibited enhanced limiting compared to the GO and pristine polyaniline due to the synergic combination of nonlinear scattering, two photon absorption and reverse saturable absorption.

## Experimental

### *Materials and methods*

Graphite powder with particle size < 20 μm was purchased from Sigma Aldrich and used as such. 98% sulfuric acid ($H_2SO_4$), potassium permanganate ($KMnO_4$) and 30% hydrogen peroxide ($H_2O_2$), phenylene diamine, camphor sulphonic acid (CSA) and ammonium persulphate (APS) from Merck, India was used. Monomer aniline, thionyl chloride and dimethyl formamide (DMF), received from Merck, India, were used after distillation.

Fourier transform infrared spectrum (FTIR) was recorded in Perkin Elmer 100 FTIR spectrometer with diffuse reflectance accessory and X-ray photoelectron spectrum (XPS) was carried out using Kratos Axis ultra photoelectron spectrometer with a monochromatic Al Kα X-ray source. Bruker AXS D8 advance X-Ray diffractometer using Cu Kα ($\lambda$ = 1.54 $A^o$) was used to elucidate the crystallographic features of the powder samples. Morphology of

the samples was analyzed using FEI Quanta FEG 200 high resolution scanning electron microscope (HRSEM). UV-visible absorption spectrum of the hybrid was recorded using Carey 100 Bio UV-Visible spectrophotometer. Nonlinear absorption and optical limiting of the samples were studied using open aperture Z-scan technique. A Q-switched Nd:YAG laser (Quanta Ray, Spectra Physics) with pulse width of 5 ns at the excitation wavelength of 532 nm operating at 10 Hz was used as a source and a lens of 10 cm focal length was used to focus the laser. The sample was mounted on a computer controlled translation stage and input energy as well as the transmitted energy was measured by two pyroelectric energy probes (RjP 735, Laser Probe Corp.), which are connected to an energy meter (RJ7600, Laser Probe Corp.). The nonlinear absorption coefficient as well as limiting threshold was evaluated by fitting the experimental data to a theoretical plot.

***Synthesis of Phenylene diamine functionalised reduced graphene oxide***

GO was synthesized by low temperature modified Hummers method, acylated using thionyl chloride and functionalised with phenylene diamine as reported by our group [14].

***Synthesis of camphor sulfonic acid doped polyaniline grafted on reduced graphene oxide***

Phenylene diamine terminated reduced graphene oxide ($rGONH_2$, 50 mg) was first dispersed in 1 M CSA (40 ml) by ultrasonication for 30 min using Sonics probe sonicator. Aniline monomer (200 µl) was added to the dispersion and stirred for 15 min to adsorb the monomer on graphene sheets. Freshly prepared aqueous solution of APS (1.4 ml, 2.9 mmol) was added drop wise to the dispersion and stirring was continued for 9 h. The green coloured hybrid formed was then filtered through Millipore 0.45 lm filter paper, washed with distilled water, methanol and acetone and dried under vacuum at $60^{o}$ C for 24 h.

## Results and discussion

The synthesis strategy for the grafting of CSA doped polyaniline on reduced graphene oxide is shown in Fig. 1.

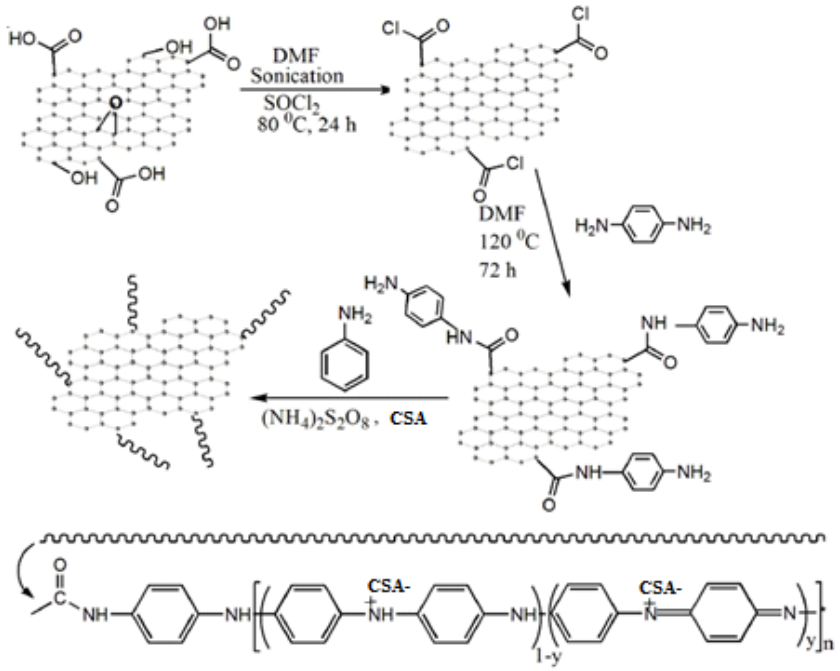


**Fig. 1 Synthesis strategy for grafting of CSA doped polyaniline on reduced graphene oxide**

Here graphene sheets act as a template for polymerisation and also participate in the polymerisation . When APS is added as a redox initiator in aniline–rGO$NH_2$ system, mainly two types of cation radicals can be formed. Anilinum radical cation adsorbed on reduced graphene oxide sheets and phenylene diamine radical cation covlently grafted on reduced graphene oxide. The polymer chains initiated by the former will get entrapped in the graphene sheets whereas the chains initiated by the latter will get grafted on the reduced graphene oxide sheets. The structural feature of the hybrid is characterized using FTIR spectrum and is given in Fig. 2(a). It reveals all the characteristic peaks of polyaniline [15]. The peaks at 1586 and 1496 $cm^{-1}$ are attributed to the C=C stretching vibrations of the quinonoid and benzenoid rings respectively. Aromatic C-H in-plane and out-of-plane bending vibrations are seen at 1130 and 815 $cm^{-1}$. The peak at 1306 $cm^{-1}$ is due to the C-N stretching vibrations. XPS spectrum shown in Fig. 2(b) clearly shows the presence of C, N, O and S corresponding to the doped state of polyaniline. In XRD spectrum shown in Fig. 2(c), the peak corresponding to graphite oxide at $10.3^0$ [14] has disappeared completely and broad peaks appeared at $25^0$, $20^0$ and $15^0$ due to the anchoring of

polyaniline on reduced graphene oxide. The broadening of the peaks indicates the amorphous nature of graphene sheets arising due to the poor ordering in the stacking direction, hence indicating significant reduction and exfoliation during covalent grafting.

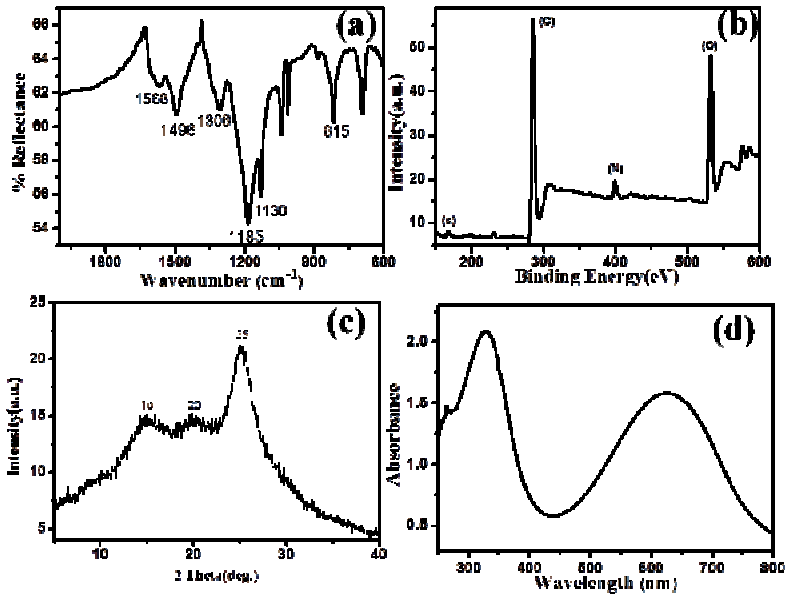


**Fig. 2 (a) FTIR spectrum (b) XPS Spectrum (c) XRD spectrum and (d) UV-Visible absorption spectrum of the hybrid**

Fig. 2(d) shows the absorption spectrum of the hybrid recorded in DMF. The $\lambda_{max}$ at 329 nm is due to the $\pi$-$\pi$* transition and the peak at 627 nm is due to the excitonic transitions of polyaniline.

Fig. 3(a) shows the HRSEM image of GO showing the layered and folded morphology. When it is functionalised with phenylene diamine, the surface became rough and shows wrinkled morphology (Fig. 3(b)). When CSA doped polyaniline is grafted on reduced graphene oxide, the introduction of rice grain like polyaniline in the graphene sheets are clearly visible (Fig. 3(c, d)).

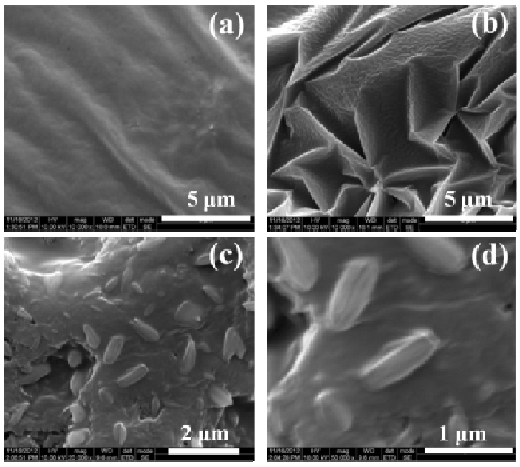


**Fig. 3 HRSEM images of (a) GO, (b) rGONH$_2$, (c & d) CSA doped polyaniline grafted on reduced graphene oxide.**

NLO properties of the samples were studied using open aperture Z-scan technique developed by Shiek-Bahae et al [16]. The samples were dispersed in DMF with a concentration of 0.2 g/l and Z-scan measurement is carried out using laser energy of 35 µJ. The Z-scan plots given in Fig. 4(a) shows a normalised transmittance valley indicating a process known as reverse saturable absorption. Hence it will show optical limiting behaviour and the limiting plots are given in Fig. 4(b).

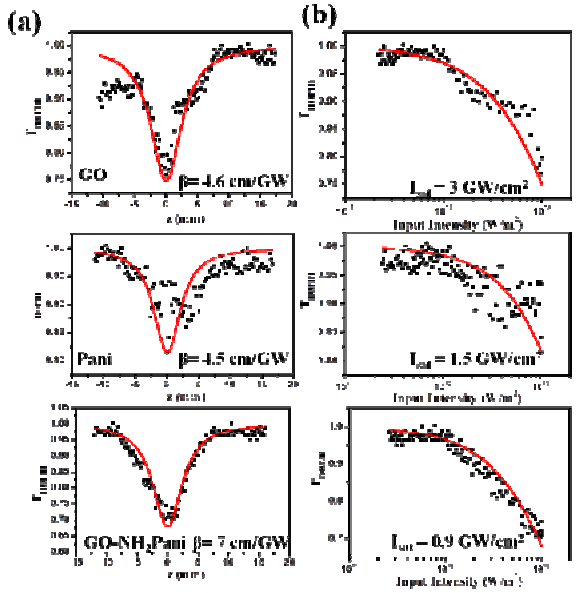


**Fig. 4 (a) Open aperture Z-scan plots and (b) Optical limiting plots of the samples**

The Z-scan data is found to fit well to a two photon absorption theory and the nonlinear absorption coefficient (β) as well as the limiting threshold ($I_{sat}$) is evaluated by fitting the experimental data with the theory and given as the inset of the corresponding Z-scan plots. The β value is increased to 7 cm/GW when polyaniline is grafted to reduced graphene oxide compared to individual counter parts (polyaniline and GO), whereas the optical limiting threshold is decreased to 0.9 GW/cm$^2$. Good nonlinear absorption coefficient and low limiting threshold is one of the desirable attributes of an optical limiter. So the polyaniline - reduced graphene oxide hybrid is found to be a better material for optical limiting applications compared to pristine polyaniline and GO. The improvement in the limiting behaviour can be attributed to the synergetic combination of nonlinear optical mechanisms of polyaniline and GO like reverse saturable absorption, nonlinear scattering and two photon absorption.

## Conclusions

Camphor sulfonic acid doped polyaniline is successfully grafted on reduced graphene oxide using phenylene diamine as a linker. The structural, crystallographic and optical features of the hybrids were characterised using FTIR, XPS, XRD and UV-Visible absorption spectrum. The HRSEM images clearly show the introduction of rice grain like polyaniline on reduced graphene oxide sheets. The hybrid shows better optical limiting behaviour with high nonlinear absorption coefficient compared to pristine polyaniline and GO.

## Acknowledgment

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## References

[1] A. K. Geim and A. H. MacDonald, *"Graphene: Exploring carbon flatland,"* Phys. Today, Aug. 2007, vol. 60, pp. 35-41, [2].

[2] J. Wu , W. Pisula, K. Muellen, *"Graphene molecules as potential material for electronics,"* Chem. Rev., 2007,vol. 107, pp. 718-47.

[3] P. Avouris, "*Graphene: Electronic and photonic properties and devices*," Nano Lett., 2010, Vol. 10, pp. 4285-4294.

[4] R. Zacharia, H. Ulbricht and T. Hertel, "*The interlayer cohesive energy of graphite from thermal desorption of polyaromatic hydrocarbons*," Phys. Rev.B. , Apr. 2004, Vol. 69, pp. 155406-155407.

[5] S. Zhou, H. Zhang, Q. Zhou, X.Wang, J. Li and F. Wang, "*Graphene-wrapped polyaniline nanofibers as electrode materials for organic supercapacitors,*" Carbon, Oct 2012, Vol. 52, pp. 440-450.

[6] T. H. Maiman, "*Stimulated optical radiation in Ruby*," Nature, Aug. 1960, Vol. 187, pp. 493-494.

[7] J. Balapanuru, J.-X. Yang, S. Xiao, Q. Bao, M. Jahan, L. Polavarapu, J. Wei, Q.-H. Xu and K. P. Loh, "*A graphene oxide-organic dye ionic complex with DNA sensing and optical-limiting properties*," Angew. Chem. Int. Ed. Jul. 2010, Vol. 49, pp. 6549-6553.

[8] M. B. M. Krishna, V. P. Kumar, N. Venkatramaiah, R. Venkatesan and D. N. Rao, "*Nonlinear optical properties of covalently linked graphene-metal porphyrene composite materials*," Appl. Phys. Lett., Feb 2011, Vol. 98, pp. 081106(1)- 081106(3).

[9] J. Zhu, Y. Li, Y. Chen, J. Wang, B. Zhang, J. Zhang and W. J. Blau, "*Graphene oxide covalently functionalised with zinc phthalocyanine for broad bang optical limiting*," Carbon, May 2011, Vol. 49, pp. 1900-1905.

[10] X.-L. Zhang, X. Zhao, Z.-B. Lio, Y.-S. Liu, Y.-S. Chen and J.-G. Tian, "*Enhanced nonlinear optical properties of graphene-oligothiophene hybrid mataerial,*" Opt. Express. *, Dec.2009,* Vol. 17, pp. 23959-23964.

[11] R. K. Pandey, C.S.S. Sandeep, R. Philip and V. Lakshimanarayanan, "*Enhanced Optical Nonlinearity of Polyaniline−Porphyrin Nanocomposite*," J. Phys. Chem. C., Apr.2009, Vol 113, pp. 8630-8634.

[12] N. A. Kumar, H.-J. Choi, Y.-R. Shin, D. W. Chang, L. Dai and J.-B. Baek, '*Polyaniline grafted reduced graphene oxide for efficient electrochemical supercapacitors*," ACS Nano, Feb.2012, Vol*.6,* pp.1715-1723.

[13] J. An, J. Liu, Y. Zhou, H. Zhao, Y. Ma, M. Li, M. Yu and S. Li, "*Polyaniline grafted graphene hybrid with amide groups and its use in supercapacitors*," J. Phys. Chem. C, Aug.2012, Vol. 116, pp. 19699–19707.

[14] T. Remyamol, H. John, P. Gopinath, "*Synthesis and nonlinear optical properties of reduced graphene oxide covalently functionalised with polyaniline*," Carbon 2013, http://dx.doi.org/10.1016/j.carbon.2013 .03.023.

[15] J. Jang, J. Ha and S. Kim, "*Fabrication of polyaniline nanoparticles using microemulsion polymerization,*" Macromol. *Res.,*2007, Vol. 15, pp. 154-159.

[16] M. Sheik-Bahae, A. A. Said, E. W. v-Stryland, "*High-sensitivity single-beam n2 measurements,*" Opt. Lett., Jun.1989, Vol. 17, pp. 955, 1989;14 (17):955.

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# MAPPING LIMINAL IDENTITY: A READING OF HANIF KUREISHI'S *THE BUDDHA OF SUBURBIA*

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## Abstract

The postmodern age with its multiple discourses and fractured subjectivities is a potential platform for enquiries and interrogations regarding the formation of subjectivities and construction of identity. Using Heidegger's idea of givenness' (*Dasein*), this paper tries to locate Karim, a mixed race teenager who wants to make it good in London, in the liminality of plural identity. In this paper titled "Mapping Liminal Identity: A Reading of Hanif Kureishi's *The Buddha of Suburbia"* an effort is made to read Hanif Kureishi's text from the point of view of phenomenology. This paper aims to analyze the concept of liminality in the realm of the postmodern fractured identity and subjectivity of the protagonist of *The Buddha of Suburbia.*

**Key Words:** Phenomenology, liminality, identity

Identity and subjectivity are essentially connected with the enquiries of phenomenology. The postmodern age with its multiple discourses and fractured subjectivities is a potential platform for enquiries and interrogations regarding the formation of subjectivities and construction of identity. Every individual is totality of selves and this pluridimensional nature of being problematize a search for self and the o/ Other in a post modern world. Hanif Kureishi's *The Buddha of Suburbia* postulates such an enquiry which may be read as a bildungsroman of the postmodern psyche which itself is paradoxical. Using Heidegger's idea of givenness' (*Dasein*), this paper tries to locate Karim, a mixed race teenager who wants to make it good in London, in the liminality of plural identity. In this paper titled "Mapping Liminal Identity: A Reading of Hanif Kureishi's *The Buddha of Suburbia"* an effort is made to read Hanif Kureishi's text from the point of view of phenomenology. This paper aims to analyze the concept of

liminality in the realm of the postmodern fractured identity and subjectivity of the protagonist of *The Buddha of Suburbia*.

Phenomenology deals with the question of being and becoming and hence is essentially concerned with the way an individual is shaped. As a reading strategy, phenomenology places importance on the reader and his integral relation with the text in question. It celebrates the way a text opens itself to the reader revealing the inherent phenomena, inviting him to fill the gaps in the text, as it touches his consciousness. The relationship the reader shares with the text and the author's consciousness is crucial to the phenomenological reading of a text. A work, empty of meaning becomes replete with signification and transforms into a text by this process. "The act of reading is possible as the texts allow the reader access to the author's consciousness" (Selden119). It is, as Poulet says, the book "is open to me, welcomes me, lets me look deep inside itself, and…allows me to…think what it thinks and feel what it feels"(qtd. Selden119).

Heidegger is a major force to be reckoned with in the discussions of phenomenology. Along with Husserl, Sartre, Maurice Merleau-Ponty, he laid a strong basis for the study and discussions of phenomenology. Phenomenology as a discipline is looked upon both as a philosophy and as a movement in the world of theory and philosophy. As a philosophy, it concentrates on the individual and his perception of the world and the things that appear in them. It places sole importance on the first person point of view and is essentially concerned with his impressions of the world. As a movement in the world of theory phenomenology facilitates a reading of the text, where it remains open for the reader to go deep and interpret it based on his consciousness of the meanings juxtaposed within the textual space.

Phenomenological enquiry concentrates on the way the subjectivity of an individual is shaped. Postmodern subjectivity is a self-cancelling term as it problematizes the multiple levels in which a subject is shaped. This paper fuses a number of concepts in its theoretical space. In this paper, as part of a phenomenological reading, the concept of liminality is also discussed as the topos in which the protagonist of *The Buddha of Suburbia* is placed. Liminality problematizes 'the median', that discursive middle course which places an individual in between topos, not owing allegiance to either space. The word is

derived from Latin *limen* and hence by extension liminality seems to signify the transitory space or state which encompasses in itself fluidity, indeterminacy, ambiguity and hybridity with the potential for subversion, resistance and possibilities for change without fixity and definiteness. There is a spatial-temporal intermediacy and indeterminacy in this space where the self is constantly in a flux, moving through experiences which shapes his self and formulates his identity, where he comes to terms with the multiple subjectivities and differential contexts. This concept has been introduced by the archaeologists Arnold Van Gennep and Victor Turner to refer to the space of transformation between separation and incorporation. It is caught between the leaving space and entering a new space especially with regard to the rites of passage. Negotiating the binaries becomes an essential point in this concept and various theorists have caught to problematize their thoughts on border identities. Homi Bhabha refers to the liminal in postcolonial poetics as "a potentially disruptive in betweenness" (Bhabha 5) and says that "this interstitial passage between fixed identifications opens up the possibility of a cultural hybridity that entertains difference without an assumed or imposed hierarchy". It also signifies possibilities for disorder, instability and asymmetry.

Another major concept associated with this enquiry is the concept of *Dasein* put forth by Heidegger which he terms as "in the world" by which our being is identified as the being in the world and the self is inextricably intertwined with the contexts, the social realities around and by extension the identity of an individual is formulated by his being in the world. *Dasein* is a German word which literally means 'to be here' or to be there and Heidegger used it as a synonym for human being or human entity. It also presupposes an understanding about language, intersubjectivity and reasoning.

Hanif Kureishi's *The Buddha of Suburbia* narrates the tale of worldly negotiations and inter subjective relatedness of Karim, a mixed race teenager living in the suburb of London, trying to come to terms with the ambivalence/ ambiguity that characterize his individual predicament. It is this suburban existence that determines his liminality and his identity based on his attempts to shirk the social world around him in a bid to move on. Throughout his life he is trying to negotiate the maze of experiences that his liminal identity weaves for him. Karim's liminality is his *Dasein.* From the locale where he is placed, to the dreams that he harbours Karim is the product of his liminality. Though it is his

context that shapes him, he is painfully aware of the indeterminacy in which he is placed and the text is characterized by the constant effort of the protagonist to shirk his *Dasein,* to deny his liminal context. He becomes a product and project of his liminality, signified by it and situating himself against it at the same time.

At the beginning of the text, Karim identifies himself, ""My name is Karim Amir, and I am an Englishman born and bred, almost"(Kureishi1). This indeterminacy paradoxically determines his (non)identity. The protagonist is the topos on which duality/ plurality is theorized in the sense that, he is born of an English mother and an Indian immigrant father who is an official in the Pakistan embassy, leading a provincial life of ordinariness, ennui and boredom. His locale Bromley is contrasted with Baron's Court in London which is the end he dreams of. Bromley is "a leaving place" (2), while Baron's Court is the place to be, the un/reachable ideal space. Here it agrees with the concept of Gennep whose sense of the luminal or the threshold world is the space between the world that a person leaves and the world in which the person is inducted. It presupposes a separation and a reincarnation in another spatial/temporal/ideological world far removed mentally/physically from the world of initiation.

Another liminal space in the text is Karim's father Haroon caught between the actual self of bureaucratic assumptions and the assumed space of Indian mystic. The non-linear deviated movement between these two roles/selves defines the Dasein for Haroon. Another context of liminality is the constant movement between the suburb and the city, the provinciality of the suburban life and the supposedly cultural enrichment of the city life. It is a constant shuttle between the drab reality and the ideal dream.

Karim's intersubjective encounters are all edifying to his sense of his given situation-his *Dasein*. His friends Helen, Jameela, and Eleanor emerge from various social strata characterized by their contexts in a strange way. Helen is from his own back ground, though Jameela inhabits a realm between Helen, and Eleanor. She belongs to a poorer London suburb, but spatially closer to the city than Bromley is. By contrast to all of them, Eleanor is from the topos of his dreams, a beautiful sophisticated signifier for the entire London ethos that Karim hopes to possesss, and hopes to be part of. But his closer encounters with the real world seems to be as shattering as his earlier life experiences and his

yearnings for the city becomes a post modern predicament of postponement of conclusions.

This text was to be titled *The Streets of My Heart* in which the streets of the city is as significantly etched as the different layers of the protagonist's consciousness, celebrating a wide array of experiences, manifesting and letting forth vivid sensory perceptions. His journey from the suburb to the centre and the shifting web of relationship with the new signifier called city is as dense, as unreaching and as indeterminate as the journey of a postmodern psyche, where the chimeras of ideal space forever attracts him to a yet distant and yet different locale both of the mind and of the body , negotiating the self in a myriad of ways, through numberless inter subjective experiences, through ever shifting margins to a point of seen but not yet felt destinations and not being sure of anything in the end.

There are a number of occasions in which Karim does not know what to do and who he is. He wants to be part of the anti racist struggle as much as he would like to be part of the socialist workers revolution. He would like to be part of the hedonist bohemian group and the cultural elite at the same time. Sometimes he would just like to go home, but he doesnot know where home is or what exactly a home is. The protagonist arrives at a point where while getting to play a lucrative but trashy role in a film, his liminality is all that he carries with him. Throughout the novel he negotiates between the projected binaries at the ontological and the epistemological levels- between his Indianness and his Englishness, between his knowledge/awareness of the cityscape and the provinces, between the various experiences- both subjective and intersubjective- between his concepts of love and sex, between his sense of ambition and the cost of it in relationships and not opting for either and being liminally unsure, and establishing postmodern uncertain liminality as his *Dasein.*

His journey from the suburb to the centre and his genealogical entry in to the cityscape is the odyssey of a postmodern fragmented soul, caught in the 'givenness'of the situation and authenticating liminality as the individual predicament as he asks, "Was I conceived like this, in the suburban night air, to the wailing of Christian curses from the mouth of a renegade Muslim masquerading as a Buddhist?".

## References

[1]. Bhabha, Homi K. *The Location of Culture.*London: Routledge, 1994. Print.

[2]. Kureishi, Hanif. *The Buddha of Suburbia.* London: Penguin, 1991. Print.

[3]. Heidegger, Martin. *Being and Time.*1927. Trans. by John Macquarrie and Edward Robinson. New York: Harper and Row, 1962. Print.

[4]. Selden, Raman. *A reader's Guide to Contemporary Literary theory*. New York: Harvester Wheatsheaf, 1985. Print.

# "I"- WITNESS: DECODING POPULAR TEXTS

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## Abstract

Every projected image is a collective imagination; one has to constantly locate oneself with the many in the collective to arrive at an appropriate image and in this 'one-to-many relationship', the 'many' often would be a fluid entity that might undergo a constant dislocation. So every collective imagination will be temporary in nature; so are the projected or popular images. This also implies that every imagination is time bound. This highlights the evolutionary nature of human imagination, what we popularly understand as aesthetics and its ever-changing positions on human interactions and priorities.

*"A text by being a text has the capacity to negate the author"*

On a fine winter morning, while I am yet to wake up from bed, rolled under my soft blanket in pleasant warmth, my cell phone started ringing continuously. As I thought and expected it to stop after some point of time, I decided to remain curled under the blanket for some more time. But unfortunately the person at the other end of the phone had no such intention of giving up. The phone continued to ring till I gave up my warm soft blanket.

To my surprise the call came from my long lost old school friend. After we left school, perhaps we had never been in contact. Yesterday he invited me in Facebook and unfortunately since then he could not control the eagerness to validate his invitation by a confirmation, he made my morning indulgence a disaster. Although I had a fire in my belly with anger for the loss of my much desired sleep, I must admit it had been a pleasant surprise to receive his call.

During our school days he was one of the most popular students in our school with his all round performance; in fact he was good at everything that were part of our student life. Although the backbench loafers like me used to dismiss him in public as chocolate boy, in private we all envied his

achievements. As age caught up with us and aspirations took us apart, the living priorities pushed many things into oblivion in our lives that once used to be very important for us, including my popular friend, who was not relevant to me anymore.

Ralph Waldo Emerson once famously said, "Every hero becomes a bore at last" and now it started making more sense to me than ever before. For a while I looked at the mirror to understand what made him popular that I am not? And what made him forgotten today? Perhaps under the luminous lamp, my simple yet complicated answer slowly emerged in the mirror and stared at me.

Compared to all other living species on earth, human beings are the only ones perhaps who has a body without a striking colour or pattern and may be, that could be the reason that except us no other animal ever bothered to invent a mirror to see their image. For animals, their image and body remained the same whereas for us the image and body always remained different. Animal species modified their body as part of evolutionary correction with colours and patterns while we learned how to supplement it artificially. We covered our bland body with artificial dresses of colour and patterns; we sprayed fragrance, and we groomed our body and hair to convince ourselves that the image is better than the body and it will take care of our evolutionary needs.

This dichotomy between artificially modified image and our natural body was not without many far-reaching consequences, particularly when one realizes the power of projected image that can be artificially produced.

In this narrative, although the ability of producing artificial makeover to supplement our natural incapacity separates us from our counterpart in the animal world, both of us however survive nature similarly by grouping against dominations or dominating others as an individual or group or by way of camouflaging from other. We achieve these objectives with artificial modification of make-ups, clothes, communities, societies, languages, cultures, and weapons, whereas in animals, the choices of abilities to dominate, unify or camouflage the environment are restricted to their body. But this capacity of need-based build-up to respond to one's own environment unfortunately complicates the idea of an individual. In other words, in this text of dual existence of projected image and natural body, the popularity of my school friend becomes an important pointer to understand its complexity. The story of

my friend proves that popularity, as an idea will exist only when a community of collective interest exists there to subscribe to it. Even during the time when my friend was a celebrity at school, he might not have been relevant even to our neighbourhood schools, but in a school where all of us had a collective interest, his levels of highest achievements made him popular among other stake holders. In other words, a community of collective interest is essential to produce an image and the popularity of this image depends on the degree to which one is able to appropriate it.

As one can see there are two things that become important here. One, since every projected image is a collective imagination, one has to constantly locate oneself with the many in the collective to arrive at an appropriate image and in this 'one-to-many relationship', the 'many' often would be a fluid entity that might undergo a constant dislocation. So every collective imagination will be temporary in nature; so are the projected or popular images. Two, this also implies that every imagination is time bound.

This highlights the evolutionary nature of human imagination, what we popularly understand as aesthetics and its ever-changing positions on human interactions and priorities. My popular school friend is forgotten the day we are out of that school or the imagination of collective goes from our mind. But if we look at other possible narratives involved in this proposition such as scaling up of the projected image over many imaginations of collectives as against an isolated collective and considering a projected image anyway as an artificially produced one, the possibility of manufacturing collective imaginations could also turn out to be a possibility.

Couple of years back Lady Gaga, the singing sensation of that time, made headlines while attending a fashion show in Paris UMBDNE (Use but Do Not Eat Meat) wearing an outfit made of red meat. Although nothing much was heard of anyone else wearing that outfit thereafter, it certainly achieved its supposed objective: it unleashed a cascade of news outpouring across the world, establishing Lady Gag as a popular icon.

This one act of production of a non-existing narrative over pre-existing imaginations of collectives becomes the classic example for manufacturing the imaginations of collectives for a projected image. Propaganda and advertising can fall in this category. As these manufactured imaginations of collectives will

be unique in existence, there won't be a possibility of comparison in society. This artificial narrative of unchallenged projected image thus becomes an icon and the degrees of its subscription among collectives (community of societies) make it popular.

Artistic idioms of western art, from the Greek period to the plasticity of renaissance, tells no other story; so do the eastern depictions of gods. John Berger in his famous book *Ways of Seeing* explains this "more than human being" traits our masterpieces of civilization produces. The biggest popular texts of our time, the leaders, film actors, fashion models, and athletic icons tell no other story as well. They artificially produce fantasy narratives of body images that are humanly impossible and unparalleled, perhaps also only next to God, the largest utopia of man's iconic imagination. But unfortunately once an iconic image is presented to the world and society appropriates it, unless it reinvents itself as another iconic narrative immediately, every icon will get dislocated in a process of comparison by the imagination of collectives.

Considering that every text is structurally produced from the notions of meaning production, the text of reflection that is produced in the image of the body in the mirror is not being the body but a projected image, completely negates its authorship from body. Hence, as we began *"a text by being a text has the capacity to negate the author"*; so are the texts of every icon and the witnesses.

# BIOPOWER AND BIOPOLITICS:

# FOUCAULT AND AGAMBEN

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## Abstract

"Biopower," a concept that holds sway in the modern theoretical era attracted the attention of intellectuals all over the world with the coinage of the term by the French philosopher and social theorist Michel Foucault. Foucault discerned the appearance of a new tendency, a new technology of prevailing power over individuals in the second half of the Eighteenth century. According to him, while 'sovereign power' is directed at individuals as part of the "social body," 'disciplinary power' is concerned with the "population".

## Introduction

"Biopower," a concept that holds sway in the modern theoretical era attracted the attention of intellectuals all over the world with the coinage of the term by the French philosopher and social theorist Michel Foucault. Foucault discerned the appearance of a new tendency, a new technology of prevailing power over individuals in the second half of the Eighteenth century. According to him, while 'sovereign power' is directed at individuals as part of the "social body," 'disciplinary power' is concerned with the "population". Foucault recognizes this power as one which acts over individuals as biological or living beings rather than political subjects. In this sense, the term biopower literally denotes

having "power over bodies" which is established through diverse procedures. Foucault often uses the word in close connection with the term 'biopolitics' which is being taken up by many contemporary theorists.

Biopolitics is an age-old notion that appeared in its crudest form in the second half of the nineteenth century with the hypothetical tendency known as *Lebensphilosophie* (the philosophy of life). The pioneers of this branch of philosophy are Arthur Schopenhauer and Friedrich Nietzsche in Germany and Henry Bergson in France. Although these philosophers took varied theoretical positions, they realized life as a bodily fact, an organic existence as opposed to the "dead" and the "petrified." They critically scrutinized adversarial processes of life like nationalization, civilization, and mechanization with the conception of life as the standard (Lemke 9). This served as the intellectual milieu for the emergence of biopolitics at the beginning of the twentieth century. The Swedish political scientist Rudolf Kjellen baptized the scheme of the "state" as a "super individual creature," competent enough to regulate the lives of the individuals as 'biopolitics'. He believed that the social struggles of classes and groups exemplify the "state as a form of life." Many of Kjellen's contemporaries also envisioned the state as a living organism, "a collective subject that rules over its own body and spirit" (Lemke 10). They observed a kind of power that underlies different disciplines that deal with life. The different understandings of the word biopolitics depend upon which part of the word is stressed. It is possible to take on two different perspectives with regard to the term. One is the naturalist concept which considers life as the basis of politics and the

other is the politicist concept which is concerned with life as the object of politics.

However, within the naturalistic research on biopolitics, it is possible to identify four prominent fields. The first is concerned with the historical and anthropological question of the development of human beings and the origins of state and society which are primarily based on Neo-Darwinian evolutionary theory. The analysis of political behaviour through ethological and socio-biological concepts forms the second category. The third area is preoccupied with the works interested in physiological factors and their potential for an understanding of political action. The political problems that arise out of the intrusions into human nature and environmental changes fall into the last category. In spite of the diversity in these theoretical fields, biopolitics has a common research perspective and is based on three underlying aspects. Principally, political behaviour is determined by biological factors. Second, it is directed towards the explication of discernible behaviour in order to draw conclusions for rational politics based on the biological constraint. Third, certain forms of behaviour are described objectively by an external observer (Lemke 17). In contrast to these methods of biopolitics stand the hypothetical and methodological orientation of the social sciences which fails to see that the political behaviour of human beings is largely biologically habituated. Conventional social-scientific research is thus one-sided and superficial since it ignores the 'deeper' aspects of human behaviour. Therefore, biopoliticians advocate a "biocultural" or "biosocial" method for a comprehensive and realistic assessment of human beings. In this outlook, democratic concurrence plays hardly any role in the creation and persistence of states but on the contrary, relies

heavily on human evolutionary history and inherited behavioural patterns. The difference in biological factors in human beings accounts for the unequal distribution of power that eventually results in the existence of social hierarchies which are inevitable. It is even assumed that human evolutionary history determines certain forms of government. Human beings are by nature tyrannous and their hereditary endowment fosters authoritarian regimes than democratic states. A democratic state may emerge only if the power resources are distributed equally thereby eliminating hierarchies. It is, however, possible to pose a question regarding how the role of biological factors can be understood in the analysis of social and political behaviour. The works of bio-politicians who defend these concepts remain largely unclear as they fail to explain how biological basis concretely evokes patterns of political behaviour. Symbolic structures and cultural patterns of meaning are not taken into consideration for the exploration of political processes, which is another problem with the naturalistic approach. The proponents of this practice turn a deaf ear to the possibility of the human being as 'the producer' and not merely a product of biocultural processes. This one-sided point of view covers an essential dimension in the relationship between biology and politics, nature and society.

The politicist conception of biopolitics comprehends it as a realm of procedures that aims at the regulation and steering of life processes. Here, it is not the life processes that determine politics but it is the politics that accounts for the control of people and their lives. Since the 1960s, this trace of contention has existed fundamentally in two different forms. The first mode is termed ecological biopolitics, a word that became increasingly relevant during the period. Biopolitics in this sense denotes

policies and mechanisms that were meant to find solutions for the global environmental crisis. It was a period threatened by the limits of natural resources along with the reverberations of the population explosion. In this scenario, biopolitics came to signify a new domain of political reflection and action directed to preserve the natural environment of humanity. In a larger context, it encompasses health policy, the regulation of the population, environmental protection, and questions about life and survival. Politicist concept that considers life as the object of politics is enforced to achieve ecological world order. Biopoliticians in many parts of the world claim that this approach helps to eradicate the wildly-rising population and the mixing together of all races which corrupt the gene pool, the two fundamental problems that humanity faces. Ecological biopolitics thus secures and protects global and natural foundations of life.

The technocentric variant of the politicist dogma of biopolitics serves to modify and transform the environment through scientific and technological means. The ecological version of biopolitics is gradually integrated into the techno-centric discourse. While the former is assigned with the function of preserving natural foundations of life, the latter which is more forceful and prolific deals with the exploitation of these foundations. The amalgamation of the ecological and techno-centric aspects evidently engenders a new hope for a better world. The fact that underpins the concepts of naturalist and politicist discourse of biopolitics is that in both cases, "either biology accounts for politics and politics regulates biology" (Lemke 4). Since the two approaches take life and politics as isolated proceedings, they fail to explain the fragility of the

border between life and politics and do not explain their relationality and historicity.

In contrast to the naturalist and politicist reading, the historical and relational perception of biopolitics as propounded by Michel Foucault is considered feasible. He is interested in the historical evolution of life as the crux of political action. According to Foucault, life is neither the basis nor the object of politics, but it presents a border to politics. He employs the notion of biopolitics to stabilize the border between life and politics. For him, it is not merely an extension of conventional politics but it is a branch which is capable of transforming fundamental political order that had its roots in sovereignty. The configuration of political action can be traced to the surfacing of modern human sciences and the normative sciences that arise out of them. Foucault found that for the first time, the biological being of individuals was structured within their political existence. He observes a historical rupture from the then-prevalent notion of Aristotle that "man is a living animal with additional capacity for political existence." Foucault rephrases this stream of thought when he states that "modern man is an animal whose politics places his existence as a living being into question" (Foucault 143). Biopolitics for him marks the reconstitution of sovereign power. It also has a crucial role to play in the rise of modern racism. In another sense, the concept refers to the distinguishing art of government in the regulation of society and the free will of the individual. He often employs the terms 'biopower' and 'biopolitics' without clearly distinguishing the two.

In his work, *The History of Sexuality Vol. 1,* Foucault draws contrasts between sovereign power and its manifestations and various mechanisms of biopower. Sovereignty is regarded as the power which

determines 'who is to be incorporated' into the political body and is characterized by power relations operating in the life processes of people. The central feature of this strand of power is that it has the liberty to assert supremacy over the individuals and in extreme cases, also to dispose of the lives of the subjects. Thus sovereign power in the traditional sense may be defined as "the right over life and death."

Foucault locates the transformation of this right to seizure in the seventeenth century with the emergence of a new brand of power that aims to maintain, develop and manage life. He christens this newly transpired way of managing lives as "biopower" which operates on man as long as he is a living being. Foucault cites the increase in agricultural and industrial production and growing medical and scientific knowledge about the human body as the factors that have contributed to the assimilation of sovereign power into biopower. When sovereign power which laid its emphasis on the formula "to make die and let live," progressively adapted into biopower, the care for the life and health of the subjects became increasingly relevant in the mechanizations and calculations of the state. The ancient right "to kill and let live" gives way to an opposing model where death is degraded and power over life became the rule as illustrated in the norm "make life and let die."

Foucault identifies two forms of power over life which engage either in disciplining the individual body or regulation of the population. The first of these is known as "anatomo-politics" of the human body which had already established itself in the seventeenth century according to which the human body is a convoluted device. This kind of power ensures political subjection of the people not through traditional methods of domination and repression but through mechanisms that make the

human body obedient by nature. This kind of discipline as technology assists the increase in the economic productivity of the body.

In the second half of the eighteenth century, the power was directed not at the human bodies individually but at the collective bodies of the population. 'Population' signifies not a legal or political entity but a "social body" which establishes its existence through its own processes and phenomena like life span, death rates, and birth rates. Rather than discipline and supervision, this technology employs regulation and control to gain power. The most evident distinction between the two manifestations of power is in the locale of imposing power. Institutions like the army, prisons, schools, and hospitals undertake disciplinary technology whereas the regulation of population is developed and organised by the state. Therefore, two levels of action take place with regard to the infliction of power. One: the body – organism – discipline – institution, two: the population – biological processes – regulatory mechanisms – state (Lemke 37). However, the two forms of power do not constitute two extremes, rather they are two sides of a global political technology that seeks to control the individual body of the people as well as the human species as a whole.

Foucault diagnoses certain "apparatuses" that observe the unification of two types of power. He gives an instance of sexuality which is a biological process that is open to discipline and regulation both at the level of individuals and collective population. It has its significance in reproductive purposes, but in a broader framework, it affects the population rate of the state. Thus, sexuality is an apparatus that has its effects on the "micro level of the body" and the "macro level of the

population." The concept of the "norm" plays a pivotal role here as opposed to the ancient "power over life and death".

Foucault's proposition of the emergence of a politics that has power over life does not suggest that it has displaced sovereignty. In contrast, the power over death still exists but is subordinated to the power that governs, fosters, and secures life. The power over death in new form shatters the extant boundaries to nurture the interest in life. The legal existence of the sovereign loses its significance to embrace a more profound concern for the biological survival of the population. The contradiction of biopolitics lies in the fact that political authority employs life-threatening means of destruction like wars and holocausts in order to manage life and preserve race. Foucault traces the reason for this paradox in his 1976 College de France lecture where he poses the same question. If biopolitics is the management of life, how does it make die, and how does it kill? In order to be able to inflict death on its subjects, its living beings, biopolitics must make use of racism. He argues that the transition from sovereign power to biopower is marked by another parallel shift from a political-military discourse to a racist-biological one. The political-military discourse existed in the seventeenth and eighteenth centuries as a defiance of sovereign power. The Puritan Rebellion and French Revolution can be pointed out as examples. The expression 'race' was prevalent during those times but then it was relevant in the historical-political division based on factors such as geographical origin, language, or religion rather than any biological signification.

In the nineteenth century, biological elements were incorporated into the 'race-war' discourse which was reflected in two affairs. These wars considered societal conflicts as existential struggles. It is also taken

as a class struggle based on the tenets of dialectics. These two transcriptions lead to the rise of a 'dynamic racism' which heavily drew on the biological model of the struggle of life (Lemke 40). The racism thus developed provides a sort of license to exercise the right to seizure (of life) under biopolitical objectives of protecting life. It creates fissures in the social sphere and segregates people in accordance with binary oppositions of good-bad, higher-lower, ascending-descending races. This decides the superiority of one race over the other to the extent that it decides which race is fit to live and which is doomed to die. People who are presumed to belong to the superior race are prioritized and are considered "worthy of living" which vindicates the death of or even the murder of the other, inferior race in that way assuring a healthier life of the 'living.'

As a continuation of this concept, Foucault takes up the question of security mechanisms which he regarded as equivalent to liberal freedom. Technologies of security are presumed to protect the perilous living conditions of the population. Foucault compares security mechanisms with legal regulations and disciplinary methods. While disciplinary techniques function on the basis of a prescriptive norm, security mechanisms function by an empirical norm which facilitates further variations. They do not assign a pre-defined value to reality, but on the contrary, take reality itself as the canon.

Foucault also examines an organic element of biopolitics which is concerned with the resistance to biopolitical strategies. The disciplining of the bodies and the control of the population initiates a political struggle which claims new rights like the right to life, health, body and the satisfaction of basic needs. As Foucault stresses the importance of

biopolitical conflicts he alludes to the Second World War which witnessed struggles against forms of subjectivation along with political, social and religious struggles against domination. These resistances develop a crisis in the government which suggests that the power of subjectivation and control over the body are on the wane. Basically, these forms of opposition are against a government of individualization.

Even though the notion of biopolitics loses grip in his later works, Foucault continues to be interested in the activities of resistance against governmental policies that regard life as its object. Foucault strived to understand human life as a 'work of art' and focused on the 'aesthetics of existence' (Lemke 51). Foucault's concept of biopolitics was received by his successors in many different ways. The writings of Giorgio Agamben and the works of Michael Hardt and Antonio Negri enjoy a prominent place among them. They tried to explore Foucault's ideas, and their shortcomings and aimed to develop the concept further.

Foucault's influence on Agamben is most profoundly felt in his 1995 work *Homo Sacer* in which he gives an alarming analysis of the contemporary political situation. In this work, Agamben seeks to elaborate on the unsaid, incomplete aspects of Foucault's work. Although his concepts are not meant to denigration of Foucault's concepts, it sometimes considerably changes those ideas. *Homo Sacer*, the first of the four-volume work, tries to explore his thesis that the present political situation is the catastrophic culmination of a political tradition that has its origin in ancient Nazi Concentration Camps. Agamben contemplates biopolitical thoughts in relation to sovereign power and the concentration camps whereas, for Foucault, the advent of biopolitical mechanisms hinted at a historical impasse.

Agamben believes that even in pre-modern times, political power has always contained both the elements of sovereign power and bio-power. In fact, for him, biopolitics forms the crux of sovereign power. As a result, the modern era does not mark a break with the Western tradition but simply signifies a radicalization of the ancient political tradition. While Foucault believed that the sovereign and the biopower are distributed unevenly over life and death, Agamben supposes that both the powers which are intertwined are exercised simultaneously. Agamben finds at the beginning of all politics the opening up of a space where the protection of the law is denied to its subjects. He identifies a distinction between a natural being and the legal existence of a person which determined Western political history since antiquity; to be more specific, the basic separation of bare life (Zoë) and existence which enjoys political rights (Bios). The concept of 'bare life' (life deprived of full legal status) is central to Agamben's analysis of power. He argues that the workings of power in the modern states can be understood only when one notices that it is the 'bare life' of the individuals and not their political existence that lies at its basis. For him, the sovereign power that is imposed on human beings is supreme in such a way that it makes bare biological matter out of them. He locates the working of power in the lives of the people which denies even the freedom to personal choices of the individuals. The political issues that have aroused after the 9/11 incident in America can be cited as an example. The prohibition of public mourning for the death of Muslims in America brings out the paradox that underlies it. These Muslims remain the citizens of America, but at the same time are denied their fundamental rights. Here, a sort of

exclusion is at work where 'the Muslim' becomes emblematic of twentieth-century bare life (Campbell, XXV).

The exclusion of bare life from political life makes the constitution of politics possible; at the same time, it makes bare life a condition of politics. Agamben believed that the formation of sovereign power entails the production of a biopolitical body and that it is in bare life where sovereign power exercises its authority. The concept of bare life can best be understood in relation to "an obscure figure of archaic Roman law-Homo Sacer (the sacred man), in which human life is included in the juridical order [*ordinamento*] solely in the form of its exclusion (that is, of its capacity to be killed)" (Agamben 8). It is in fact an act of sovereign power that places the homo sacer outside the law.

According to Agamben, anyone can kill the sacred man without being punished for it, thus to be a homo sacer is to be placed outside the protection of the law. Through the act of being excluded from legal protection, the sacred man in reality is being included within the space of power. Thus for Agamben, the decision to define someone as the homo sacer is an act of power and necessarily a political decision. As a consequence, though it is ostensibly renounced, bare life forms the basis of the political body.

Agamben traces the existence of homo sacer among ancient Roman exiles and among the inmates of the Nazi Camps and in the modern era in the refugees, people in sanatoriums and the brain dead. The common factor about them is that they are all included in human life, but are excluded from the law's protection. They depend on human assistance where scientific interpretations and definitions reduced them to the status of "biomass". For Agamben, the Nazi Concentration Camp serves as the

centre where bare life is systematically produced. The hidden parameters of the political domain are witnessed in the Camps. According to Agamben, the Camps provide the locale for "the materialization of the state of exception" (Agamben 173-174). What is decisive for modern biopolitics is that together with the process by which the exception becomes the norm, the realm of bare life which is originally situated at the edge of the political order gradually begins to be included within the political jurisdiction.

Agamben tries to find in the production of bare life, a common ground for different forms of government. For him, bare life is an inevitable factor of contemporary political existence. While individuals engage in constant conflicts with the central power or the government to win a space of their own which gives them freedom and access to rights, their lives are inextricably entwined within the state order. It makes them all the more dependent on the sovereign power from which they wanted to set themselves free. The bare life operates on various levels, irrespective of the kind of government. In democracies, it results in the private having power over the public, in totalitarianism, it takes a decisive role in the suspension of individual rights (Lemke 57). These instances prove that the defence and maintenance of bare life is an essential component of the modern political regime.

Agamben ascertains that the boundary between politically relevant existence and mere physical existence or bare life is to a certain degree internalized by the individual bodies. As a result, "bare life now dwells in the biological body of every living being" (Agamben 140). Agamben's central thesis states that everyone is vulnerable to the state of a "homo

sacer". However, he does not clearly differentiate between the subjects who share the status in different ways. That is the question: in what way a patient in asylum shares the fate of the prisoners in concentration camps remains unanswered. The degree of their experience of bare life varies and Agamben leaves this concept unexplained. This is because of the one-sided perspective that he assumes in his analysis of biopolitics.

Three sets of problems can be identified in Agamben's analysis of biopolitics. The first one is the juridical framing of the concept. Agamben's conception of 'the camp' is directed only towards the separation of bare life and political existence. He does not consider the fact that there can be differentiation among them and life can be distinguished as "higher," "lower", "ascending," and "descending." He is more fixated on life in its 'bareness' than 'real life'. This is the point of difference between Foucault's and Agamben's thesis. For Foucault, sovereign power is inferior whereas in Agamben's work sovereign plays a pivotal role in the production of a biopolitical body and dictates bare life. Agamben's concern is for binary oppositions like Bios-Zoë and political existence - bare life which Foucault denounces. In this aspect, Agamben seems to be influenced more by Carl Schmitt than Foucault.

Agamben's thesis is to an extent paradoxical as his analysis is confined to the mechanisms and binary oppositions inside the law that he himself condemns for its disastrous effects. He fails to look beyond the concept of sovereignty, the state of exception and the production of bare life. However, his works have their place outside political theory. The themes that he deals with life and death, health and sickness, the body and medicine etc, are those which are supposedly barred from the political domain. His thesis illustrates the importance of these topics to be

considered within a political sphere that encompasses itself through the omission of seemingly apolitical 'bare life' (Lemke 64). His compelling volume of *Homo Sacer* facilitates a study of similarities and continuities between fascist regimes and democratic states. His work is a clarion call to the formulation of a "new political grammar" which caters to the rights of 'homo sacri' and also transcends the legal conception of the borderline between political existence and natural being. All the same, the thought that we need to stress is that both Foucault and Agamben identify the supremacy of politics that borders on our biological lives and bodies.

**Reference**

[1]. Agamben, Giorgio. *Homo Sacer: Sovereign Power and Bare Life*. Stanford: Stanford University Press, 1995.Print.

[2]. Barry, Peter. *Beginning Theory: An Introduction to Literary & Cultural Theory*, Manchester: Manchester University Press, 2012. Print.

[3]. Esposito, Roberto. *Bios: Biopolitics and Philosophy*. Trans. Campbell, Timothy. Minneapolis: University of Minnesota Press, 2008. Print.

[4]. Foucault, Michel. *Discipline and Punish: The Birth of the Prison.* Toronto: Random House, Inc. 1995. Print.

[5]. Foucault, Michel. *The History of Sexuality: Volume 1: An Introduction.* Trans. Hurley, Robert. London: Allen Lane, 1979.

[6]. Foucault, Michel. "Nietzsche, Genealogy, History." *Language, Counter-Memory, Practices – Selected Essays and Interviews*. Ed. Donald F. Bouchard. New York: Cornell University Press, 1980. Print.

[7]. Foucault, Michel. *Society Must Be Defended: Lectures at the College de France, 1*975-1976. Trans. Macey, David. New York: Picador. 2003. Print

[8]. Lemke, Thomas. Bio-Politics: An Advanced Introduction. New York and London: New York University Press, 2011.Print.

# PRICE VOLATILITY AND MARKET EFFICIENCY OF INDIAN DERIVATIVE MARKET - AN ANALYTICAL STUDY

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## Abstract

Due to the increased effects of globalization, economies are invariably exposed to global market factors and are volatile and sensitive to rising level of complexity of risks and changing conditions. Hence risk has become universal. However, due to the word of the ill effect of wide fluctuations of risk, various financial innovations have taken place at all times. Derivatives are the most important among them. Off late, the uses of derivatives have become very predominant because of increased globalization and financial integration causing unpredictable variables and fluctuations. Popularity of equity futures contracts in India can be adjudged from the fact that in terms of trading volume.India's experience with the launch of equity derivatives market has been extremely positive. The derivatives turnover on the NSE has surpassed the equity market turnover. The turnover of derivatives on the NSE increased from Rs. 23,654 million (US $ 207 million) in 2000-01 to Rs. 292,482,211 million in 2011-12.

**Key words:** Futures Market, Market Efficiency, Price Volatility, Spot Market etc.

## Introduction

Within the economic sector, globalization has been particularly dynamic in the financial markets. Financial innovation, internationalisation and institutionalisation of investment activities are differently inseparable aspects of the radical fundamental changes in the financial sector. The markets for financial derivatives -- futures and options -- can be regarded as the epitome of these new structures. The infrastructure of derivatives markets is geared to international transactions. The contract volumes and trading practices are tailored to meet the

challenges of professional market players. Taking this fact into consideration, the derivative market are characterised by exceptionally high degree of internationality.

Economies that do not have systems for derivative trading are supposed to be deprived of the benefits of beneficial financial instruments and are considered to be at comparative disadvantage. Stulz (2004) while unfolding some benefits of derivatives argued that derivatives allow individuals and businesses to achieve payoffs that they would not be able to achieve in the absence of derivatives. Derivatives can make the underlying markets more efficient. Derivatives facilitate investors to trade on information that otherwise might be costly to trade on. Fratzscher et al., (2006) compared advantages of derivatives such as market efficiency, risk sharing & transfer, low transaction costs, capital intermediation, liquidity enhancement, price discovery, cash market development, provide hedging tools and regulatory savings, with their disadvantages such as more leverage, less transparency, dubious accounting, regulatory arbitrage, hidden systematic risk, counter-party risk, tail-risk future exposure, weak capital requirements and zero-sum transfer tools, and concluded that derivatives trading is increasingly migrating towards some of the world's largest and most innovative areas but at the same time dangers are still lurking.

In terms of number of single stock futures contracts traded in 2011, NSE holds the third position for single stock futures with 161 million contracts. It occupies second position in terms of number of stock index options with 871 million contracts traded and third in terms of number of stock index futures contracts traded. These rankings are based on World Federation of Exchanges (WFE) Market Highlights 2011. As per the data revealed by Global F & O volume of trade, from the view point of total equity derivative turnover, NSE holds third position depicting a massive growth of 37.1% for the year 2011-12, consistently improving its worldwide ranking form fifteenth position in 2006 to eighth in 2008, seventh in 2009 and fifth in 2010. Since, efficient price discovery is an important feature of futures market, which enables the traders to take optimal hedging and arbitrage positions, it has become so popular that trading volume of futures is three times more than the trading volume of underlying indices/ stocks.

In the Indian context, derivatives were mainly introduced with a view to curb the increasing volatility of the asset prices in financial markets; bring about sophisticated risk management tools leading to higher returns by reducing risk and transaction costs as compared to individual financial assets. However, it is yet to be known if the introduction of stock index futures has served the purpose claimed by the regulators.

This raises important questions about the effect that index derivatives have on volatility of the spot market. While there is still disagreement as to whether futures trading increases or decreases the volatility of spot prices, the question is still an empirical one. However, if one market reacts faster to information, and the other market is slow to react, a lead-lag relation is observed. The lead-lag relation between price movements of stock index futures and the underlying cash market illustrates how fast one market reflects new information relative to the other, and how well the two markets are linked. Hence the need for such a study.

## Significance of Study

Derivatives markets serve two important socio - economic purposes: risk shifting and price discovery. Risk shifting, commonly called hedging, is the transfer of risk from one entity who does not want it to another entity that is more willing or able to bear it. In doing so, derivatives can help discover the price of underlying assets, commodities, events or certain types of risk. Risk shifting is important for a variety of economic reasons. Importers and exporters hedge their foreign exchange exposure so that the local currency value of their importing costs and exporting revenues is less volatile. Firms borrowing in foreign markets hedge the local currency value of their foreign currency debt payments.

Price discovery might not otherwise occur because of transactions costs, dispersion of the underlying item or the conglomeration of many values or risks into one whole thing. Derivatives are assumed to play an important role in price discovery because they offer market participants the possibility to price their expectations of future states of the economy and the underlying asset. Thus, expectations about future prices of the underlying become measurable and this additional information is revealed to other market participants acting in the derivatives and cash markets. This follows from the fact that prices in derivatives and cash markets value the same underlying asset. They therefore,

are linked and will move together if markets are at least partly efficient. Thus, the information about future prices of the underlying incorporated in the price of the derivative can be shared free of charge by other market participants who have to make their investment, production or consumption decisions. With the help of an efficient price discovery process a more efficient inter temporal allocation of resources can be achieved which is regarded as socially beneficial.

Price discovery involves number of buyers and sellers, market mechanism, information about the markets and risk management mechanism. Actually, price discovery helps to find the exact price for a commodity or a share of a company. The price discovery is used in speculative markets which help the traders, manufacturers, exporters, farmers, refineries, governments, consumers, and speculators.

The end-users are the final customers in the derivatives market place. They trade in order to hedge some existing risk, to adjust their hedge due to a change in the market or to speculate. End-users include a variety of firms and investors. These include small and medium sized banks that unlike the larger banks do not act as derivatives dealers, pension fund managers and other institutional asset managers who employ derivatives to manage the risks on their portfolios. End-users also include non-financial corporations who use derivatives to hedge their market risk (due to variations in interest rates, exchange rates and commodity prices) as well as to structure their financing so as to lower borrowing costs. Non-financial corporations might face the risk of exchange rate volatility if they are importers or exporters, and they might face commodity price volatility if they are producers or heavy users of commodities. End-users also include hedge funds that use derivatives as part of their investment strategies.

The potential economic utility of the role of derivative trading in price discovery and risk management is yet to be recognised by society at large. There are still apprehensions about the use of derivative trading because of its ill effects. As a result, over time, futures trading has been subjected to strict regulations, and certain commodities have been inflicted with occasional bans. Thus, while the "disutility" of the market is yet to be proven, the overcautious behaviour of the government has never really allowed the market to develop and prove its utility.

There is another aspect to price discovery function of the futures markets. The anti-market faction has often interpreted results as per its convenience. If futures prices act as reference prices for the physical markets during the time of a price rise, this faction assumes that the rise in futures price is responsible for the commodity price rise in the economy. Eventually, the entire blame for the inflationary trend is placed on the speculative elements in the futures markets, without considering the fact that price, fundamentally, is a function of demand and supply. An efficient futures market will be able to access this information, process it and pass this on to the physical markets.

Thus, there are various socio economic aspects related to the arena of role of derivatives in price discovery and market volatility which is clear from the related literature.

## Review of Literature

Tina. M. Galloay and James M. Miller (1997) investigated the index futures trading and stock returns volatility of Midcap 400 index futures. Using skinners methodology, the analysis indicated that the documented decrease in return volatility for the Midcap 400 stocks is simply a reflection of decrease in return volatility that affected all medium capitalization.

Rojer Craine (1997) valued the futures market performance guarantees using Black's option pricing model. The result showed that the implied variances from the November option, although high by historical standards are an order of magnitude smaller than G-K estimates. Kee-Kong Bae, Kalok Chan and Yan- Leung Cheung (1998) investigated the profitability and arbitrage in Hong Kong Futures for Hang Sang futures index and option. Results showed that the frequency of mispricing opportunities varies across different approaches in a pattern similar to before the percentage violation are the highest for transaction prices, lower for feasible transaction prices and the lowest for bid-ask quotations.

Minho Kim, Andrew C. Szakmary and Thomas V. Schwarz (1999) studied trading costs and price discovery across stock index futures and cash markets by adapting the impulse response functions to examine how an innovation in one market transmits across different markets. Johansen Cointegration and Vector Autoregressive techniques were applied as the tools for the analysis.

Joshua Turkinton and David Walsh (1999) made an investigation on price discovery and causality in the Australian share price index futures markets. Simple cost and carry method, Cointegration test, ARMA model and simple Granger indicated test were employed for the analysis of the study. The causality tests results indicated that bi directional causality among the variables and authors found that an index shop appears to induce a very large response in the futures.

Joseph K.W.Fung and Paul Draper (1999) made an empirical analysis on mispricing of index futures contracts and short sales constraints. The authors analyzed the mispricing of index futures contracts and short sales constraints. Jae H. Min and Mohammad Najand (1999) invested the lead lag relationship between the spot markets and stock index evidence from Korea by applying Dynamics Simultaneous Equation Model (SEM) and Vector Auto Regression Models (VAR). Simultaneous equation models results indicated that in the early inception of Korean futures markets, the futures lead the spot markets by at least 30minutes. The Wald statistics also indicated the model is well specified and there is a strong relation between the futures and spot markets.

Gerald. D. Gay and Dae. Y. Jung(1999) had investigated a further look at transaction cost, short sale restriction and futures market efficiency in Korean stock index futures by using GARCH (1, 1) model. Alan E.H.Speight, David G. Mc Millan and Owain A.P Gwilyan (2000) investigated intraday volatility component in FTSE- 100 stock index futures. GARCH, RCH-LM test and BDS tests were employed in its empirical analysis and the GARCH model specifically remaining diagnostic indicated the presence of residual ARCH structure at all frequencies other than half day.

Alex Frino, Terry Walter and Andrew West (2000) investigated the lead lag relationship between equities and stock index futures market around information releases by using data from the Australian stock exchange & Sydney stock exchange. This study proved that the index futures are influenced by the release of the macroeconomic and stock specific information. Joachim Grammig, Michael and Christian Schlag (2000) addressed to the question of price discovery using Cointegration and Vector models were used for the analysis. Leo Chan and Donald Lien (2001) examined the cash settlement and piece discovery in futures market in USA by adopting Vector Auto Regression model

with Error Correction was applied to analysis the data. Mathew Roope and Ralf Zurbruegg (2002) analyzed the intra –day price discovery process between the Singapore Exchange and Taiwan Futures Exchange using as Error Correction Model, Gonzalo and Granger (1995) Methodology and ARMA Model. Alexande A. Kurov and Donnis J. Lasser (2002) investigated the effect of the introduction of CUBES on the Nasdaq-100 index spot- futures pricing relationship. To compute the mispricing series futures prices are synchronized with the spot index value using a MIN SPAN procedure suggested by Harris Mclnish and Wood (1995) was applied. Quentin C. Chu and Wen- Liang Gideon Hsieh (2002) investigated price efficiency of the S&P 500 index markets. The study found a surprisingly close price relationship between SPDR's and the S&P500 index futures.

Abhay and Abhyankar (1998) made an investment on linear and non linear Granger Causality. The main purpose of this study was to tie together of Dwyer, Locke and Yu (1996) and explore further the nature of non linear of causal relationship between the index futures and the cash market in U.K. Back and Brock test, Granger Causality test and ARMA model were used in its empirical analysis as tools to reveal the objectives. The results of the linear Granger Causality test based on the multivariate regression indeed using both raw and AR filtered cash index return indicated that a high degree of contemporaneous correlation between the cash and futures contracts.

K. Kiran Kumar and Chiranjith Mukhopadyay (2002) made a comparative study on short term dynamic linkage between NSE Nifty and by employing two stages GARCH Model and ARMA – GARCH Model. The Granger Causality result indicated unidirectional Granger causality running from the US a stock market the Indian stock market.

KEDAR Nath Mukherajee and K. Mishra (2004) made an empirical study on the topic lead lag relationship between equity and stock index futures market and its variation around information release from India. VAR model and the Granger Causality test among the return series of the spot and the future market in India revealed that a symmetric spillover among the stock return volatility in India spot and future markets.

Sathya Saroop Debasish (2007) made a study on an econometric analysis of the lead lag relationship between Indian's NSE Nifty and its derivatives contracts employing the Cointegration and ARMA models. Suchismitha Bose

(2007) investigated the contribution of Indian index futures the price formulation in the stock markets. Kapil Gupta and Balwinder Singh (2008) studied the price discovery and arbitrage. The research work applied Johansen Co-integration procedure, Vector Error Correction Model, Granger Causality Methodology and Vector Auto Recreation methodology.

Thenmozhi and Manish Kumar (2008) conducted a study on dynamic interaction among mutual funds flows, stock marker retunes and volatility with a purpose of examining whether the information on mutual funds flows can be used to predict the changes in market returns and volatility. Ulkem Basdas (2009) investigated the lead lag relationship between the spot index and futures price for the Turkish derivatives exchange by using ISE30 and compare the forecasting abilities of ECM, ECM with COC, ARIMA, VAR model. Y.P.Singh and Megha Agrwal (2009) investigated the impacts of Indian index futures on the index and Nifty futures to determine the direction of flow of the information between Nifty spot index and Nifty futures. This result indicated that futures lead the spot market for Nifty.

Kapil Gupta and Balwinder Singh (2009) investigated information memory and pricing efficiency of futures markets to examine the information dissemination efficiency of Indians equity futures markets using GARCH and EGARCH econometrics models implied that previous information shock plays significant role in the return generation process.

## Objectives of Study

The objective of the study can be stated as:-

- To analyze the price discovery mechanism in the futures market with respect to spot market in Indian Derivative Segment.
- To measure the market efficiency of futures market by comparing the relationship between futures and spot market in Indian Derivative Segment.

The hypothesis framed for the study is:

$H_{01}$: There is no significant lead –lag effect between spot and futures markets.

$H_{02}$: There is no significant relationship between spot and futures in long term and short term period

## Methodology

The study undertaken can be categorized as a descriptive study as well as analytical study. The approach adopted under this study is that of quantitative approach since the data collected in the quantitative from is put to analysis in a formal and rigid fashion. The methods of data collection used for this study is from secondary sources. For the purposes of achieving the cited objectives, NSE has been considered as the bench mark for measuring the extent of derivative trades in India since nearly 100 percent of the derivative trade is taking place in NSE. Secondary data has been collected through the annual reports of various registered stock exchanges, journals, publications and books on the related matters. Various studies conducted by different researchers have been extensively referred to for this study. Alongside, the publications of Reserve Bank of India and also that of NSE, other stock exchange have been also referred to.

The study covers a period of five years comprising of the years from 2007-08 to 2011-2012. The variables used for the study are S&P CNX Nifty futures and its underlying Nifty spot. The daily closing prices of the select companies at NSE –both in F&O segment as well as in spot market, have been analyzed for the study period. Near month daily closing prices of S&P CNX Nifty futures and its underlying values are selected for the study. For this purpose, 19 companies which satisfy the conditions as it should be from the introduction of derivatives being continuously traded during the study period which is a part of Nifty have been selected. 19 individual companies which are included in the sample of the study are – ACC, AMBUJA, BHEL, BPCL, CIPLA, GRASIM, HDFC, HINDALCO, HIND UNILVR, INFOSYS, ITC, M&M, RANBAXY, RELIANCE, RELINFRA, SBIN, TATA MOTORS, TATA POWER, TATASTEEL. Individual stock price series of 19 stocks are transmitted in to log form for the purposes of smoothing the data. Descriptive statistics and line graphs of the variable and separately are shown for depicting the behavior and trend pattern of data series. Preliminary analysis of futures market and spot market is done with summary statistics. The movement and trend of the market is analyzed through the line graph. Stationarity properties of time series data is tested by using Augmented Dickey Fuller test, lag length of the model has been fixed through the AIC lag selection criteria.

## Results and Discussion

**Table 1 Descriptive Statistics for the Whole Study Period**

| | Futures | Spot |
|---|---|---|
| Mean | 2.777708958 | 2.778049549 |
| Standard Error | 0.002720391 | 0.002717418 |
| Median | 2.801438013 | 2.801060528 |
| Mode | 2.27485032 | 2.36361198 |
| Standard Deviation | 0.428580288 | 0.428112002 |
| Sample Variance | 0.183681063 | 0.183279886 |
| Kurtosis | -0.954444214 | -0.952016883 |
| Skew ness | -0.11003785 | -0.112451389 |
| Jarque Bera | 992.2681 | 989.7041 |
| Probability | 0.000000 | 0.000000 |
| Range | 2.019533911 | 2.014828141 |
| Observations | 24820 | 24820 |

Source: Compiled from NSE site.

Table 5.1 shows the summary statistics of variables included in the study period. In order to understand the raw data series included in the study, mean, median, standard deviation, skewness, kurtosis and Jarque – Bera are measured and presented. During the whole study period, the spot and futures variable means are 2.77805 and 2.77770 respectively. It shows the average of this data set is about 2 and the median value drawn shows the mid value of the series. Standard deviation shows the dispersion of the variables, 0.42811 and 0.42858 respectively for spot and futures market. Spot and futures market are negatively skewed and kurtosis values are – 0.95201 and -0.95444 respectively for spot and futures market. Jarque – Bera test value and the probability show that both the variables distributions from spot and futures market are not normal.

**Table 2. Summary Statistics of Individual Stocks included in Sample**

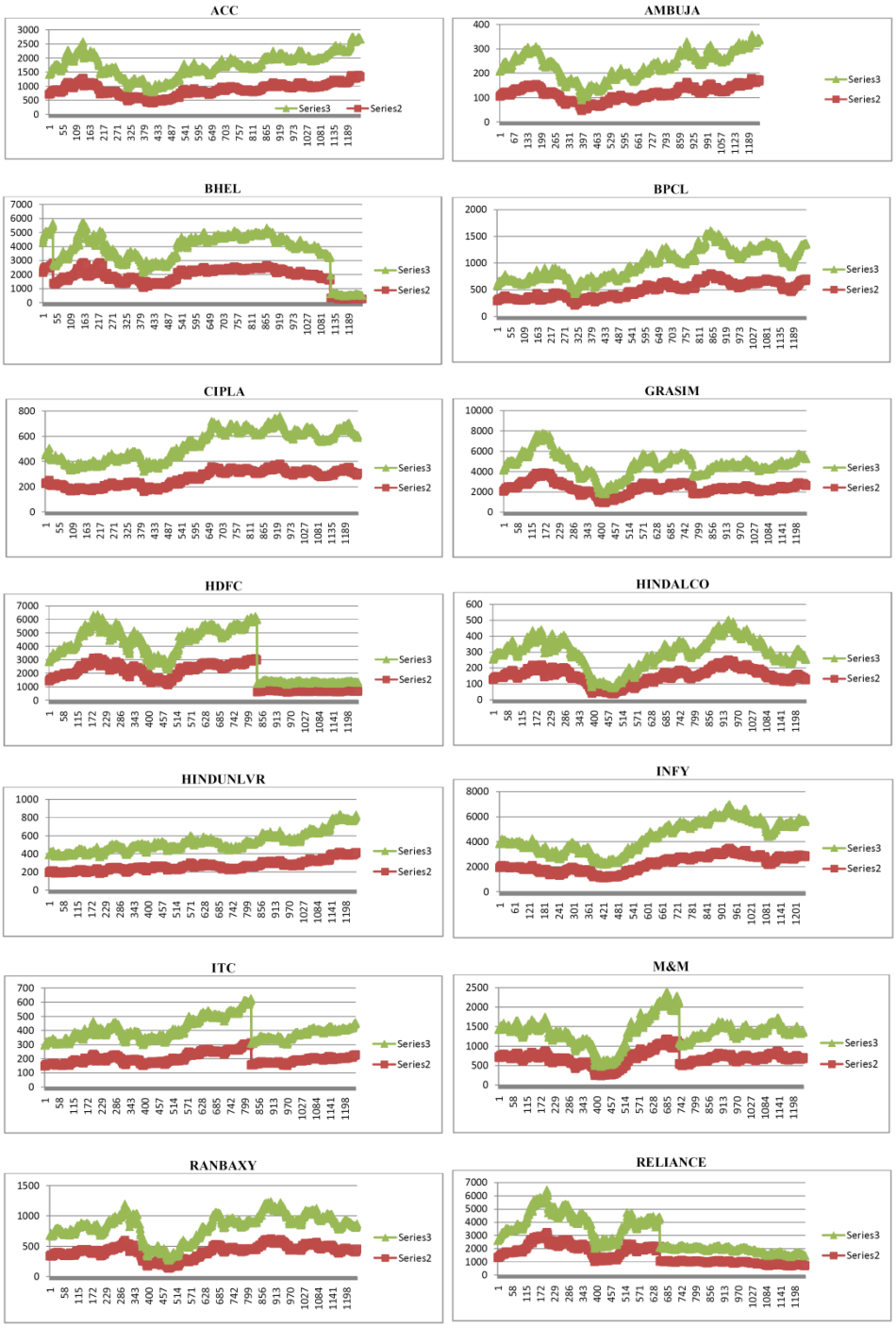
| Name of Company | | Mean | Standard Error | Median | Mode | Standard Deviation | Sample Variance | Kurtosis | Skewness | Jarque-Bera | Observations |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ACC | FUT | 2.931 | 0.003 | 2.943 | 2.7684 | 0.115 | 0.0132 | 0.011 | -0.754 | 117.4287 | 1241 |
| | SPOT | 2.931 | 0.003 | 2.945 | 2.8969 | 0.114 | 0.013 | 0.036 | -0.774 | 123.6752 | 1241 |
| AMBUJA | FUT | 2.052 | 0.003 | 2.073 | 2.0797 | 0.117 | 0.0137 | 0.022 | -0.765 | 120.7168 | 1241 |
| | SPOT | 2.052 | 0.003 | 2.073 | 2.0797 | 0.117 | 0.0137 | 0.022 | -0.765 | 127.3982 | 1241 |
| BHEL | FUT | 3.215 | 0.008 | 3.305 | 3.3972 | 0.271 | 0.0735 | 3.68 | -2.198 | 1689.281 | 1241 |
| | SPOT | 3.216 | 0.008 | 3.309 | 3.3856 | 0.269 | 0.0721 | 3.816 | -2.227 | 1768.532 | 1241 |
| BPCL | FUT | 2.675 | 0.004 | 2.704 | 2.5264 | 0.13 | 0.0169 | -1.22 | -0.182 | 83.91950 | 1241 |
| | SPOT | 2.679 | 0.004 | 2.706 | 2.5849 | 0.126 | 0.0159 | -1.1 | -0.242 | 75.01319 | 1241 |
| CIPLA | FUT | 2.414 | 0.003 | 2.45 | 2.2566 | 0.104 | 0.0108 | -1.44 | -0.283 | 123.4818 | 1241 |
| | SPOT | 2.415 | 0.003 | 2.449 | 2.4999 | 0.101 | 0.0103 | -1.44 | -0.267 | 121.1178 | 1241 |
| GRASIM | FUT | 3.359 | 0.003 | 3.374 | 3.4231 | 0.116 | 0.0135 | 1.748 | -0.011 | 374.4692 | 1241 |
| | SPOT | 3.359 | 0.003 | 3.373 | 3.3733 | 0.116 | 0.0133 | 1.771 | -1.029 | 382.3321 | 1241 |
| HDFC | FUT | 3.181 | 0.007 | 3.285 | 2.8386 | 0.259 | 0.0673 | -1.51 | -0.471 | 163.7354 | 1241 |
| | SPOT | 3.18 | 0.007 | 3.284 | 2.835 | 0.26 | 0.0674 | -1.51 | -0.472 | 163.8886 | 1241 |
| HINDALCO | FUT | 2.142 | 0.005 | 2.183 | 2.1992 | 0.183 | 0.0333 | 1.304 | -1.39 | 484.9499 | 1241 |
| | SPOT | 2.142 | 0.005 | 2.184 | 2.1714 | 0.182 | 0.0332 | 1.322 | -1.397 | 491.4024 | 1241 |
| HINDUNILVR | FUT | 2.416 | 0.002 | 2.408 | 2.4206 | 0.083 | 0.0069 | -0.2 | 0.55 | 64.74353 | 1241 |
| | SPOT | 2.416 | 0.002 | 2.408 | 2.4014 | 0.081 | 0.0066 | -0.2 | 0.549 | 64.30187 | 1241 |
| INFOSYS | FUT | 3.33 | 0.004 | 3.347 | 3.2867 | 0.129 | 0.0165 | -0.99 | -0.4 | 84.23470 | 1241 |
| | SPOT | 3.33 | 0.004 | 3.347 | 3.2875 | 0.128 | 0.0165 | -0.99 | -0.404 | 84.79998 | 1241 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ITC | FUT | 2.296 | 0.002 | 2.284 | 2.2743 | 0.072 | 0.0052 | -0.24 | 0.65 | 90.19318 | 1241 |
| | SPOT | 2.296 | 0.002 | 2.284 | 2.2335 | 0.072 | 0.0052 | -0.21 | 0.677 | 96.87378 | 1241 |
| M&M | FUT | 2.82 | 0.004 | 2.843 | 2.8327 | 0.129 | 0.0166 | 1.96 | -1.231 | 508.6157 | 1241 |
| | SPOT | 2.82 | 0.004 | 2.844 | 2.8227 | 0.128 | 0.0165 | 1.978 | -1.225 | 509.3996 | 1241 |
| RANBAXY | FUT | 2.602 | 0.004 | 2.642 | 2.6434 | 0.136 | 0.0186 | 1.16 | -1.328 | 432.3703 | 1241 |
| | SPOT | 2.601 | 0.004 | 2.643 | 2.6266 | 0.137 | 0.0186 | 1.158 | -1.336 | 436.4099 | 1241 |
| RELIANCE | FUT | 3.141 | 0.005 | 3.078 | 3.2449 | 0.181 | 0.0327 | -1.36 | 0.238 | 106.9302 | 1241 |
| | SPOT | 3.14 | 0.005 | 3.078 | 3.0237 | 0.181 | 0.0327 | -1.36 | 0.235 | 107.5810 | 1241 |
| RELIANCEINFRA | FUT | 2.922 | 0.005 | 2.945 | 2.6769 | 0.19 | 0.0361 | -0.74 | 0.079 | 29.75699 | 1241 |
| | SPOT | 2.921 | 0.005 | 2.946 | 2.7014 | 0.19 | 0.036 | -0.75 | 0.076 | 30.34350 | 1241 |
| SBIN | FUT | 3.276 | 0.004 | 3.292 | 3.0539 | 0.129 | 0.0166 | -0.59 | -0.377 | 47.40993 | 1241 |
| | SPOT | 3.276 | 0.004 | 3.291 | 3.3719 | 0.129 | 0.0165 | -0.59 | -0.374 | 47.05429 | 1241 |
| TATAMOTORS | FUT | 2.727 | 0.008 | 2.838 | 2.8846 | 0.286 | 0.0817 | -0.68 | -0.714 | 129.0552 | 1241 |
| | SPOT | 2.73 | 0.008 | 2.84 | 2.851 | 0.285 | 0.0813 | -0.67 | -0.721 | 130.6705 | 1241 |
| TATAPOWER | FUT | 2.928 | 0.01 | 3.08 | 3.105 | 0.336 | 0.1126 | 3.187 | -2.108 | 1436.593 | 1241 |
| | SPOT | 2.93 | 0.009 | 3.081 | 3.1218 | 0.334 | 0.1114 | 3.304 | -2.133 | 1497.045 | 1241 |
| TATASTEEL | FUT | 2.71 | 0.005 | 2.758 | 2.8009 | 0.173 | 0.0298 | 1.503 | -1.315 | 471.8769 | 1241 |
| | SPOT | 2.711 | 0.005 | 2.758 | 2.7607 | 0.172 | 0.0296 | 1.516 | -1.321 | 477.3990 | 1241 |

Table 5 shows the summary statistics of the variable included in the study for the index spot and futures and 19 individual companies spot and futures series. S&P CNX Nifty futures series and spot series are taken for the analysis and mean value, median, standard deviation, skewness, kurtosis and range measures are presented in the table. The spot and future variables of HIND UNILVR, ITC, RELIANCE, RELINFRA are positively skewed and that of ACC, AMBUJA, BHEL, BPCL, CIPLA, GRASIM, HDFC, HINDALCO, INFOSYS, M&M, RANBAXY, SBIN, TATAMOTORS, TATAPOWER, TATASTEEL are negatively skewed. The negatively skewed individual stock implies that futures market is backwardation and offers significant arbitrage opportunities to traders( Vipul 2005). Jarque-Bera statistics of all the companies variables indicate that there is no possibility to accept the null hypothesis and the probability value of JB test also supports the result .In order to get more clarity on the basic structure of the variables line graphs are presented.

Line graphs of series of futures and spot market of all 19 companies are presented in the Figure 5.1

The stationarity of the market return shows the strong arbitrage opportunities between Indian Futures and spot market. It is the symbol of efficiency of one market to another market. In order to check the stationarity properties, popular unit root test namely ADF is used. The Table given below presents the results of stationarity test.


ACC
AMBUJA
BHEL
BPCL
CIPLA
GRASIM
HDFC
HINDALCO
HINDUNLVR
INFY
ITC
M&M
RANBAXY
RELIANCE
Series3
Series2

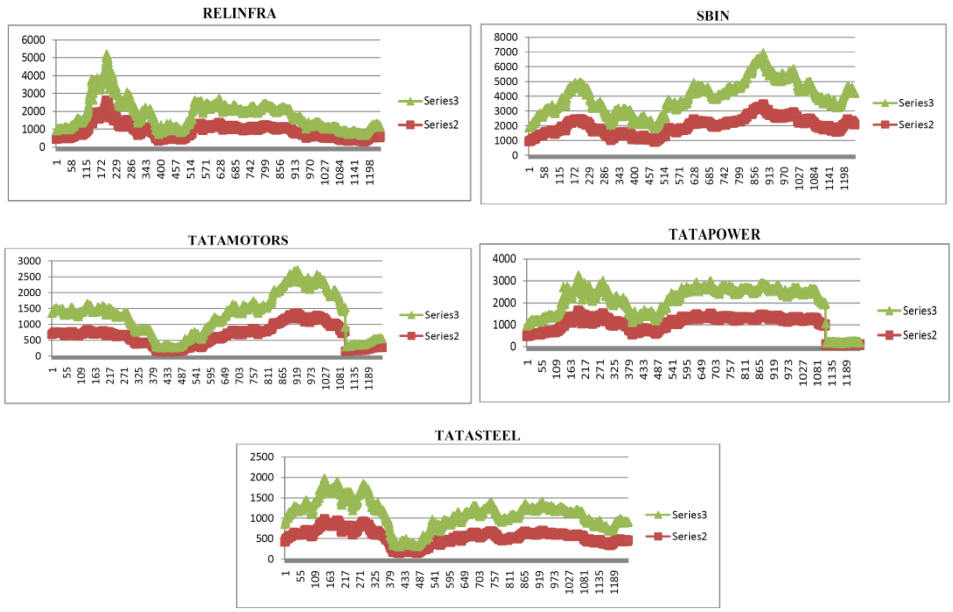



**Figure 1. Line Graphs of 19 Individual Stocks**

**Table 3 . Results of Stationarity tests of the variables included in the study**

| Sl No | Name of Company | Variables | ADF |
|---|---|---|---|
| 1 | ACC | FUT | 0.664954 |
| | | SPOT | 0.650736 |
| 2 | AMBUJA | FUT | 0.530386 |
| | | SPOT | 0.484783 |
| 3 | BHEL | FUT | -1.065960 |
| | | SPOT | -1.083651 |
| 4 | BPCL | FUT | 0.835073 |
| | | SPOT | 0.790058 |
| 5 | CIPLA | FUT | 0.413240 |
| | | SPOT | 0.333591 |
| 6 | GRASIM | FUT | 0.187000 |
| | | SPOT | 0.162773 |
| 7 | HDFC | FUT | -0.501587 |
| | | SPOT | -0.511640 |
| 8 | HINDALCO | FUT | -0.117403 |
| | | SPOT | -0.131433 |
| 9 | HINDUNILVR | FUT | 1.126979 |
| | | SPOT | 1.102362 |
| 10 | INFOSYS | FUT | 0.539153 |
| | | SPOT | 0.525066 |
| 11 | ITC | FUT | 0.350875 |
| | | SPOT | 0.381537 |
| 12 | M&M | FUT | -0.110278 |
| | | SPOT | -0.130602 |
| 13 | RANBAXY | FUT | 0.211151 |
| | | SPOT | 0.086409 |
| 14 | RELIANCE | FUT | -0.580385 |
| | | SPOT | -0.605644 |
| 15 | RELINFRA | FUT | 0.038095 |
| | | SPOT | 0.027072 |
| 16 | SBIN | FUT | 0.666432 |
| | | SPOT | 0.674103 |
| 17 | TATAMOTORS | FUT | -0.571199 |
| | | SPOT | -0.576899 |
| 18 | TATAPOWER | FUT | -0.680684 |
| | | SPOT | -0.699858 |
| 19 | TATASTEEL | FUT | -0.139099 |
| | | SPOT | -0.078139 |

AIC criterion is used to select lag length. Results are at 5% level of significance

Table 3 shows the results of stationarity test of the variables included in the study period for sample companies. The return series of BHEL, HDFC, HINDALCO, M&M, RELIANCE, TATAMOTORS, TATAPOWER and TATASTEEL are stationary in its level form. Augmented Dickey Fuller unit root test are supporting the results and variables are stationary. Stationarity shows the strong lead-lag relationship between spot and future variables of the individual stock. Existence of stationary suggests that returns on both futures and spot market are significantly predictable. Stationary futures and spot market return suggest that dissemination of information is weak, thereby the possibility of efficient price discovery mechanism in Indian Spot and futures market.

## Conclusion

From the study, it can be seen that there exists a bidirectional relationship linkage between spot and futures market in Indian Equity Market. This situation provides the opportunities to the traders to make profit through arbitrage process. Informational linkage between stock index spot and future market implies that the investors use these markets to explore significant arbitrage profit and hedging opportunities. By rejecting both the null hypothesis formulated for the study ,it is again proved that there exists a strong lead-lag relationship between spot and futures market and also these markets provide an efficient price discovery mechanism.

## References

[1]. Alex Frino, Terry Walter and Andrew west , *The lead – lag Relationship between equities and stock index futures markets around information release,* The Journal of Futures Markets, 2000, Vol.20, No.5,pp.467-487.

[2]. Alexander A. Kurov and Dennis J. Lasser , *The Effect of the Introduction of Cubes on the NASARDQ-100 index spot – futures pricing relationship*, The Journal of Futures Markets, 2002, Vol.22, No3,pp.197-218.

[3]. Abhay Abhyankar , *Linear and nonlinear Granger Causality-Evidence from the U.K Stock Index Futures markets*, The Journal of Futures Markets, 1998, Vol.18,, No.5, pp.519-540

[4]. Alan E.H. Speight, David G Mc Millan and Owain A.P. Gwilym, *Intraday Volatility Components on FTSE- 100 stock index futures*, The Journal of Futures Markets, 2000, Vol.20, No.5, pp.425 -444.

[5]. Fratzscher, Oliver and Natalie Oh, 2002, "*Why are Korean markets so volatile", FSAP background papers*, World Bank, 2002

[6]. Joshua Turkington and David Walsh , *price discovery and Casuality in the Australian share price index futures markets,* Australian Journal of Management, 1999, Vol.24,No.2,pp.97-113.

[7]. Joseph K.W. Fung and Paul Draper, *Mispricing of index futures contracts and shorts sales constraints,* The Journal of Futures Markets, 1999, Vol.19, No.6, pp.695-715.

[8]. Jae H. Min and Mohammad Najand, *A further investigation of the lead lag relationship between the spot market and stock index futures: - Early evidence from Korea,* The Journal of Markets, 1999, Vol.19, No..2, pp.217-232

[9]. Kee –Kong Bee, Kalok Chan and Yan – Leung Cheung, *the profitability of Index Futures Arbitrage – Evidence from Bid – Ask Quotes*, The Journal of Futures Markets, 1998, Vol.18, No.7, pp.743-763.

[10]. Kedar Nath Mukerjee and Misha R.K , *Impact of open interest and trading volume in option market on underlying cash markets- Empirical evidence from Indian equity option market,* ssrn. 2004, Com.pp. 1-26.

[11]. Kapil Gupta and Balwinder Singh, *price discovery and Arbitrage efficiency of Indian equity futures and cash markets,*ssrn.com, 2008,

pp.1-58.

[12]. Kapil Gupta and Balwinder Singh , *Estimating the optimal hedge ratio in the Indian equity futures Markets,* The IUP Journal of Financial Risk Management, 2009, Vol.6, No.3 & 4, pp.39-98.

[13]. Kirankumar. K. and Chiranjit Mukopadyay , *A case of US and Indian,* 1991*,* ssrn.com,pp.I-28.

[14]. Leo Chan and Donald Lien, *cash settlement and price discovery in futures markets, Working papers series*, 2001, ssrn.com,pp.1-24.

[15]. Mino Lo Kim, Andrew C. Szakmary and Thomas V. Schward, *Trading costs and price discovery across stock index futures cash markets,* The Journal of Futures Markets, 1999, Vol.19, No.4,pp.475-498.

[16]. Mathew Roope and Ralf Zurbruegg, *The intraday price discovery process between the Singapore exchange and Taiwan futures exchange,* The Journal of Futures Markets, 2002, Vol.22, No.3, pp.219-240.

[17]. Quentin C. Chu and Wen-Liang Gideom Hsieh, *pricing efficiency of the S&P 500 index market- evidence from the S&P's depository receipts*. The Journal of Futures Markets, 2002, Vol.22, No.9. pp 877-800.

[18]. Roger Craine, *Valuing the futures markets performance guarantee,* Macro Economic Dynamics, 1997, Vol.1.pp. 701-719.

[19]. Suchismita Bose *Contribution of Indian index futures to price formation in the stock market.* Money and Finance, 2007, Vol.2pp.39-56.

[20]. Sathya Swaroop Debasish, *an econometric analysis of the lead lag relationship between India's NSE and its derivative contracts*. The journal of Risk Finance, 2009, Vol.10, No.4 pp.350-364.

[21]. Thenmozhi M. and Manish Kumar, *dynamic interaction among mutual fund flows, stock market return and volatility,* ssrn,com, 2008, pp.1-30.

[22]. Tina M Galloway and James M. Miller, *Index futures trading and stock return volatility: evidence from the introduction of Mid Cap-400 Index Futures,* The Financial Review, 1997, vol.32, No.3, pp.845 -866.

[23]. Ulkem Basdas , *Lead lag relationship between the spot index and futures price for the Turkish Derivative Exchange,* 2009, ssrn. Com. Pp.1-18.

# STAKEHOLDER SATISFACTION IN EDUCATION

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## Abstract

The question of effectiveness and efficiency with which educational institutions are being run, irrespective of the country in which they situate, whether they are privately owned or are cradled by the government of the state, are significantly disturbing thoughts, especially when the attitude of these institutions reflect the 'take it or leave it policy'. The application of the principles of total quality management in education aims to satisfy the customers. The new method of activity oriented, student centered learning and continuous and comprehensive internal evaluation introduced in the higher secondary school education in Kerala in the year 2005, replaced the traditional teacher centered education system. The government efforts made to build up and improve the infrastructural facilities and its programmes for providing training and education to the teachers to empower them to engage classes in a more efficient and effective manner are praiseworthy. All these efforts throw light on the "customer orientation of Kerala education ". This study specifically assessed the satisfaction of students of the higher secondary school education in Kerala. The opinion of the 300 students on the various quality variables was gathered. Percentage analysis and descriptive statistics were computed for identifying the nature of the data and the hypotheses are tested using Z-test. The study found that the satisfaction of the students in the government, aided and unaided higher secondary schools, under the Directorate of Higher Secondary Education, was above moderate.

**Key Words:** Total Quality Management, Student Satisfaction

## Introduction

Education is one of the most crucial factors in empowering people with skill and knowledge and in giving them access to productive employment in future. Quality of education in every stage is a serious concern all over the world (Hanushek & Woesmann; Vegas & Petrow). This becomes all the more important in the age of globalization which ensures that only the fittest can survive. Therefore, it is inevitable to provide quality education and equip the learner with the ability to face the growing challenges of this complex world (Govt. of Kerala). Kerala boasts lowest drop out ratios, highest literacy rates, wider distribution of schools and educational accessibility is equitable, region wise and also gender wise (Govt. of India; Govt. of Kerala; George & Kumar). These credentials are as a result of constant and pioneering efforts of the administartors of the state who has in recent times recoganised the needs of the stakeholders of education. All quality up gradation efforts of the government are expected to have remarkable impact on school education in the state (Govt. of Kerala), and ensures better academic performance of students and aims at satisfying the customers of education, primarily, the students and their parents. This paper attempts to assess the satisfaction of the students of Higher Secondary School Education in Kerala.

### *Total Quality Management in Education*

Customer focus is the back bone of TQM. Excellent organizations, both public and private, keep close to the customer and have an obsession with quality (Peters & Waterman). In the case of service sector, especially in education, the identification of customer is an intricate question. Customer orientation is a relevant concept in Indian education and is extremely important for quality management (Mukhopadhyay; Sallis). From the angle of TQM, customers of education, both internal as well as external, include students, parents, employers, community and the government of the state, teachers, non-academic staff, principal and the management. Students are internal customers as they are the core and part and parcel of the institution and they are also external because they are the immediate consumers of education (Mukhopadhyay). The customer focus aspect of TQM is a major characteristic and there is a paradigm shift in focus, from the conventional system, where, the highest importance is given to managers who decide what should happen in a school and the students are on the receiving end to one where, the student's

needs and wants are prioritized (Sallis). Education faces considerable challenge in its relationship with its customers as the expectations of the customers are diverse and often contradictory.

### *Earlier Studies*

The application of the principles of total quality management as a panacea to the problems of achieving quality in education has been receiving a lot of attention worldwide (Blackiston & Sabatella; Chatson; Crawford & Shutler; Cunningham; Dheeraj; Doraiswamy; Edwards; Hill & Taylor; Kanji, Malek, & Tambi; Kaufman; Kwan; Murgatroyd & Morgan; Ngware, Wamukuru, & Odebero; Sallis; Sharples; Shejwalkar; Sherr & Lozier; Hansen). Studies on the concept of TQM and its application to higher education argues that continuous quality improvement, staff and student participation, meeting customer needs and co-ordination, help to increase the quality of higher education systems, even if, these institutions are not market oriented (Williams). A study conducted by Jie & Idris found that the quality of service and student focus; positively affect attractiveness of the place of study. Rany found that the prevailing classroom management practices of teachers at the higher secondary level were not satisfactory at all, which in turn has triggered the question whether the students are satisfied at all? There are studies which show that the perception about quality varies among different stakeholders of education. Bagalkoti, Devi and Hegde assessed the students' perception of quality in higher education and found that the perception of quality changes from person to person, therefore, the society, government, parents, employers and students have their own perception about the quality of higher education.

## Statement of the Problem

Of lately, the quality of education in Kerala is on the downhill of progress (Govt. of Kerala), even though, quantity-wise the progress is astounding, as evidenced through the study reports of NCERT and Kerala Sasthra Sahitya Parishat and other individual research endeavors (NCERT; Kumar; RamaKrishnan; Prakash, Gautam, Bansal, & Bhalla). Parents and people in general are not satisfied with achievements made by government run schools and private aided schools. This is one of the reasons for the flight of students in search of quality to other schools and for the increasing number of uneconomic schools (Prakash, Gautam, Bansal, & Bhalla). The government of Kerala has

implemented a number of quality improvement programmes. It is indispensable for our education system to achieve success in its quality pursuit. To a great extent the proof lies in the ability of the system to satisfy students, parents and other stakeholders. An attempt is therefore made here to find answers to the following research questions; Are the students of the higher secondary school education satisfied?; What similarities and dissimilarities are observed among the government, aided and unaided higher secondary schools with respect to the satisfaction of students?

## Objectives of the Study

Examine the student satisfaction attained, as part of application of TQM in higher secondary school education in Kerala.

## Hypotheses

Based on the above objectives, the following hypotheses were formulated for the study.

1. The overall satisfaction level of students achieved, as part of application of TQM in the higher secondary school education in Kerala, is moderate.
2. The overall satisfaction of students in higher secondary school education in Kerala is the same, irrespective of, the type of ownership and type of school based on students' composition.

## Methodology

The study is descriptive in nature examining the application of TQM in higher secondary school education in Kerala. It is concentrated on an important tenet of total quality management namely; customer satisfaction. The population of the study comprises of, the students belonging to the government, aided and unaided higher secondary schools coming under the Directorate of Higher Secondary Education in Kerala. There were 760 government higher secondary schools, 686 aided and 461 unaided higher secondary schools in the state in the year 2010-11 totaling to 1907 higher secondary schools in all (Govt. of Kerala). From the total number of schools in the state, about 1.5 per cent (30) schools were selected for the sample through a multi-stage sampling process. From each of the school 10 students were selected and thus data were collected from 300 students. The study selected 130 students from the government schools, 110

students from the aided schools and 60 from the unaided schools. The opinion of the students were gathered and plotted on a five point Likert-type scale, values ranging from very dissatisfied to very satisfied. Percentage analysis and descriptive statistics were computed for identifying the nature of the data. The hypotheses are tested using Z-test, one sample t-test, one way analysis of variance (ANOVA) along with least significant difference test for comparison between more than two groups and independent t-test for comparing between two groups and also correlation. The level of significance was fixed at 5 per cent.

## Results and Discussion

The study specifically assessed the satisfaction of the students on a number of quality variables. The profile of the students is given in Table 1. It covers gender, age, subject combination and place of residence. The percentage score on various quality variables indicating the level of satisfaction in shown in Table 2.

**Table 1. General Profile of Students**

| Characteristics | Nature | Frequency | Percent |
|---|---|---|---|
| Gender | Male | 121 | 40.3 |
| | Female | 179 | 59.7 |
| Age of the students | 16 | 34 | 11.3 |
| | 17 | 227 | 75.7 |
| | 18 | 39 | 13.0 |
| Subject combination | Science | 185 | 61.7 |
| | Humanities | 39 | 13.0 |
| | Commerce | 76 | 25.3 |
| Place of residence | Urban | 180 | 60.0 |
| | Rural | 120 | 40.0 |

*Source: Primary data.*

Most of the students are females (59.7 per cent) and majority of the students are of the age, seventeen years, and 61.7 per cent of them belong to the science stream. Majority of the students (60 per cent) reside in the urban area. Satisfaction of the students assessed on the variables given in Table 2 shows that

students are very satisfied with the attitude of their teachers and lesser satisfied on playground, technological aids in the classrooms and toilets. The study assessed and brought out the differences in the satisfaction level of the students on the basis of their gender, stream of study, school ownership and gender wise composition of their school.

**Table 2. Descriptive Statistics of Satisfaction of Students**

| Variables | No of items | Mean | Std. Error | Percentage score |
|---|---|---|---|---|
| Classrooms | 6 | 23.69 | 0.21 | 79.0 |
| Library | 8 | 27.36 | 0.44 | 68.4 |
| Toilets | 8 | 25.78 | 0.42 | 64.5 |
| Auditorium | 4 | 13.87 | 0.24 | 69.4 |
| Computer Lab | 4 | 13.50 | 0.18 | 67.5 |
| Science Lab | 5 | 18.06 | 0.26 | 72.2 |
| Common area | 3 | 10.95 | 0.16 | 73.0 |
| Playground | 5 | 13.81 | 0.30 | 55.3 |
| Other General facilities | 3 | 9.14 | 0.16 | 60.9 |
| Technological aids | 3 | 9.57 | 0.21 | 63.8 |
| **Overall Satisfaction on Infrastructure** | **49** | **165.73** | **1.65** | **67.6** |
| Teachers and their Attitude | 17 | 70.04 | 0.60 | 82.4 |
| Conduct of Examination | 3 | 11.90 | 0.14 | 79.3 |
| **Overall Satisfaction** | **69** | **247.67** | **2.09** | **71.8** |

*Source: Primary data.*

***Satisfaction of Students based on Ownership of Schools***

The study found that the aided and unaided school students were more satisfied than students from government school in the case of overall satisfaction and the difference in satisfaction is highly significant (p-value less than 0.001). The satisfaction of students on 'teachers and their attitude' and 'conduct of examination' was assessed. The variable 'teacher and their attitude' comprises of, subject knowledge, language skill and general awareness, ability for teaching, individual attention given to students, constructive criticism of

students, disciplinary actions, moral value creation, appearance and dressing, accessibility, recognition of good behavior, appreciation of academic abilities, impartial assessment of students, punctuality, class control, interest in organizing class activities and covering of syllabus. It is interesting to find that there is no significant difference in the level of satisfaction of students of all kinds of schools with respect to teachers and their attitude (p-value 0.183) and about the way in which examinations are conducted (p-value 0.248).

In the case of overall satisfaction which comprises of satisfaction on all the variables of 'infrastructure', 'teachers and their attitude' and 'conduct of examination', there is significant difference in the level of satisfaction of the students of government, aided and unaided schools (p-value 0.006). The students of aided schools are more satisfied than students of government schools. It should be noted here that the students of aided and government schools had the same level of satisfaction in the matter of 'teachers and their attitude' and therefore, the factor that creates differences in satisfaction level between them is the inadequacy of infrastructural facilities in government schools. In a similar study, Das ascertained the impact of physical facilities of primary schools on the retentive power and effectiveness of educational programme and found that better physical facilities contributed to the attractiveness of the school, thereby increasing the retentive power of the school. Though another interesting study done by Behrman, Khan, Ross, & Sabot, it was pointed out that the cognitive achievements in mathematics and reading are correlated positively with student exposure to the teachers, teacher-pupil ratio and teacher quality and that quite surprisingly, neither the school materials nor infrastructure are significantly associated with cognitive achievement.

### *Satisfaction of Students based on Gender*

The study found that, there are significant differences between the satisfaction level of male and female students on the variables toilets, classrooms and computer labs. In these cases the female students are more satisfied than male students. The study also found that, there is no significant difference between the satisfaction level of male and female students in the overall satisfaction in infrastructure (p-value 0.052). Regarding the satisfaction on 'teachers and their attitude' and 'conduct of examinations'; there is no significant differences in the satisfaction level of male and female students, the p-value being 0.139 and 0.367, respectively. However, in the matter of overall satisfaction in higher secondary

school education in Kerala, the study found that the female students (mean 251.13) were more satisfied than male students (mean 242.55) (p-value 0.044).

***Satisfaction of Students based on Type of School – Gender wise***

The satisfaction of the students would also vary based on whether it is a boys' only school or a girls' only school or a co-educational school. It is interesting to note that there is significant difference in the level of satisfaction of students on the variables like classroom, toilet, auditorium, science lab, play ground, other general facilities and technological aids. In the case of class room, the students of boys only schools and girls only schools are having same level of satisfaction, but, they were more satisfied than co-educational school students (p-value less than 0.001). Most of the classes built for high schools were converted to plus two classes, therefore, the size of the classes suitable for high school students were observed to be inadequate for the plus two students. In the matter of toilets, the students of girls only schools are more satisfied than the students of boys only schools and co-educational schools (p-value < 0.001). This is supported with the fact that the toilet facilities for the girls students are given much importance by the government and funds are being allocated for this purpose, which has been channelized to the 44 girls only schools in the state and to a number of selected co-educational schools also (Govt. of Kerala). The study found that in the case of overall satisfaction in infrastructure, there is no significant difference between the satisfaction of students in boys only schools and girls only schools, but, they are more satisfied than students of co-educational schools (p-value < 0.001). The satisfaction level of students from different type of schools, gender wise, show that there is significant difference in the level of satisfaction at 0.05 levels in the aspect of 'teachers and their attitude'. The students of girls only and co-educational schools are having more satisfaction, than the students of boys only schools (p-value 0.039). In the matter of 'overall satisfaction' (p-value 0.001), the students of girls only schools were more satisfied, than students of co-educational schools.

***Satisfaction of Students based on Stream of Study***

The satisfaction of students may differ on the basis of, the subject combination (Stream of Study) taken for study in standard XI and XII. Accordingly, the students are classified as Science, Humanities and Commerce groups. The study found that students belonging to different subject combinations do not have any significant

difference with regard to overall satisfaction in infrastructure (p-value 0.337), teachers and their attitude (p-value 0.351)and conduct of examinations (0.607) and in the matter of overall satisfaction in higher secondary school education in Kerala (p-value 0.396).

### *Overall Satisfaction of Students*

The overall satisfaction of the students was subjected to Z-test. The Z-value, 19.476 is found to be significant at 0.01 levels of significance. The mean value 3.589 is considered to be higher than the central value (3) of the five point Likert-type scale of measurement. Therefore, it can be inferred that the overall satisfaction of the students of higher secondary school education in Kerala is above moderate.

**Table 3. Hypothesis Testing of Overall Satisfaction of Students**

| Variables | Mean | Z-value |
|---|---|---|
| Overall satisfaction | 3.589 | 19.476** |

*** Significant at 0.01 levels;*

## Conclusion

The application of total quality management aims to satisfy the customers. The new method of activity oriented student centered learning introduced in the higher secondary school education in Kerala in the year 2005, replaced the traditional teacher centered education system. The continuous and comprehensive internal evaluation emphasizes on the assessment of the multidimensional competencies of the learner. The government efforts made to build up and improve the infrastructural facilities is also praiseworthy. Moreover, the government is also investing in providing training and education to the teachers to empower them to engage classes in a more efficient and effective manner. All these efforts throw light on the "customer orientation of Kerala education". This study specifically assessed the satisfaction of students of the higher secondary school education in Kerala and found it to be above moderate. The school education supported financially by the government should recognize the impending danger of private efforts in providing education at a higher cost and the willingness of the stakeholders to fish out more money for the sake of better quality. In the era of globalization, the periodical standard upliftment of the quality of education, by the concerned Government, based on general satisfaction, should be in par with national

and international standards, so as to generate efficient and skilled hands to meet with the national and global requirements.

## References


[1]. Bagalkoti, S.T., B.Devi and N.Hedge. "*Student's Perception of Quality in Higher Education*." University News 44.46 2006, 7-13.

[2]. Behrman, Jere R. et al. "*School Quality and Cognitive Achievement Production: A case study for Rural Pakistan*." Economics of Education Review 16.2, 1997, 127-142.

[3]. Blackiston, G.Howland and Joseph Sabatella. "*Charting a New Course: Public Schools Embarking on a Quality Journey.*" International Journal: Continous Improvement Monitor 1 .1, 1996.

[4]. Chatson., I. "*Are British Universities in a position to consider Implementing Total Quality Management.*" Higher Education Quarterly 48 1994, 118-134.

[5]. Crawford, L.E.D and P.Shutler. "*Total Quality Management in Education: Problems and issues for classroom teacher.*" The International Journal of Educational Management 13.2, 1999, 67-72.

[6]. Cunningham, Melinda K. "*Educator attitudes towards the appropriateness of Total Quality Management: a Survey of Elementary and Middle School Administrators and Faculty*." Capella University, 2007.

[7]. Das, R.C. *Impact of School Conditions on Primary Education. Assam:* State Institute of Education, 1974.

[8]. Dheeraj, Mehrotra. Applying TQM in Academics. 2004. 10 June 2011 <www.menon.org/ publications>.

[9]. Doraiswamy, P.K. "*Total Quality Management and Education*." 2005.

[10]. Edwards, davis. "*Total Quality Management in Education*." Management Services ,1991, 16-19.

[11]. George, K.K. and N.Ajith Kumar. *What is Wrong with Kerala's Education System? CSES Working Paper No.3 , December. Ernakulam*: Centre for Socio - Economic and Environmental Studies., 1999.

[12]. Govenment of Kerala. Education for the New Age: Report of the Kerala State School Education Commission. Thiruvananthapuram: Government of Kerala , 2003-04.

[13]. Government of India. Kerala Development Report. New Delhi: Planning Commission, 2008.

[14]. Government of Kerala. Economic Review. Thiruvananthapuram: Government of Kerala, 2011.

[15]. Government of Kerala, Economic Review. Thiruvananthapuram: Government of Kerala, 2010.

[16]. Government of Kerala, Education for New Age: Report of the Kerala State School Education Commission. Thiruvananthapuram: Government of Kerala, 2004.

[17]. Hansen, W.Lee. "*Bringing Total Quality Improvement into the College Classroom*." Higher Education, 1993, 259-279.

[18]. Hanushek, Eric A. and Ludger Woesmann. *Education Quality and Economic Growth.* Washington D.C: World Bank, 2007.

[19]. Hill, F.M and W.A.Taylor. "*Total Quality Management in Higher Education.*" International Journal of Educational Management 5.5, 1991, 4-9.

[20]. Jie, Feng and Aida Idris. "*Education Management: Perception of TQM and its Effect on Attractiveness of Place of Study*." E Leader, 2009.

[21]. Kanji, Gopal K, Abdul Malek and Bin A.Tambi. "*Total Quality Management in U.K. Higher Education Institutions*." Total Quality Management 10.1, 1999, 129-153.

[22]. Kaufman, R. "*The Challenge of Total Quality Management in Education*." International Journal of Educational Reform 1.2, 1992, 149-165.

[23]. Kumar, B.Vijaya. "*Poor Quality of Education in Kerala Examination Reforms at School Level*." National Workishop on Education. Thiruvananthapuram, 1998.

[24]. Kwan, Paula Y.K. "*Application of Total Quality Management in Education: Retrospect and Prospect."* International Journal of Educational Management 10.5, 1996, 25-35.

[25]. Mukhopadhyay., Marmar. *Total Quality Management in Education*. New Delhi: National Institute of Educational Planning and Administration., 2001.

[26]. Murgatroyd, S. and C.Morgan. *Total Quality Management and the School*. Buckigham: Open University, 1993.

[27]. NCERT. *Education and National Development*-Report of the Education Commission. New Delhi: Ministry of Education, 1966.

[28]. Ngware, Moses Waithanji, David Kuria Wamukuru and Stephen Onyango Odebero. "*Total Quality Management in Secondary schools in Kenya: An Extent of Practice."* , Quality Assurance in Education 14.4, 2006, 339-362.

[29]. Peters, Thomas J. and Robert H.Waterman. In Serach of Excellence. New York: Harper Collins Publishers Inc, 2004.

[30]. Prakash, Ved, et al. *Mid Term Assessment Survey: An Appraisal of Students' Achievement.* New Delhi: Educational Consultants India Limited, 1998.

[31]. Rajani, K.M. "*Human Resources Development in Higher Education in Kerala.*" Kochi: Cochin University of Science and Technology, October 2009.

[32]. RamaKrishnan, C. *An Action Research Project to Improve the teaching Learning Environment and Number of Working Days in Schools in Kerala Through a Participatory Intervention Strategy*. Thiruvananthapuram: Kerala Sasthra Sahitya Parshad, 1998.

[33]. Rany, S. "*Developing certain strategies for the effective classroom management at Higher secondary level."* Developing certain strategies for the effective classroom management at Higher secondary level. Kottayam: School of Pedagogical Sciences, Mahatma Gandhi University, 2008.

[34]. Sallis, Edward. *Total Quality Management in Education*. 3rd Edition. London: Kogan Page Ltd, 2002.

[35]. Sharples, Cathleen A. "*How TQM can work in Education*." Quality Progress, 1996, 75-78.

[36]. Shejwalkar, P.C. "*Total Quality Management in Higher Education.*" University News 37.33, 1999.

[37]. Sherr, Lawrence A. and G.Gregory Lozier. "*Total Quality Management in Higher Education*." New Directions for Institutional Research 1991.71 1991, 3-11.

[38]. Vegas, Emiliana and Jenny Petrow. *Raising Student Learning in Latin America- The Challenge of the 21st century*. Washington. D.C.: World Bank, 2008.

[39]. Viswanathan, C.N. "*Total Quality Management in Higher Education in Kerala.*" Mahatma Gandhi University, 2007.

[40]. Williams., Gareth. "*Total Quality Management in Higher Education*." Higher Education 25.3, 1993, 229-237.

# MANAGEMENT OF FUNDS IN COMMERCIAL BANKS-A STUDY ON KERALA BASED PRIVATE SECTOR BANKS

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## Abstract

The Indian banking witnessed a paradigm shift in their operations after the financial sectorreforms in 1991. These reforms led to the emergence of new banks, new instruments, new methodsof doing business, and finally heightened competition in the banking industry. In this context, it isimperative on the part of the Indian banking industry to strengthen the financial base, increase theoverall efficiency, and improvethe profitability by designing appropriate funds management policiesand practices. This paper examines the profitability of funds management of Kerala based private sector banks.

## Introduction

The key to a bank's success is the selection of sources and uses of funds. The source consists ofcapital funds, deposits and borrowings. Capital funds are the owned funds that serve as a protectionagainst risk and insolvency.The commercial banks mobilize a major part of their funds through deposits and borrowings, with deposits having a dominating share. These funds are tobe deployed in various avenues considering the risk and return factors. These avenues are, however, not alike intheir returns.The assets like cash in hand, balance with Reserve Bank of India (RBI), money at call and shortnotice, are held as per the liquidity requirements, and the return on these funds is almost zero, except money at calland short notice. Investments under Statutory Liquidity Ratio (SLR) serve the purpose of liquidity as well asincome. The rate of return on such investments should be adequate enough to cover financial and operating costs.

Further, lending is a significant area of employment of funds in terms of size of funds involved as well as quantumof revenue generated. However, it carries a high degree of credit risk. Efficient management of funds essentially includes raising of funds and their use in the manner thatgenerates revenues

sufficient to meet the operational as well as financial costs and contributes a reasonable return oncapital. Thus, the objective of earning profits can be fulfilled by an appropriate design of funds management onsound commercial principles.

## Objectives

1) To examine the cost of sources of fundsof Kerala based Private Sector banks.
2) To analyze the return from deployment of funds in these banks.
3) To study the pattern of utilization of funds and examine the underlying profitability of fundsmanagement.

## Scope& methodology

The study is based on the data drawn from the annual reports of the Kerala based private sector banks(old private sector banks) which includes Federal bank(FDRL),South Indian bank(SIB),Dhanalaxmi bank(DLB) and Catholic Syrian bank(CSB).A comparison is also done with State bank of India (SBI), the leading public sector bank and ICICI, theleading newgeneration private sector bank in India. The study covers a period of 10 years from 2003- 2012. The sources and uses of funds asrepresented by various items of assets and liabilities contained in balance sheets and the items such as interest cost, interest income, etc., drawn from P&L accounts of thesebanks are considered for the purpose ofanalysis. Thedata are presented through tables and analyzed with the help of ratios, percentages, Arithmetic means, Standard deviation (Std. Dev) and Coefficient of variation (C.V.).

The approach to cost benefit analysis of funds management in this paper is developed from three broadperspectives: cost approach, return approach and an integrated approach to funds management. In each perspectivekey financial indicators have been used. The indicators of cost approach to funds management include cost ofdeposits, cost of borrowings, and cost of total funds. Similarly, the indicators of return approach to fundsmanagement cover return on investments, and return on advances. Finally the ratios such as ratio of deposits to totalliabilities, ratio of investments to deposits, and ratio of credit to deposits are used under integrated approach to fundsmanagement.

## Analysis and Discussion

### *Cost of Deposits*

Deposits constitute a vital source of funds required for banking business. The components of deposit mix, Such as fixed, current, and savings deposits,

have their own risk-return profiles that affect the profitability of banks. Average cost of deposits, which is a percentage of interest cost to total deposits, can be used as an indicator foranalysing the cost or efficiency of deposits of banks and the banks overall profitability. The higher the ratio, lower will be the productivity of funds management and vice versa. A lower ratio has a positive impact on the banks Profitability. The information relating to cost of deposits of the banks covered in the study is given in Table 1.

**Table 1 Cost of Deposits (Percentages)**

| Year | FDRL | SIB | DLB | CSB | SBI | ICICI | SCBs |
|---|---|---|---|---|---|---|---|
| 2003 | 7.36 | 7.33 | 7.40 | 7.52 | 7.12 | 6.18 | 6.46 |
| 2004 | 5.92 | 6.15 | 5.84 | 6.20 | 5.90 | 5.20 | 5.30 |
| 2005 | 4.58 | 5.20 | 5.07 | 5.47 | 5.01 | 3.87 | 4.53 |
| 2006 | 4.82 | 4.8 | 4.96 | 5.07 | 4.85 | 4.41 | 4.1 |
| 2007 | 5.22 | 5.43 | 5.05 | 5.32 | 4.68 | 5.89 | 4.4 |
| 2008 | 6.42 | 6.53 | 6.12 | 6.11 | 5.57 | 7.21 | 5.4 |
| 2009 | 6.45 | 6.84 | 6.52 | 6.54 | 5.93 | 6.82 | 6.24 |
| 2010 | 6.35 | 6.52 | 6.14 | 6.7 | 5.61 | 5.48 | 5.41 |
| 2011 | 5.47 | 6.15 | 5.95 | 6.32 | 4.98 | 4.71 | 5.01 |
| 2012 | 7.25 | 7.61 | 8.35 | 7.64 | 5.63 | 5.95 | 4.1 |
| Total | 59.84 | 62.56 | 61.4 | 62.89 | 55.28 | 55.72 | 50.95 |
| Average | 5.98 | 6.26 | 6.14 | 6.29 | 5.53 | 5.57 | 5.09 |
| Std Dev | 0.95 | 0.90 | 1.07 | 0.86 | 0.71 | 1.05 | 0.82 |
| C.V | 15.88 | 14.39 | 17.43 | 13.67 | 12.84 | 18.85 | 16.11 |

Source: Statistical tables relating to banks of various years

Table 1 reveals that the overall cost of deposits of the banking industry is 5.09% during the studyperiod. The industry's average cost of deposits is on decreasing trend till2006.It is highest in 2008 and 2009 due to the economic crisis experienced during the recession period .From 2010 onwards it is decreasing and the margin is more in 2012.The declining trend in the cost of deposits has a positiveimpact on the banks Profitability.

Bank wise data shows that SBI has registered the lowest cost of deposit (5.53) followed by ICICI. Among the old private sector banks FDRL has the lowest cost of deposits (5.98) followed by DLB(6.14). Regarding consistency inperformance, SBI(12.84) has maintained consistency in cost of deposits compared to old private sector banks and ICICI.Among the old private sector

banks CSB(13.67)is more consistent and DLB(17.43) is least consistent in maintaining the cost of deposits which is evident by their C.V.values.

***Cost of borrowings***

Banks procure funds from time to time from money market to meet temporary deficiency. Purchased funds include inter-bank and short-term institutional liabilities and certificate of deposits. These funds are mobilized in national and international money markets. Since these markets are more competitive, the funds raised in such markets are more volatile than deposits. Hence, funding the assets through these sources would entail liquidity risk.Cost of borrowings which is calculated as a percentage of interest on borrowings to total borrowings reveals the efficiency of cost of borrowed funds. Higher the ratio, lower will be productivity of funds management. On the other hand, lower interest on borrowings has a positive impact on the banks. The information relating to cost of borrowings is given in Table 2.

**Table 2 Cost of Borrowed Funds (Percentages)**

| Year | FDRL | SIB | DLB | CSB | SBI | ICICI | SCBs |
|---|---|---|---|---|---|---|---|
| 2003 | 1.87 | 0.39 | 2.25 | 3.74 | 2.1 | 0.44 | 2.71 |
| 2004 | 1.61 | 0.38 | 2.42 | 1.84 | 1.42 | 0.71 | 2.72 |
| 2005 | 0.78 | 1.90 | 2.89 | 1.19 | 2.51 | 0.79 | 2.18 |
| 2006 | 0.86 | 23.23 | 13.26 | 115.55 | 5.3 | 2.57 | 3 |
| 2007 | 2.07 | 5.49 | 60.79 | 34.15 | 6.09 | 2.9 | 3.3 |
| 2008 | 3.17 | 22.62 | 42.79 | 7.76 | 6.43 | 3.11 | 3.7 |
| 2009 | 3.27 | 10.04 | 32.03 | 31.25 | 4.85 | 3.02 | 3.37 |
| 2010 | 0 | 0.81 | 6.81 | 0.04 | 1.31 | 1.28 | 1.7 |
| 2011 | 0.57 | 2.68 | 6.94 | 1.52 | 2.3 | 1.22 | 2.34 |
| 2012 | 1.58 | 4.03 | 7.25 | 1.47 | 3.15 | 1.18 | 2.81 |
| Total | 15.78 | 71.57 | 177.43 | 197.04 | 35.46 | 17.22 | 27.83 |
| Average | 1.57 | 7.15 | 17.74 | 19.85 | 3.54 | 1.72 | 2.78 |
| Std Dev | 1.07 | 8.80 | 20.40 | 35.95 | 1.94 | 1.05 | 0.60 |
| C.V. | 68.15 | 123.08 | 114.99 | 181.11 | 54.80 | 61.04 | 21.58 |

Source: Statistical tables relating to banks of various years

The overall cost of borrowings of the banking industry as a whole is 2.78%.The cost of borrowed funds of the industry shows a declining trend till 2005.From2006 onwards it is increasing and In 2010 the industry managed to reach lowest .From 2011 it is again increasing .

Among the sample banks FDRL (1.57) and ICICI (1.72)has the lowest cost on their borrowings and CSB(19.85) has got the highest cost on their borrowings. We can see all the banks has a declining cost on borrowed funds since2009.The overall cost of borrowed funds of FDRL and ICICI is lower than the industry average. Regarding consistency SBI (54.80) is more consistent among the sample banks and among the old private sector banks FDRL (68.15) is more consistent on cost of borrowings. Among the sample banks CSB (181.11) is least consistent in maintaining cost of borrowings which had an adverse impact on their profitability.

***Cost of total funds***

Behaviour of profitability of funds essentially depends on cost of funds. Cost of funds includes the hiring costs of funds such as interest on deposits and borrowings. Composition of these liabilities and the respective interest rates on each component influence the total cost of funds. Higher the ratio, lower will be the productivity of funds management and vice versa. Details of cost of total funds is given in table 3

**Table 3 Cost of total funds (Percentages)**

| Year | FDRL | SIB | DLB | CSB | SBI | ICICI | SCBs |
|---|---|---|---|---|---|---|---|
| 2003 | 7.24 | 7.25 | 7.32 | 7.51 | 6.96 | 3.25 | 6.19 |
| 2004 | 5.88 | 6.08 | 5.8 | 6.19 | 5.74 | 3.59 | 5.14 |
| 2005 | 4.54 | 5.18 | 5.07 | 5.46 | 4.9 | 3.02 | 4.36 |
| 2006 | 4.73 | 4.81 | 4.9 | 5.08 | 4.88 | 4.01 | 4 |
| 2007 | 5.11 | 5.43 | 5.1 | 5.33 | 4.79 | 5.34 | 4.3 |
| 2008 | 6.32 | 6.57 | 6.17 | 6.11 | 5.64 | 6.4 | 5.3 |
| 2009 | 6.36 | 6.87 | 6.53 | 6.59 | 5.85 | 5.97 | 5.96 |
| 2010 | 6.11 | 6.42 | 6.15 | 6.61 | 5.14 | 4.18 | 5.1 |
| 2011 | 5.26 | 6.11 | 6.00 | 6.2 | 4.67 | 3.59 | 4.73 |
| 2012 | 6.89 | 7.56 | 8.25 | 7.36 | 5.35 | 4.32 | 5.89 |
| Total | 58.44 | 62.28 | 61.29 | 62.44 | 48.57 | 43.67 | 50.97 |
| Average | 5.84 | 6.22 | 6.12 | 6.24 | 5.39 | 4.36 | 5.09 |
| Std Dev | 0.91 | 0.89 | 1.05 | 0.81 | 0.69 | 1.15 | 0.75 |
| C.V | 15.58 | 14.31 | 17.16 | 12.98 | 12.80 | 26.37 | 14.73 |

Source: Statistical tables relating to banks of various years

Table3 reveals that the overall total cost of funds for the banking industry, as a whole, is 5.09%over thestudy period. The industry wise cost isdeclining during the first 4 years. From 2006-09 it is increasing. From 2009 onwards it is decreasing and it is lowest in 2011.But 2012 the cost has raised among all banks.

The bank wise comparison reveals thatICICI (4.36) and SBI (5.39) have registered the lowest average cost of funds. ICICIhas got the lowest cost of funds which is lower than the industry average .This is due to the decline in both the cost of deposits as well as borrowings due to soft interest rate scenario and better liquidity position of the bank. Among the old private sector banks FDRL (5.84) has the lowest rate compared to other banks and CSB (6.24) has incurred the highest cost on their funds. Regardingconsistency among sample banks SBI (12.80) has maintained greaterconsistency and ICICI (26.37) has got the lowestone. Among the old private sector banks CSB (12.98) is more consistent and DLB (17.16) is least consistent in maintaining cost of funds.

***Return on advances***

A major share of banks revenue emanates from return on advances. Return on advances includes interestand discount on various loans and advances such as cash credits, overdrafts, term-loans, bills purchased anddiscounted. Ratio of return on advances to total advances indicates the ability of banks in generating income from itslending operations. Higher the ratio of return on advances, higher will be the productivity of funds management andvice versa. A lower return on advances signifies poor return on advances or higher losses in loans. The information relating to return on advances is given in table-5

**Table 5 Return on Advances (Percentages)**

| Year | FDRL | SIB | DLB | CSB | SBI | ICICI | SCBs |
|---|---|---|---|---|---|---|---|
| 2003 | 11.6 | 10.89 | 10.81 | 11.6 | 8.69 | 11.99 | 9.89 |
| 2004 | 10.26 | 9.17 | 10.32 | 10.24 | 7.62 | 10.53 | 8.74 |
| 2005 | 9.35 | 9.15 | 9.69 | 9.97 | 7.24 | 8.77 | 8.08 |
| 2006 | 8.91 | 9.36 | 9.62 | 9.66 | 7.62 | 8.59 | 7.2 |
| 2007 | 9.62 | 9.72 | 10.3 | 10.2 | 8.29 | 9.41 | 7.9 |
| 2008 | 10.81 | 10.46 | 11.15 | 11.23 | 9.34 | 10.72 | 8.9 |
| 2009 | 12.42 | 11.4 | 11.03 | 11.76 | 9.68 | 10.06 | 10.5 |
| 2010 | 11.55 | 10.98 | 10.23 | 10.24 | 8.62 | 8.7 | 9.29 |
| 2011 | 10.76 | 10.63 | 9.94 | 11.24 | 8.64 | 8.26 | 9.18 |
| 2012 | 12.02 | 12.01 | 12.07 | 12.41 | 9.98 | 9.42 | 10.7 |
| Total | 107.3 | 103.77 | 105.16 | 108.55 | 85.72 | 96.45 | 90.38 |
| Average | 10.73 | 10.38 | 10.52 | 10.86 | 8.57 | 9.65 | 9.04 |
| Std Dev | 1.18 | 0.99 | 0.75 | 0.91 | 0.91 | 1.17 | 1.12 |
| C.V. | 10.99 | 9.54 | 7.13 | 8.38 | 10.62 | 12.12 | 12.39 |

Source: Statistical tables relating to banks of various years

Table 5reveals that the overall trend in return on advances is fluctuating. It has reached the highest points in 2012 during the last 10 years. Among the sample

banks,CSB(10.86) has got the highest return on advances followed by FDRL(10.73).It is interesting to note that all the old private sector banks have got return on advanceshigher than the industry average. Among the sample banksSBI(8.57) hasthe lowestreturn followed by ICICI(9.65). Regarding consistency DLB (7.13)is moreconsistent andFDRL (10.99) is least consistent among old private sector banks and ICICI (12.12) among sample banks in maintaining return on advances.

***Ratio of Deposits to Total Liabilities***

The size of deposits determines the funds available for profitable deployment by banks. Deposits are mobilized in local markets which serve as a stable source of financing. Further, the deposits can be obtained at lower cost of financing when compared to the alternative sources of bank funds. Higher ratio of deposits to total liabilities indicates the banks Preference for deposits in their resource mobilisation. In addition, a higher share of deposits generally coexists with lower size of borrowings and vice versa. Thedetails on ratio of deposits to total liabilities are shown in Table 6.

The industry average of deposits to totalliabilities is 78.21%.All the old private sector banks have performed well in deposit mobilisation during the study period. Among the sample banks CSB is more efficient in deposit mobilisation. Regarding consistency also CSB is more consistent in deposit mobilisation .Among the sample banks ICICI has the lowest ratio and highly inconsistent in deposit mobilization.

**Table 6 Ratio of Deposits to Total Liabilities (Percentages)**

| Year | FDRL | SIB | DLB | CSB | SBI | ICICI | SCBs |
|---|---|---|---|---|---|---|---|
| 2003 | 89.7 | 89.94 | 87.26 | 90.8 | 78.78 | 45.1 | 79.9 |
| 2004 | 89.17 | 89.47 | 88.18 | 90.09 | 78.13 | 54.39 | 79.77 |
| 2005 | 90.32 | 89.6 | 88.44 | 90.66 | 79.81 | 59.54 | 77.96 |
| 2006 | 86.6 | 88.5 | 88.9 | 89.8 | 76.9 | 65.7 | 77.7 |
| 2007 | 86 | 89.6 | 89.6 | 89.6 | 76.9 | 66.9 | 77.87 |
| 2008 | 79.7 | 88.7 | 89.5 | 89.2 | 74.5 | 61.1 | 76.74 |
| 2009 | 82.9 | 88.8 | 88.1 | 90 | 76.9 | 57.6 | 77.52 |
| 2010 | 82.6 | 90.1 | 87.8 | 90.8 | 76.3 | 55.6 | 78.76 |
| 2011 | 83.6 | 90.6 | 87.8 | 88.8 | 76.3 | 55.5 | 78.17 |
| 2012 | 80.72 | 90.4 | 81.43 | 88.03 | 78.15 | 53.94 | 77.76 |
| Total | 851.31 | 895.71 | 877.01 | 897.78 | 772.67 | 575.37 | 782.15 |
| Average | 85.13 | 89.57 | 87.70 | 89.77 | 77.26 | 57.53 | 78.21 |
| Std Dev | 3.79 | 0.720 | 2.32 | 0.90 | 1.49 | 6.29 | 0.99 |
| C.V | 4.45 | 0.80 | 2.65 | 1.00 | 1.93 | 10.93 | 1.27 |

Source: Statistical tables relating to banks of various years

***Ratio of Investments to Deposits***

Banks have to invest a portion of their deposits in government and corporate securities which earnrelatively low income as compared to investments on loans and advances. A higher ratio of investment to depositsindicates that more funds are deployed in low return investments than in high return credit business. It also impliesthat the funds are diverted from credit business to investment activities for liquidity purpose than to earn a handsomereturn. This tends to adversely affect on the profitability of bank funds. Information relating to investment to deposits is given in table-7

**Table 7 Ratio of investments to deposits (Percentages)**

| Year | FDL | SIB | DLB | CSB | SBI | ICICI | SCBs |
|---|---|---|---|---|---|---|---|
| 2003 | 41.6 | 43.71 | 36.73 | 51.6 | 58.2 | 73.62 | 51.13 |
| 2004 | 40.87 | 47.85 | 41.51 | 46.87 | 58.28 | 62.76 | 50.92 |
| 2005 | 38.17 | 36.9 | 30.27 | 32.9 | 53.7 | 50.58 | 47.26 |
| 2006 | 35.08 | 28.6 | 28.02 | 33.38 | 42.77 | 43.34 | 40 |
| 2007 | 32.58 | 28.03 | 28.02 | 32.71 | 34.25 | 39.59 | 35.3 |
| 2008 | 38.64 | 30.17 | 29.79 | 34.12 | 35.26 | 45.6 | 35.5 |
| 2009 | 37.64 | 33.58 | 31.54 | 34.79 | 37.19 | 47.2 | 35.7 |
| 2010 | 36.2 | 31.1 | 28.57 | 32.81 | 36.78 | 59.84 | 36.4 |
| 2011 | 33.8 | 30.03 | 29.05 | 30.83 | 31.65 | 59.7 | 34.1 |
| 2012 | 35.56 | 25.75 | 36.94 | 29.66 | 25.75 | 62.45 | 34.56 |
| Total | 370.14 | 335.72 | 320.44 | 359.67 | 413.83 | 544.68 | 400.87 |
| Average | 37.01 | 33.57 | 32.04 | 35.96 | 41.38 | 54.46 | 40.09 |
| Std Dev | 2.92 | 7.18 | 4.68 | 7.236 | 11.49 | 10.79 | 6.9 |
| C.V. | 7.89 | 21.39 | 14.61 | 20.12 | 27.76 | 19.81 | 17.31 |

Source: Statistical tables relating to banks of various years

Table 7 reveals that the overall ratio of investments to deposits of the banking industry as a whole is 40.09% .There is no wide variationsince2007.Bankwise data shows that ICICI has got the highest ID ratio and DLB the lowest.All the old private sector banks have a ratio lower than the industry average.Higher ratio reveals that the substantial amount of funds is tied up in the investments that yield a relatively lower return when compared to return on the advances. This tends to affect the overall profitability of banks. In terms of consistency in performance, FDRL (7.89) has maintained consistency in this ratio as compared to other banks and SBI (27.76) is least consistent.

***Ratio of Credit to Deposits***

Profitability of banks essentially depends on the volume of credit. Credit deposit ratio reveals the extent ofdeposit utilized for meeting the credit needs of the banks. Change in the volume of loan business causes a change inthe size of profits. Credit business carries high risk as well as high return. A higher credit deposit ratio indicates thehigher deployment of deposits for credit business and higher will be the productivity of funds.

**Table 8 Ratio of Credit to Deposits (Percentages)**

| Year | FDL | SIB | DLB | CSB | SBI | ICICI | SCBs |
|---|---|---|---|---|---|---|---|
| 2003 | 46.52 | 52.66 | 58.79 | 41.95 | 46.52 | 110.61 | 54.53 |
| 2004 | 49.57 | 50.69 | 52.82 | 48.92 | 49.57 | 91.97 | 54.86 |
| 2005 | 55.14 | 63.18 | 60.29 | 56.93 | 55.14 | 91.57 | 62.69 |
| 2006 | 65.64 | 66.5 | 62.95 | 62.83 | 68.89 | 88.54 | 70.1 |
| 2007 | 69.03 | 64.7 | 59.49 | 63.44 | 77.46 | 84.97 | 73.5 |
| 2008 | 72.95 | 68.97 | 58.25 | 62.31 | 77.55 | 92.3 | 74.6 |
| 2009 | 69.54 | 65.51 | 64.32 | 58.17 | 73.11 | 99.98 | 73.9 |
| 2010 | 74.74 | 68.76 | 70.53 | 64.01 | 78.58 | 89.7 | 73.66 |
| 2011 | 74.28 | 68.94 | 72.35 | 71.28 | 81.03 | 95.91 | 76.54 |
| 2012 | 77.15 | 74.74 | 74.19 | 72.26 | 83.13 | 99.31 | 78.6 |
| Total | 654.56 | 644.65 | 633.98 | 602.1 | 690.98 | 944.86 | 692.98 |
| Average | 65.46 | 64.47 | 63.40 | 60.21 | 69.10 | 94.49 | 69.30 |
| Std Dev | 11.07 | 7.46 | 6.94 | 18.62 | 13.63 | 7.33 | 8.79 |
| C.V. | 16.91 | 11.57 | 10.95 | 30.93 | 19.73 | 7.76 | 12.68 |

Source: Statistical tables relating to banks of various years

Table-8 reveals that the Overall trend in baking industry is increasing and ratio is69.30% during the study period.Among the old private sector banks FDRL (65.46) has the highest CD ratio closely followed by SIB (64.47). Among the sample banks ICICI(94.49) has registered amuch higher CD ratio which reflects the profitable utilization of deposits by the bank. Regardingconsistency ICICI (7.76) is more consistent among sample banks and DLB (10.95)among old private sector banks and CSB (30.93) is leastconsistent in maintaining CD ratio.

## Findings

The study reveals that the overall cost of funds, in terms of cost of deposits, aswell as borrowings for the banking industry, as a whole, has maintained a

decreasing trend since2009. But in2012 it has increased due to the high interest rates offered on term deposits, decreasing share of CASA deposits and high interest rate on borrowings. Among the old private sector banks FDRL has performed well in reducing both the costs. Among the sample banks ICICI leads the row. This is attributed to the bank's ability to get funds in the call money market by exploiting the opportunities of soft interest rates. Similarly, the analysis of components of return on funds reveals that both the return on advances, as well as investments, has maintained a decreasing trend. All the old private sector banks performed well than SBI and ICICI in deposit mobilisation and earning returns in advances.. Among them it is interesting to note that CSB has improved their performance both in investments and advances.

The declining trend in the rate of investments and advances leads to squeezing of the spread. This thin margin between cost and return of funds can be attributed to the deregulation of interest rates as well as the competition among the various banks. With regard to funding of operations, it is evident that the banking industry has demonstrated its preference for deposits.Among the sample banks, CSB and SIB have maintained a relatively higher ratio of deposits to total liabilities. With regard to utilization of deposits, the study reveals that more funds are put in credit businessthan investments. The average CD ratio and investments to deposits ratios are 70% and 40%, respectively.

## Conclusion

All the old private sector banks have performed well in deposit mobilisation and earning returns in advances.With regard to utilization of deposits, the study reveals that more funds are put in credit business than investmentsIn the light of these findings, the banks need to mobilize funds by exploiting the opportunities of soft interest rates in the call market. Further, the excessive investments in low earnings SLR securities should be diverted toward relatively profitable loans and advances. In view of a declining spread, the banks needto explore the non-interest income generating activities

## References

[1]. Uppal R.K., "*Cost-Benefit Analysis of Commercial Banks In the Global Age: Future Strategies for Fund Management*", Business Horizon- A Journal of Commerce and Economics, Vol.1 July-Dec, 2007- Page No.121.

[2]. Dr.Suvendu sekhar Dash, *Trends in growth & development,* Indian Banker Vol II -No.10, Oct-2007. Page 28-33

[3]. Brinds Jagirdar and Amlendu K Dubey, "*Performance of Public Sector anks*", The Indian Banker, December 2007, Vol II No 12, 4.

[4]. Dr.K.Srinivasa Rao, "*Profitability of commercial banks*"-Indian banker Vol II No.11., Nov2012, page34-39

[5]. R.K.Anand, "*Capital optimization not maximization*". Indian Banker- Vol II, No.12. Dec2012, Page No.48.

[6]. www.rbi.org.in-"*Statistical tables relating to banks in India*"-2003-2012

[7]. www.rbi.org.in.- "*Trends and progress of banking in India*"-2003-2012.

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Table 1 Damage location accuracy

| Sl.No | Predicted location(m) | Actual location(m) | Error (%) |
|---|---|---|---|
| **1** | 1.54 | 1.53 | 0.002 |
| **2** | 1.98 | 1.67 | 0.006 |
| **3** | 1.87 | 1.61 | 0.224 |

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