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The Color of Whiteness and the Paradox of Diversity

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Abstract

In this chapter, I seek to deconstruct the underlying structure of the notion of "diversity" as it is commonly used in the United States. Prejudice and ethnocentrism arise when Whiteness is the standard from which other ethnic and racial categories diverge and deviate. Mutually respectful interracial and intercultural communication and interaction depends on Whiteness taking its place as simply one among many racial and ethnic categories, all of which are socially constructed and none of which can be set up as the norm. Clinical implications are spelled out with an extended illustration.

Keywords

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Contents

A Goal Programming Model for Advertisement Selection on Online News Media

Prerna Manik, Anshu Gupta and P. C. Jha

Abstract Promotion plays an important role in determining success of a product/service. Out of the many mediums available, promotion through means of advertisements is most effective and is most commonly used. Due to increasing popularity of the Internet, advertisers yearn for placing their ads on web. Consequently, web advertising has become one of the major sources of income for many websites. Several websites provide free services to the users and generate revenue by placing ads on its webpages. Advertisement for any product/service is placed on the site considering various aspects such as webpage selection, customer demography, product category, page, slot, time, etc. Further, different advertisers bid different costs to place their ads on a particular rectangular slot of a webpage, that is, many ads compete with each other for their placement on a specific position. Hence, in order to maximize the revenue generated through the ads, optimal placement of ads becomes imperative. In this paper, we formulate an advertisement planning problem for web news media maximizing their revenue. Mathematical programming approach is used to solve the problem. A case study is presented in the paper to show the application of the problem.

Keywords Advertisement planning · Revenue maximization · Online news web

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1 Introduction

Advertising is an indispensable component of the marketing strategy for any firm. A well-designed advertisement campaign attracts a huge customer base, creates a brand name for the product and thereby enhances sales. Firms spend a large amount of capital to create effective exposure for its products by means of advertisements (ads). Today we see various media for advertising, starting from hoardings to television commercials, print ads to web media, and many more. Companies generally use a mix of various ad media to create maximum exposure for their products. Amongst all kinds of advertising media, the Internet has become the most famous and adopted media by the advertisers as well as consumers. And its popularity is increasing as information technology is reaching more and more people in the world and consumers stay connected to web for long hours. Other reasons for popularity of web advertising over other traditional media include traceability, cost effectiveness, reach, interactivity, etc. It is also capable of providing the dual features of both print and television media. The study in this paper focuses on a web ad scheduling problem where the objective is to maximize the revenue generated from placing ads on the multiple pages of a website. Maximization is achieved by selecting the ads on a slot from various competing ads in such a way that all the slots on every webpage under consideration are full at every time instant throughout the planning horizon. The proposed model surmounts one of the major limitations of the literature in the area.

Web ads commonly known as "banner ads" are devoted to promote, market, sell, or provide specific information about a product, service, or commercial event on web. Television and radio ads are expensive, short lived, and people tend to ignore them. However, in the case of web ads, customers have a choice as to whether or not they want to read or click on a web ad, while the ads may create an impression on the web users irrespective of their choice.

Though banner ads are the most popular ads on the web and constitute a major proportion of web advertising, there are also other ads that have been adopted by the advertisers such as are pop-up and pop-under ads, floating ads, unicast ads, etc. However, scope of this paper is limited to banner ads only. A banner ad is a small, typically rectangular, graphic image, which is linked to a target webpage. Many different types of banners with different sizes are being used in web advertisement. Rectangular-shaped banner ads are the most common type of banner ads. These banners usually appear on the side, top, or bottom of a screen as a distinct, clickable image [9]. For e.g., in Fig. 1, www.newswebsite.com displays a top banner ad of IBEF and two side banner ads of Artha Villas and CRAZEAL.

Due to constantly increasing popularity and power of web advertising, more and more websites and blogs are evolving that provide free services to their users. For e.g., websites such as Download.com, soft32, softpedia provide free software download facilities to the users. Also there are websites such as ApnaCircle and LinkedIn which help millions of professionals to connect and share their ideas for free. Then there are also websites such as hindustantimes.com and timesofindia.com, which provides their users a free service of e-paper, that is, a reader can read the newspaper

Fig. 1 Banner Ads on www.newswebsite.com (Date clicked: September 15, 2012)

online. Such websites generate major portion of their revenue by placing ads on their webpages. Hence, for such sites, optimal placement of ads on their webpages becomes imperative.

Many researchers have been working in the area of scheduling ads on web from past few years. One of the major focuses of the work has been on the effectiveness of web ads. Yager [14] described a general framework for the competitive selection of ads at web sites. A methodology was described in the paper for the use of intelligent agents to help in the determination of the appropriateness of displaying a given ad to a visitor at a site using very specific information about potential customers. Fuzzy system modeling was used for the construction of these intelligent agents. Dreze and Zufryden [3], Intern.com Corp. [5], Kohda and Endo [6], Marx [8] and Risden et al. [11] tackled the issue of increasing the effectiveness of web ads. Intern.com Corp. [5], McCandless [9], and Novak and Hoffman [10] described web advertising theories and terminologies. Researchers viz. Aggarwal et al. [2], Adler et al. [1], Kumar et al. [7] considered the issue of optimizing the ad space on the web. Aggarwal et al. [2] described a framework and provided an overview of general methods for optimizing the management of ads on web servers. They described a minimum cost flow model in order to optimize the assignment of ads to the predefined standard sizes of slots on webpages. Adler et al. [1] provided a heuristic called SUBSET-LSLF.

A major contribution in the area of ad scheduling has been done by Kumar et al. [7] and Gupta et al. [4]. Kumar et al. [7] addressed the problem of scheduling ads on a webpage in order to maximize revenue, for which they maximized the utilization of space available to place the ads. They used genetic algorithms to solve the problem. The major limitations of the model are that it considers only a particular side banner space on a specific page whose width is fixed and length can vary. The rectangular dimensions can thus be reduced to single dimension as the other dimension, i.e., width was assumed to be of unit size. All or some ads that can fit in this banner should therefore have the width of unit size. However, in practice banner ads that compete to be placed on a rectangular slot may be of varying rectangular dimensions. Second, in reality, the varying dimension of the slot for the banner can be a real value and need

not necessarily be an integral multiple of the defined unit slot length. Therefore, the problem that maximizes the space utilization may not be the true representative of the revenue maximization problem. Gupta et al. [4] overcame the limitations of the model formulated by Kumar et al. [7]. They considered the set of ads competing to be placed on various rectangular slots (that may have varying rectangular dimensions) in a given planning horizon on various webpages of a news website in order to maximize the revenue, where the revenue is generated from the costs different advertisers pay to place their ads on the website. One of the limitations of the model formulated by Gupta et al. [4] is that it allows an ad to appear more than once on the same webpage. For instance, suppose that a webpage W_1 has three rectangular slots and suppose that an ad A_1 has appeared in slot 1 of this webpage at time period T_1. Then according to this model this ad A_1 can also appear in slot 2 and/or slot 3 of webpage W_1 at the same time period T_1.

In this paper, we formulate a web ad scheduling problem considering sets of ads competing to be placed on various rectangular slots (which may have different rectangular dimensions) in a given planning horizon on different webpages of a news website in order to maximize the revenue. The revenue is generated from the costs different advertisers pay to place their ads on the website. The proposed model restricts the selection of an ad on the same webpage more than once at any instant of time. We also discuss the solution methods for the proposed model, which is a 0-1 linear programming model. The model can be programmed and solved on LINGO [13] software. Depending on the available data the model may or may not be feasible. As the number of constraints increase the feasible area reduces and may tend to infeasibility. In this case, we use goal programming approach (GPA) [12] to obtain a compromised solution. The goal model of the problem can also be programmed and solved on LINGO [13].

The rest of the paper is organized as follows. In Sect. 2, we discuss the mathematical model formulation. A Case study has been discussed in Sect. 3. Section 4 concludes the paper.

2 Model Formulation

Notations

n : total number of webpages
m_j : number of rectangular slots on jth webpage
K : total number of ads
P   : total number of time units in a day
Q   : total number of days in a planning horizon
T : total number of time units over the planning horizon, where $T = P \times Q$
C_{ijk} : cost of kth ad competing for ith rectangular slot on jth webpage
S : set of K ads
S_{ij} : set of ads which compete for ith rectangular slot on jth webpage; $S_{ij} \subseteq S \forall i, j$

A_k : kth ad
w_k : minimum required time units for which kth ad appears in any rectangular slot
W_k : maximum time units for which kth ad appears in all the rectangular slots
D : total number of rectangular slots over a planning horizon (= Total number of rectangular slots on all the webpages $\times$ Length of planning horizon)

2.1 Web Ad Scheduling Problem

Web service providers endeavors to generate maximum revenue from the ads that are displayed on the webpages of their website. Therefore, optimal selection of the ads from the available sets of ads that compete to be placed on different rectangular slots of different webpages becomes critical.

We consider a set of K ads, $S = \{A_1, A_2, \ldots, A_K\}$ that compete to be placed on different rectangular slots of various webpages of a website in a planning horizon. The problem is formulated for a website consisting of n webpages, where jth webpage consists of m_j number of rectangular slots. A subset of ads S_{ij} competes to be placed on ith rectangular slot of jth webpage over a planning horizon. An advertiser k, where $A_k \in S_{ij}$, pays cost C_{ijk} to place his ad on ith rectangular slot of jth webpage with minimum frequency w_k and maximum frequency W_k.

Web ads are scheduled daily, fortnightly, weekly, monthly, or quarterly and so on depending on to the time units allocated to the ads. An ad which appears at any location stays there for some time and is then replaced by another ad. Consider for example, the minimum time for which an ad appears in any rectangular slot is one minute then, there will be $60 \times 24 = 1440$ time slots/units (P) in a day. And if the scheduling is to be done for say one week (i.e., $Q = 7$ days) then there will be a total of $1440 \times 7 = 10080$ time slots, i.e., the planning horizon would be $T = P \times Q = 1440 \times 7 = 10080$ time units.

Over a planning horizon, for each rectangular slot, web service provider selects ads which maximize their revenue and the unscheduled ads may compete for space in the next planning horizon with new ads. The set of ads assigned to all the slots for this time period is seen by the visitors who visit the site during that time interval and then the ads are updated according to their schedule. Now consider that we have in total $\sum_{j=1}^{n} m_j$ number of rectangular slots and a total of $T = P \times Q$ time units in the planning horizon, which can be considered as a scheduling problem of $D = T \times \sum_{j=1}^{n} m_j$ slots. Minimum frequency w_k represents the number of time units for which the ad A_k must appear when selected for some slot and maximum frequency W_k represents the number of time units for which the ad A_k must appear in all the rectangular slots over a planning horizon.

The problem to maximize the revenue generated by placing ads on the website over a planning horizon, which depends heavily on the costs different companies pay for placing their ads on ith rectangular slot of jth webpage is as follows:

$$\textbf{Maximize} \quad R = \sum_{i=1}^{m_j}\sum_{j=1}^{n}\sum_{k\in S_{ij}}\sum_{t=1}^{T} C_{ijk}x_{ijkt}$$

$$\textbf{Subject to} \quad \sum_{t=1}^{T} x_{ijkt} \geq w_k z_{ijk} \quad \forall\, i,j,k \in S_{ij}$$

$$\sum_{i=1}^{m_j}\sum_{j=1}^{n}\sum_{t=1}^{T} x_{ijkt} \leq W_k \quad \forall\, k \in S_{ij}$$

$$\sum_{i=1}^{m_j}\sum_{j=1}^{n}\sum_{k\in S_{ij}}\sum_{t=1}^{T} x_{ijkt} \leq D \tag{1}$$

$$\sum_{i=1}^{m_j} x_{ijkt} = 1 \quad \forall\, j, k \in S_{ij}, t$$

$$\sum_{k\in S_{ij}} x_{ijkt} \leq 1 \quad \forall\, i,j,t$$

$$\sum_{k\in S_{ij}} z_{ijk} \geq 1 \quad \forall\, i,j$$

where $x_{ijkt} = \begin{cases} 1, & \text{if } k\text{th ad is chosen to be placed on } i\text{th rectangular slot of } j\text{th} \\ & \quad \text{webpage at } t\text{th time unit} \\ 0, & \text{otherwise} \end{cases}$

$z_{ijk} = \begin{cases} 1, & \text{if } k\text{th ad is placed on } i\text{th rectangular slot of } j\text{th webpage} \\ 0, & \text{otherwise} \end{cases}$

In the above problem $t = 1, \ldots, P \times Q = T$. Time slots are arranged in the ordinal manner i.e. the 1st P time units will correspond to 1st day, next P for 2nd day and so on.

Here, first constraint ensures that kth ad is assigned to at least w_k time slots. Second constraint guarantees that kth ad is assigned to not more than W_k number of slots over the planning horizon. Next constraint ensures the fullness of total number of rectangular slots over the planning horizon. Fourth constraint guarantees that if an ad is selected to be placed on any rectangular slot of a webpage at any given time period then that ad cannot appear on any other rectangular slot of that webpage at the same time unit. Next constraint ensures that at a particular time unit, on each rectangular slot on a webpage, not more than one ad can be placed. Last constraint ensures that number of times ad k appears on a particular rectangular slot over the planning horizon can be one or more than one.

Problem (1) can be solved using LINGO [13] software if a feasible solution to the problem exists. Otherwise for an infeasible solution, GPA [12] can be used to obtain a compromised solution.

2.2 Goal Programming Approach

In a simpler version of goal programming approach (GPA), management sets goals and relative importance (weights) for different objectives. Then an optimal solution is defined as one that minimizes both positive and negative deviations from set goals simultaneously or minimizes the amount by which each goal can be violated. First we solve the problem using rigid constraints only and then the goals of objectives are incorporated depending upon whether priorities or relative importance of different objectives are well defined or not. Problem (1) can be solved in two stages as follows:

$$
\textbf{Minimize} \quad g_0(\eta, \rho, x, z) = \sum_{i=1}^{m_j} \sum_{j=1}^{n} \sum_{k \in S_{ij}} \eta_{ijk}^1 + \sum_{k \in S_{ij}} \rho_k^2 + \rho^3
$$

$$
+ \sum_{j=1}^{n} \sum_{k \in S_{ij}} \sum_{t=1}^{T} \left(\eta_{jkt}^4 + \rho_{jkt}^4 \right) + \sum_{i=1}^{m_j} \sum_{j=1}^{n} \sum_{t=1}^{T} \rho_{ijt}^5
$$

$$
+ \sum_{i=1}^{m_j} \sum_{j=1}^{n} \eta_{ij}^6
$$

$$
\textbf{Subject to} \quad \sum_{t=1}^{T} x_{ijkt} + \eta_{ijk}^1 - \rho_{ijk}^1 = w_k z_{ijk} \quad \forall\, i, j, k \in S_{ij}
$$

$$
\sum_{i=1}^{m_j} \sum_{j=1}^{n} \sum_{t=1}^{T} x_{ijkt} + \eta_k^2 - \rho_k^2 = W_k \quad \forall\, k \in S_{ij}
$$

$$
\sum_{i=1}^{m_j} \sum_{j=1}^{n} \sum_{k \in S_{ij}} \sum_{t=1}^{T} x_{ijkt} + \eta^3 - \rho^3 = D \tag{2}
$$

$$
\sum_{i=1}^{m_j} x_{ijkt} + \eta_{jkt}^4 - \rho_{jkt}^4 = 1 \quad \forall\, j, k \in S_{ij}, t
$$

$$
\sum_{k \in S_{ij}} x_{ijkt} + \eta_{ijt}^5 - \rho_{ijt}^5 = 1 \quad \forall\, i, j, t
$$

$$
\sum_{k \in S_{ij}} z_{ijk} + \eta_{ij}^6 - \rho_{ij}^6 = 1 \quad \forall\, i, j
$$

$$
\eta, \rho \geq 0
$$

where, x_{ijkt} and z_{ijk} are as defined above and η and ρ are over-and under-achievement (positive- and negative-deviational) variables from the goals for the objective/constraint function and $g_0(\eta, \rho, x, z)$, is Goal objective function corresponding to rigid constraints.

The choice of deviational variable in the goal objective functions which has to be minimized depends upon the following rule. Let $f(X)$ and b be the function and its goal respectively and η and ρ be the over and under achievement variables then

if $f(X) \leq b$, ρ is minimized under the constraints $f(X) + \eta - \rho = b$,

if $f(X) \geq b$, η is minimized under the constraints $f(X) + \eta - \rho = b$,

if $f(X) = b$, $\eta + \rho$ is minimized under the constraints $f(X) + \eta - \rho = b$.

Let $(\eta^0, \rho^0, x^0, z^0)$ be the optimal solution for the problem (2) and $g_0 (\eta^0, \rho^0, x^0, z^0)$ be its corresponding objective function value then finally GP problem can be formulated using optimal solution of the problem (2) through the problem (1) as follows:

$$\textbf{Minimize} \quad g(\eta, \rho, x, z) = \eta^7$$

$$\textbf{Subject to} \sum_{t=1}^{T} x_{ijkt} + \eta_{ijk}^1 - \rho_{ijk}^1 = w_k z_{ijk} \quad \forall \, i, j, k \in S_{ij}$$

$$\sum_{i=1}^{m_j} \sum_{j=1}^{n} \sum_{t=1}^{T} x_{ijkt} + \eta_k^2 - \rho_k^2 = W_k \quad \forall \, k \in S_{ij}$$

$$\sum_{i=1}^{m_j} \sum_{j=1}^{n} \sum_{k \in S_{ij}} \sum_{t=1}^{T} x_{ijkt} + \eta^3 - \rho^3 = D$$

$$\sum_{i=1}^{m_j} x_{ijkt} + \eta_{jkt}^4 - \rho_{jkt}^4 = 1 \quad \forall \, j, k \in S_{ij}, t \tag{3}$$

$$\sum_{k \in S_{ij}} x_{ijkt} + \eta_{ijt}^5 - \rho_{ijt}^5 = 1 \quad \forall \, i, j, t$$

$$\sum_{k \in S_{ij}} z_{ijk} + \eta_{ij}^6 - \rho_{ij}^6 = 1 \quad \forall \, i, j$$

$$\sum_{i=1}^{m_j} \sum_{j=1}^{n} \sum_{k \in S_{ij}} \sum_{t=1}^{T} C_{ijk} x_{ijkt} + \eta^7 - \rho^7 = R^*$$

$$g_0(\eta, \rho, x, z) = g_0(\eta^0, \rho^0, x^0, z^0)$$

$$\eta, \rho \geq 0$$

where R^* is the aspiration level desired by the management on revenue and $g(\eta, \rho, x, z)$ is objective function of the problem (3). Problem (3) is solved using LINGO [13].

3 Case Study

In case of online news services, users spend long time on sites for reading news. In case of such websites, ads are updated periodically during this period, which is taken to be 1 h (length of one time slot) here.

We consider a news website which consists of five webpages. These pages have 3, 4, 2, 3, and 3 rectangular slots, respectively. A set of sixty ads, $S = \{A_1, A_2, \ldots, A_{60}\}$ compete to be placed on webpages of a news website in a planning horizon, which is taken as 1 week. Now, a week consists of 7 days and each day consists of 24 h. Since ads are updated every hour on the webpages, we refer to each hour as a time unit. Thus, in this case, we have $168(= 24 \times 7)$ time units to schedule ads. Ads need to be placed in $D = \sum_{j=1}^{5} m_j \times T (= 3 + 4 + 2 + 3 + 3) \times 168 = 2520$ slots. Sets of ads competing for ith rectangular slot on jth webpage and corresponding costs are as follows:

$S_{11} = \{A_1, A_3, A_6, A_8, A_{10}, A_{13}, A_{15}, A_{18}, A_{20}, A_{23}, A_{25}, A_{27}, A_{29}, A_{32}, A_{33}, A_{36}, A_{38}, A_{40},$
$\quad A_{43}, A_{44}, A_{46}, A_{49}, A_{51}, A_{54}, A_{57}, A_{59}\}; C_{11k} = 2,500 \quad \forall k \in S_{11}$

$S_{21} = \{A_2, A_4, A_6, A_9, A_{11}, A_{13}, A_{14}, A_{16}, A_{19}, A_{22}, A_{24}, A_{26}, A_{28}, A_{31}, A_{33}, A_{35}, A_{37},$
$\quad A_{39}, A_{42}, A_{44}, A_{47}, A_{49}, A_{50}, A_{52}, A_{54}, A_{56}, A_{57}, A_{60}\}; C_{21k} = 2,300 \quad \forall k \in S_{21}$

$S_{31} = \{A_1, A_2, A_5, A_8, A_{10}, A_{12}, A_{14}, A_{17}, A_{18}, A_{20}, A_{23}, A_{24}, A_{26}, A_{28}, A_{29}, A_{31}, A_{34}, A_{36},$
$\quad A_{37}, A_{38}, A_{40}, A_{42}, A_{43}, A_{45}, A_{47}, A_{50}, A_{51}, A_{53}, A_{55}, A_{58}, A_{59}\}; C_{31k} = 2,000 \quad \forall k \in S_{31}$

$S_{12} = \{A_2, A_3, A_5, A_7, A_9, A_{11}, A_{13}, A_{15}, A_{17}, A_{19}, A_{21}, A_{22}, A_{24}, A_{25}, A_{27}, A_{30}, A_{32}, A_{35},$
$\quad A_{36}, A_{38}, A_{39}, A_{41}, A_{43}, A_{44}, A_{46}, A_{47}, A_{49}, A_{52}, A_{54}, A_{56}, A_{60}\}; C_{12k} = 1850 \quad \forall k \in S_{12}$

$S_{22} = \{A_1, A_3, A_4, A_6, A_8, A_{11}, A_{14}, A_{16}, A_{18}, A_{19}, A_{21}, A_{23}, A_{26}, A_{27}, A_{28}, A_{29}, A_{33}, A_{34},$
$\quad A_{37}, A_{39}, A_{41}, A_{44}, A_{45}, A_{47}, A_{48}, A_{50}, A_{51}, A_{54}, A_{55}, A_{57}, A_{59}\}; C_{22k} = 1800 \quad \forall k \in S_{22}$

$S_{32} = \{A_1, A_2, A_5, A_6, A_9, A_{12}, A_{15}, A_{17}, A_{18}, A_{20}, A_{22}, A_{24}, A_{25}, A_{26}, A_{28}, A_{30}, A_{34}, A_{35},$
$\quad A_{38}, A_{40}, A_{42}, A_{46}, A_{48}, A_{51}, A_{55}, A_{58}\}; C_{32k} = 1700 \quad \forall k \in S_{32}$

$S_{42} = \{A_3, A_4, A_6, A_7, A_{10}, A_{12}, A_{14}, A_{16}, A_{17}, A_{19}, A_{22}, A_{25}, A_{27}, A_{29}, A_{30}, A_{32}, A_{35}, A_{36},$
$\quad A_{37}, A_{40}, A_{42}, A_{45}, A_{46}, A_{47}, A_{48}, A_{50}, A_{52}, A_{54}, A_{56}, A_{58}, A_{60}\}; C_{42k} = 1600 \quad \forall k \in S_{42}$

$S_{13} = \{A_1, A_2, A_4, A_5, A_8, A_9, A_{11}, A_{13}, A_{15}, A_{17}, A_{18}, A_{20}, A_{21}, A_{23}, A_{24}, A_{28}, A_{31}, A_{33}, A_{35},$
$\quad A_{37}, A_{39}, A_{41}, A_{43}, A_{45}, A_{48}, A_{51}, A_{52}, A_{53}, A_{54}, A_{55}, A_{57}, A_{59}\}; C_{13k} = 1500 \quad \forall k \in S_{13}$

$S_{23} = \{A_2, A_3, A_5, A_6, A_7, A_{10}, A_{12}, A_{14}, A_{16}, A_{18}, A_{19}, A_{21}, A_{23}, A_{26}, A_{28}, A_{29}, A_{31}, A_{34},$
$\quad A_{36}, A_{38}, A_{40}, A_{42}, A_{44}, A_{46}, A_{49}, A_{53}, A_{54}, A_{58}, A_{60}\}; C_{23k} = 1400 \quad \forall k \in S_{23}$

$S_{14} = \{A_3, A_4, A_8, A_{10}, A_{11}, A_{14}, A_{17}, A_{22}, A_{24}, A_{25}, A_{26}, A_{29}, A_{32}, A_{34}, A_{38}, A_{41}, A_{44}, A_{46},$
$\quad A_{49}, A_{51}, A_{53}, A_{56}, A_{59}\}; C_{14k} = 1300 \quad \forall k \in S_{14}$

$S_{24} = \{A_2, A_4, A_7, A_9, A_{12}, A_{14}, A_{16}, A_{18}, A_{21}, A_{23}, A_{26}, A_{28}, A_{29}, A_{31}, A_{33}, A_{35}, A_{37}, A_{39},$
$\quad A_{42}, A_{45}, A_{47}, A_{49}, A_{52}, A_{54}, A_{56}, A_{59}, A_{60}\}; C_{24k} = 1200 \quad \forall k \in S_{24}$

$S_{34} = \{A_2, A_3, A_5, A_7, A_{10}, A_{13}, A_{15}, A_{17}, A_{19}, A_{22}, A_{25}, A_{26}, A_{29}, A_{32}, A_{33}, A_{36}, A_{38}, A_{40},$
$\quad A_{43}, A_{44}, A_{46}, A_{48}, A_{51}, A_{53}, A_{55}, A_{58}, A_{60}\}; C_{34k} = 1100 \quad \forall k \in S_{34}$

$S_{15} = \{A_1, A_5, A_6, A_8, A_9, A_{11}, A_{12}, A_{16}, A_{18}, A_{20}, A_{22}, A_{23}, A_{25}, A_{27}, A_{30}, A_{34}, A_{35}, A_{39},$
$\quad A_{41}, A_{43}, A_{45}, A_{46}, A_{47}, A_{48}, A_{51}, A_{54}, A_{55}, A_{57}, A_{59}\}; C_{15k} = 1000 \quad \forall k \in S_{15}$

$S_{25} = \{A_2, A_4, A_6, A_8, A_{10}, A_{13}, A_{15}, A_{17}, A_{19}, A_{21}, A_{24}, A_{26}, A_{28}, A_{31}, A_{33}, A_{35}, A_{36}, A_{38},$
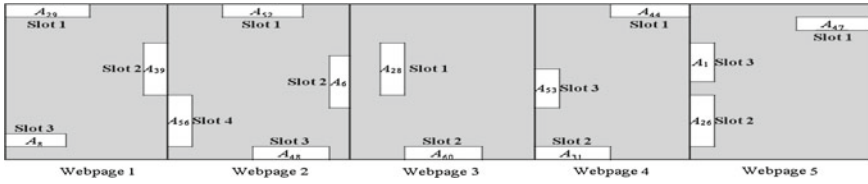
Fig. 2 Display of ads on the news website at time unit $t = 66$

$$A_{40}, A_{42}, A_{44}, A_{46}, A_{47}, A_{49}, A_{50}, A_{53}, A_{56}, A_{58}, A_{59}\}; C_{25k} = 850 \quad \forall k \in S_{25}$$
$$S_{35} = \{A_1, A_3, A_5, A_7, A_9, A_{11}, A_{12}, A_{14}, A_{18}, A_{20}, A_{21}, A_{23}, A_{25}, A_{27}, A_{30}, A_{32}, A_{34}, A_{37},$$
$$A_{39}, A_{41}, A_{43}, A_{45}, A_{48}, A_{50}, A_{52}, A_{54}, A_{57}, A_{59}\}; C_{35k} = 800 \quad \forall k \in S_{35}$$

Although different companies may pay different costs for placing their ads on a particular rectangular slot of a specific webpage but for the sake of simplicity, cost for all the ads competing to be placed on any rectangular slot is taken to be same here. Further, minimum and maximum frequencies of the ads are tabulated in Table 1.

When problem (1) is solved using the above data, we get an infeasible solution and hence it is imperative to use GPA to obtain a compromised solution. Aspiration desired on revenue is taken to be ₹ 40,00,000. The compromised solution obtained after applying GPA is given in Table 2.

The revenue generated by this placement of ads comes out to be ₹ 38,47,200. It can be seen from Table 2 that when users access webpage 3 of news website at 18th hour of day 3 i.e., at $t = 66$, ad A_{60} appears in second slot of that webpage. To give a clear picture of how the ads are actually displayed to the users in accordance with the schedule obtained in Table 2, a pictorial representation of the selected ads on the news website at time unit $t = 66$ is shown in Fig. 2.

Table 1 Frequency table

Ads (A_k)	Min. freq. (w_k)	Max. freq. (W_k)	Ads (A_k)	Min. freq. (w_k)	Max. freq. (W_k)	Ads (A_k)	Min. freq. (w_k)	Max. freq. (W_k)	Ads (A_k)	Min. freq. (w_k)	Max. freq. (W_k)	Ads (A_k)	Min. freq. (w_k)	Max. freq. (W_k)	Ads (A_k)	Min. freq. (w_k)	Max. freq. (W_k)
A_1	6	50	A_{11}	6	68	A_{21}	5	55	A_{31}	5	50	A_{41}	5	50	A_{51}	7	50
A_2	7	62	A_{12}	5	50	A_{22}	6	60	A_{32}	4	48	A_{42}	7	55	A_{52}	5	45
A_3	6	55	A_{13}	4	52	A_{23}	7	55	A_{33}	6	52	A_{43}	6	52	A_{53}	4	44
A_4	5	60	A_{14}	6	50	A_{24}	6	52	A_{34}	5	50	A_{44}	7	60	A_{54}	8	65
A_5	7	60	A_{15}	4	45	A_{25}	7	60	A_{35}	7	62	A_{45}	6	55	A_{55}	5	50
A_6	6	58	A_{16}	5	52	A_{26}	7	55	A_{36}	6	58	A_{46}	8	62	A_{56}	4	48
A_7	5	55	A_{17}	7	68	A_{27}	5	60	A_{37}	6	55	A_{47}	7	58	A_{57}	4	50
A_8	5	60	A_{18}	8	70	A_{28}	7	60	A_{38}	7	60	A_{48}	5	50	A_{58}	3	40
A_9	6	62	A_{19}	6	60	A_{29}	6	55	A_{39}	6	55	A_{49}	6	52	A_{59}	7	56
A_{10}	5	60	A_{20}	4	50	A_{30}	4	52	A_{40}	6	58	A_{50}	5	48	A_{60}	5	60

Table 2 Ads allocated to rectangular slot i of web page j at time unit t

Time slots	Rectangular slots														
	Slot 11	Slot 21	Slot 31	Slot 12	Slot 22	Slot 32	Slot 42	Slot 13	Slot 23	Slot 14	Slot 24	Slot 34	Slot 15	Slot 25	Slot 35
1	A_{59}	A_{26}	A_{12}	A_3	A_{26}	A_{34}	A_{32}	A_{51}	A_{18}	A_{11}	A_{54}	A_{32}	A_{11}	A_{40}	A_{39}
2	A_{33}	A_{39}	A_5	A_{52}	A_{59}	A_{51}	A_{30}	A_{48}	A_{14}	A_{44}	A_{52}	A_{26}	A_9	A_{38}	A_{37}
3	A_{59}	A_{35}	A_1	A_{47}	A_{55}	A_{35}	A_{29}	A_{45}	A_{12}	A_{41}	A_{49}	A_{22}	A_8	A_{36}	A_{34}
4	A_1	A_{49}	A_{59}	A_{44}	A_{51}	A_{17}	A_{27}	A_{43}	A_{10}	A_{38}	A_{14}	A_{15}	A_6	A_{35}	A_{32}
5	A_{59}	A_{16}	A_{55}	A_{41}	A_{48}	A_{12}	A_{25}	A_{41}	A_7	A_{53}	A_{45}	A_{13}	A_5	A_{33}	A_{30}
6	A_{40}	A_{33}	A_{51}	A_{19}	A_{51}	A_6	A_{22}	A_{39}	A_6	A_{49}	A_{39}	A_{10}	A_1	A_{28}	A_{27}
7	A_{29}	A_{24}	A_{47}	A_{35}	A_{41}	A_2	A_{19}	A_{37}	A_5	A_{46}	A_{37}	A_7	A_{16}	A_{26}	A_{11}
8	A_{33}	A_{16}	A_{43}	A_{30}	A_{37}	A_{22}	A_{17}	A_{35}	A_3	A_{49}	A_{35}	A_5	A_{57}	A_{24}	A_{23}
9	A_{18}	A_{26}	A_{40}	A_{25}	A_{33}	A_{17}	A_{16}	A_{33}	A_{42}	A_{38}	A_{33}	A_3	A_{55}	A_{21}	A_{27}
10	A_{43}	A_9	A_{37}	A_{22}	A_3	A_9	A_{14}	A_{31}	A_{38}	A_{29}	A_{31}	A_2	A_{54}	A_{19}	A_{20}
11	A_{25}	A_2	A_{34}	A_{19}	A_{47}	A_{26}	A_{12}	A_{28}	A_{34}	A_{24}	A_{29}	A_{60}	A_{51}	A_{17}	A_{18}
12	A_{57}	A_{50}	A_{29}	A_{13}	A_{39}	A_{58}	A_{10}	A_{39}	A_{29}	A_{17}	A_{28}	A_{58}	A_{48}	A_{15}	A_{14}
13	A_{59}	A_{49}	A_{37}	A_9	A_{29}	A_{48}	A_7	A_{35}	A_{26}	A_{11}	A_{26}	A_{55}	A_{47}	A_{13}	A_{12}
14	A_{40}	A_{47}	A_{31}	A_2	A_{19}	A_{40}	A_6	A_{39}	A_{40}	A_8	A_{56}	A_{53}	A_{46}	A_{10}	A_{11}
15	A_{23}	A_{44}	A_{24}	A_{27}	A_{59}	A_{34}	A_4	A_{31}	A_{34}	A_3	A_{52}	A_{51}	A_{45}	A_8	A_9
16	A_{51}	A_{42}	A_{18}	A_{60}	A_{54}	A_{25}	A_3	A_{21}	A_{28}	A_{59}	A_{52}	A_{55}	A_1	A_6	A_7
17	A_{10}	A_{39}	A_{26}	A_{54}	A_{48}	A_{20}	A_{60}	A_{15}	A_{19}	A_{53}	A_{47}	A_{48}	A_{59}	A_4	A_5
18	A_{44}	A_{37}	A_5	A_{49}	A_{44}	A_{15}	A_{58}	A_{33}	A_{14}	A_{49}	A_{23}	A_{44}	A_{57}	A_2	A_3
19	A_{40}	A_{35}	A_{29}	A_{46}	A_{37}	A_6	A_{56}	A_{31}	A_7	A_{44}	A_{21}	A_{43}	A_{55}	A_{59}	A_{27}
20	A_{54}	A_{60}	A_{55}	A_{43}	A_{29}	A_2	A_{54}	A_{28}	A_2	A_{41}	A_{16}	A_{40}	A_{54}	A_{58}	A_{23}
21	A_{27}	A_{56}	A_{37}	A_{39}	A_{23}	A_{55}	A_{52}	A_{55}	A_{60}	A_{22}	A_{16}	A_{38}	A_{51}	A_{56}	A_{20}
22	A_{57}	A_{52}	A_{34}	A_{36}	A_{21}	A_{46}	A_{50}	A_5	A_{53}	A_{34}	A_{14}	A_{36}	A_{48}	A_{53}	A_{14}
23	A_{18}	A_{49}	A_{29}	A_{32}	A_{21}	A_{38}	A_{48}	A_{51}	A_{44}	A_{32}	A_{12}	A_{33}	A_{47}	A_{50}	A_{11}

(continued)

Table 2 (continued)

Time slots	Rectangular slots														
	Slot 11	Slot 21	Slot 31	Slot 12	Slot 22	Slot 32	Slot 42	Slot 13	Slot 23	Slot 14	Slot 24	Slot 34	Slot 15	Slot 25	Slot 35
24	A_1	A_{22}	A_{40}	A_{27}	A_{18}	A_{30}	A_{47}	A_{45}	A_{40}	A_{29}	A_4	A_{32}	A_{46}	A_{49}	A_7
25	A_{57}	A_{39}	A_{36}	A_{49}	A_{14}	A_{24}	A_{46}	A_{41}	A_{34}	A_{26}	A_2	A_{29}	A_{45}	A_{47}	A_1
26	A_3	A_{33}	A_{51}	A_{21}	A_{14}	A_{18}	A_{45}	A_{37}	A_6	A_{25}	A_{60}	A_{26}	A_{43}	A_{46}	A_{59}
27	A_{43}	A_{28}	A_{50}	A_2	A_{11}	A_{12}	A_{58}	A_{33}	A_{28}	A_{24}	A_{59}	A_{25}	A_{41}	A_{15}	A_{54}
28	A_{57}	A_{24}	A_{40}	A_{54}	A_8	A_{51}	A_{56}	A_{24}	A_{21}	A_{38}	A_{56}	A_{22}	A_{39}	A_{13}	A_{50}
29	A_{36}	A_{16}	A_{31}	A_{49}	A_6	A_{58}	A_{54}	A_{21}	A_2	A_{17}	A_{54}	A_{19}	A_{35}	A_{10}	A_{41}
30	A_{49}	A_{13}	A_{18}	A_{46}	A_4	A_6	A_{52}	A_{18}	A_{60}	A_{14}	A_{52}	A_{17}	A_{34}	A_8	A_{37}
31	A_{46}	A_9	A_8	A_{43}	A_3	A_5	A_{50}	A_{15}	A_{58}	A_{11}	A_{49}	A_{15}	A_{30}	A_6	A_{32}
32	A_{54}	A_4	A_1	A_{39}	A_8	A_2	A_{48}	A_{11}	A_{49}	A_4	A_{47}	A_{10}	A_{27}	A_4	A_{21}
33	A_{46}	A_2	A_{55}	A_{38}	A_4	A_{12}	A_{47}	A_8	A_{44}	A_8	A_{45}	A_7	A_{25}	A_2	A_{21}
34	A_{44}	A_{60}	A_{45}	A_{35}	A_1	A_6	A_{46}	A_4	A_{42}	A_{10}	A_4	A_5	A_{23}	A_{59}	A_{18}
35	A_{43}	A_{57}	A_{42}	A_{32}	A_3	A_{26}	A_{45}	A_{51}	A_{36}	A_3	A_{39}	A_{33}	A_{22}	A_{58}	A_{12}
36	A_{40}	A_{56}	A_{38}	A_{30}	A_{54}	A_{55}	A_{42}	A_{55}	A_{31}	A_{59}	A_{37}	A_2	A_{20}	A_{56}	A_9
37	A_{38}	A_{54}	A_{34}	A_{27}	A_{51}	A_2	A_{40}	A_{52}	A_{28}	A_{56}	A_{35}	A_{60}	A_{18}	A_{53}	A_5
38	A_{44}	A_{52}	A_{17}	A_{25}	A_{59}	A_{40}	A_{37}	A_{43}	A_{23}	A_{53}	A_{33}	A_{58}	A_{16}	A_{50}	A_1
39	A_{36}	A_{50}	A_{26}	A_{24}	A_{55}	A_{35}	A_{36}	A_{37}	A_{18}	A_{51}	A_{31}	A_{55}	A_{12}	A_{49}	A_{59}
40	A_{32}	A_{49}	A_{23}	A_{22}	A_{50}	A_{30}	A_{35}	A_{31}	A_{14}	A_{49}	A_{29}	A_{53}	A_{11}	A_{47}	A_{57}
41	A_{27}	A_{47}	A_{18}	A_{21}	A_{47}	A_{25}	A_{32}	A_{23}	A_{10}	A_{46}	A_{28}	A_{51}	A_9	A_{46}	A_3
42	A_{27}	A_{44}	A_{14}	A_{19}	A_{44}	A_{35}	A_{30}	A_{18}	A_6	A_{44}	A_{26}	A_{58}	A_8	A_{44}	A_{52}
43	A_{25}	A_{42}	A_{10}	A_{17}	A_{41}	A_{28}	A_{29}	A_{13}	A_5	A_{41}	A_{56}	A_{44}	A_6	A_{42}	A_{50}
44	A_{23}	A_{39}	A_5	A_{15}	A_{39}	A_{20}	A_{27}	A_9	A_3	A_{38}	A_{52}	A_{43}	A_5	A_{40}	A_{48}
45	A_{40}	A_{37}	A_2	A_{13}	A_{37}	A_{15}	A_{25}	A_5	A_{54}	A_{34}	A_{47}	A_{40}	A_1	A_{38}	A_{45}
46	A_{36}	A_4	A_{58}	A_{11}	A_{34}	A_6	A_{22}	A_2	A_{49}	A_{32}	A_{42}	A_{38}	A_{59}	A_{36}	A_{43}

(continued)

Table 2 (continued)

Time slots	Rectangular slots														
	Slot 11	Slot 21	Slot 31	Slot 12	Slot 22	Slot 32	Slot 42	Slot 13	Slot 23	Slot 14	Slot 24	Slot 34	Slot 15	Slot 25	Slot 35
47	A_{32}	A_{33}	A_{53}	A_9	A_{33}	A_1	A_{19}	A_{54}	A_{19}	A_{29}	A_{37}	A_{36}	A_{57}	A_{35}	A_{41}
48	A_{27}	A_{31}	A_{50}	A_7	A_{29}	A_{58}	A_{17}	A_{48}	A_{40}	A_{10}	A_{33}	A_3	A_{55}	A_{33}	A_{39}
49	A_{20}	A_{28}	A_{45}	A_5	A_{28}	A_{51}	A_{16}	A_{41}	A_{36}	A_{25}	A_{29}	A_{32}	A_{54}	A_{31}	A_{37}
50	A_{15}	A_{16}	A_{51}	A_3	A_{27}	A_{55}	A_{14}	A_{35}	A_{31}	A_{24}	A_{23}	A_{29}	A_{51}	A_{28}	A_{34}
51	A_{10}	A_{13}	A_{38}	A_{24}	A_{26}	A_{42}	A_{12}	A_{45}	A_{28}	A_{53}	A_{18}	A_{26}	A_{48}	A_{26}	A_{32}
52	A_{51}	A_9	A_{36}	A_{21}	A_{33}	A_{35}	A_{10}	A_{39}	A_2	A_{49}	A_{14}	A_{25}	A_{16}	A_{24}	A_{30}
53	A_{49}	A_6	A_{31}	A_{17}	A_{16}	A_{28}	A_7	A_{33}	A_{21}	A_{44}	A_9	A_{22}	A_{12}	A_{21}	A_{27}
54	A_{54}	A_4	A_{28}	A_{21}	A_{23}	A_{12}	A_6	A_{24}	A_{38}	A_{38}	A_4	A_{19}	A_{11}	A_{19}	A_{25}
55	A_{43}	A_2	A_{50}	A_{11}	A_{19}	A_{22}	A_4	A_{20}	A_{31}	A_{32}	A_2	A_{17}	A_9	A_{17}	A_{50}
56	A_{33}	A_{60}	A_{45}	A_5	A_{16}	A_{18}	A_3	A_{15}	A_{26}	A_{25}	A_{52}	A_{15}	A_8	A_{15}	A_{45}
57	A_{13}	A_{57}	A_{42}	A_{17}	A_{26}	A_{15}	A_{60}	A_9	A_{16}	A_{22}	A_{49}	A_{13}	A_6	A_{13}	A_{41}
58	A_{13}	A_{56}	A_{38}	A_{56}	A_{29}	A_9	A_{58}	A_1	A_{10}	A_{14}	A_{47}	A_{10}	A_5	A_{10}	A_{37}
59	A_3	A_{54}	A_{36}	A_{47}	A_{27}	A_5	A_{56}	A_{59}	A_{54}	A_{10}	A_{45}	A_7	A_1	A_8	A_{32}
60	A_{20}	A_{52}	A_{31}	A_{43}	A_{21}	A_1	A_{54}	A_{54}	A_{49}	A_4	A_{42}	A_5	A_{59}	A_6	A_{27}
61	A_6	A_{50}	A_{28}	A_{38}	A_{18}	A_{58}	A_6	A_{52}	A_{46}	A_{29}	A_{21}	A_3	A_{57}	A_2	A_{21}
62	A_{44}	A_{49}	A_{24}	A_{11}	A_{16}	A_{51}	A_4	A_{48}	A_{40}	A_{56}	A_{26}	A_2	A_{55}	A_{59}	A_{18}
63	A_{40}	A_{47}	A_{18}	A_7	A_{14}	A_{48}	A_3	A_{43}	A_{36}	A_{51}	A_{49}	A_{60}	A_{54}	A_{33}	A_{12}
64	A_{25}	A_{44}	A_{17}	A_2	A_{11}	A_{46}	A_{60}	A_{39}	A_{31}	A_{49}	A_{45}	A_{58}	A_{51}	A_{31}	A_9
65	A_{10}	A_{42}	A_{12}	A_{56}	A_8	A_{42}	A_{58}	A_{33}	A_2	A_{46}	A_{35}	A_{55}	A_{48}	A_{28}	A_5
66	A_{29}	A_{39}	A_8	A_{52}	A_6	A_{48}	A_{56}	A_{28}	A_{60}	A_{44}	A_{31}	A_{53}	A_{47}	A_{26}	A_1
67	A_{46}	A_{37}	A_1	A_{47}	A_4	A_{38}	A_{54}	A_{31}	A_{53}	A_{41}	A_{28}	A_{51}	A_{46}	A_{24}	A_{41}
68	A_{32}	A_{35}	A_{59}	A_{44}	A_3	A_{35}	A_{52}	A_{21}	A_{44}	A_{38}	A_{26}	A_{53}	A_{45}	A_{21}	A_{39}
69	A_{15}	A_{57}	A_{55}	A_{41}	A_8	A_{30}	A_{50}	A_{17}	A_{38}	A_{34}	A_{49}	A_{46}	A_{43}	A_{19}	A_{37}

(continued)

Table 2 (continued)

Time slots	Rectangular slots			Slot 12	Slot 22	Slot 32	Slot 42	Slot 13	Slot 23	Slot 14	Slot 24	Slot 34	Slot 15	Slot 25	Slot 35
	Slot 11	Slot 21	Slot 31												
70	A_1	A_{54}	A_{37}	A_{38}	A_4	A_{40}	A_{48}	A_{11}	A_{29}	A_{32}	A_{45}	A_{44}	A_{41}	A_{17}	A_{34}
71	A_{57}	A_{50}	A_{47}	A_{36}	A_1	A_{22}	A_{47}	A_9	A_{23}	A_4	A_{39}	A_{43}	A_{39}	A_{15}	A_{32}
72	A_3	A_{22}	A_{43}	A_{35}	A_{57}	A_{12}	A_{46}	A_5	A_{18}	A_{26}	A_{33}	A_{40}	A_{35}	A_{13}	A_{30}
73	A_{43}	A_{19}	A_{40}	A_{32}	A_{54}	A_{34}	A_{45}	A_1	A_{12}	A_{59}	A_{29}	A_{38}	A_{34}	A_{10}	A_{27}
74	A_{38}	A_{31}	A_{37}	A_{30}	A_{51}	A_{28}	A_{42}	A_{59}	A_{58}	A_{53}	A_{28}	A_{36}	A_{30}	A_8	A_{25}
75	A_{33}	A_{37}	A_{31}	A_{27}	A_{59}	A_{26}	A_{40}	A_{55}	A_{53}	A_{49}	A_{21}	A_{32}	A_{27}	A_6	A_{50}
76	A_{27}	A_{24}	A_{28}	A_{25}	A_4	A_{55}	A_{37}	A_{53}	A_{46}	A_{44}	A_{14}	A_{29}	A_{25}	A_4	A_{45}
77	A_{23}	A_{26}	A_{24}	A_{24}	A_{50}	A_{48}	A_{36}	A_2	A_{42}	A_{38}	A_{12}	A_{26}	A_{23}	A_2	A_{41}
78	A_{18}	A_{14}	A_{20}	A_{22}	A_{47}	A_{34}	A_{35}	A_{45}	A_{38}	A_{32}	A_4	A_{25}	A_{22}	A_{59}	A_{37}
79	A_{13}	A_{11}	A_{17}	A_{21}	A_{44}	A_{38}	A_{32}	A_{43}	A_{34}	A_{25}	A_2	A_{22}	A_{20}	A_{58}	A_{32}
80	A_6	A_2	A_{12}	A_{19}	A_{41}	A_{34}	A_{30}	A_{41}	A_{29}	A_{22}	A_{59}	A_{19}	A_{18}	A_{56}	A_{27}
81	A_3	A_4	A_8	A_{17}	A_{39}	A_{25}	A_{29}	A_{39}	A_{26}	A_{14}	A_{26}	A_{17}	A_{16}	A_{53}	A_{21}
82	A_{29}	A_6	A_2	A_{15}	A_{37}	A_{24}	A_{27}	A_{37}	A_{60}	A_{10}	A_{52}	A_{13}	A_{12}	A_{50}	A_{18}
83	A_{54}	A_{60}	A_{59}	A_{13}	A_{34}	A_{20}	A_{25}	A_{35}	A_{53}	A_4	A_{49}	A_{10}	A_{11}	A_{49}	A_{12}
84	A_{44}	A_{57}	A_{55}	A_{11}	A_{33}	A_{17}	A_{22}	A_{39}	A_{44}	A_3	A_{47}	A_7	A_9	A_{47}	A_1
85	A_{38}	A_{56}	A_{51}	A_9	A_{29}	A_{12}	A_{19}	A_{37}	A_{23}	A_{56}	A_{45}	A_5	A_8	A_{46}	A_3
86	A_{32}	A_{54}	A_{47}	A_7	A_{28}	A_6	A_{17}	A_{35}	A_{31}	A_{51}	A_{42}	A_3	A_6	A_{44}	A_1
87	A_{23}	A_{52}	A_{43}	A_5	A_{27}	A_2	A_{16}	A_{33}	A_{28}	A_{49}	A_{60}	A_2	A_5	A_{42}	A_{59}
88	A_{15}	A_{39}	A_{40}	A_3	A_{26}	A_6	A_{12}	A_{31}	A_{21}	A_{46}	A_{56}	A_{60}	A_{30}	A_{40}	A_{57}
89	A_8	A_{35}	A_2	A_{22}	A_{29}	A_5	A_{10}	A_{28}	A_{18}	A_{44}	A_{52}	A_{58}	A_{27}	A_{38}	A_{54}
90	A_1	A_{56}	A_{59}	A_{19}	A_{27}	A_1	A_7	A_{24}	A_{14}	A_{41}	A_{16}	A_{55}	A_{25}	A_{36}	A_3
91	A_{59}	A_{52}	A_{55}	A_{15}	A_8	A_{51}	A_6	A_{23}	A_{10}	A_{38}	A_{39}	A_{53}	A_{23}	A_{35}	A_{50}
92	A_{51}	A_{49}	A_{24}	A_{11}	A_{55}	A_{48}	A_4	A_{21}	A_6	A_{34}	A_{35}	A_{51}	A_{22}	A_{33}	A_{48}
93	A_{43}	A_{24}	A_{47}	A_7	A_1	A_{46}	A_3	A_{20}	A_3	A_{32}	A_{31}	A_{48}	A_{20}	A_{31}	A_{45}

(continued)

Table 2 (continued)

Time slots	Rectangular slots														
	Slot 11	Slot 21	Slot 31	Slot 12	Slot 22	Slot 32	Slot 42	Slot 13	Slot 23	Slot 14	Slot 24	Slot 34	Slot 15	Slot 25	Slot 35
94	A_{36}	A_{39}	A_{43}	A_2	A_{57}	A_{42}	A_{60}	A_{51}	A_{42}	A_{51}	A_{28}	A_{46}	A_{18}	A_{26}	A_{43}
95	A_{49}	A_{33}	A_{40}	A_{60}	A_{54}	A_{55}	A_{14}	A_{28}	A_{36}	A_{26}	A_{21}	A_{44}	A_{16}	A_{24}	A_{41}
96	A_{27}	A_{26}	A_{37}	A_{24}	A_{50}	A_{48}	A_{12}	A_{39}	A_{29}	A_{59}	A_{18}	A_{43}	A_{12}	A_{21}	A_{39}
97	A_{25}	A_{24}	A_{34}	A_{21}	A_{47}	A_{40}	A_{10}	A_{31}	A_{21}	A_{25}	A_{16}	A_{40}	A_{11}	A_{19}	A_{37}
98	A_{23}	A_{19}	A_{29}	A_{17}	A_{44}	A_{35}	A_7	A_{20}	A_{16}	A_{24}	A_{14}	A_{38}	A_9	A_{17}	A_{34}
99	A_{43}	A_{14}	A_{26}	A_{13}	A_{39}	A_{30}	A_6	A_{11}	A_{10}	A_{22}	A_{12}	A_{36}	A_8	A_{47}	A_{32}
100	A_{20}	A_{11}	A_{51}	A_9	A_{34}	A_{18}	A_4	A_{57}	A_6	A_{17}	A_9	A_{33}	A_6	A_{46}	A_{30}
101	A_{32}	A_9	A_{45}	A_5	A_{29}	A_{25}	A_3	A_{54}	A_3	A_{14}	A_2	A_{32}	A_5	A_{44}	A_{27}
102	A_{27}	A_6	A_{40}	A_2	A_{27}	A_{26}	A_{60}	A_{52}	A_{31}	A_{11}	A_{37}	A_{29}	A_1	A_{42}	A_{25}
103	A_{20}	A_4	A_{36}	A_{56}	A_{23}	A_{22}	A_{58}	A_{45}	A_{28}	A_{10}	A_{33}	A_{26}	A_{59}	A_{40}	A_{50}
104	A_{15}	A_2	A_{29}	A_{52}	A_{19}	A_{20}	A_{56}	A_{41}	A_{23}	A_8	A_{60}	A_{25}	A_{57}	A_{38}	A_{45}
105	A_{10}	A_{60}	A_{24}	A_{47}	A_{16}	A_{18}	A_{54}	A_{37}	A_{21}	A_4	A_{59}	A_{22}	A_{55}	A_{36}	A_{18}
106	A_6	A_{57}	A_{17}	A_{44}	A_{11}	A_{17}	A_{52}	A_{33}	A_{58}	A_3	A_{56}	A_{19}	A_{54}	A_{35}	A_{11}
107	A_1	A_{56}	A_{10}	A_{41}	A_6	A_{15}	A_{50}	A_{20}	A_{54}	A_{59}	A_{54}	A_{17}	A_{51}	A_{33}	A_5
108	A_{29}	A_{54}	A_1	A_{38}	A_1	A_{12}	A_{48}	A_{23}	A_{53}	A_{56}	A_{52}	A_{15}	A_{48}	A_{31}	A_1
109	A_{57}	A_{52}	A_{59}	A_{36}	A_{59}	A_9	A_{47}	A_{20}	A_{49}	A_{53}	A_{49}	A_{13}	A_{47}	A_{28}	A_{57}
110	A_{54}	A_{50}	A_{53}	A_{35}	A_{55}	A_{15}	A_{46}	A_{17}	A_{46}	A_{51}	A_9	A_{10}	A_{46}	A_{26}	A_{52}
111	A_{51}	A_{49}	A_{47}	A_{32}	A_{51}	A_{12}	A_{45}	A_{13}	A_6	A_{49}	A_{45}	A_7	A_{45}	A_{24}	A_{50}
112	A_{49}	A_{47}	A_{40}	A_{30}	A_{59}	A_9	A_{42}	A_9	A_{26}	A_{46}	A_{42}	A_5	A_{43}	A_{21}	A_{48}
113	A_{49}	A_{44}	A_{36}	A_{27}	A_{55}	A_6	A_{40}	A_5	A_{40}	A_{44}	A_{29}	A_3	A_{41}	A_{19}	A_{45}
114	A_{44}	A_{42}	A_{29}	A_{25}	A_{50}	A_1	A_{37}	A_2	A_{38}	A_{41}	A_{49}	A_2	A_{39}	A_{17}	A_{43}
115	A_{40}	A_{39}	A_{23}	A_{24}	A_{47}	A_{35}	A_{36}	A_{57}	A_{36}	A_{38}	A_{45}	A_{58}	A_{35}	A_{15}	A_{41}
116	A_{36}	A_{37}	A_{26}	A_{22}	A_{44}	A_{30}	A_{35}	A_{53}	A_{34}	A_{34}	A_{37}	A_{55}	A_{34}	A_{13}	A_{39}
117	A_{32}	A_{35}	A_{14}	A_{21}	A_{41}	A_{58}	A_{32}	A_{41}	A_{10}	A_{32}	A_{33}	A_{53}	A_{30}	A_{10}	A_{37}

(continued)

Table 2 (continued)

Time slots	Rectangular slots														
	Slot 11	Slot 21	Slot 31	Slot 12	Slot 22	Slot 32	Slot 42	Slot 13	Slot 23	Slot 14	Slot 24	Slot 34	Slot 15	Slot 25	Slot 35
118	A_{25}	A_{54}	A_{10}	A_{19}	A_{39}	A_{55}	A_{29}	A_{39}	A_{40}	A_3	A_{29}	A_{51}	A_{27}	A_8	A_{34}
119	A_{20}	A_{50}	A_5	A_{17}	A_{37}	A_{25}	A_{27}	A_{37}	A_{36}	A_{46}	A_{26}	A_{53}	A_{25}	A_6	A_{32}
120	A_{15}	A_{24}	A_2	A_{15}	A_{34}	A_{48}	A_{25}	A_{35}	A_{29}	A_{51}	A_{23}	A_{46}	A_{23}	A_2	A_{30}
121	A_8	A_{42}	A_{58}	A_{11}	A_{33}	A_{46}	A_{22}	A_{33}	A_5	A_8	A_{21}	A_{40}	A_{22}	A_{59}	A_{27}
122	A_3	A_{37}	A_{53}	A_{11}	A_{29}	A_{42}	A_{19}	A_{31}	A_{19}	A_{41}	A_{18}	A_{43}	A_{20}	A_{58}	A_{25}
123	A_{36}	A_{31}	A_{18}	A_7	A_{28}	A_{58}	A_{17}	A_{28}	A_{18}	A_{34}	A_{16}	A_{40}	A_{18}	A_{56}	A_{52}
124	A_{27}	A_{26}	A_{14}	A_5	A_{27}	A_{24}	A_{16}	A_{24}	A_{16}	A_{29}	A_{14}	A_{38}	A_{46}	A_{53}	A_{48}
125	A_{20}	A_{22}	A_{10}	A_3	A_{48}	A_{18}	A_{14}	A_{23}	A_{14}	A_{24}	A_{12}	A_{33}	A_{45}	A_{50}	A_{43}
126	A_{13}	A_{39}	A_5	A_{25}	A_{44}	A_{38}	A_{12}	A_{21}	A_{12}	A_{17}	A_9	A_{32}	A_{43}	A_{49}	A_{39}
127	A_6	A_{16}	A_2	A_{22}	A_{37}	A_{34}	A_{10}	A_{20}	A_{10}	A_{11}	A_7	A_{29}	A_{41}	A_{47}	A_{34}
128	A_1	A_{31}	A_{58}	A_{19}	A_{29}	A_{28}	A_7	A_{18}	A_7	A_8	A_4	A_{26}	A_{39}	A_{46}	A_{30}
129	A_{54}	A_{24}	A_{53}	A_{15}	A_{23}	A_{26}	A_{22}	A_{17}	A_6	A_3	A_2	A_{25}	A_{35}	A_{44}	A_{23}
130	A_{46}	A_{19}	A_{50}	A_{39}	A_{18}	A_{51}	A_{19}	A_{15}	A_5	A_{59}	A_{60}	A_{22}	A_{34}	A_{42}	A_{20}
131	A_{40}	A_{14}	A_{45}	A_{36}	A_{11}	A_{46}	A_{17}	A_{13}	A_3	A_{53}	A_{59}	A_{19}	A_{30}	A_{40}	A_{14}
132	A_{33}	A_{11}	A_{42}	A_{32}	A_4	A_{30}	A_{16}	A_{11}	A_{58}	A_{51}	A_{56}	A_{17}	A_{27}	A_{38}	A_{11}
133	A_{25}	A_6	A_{38}	A_{27}	A_1	A_{38}	A_{14}	A_9	A_{53}	A_{49}	A_{54}	A_{15}	A_{25}	A_{36}	A_7
134	A_{20}	A_2	A_{36}	A_{22}	A_{57}	A_{34}	A_{12}	A_8	A_{46}	A_{46}	A_{54}	A_{13}	A_{23}	A_{35}	A_3
135	A_{13}	A_{60}	A_{31}	A_{19}	A_{54}	A_{25}	A_{10}	A_5	A_{42}	A_{44}	A_{52}	A_{10}	A_{22}	A_2	A_5
136	A_1	A_{56}	A_{28}	A_{15}	A_{48}	A_{24}	A_7	A_4	A_{38}	A_{41}	A_{49}	A_7	A_{20}	A_2	A_1
137	A_3	A_{52}	A_{23}	A_{11}	A_{44}	A_{20}	A_6	A_2	A_{14}	A_{38}	A_{47}	A_5	A_{18}	A_2	A_{57}
138	A_{54}	A_{49}	A_{20}	A_7	A_{41}	A_{17}	A_4	A_{17}	A_{12}	A_{34}	A_{45}	A_3	A_{16}	A_2	A_{52}
139	A_{43}	A_{44}	A_{17}	A_2	A_{37}	A_{12}	A_3	A_{13}	A_{10}	A_{32}	A_{42}	A_2	A_{12}	A_2	A_{50}
140	A_{49}	A_{39}	A_{12}	A_{60}	A_{33}	A_6	A_{48}	A_9	A_6	A_{29}	A_{39}	A_{60}	A_{11}	A_2	A_{48}
141	A_{46}	A_{35}	A_8	A_{54}	A_{28}	A_2	A_{58}	A_{53}	A_5	A_{26}	A_{37}	A_{58}	A_9	A_2	A_{45}
142	A_{44}	A_{47}	A_1	A_{49}	A_{26}	A_6	A_{56}	A_1	A_3	A_{59}	A_{35}	A_{55}	A_8	A_2	A_{43}
143	A_{43}	A_{39}	A_{59}	A_{46}	A_{21}	A_1	A_{54}	A_{59}	A_6	A_3	A_{33}	A_{53}	A_6	A_{44}	A_1

(continued)

Table 2 (continued)

Time slots	Rectangular slots														
	Slot 11	Slot 21	Slot 31	Slot 12	Slot 22	Slot 32	Slot 42	Slot 13	Slot 23	Slot 14	Slot 24	Slot 34	Slot 15	Slot 25	Slot 35
144	A_{40}	A_{31}	A_{55}	A_{43}	A_{18}	A_{55}	A_{52}	A_{55}	A_2	A_3	A_{31}	A_{51}	A_5	A_{42}	A_1
145	A_{38}	A_{26}	A_{36}	A_{39}	A_{14}	A_{51}	A_{50}	A_{53}	A_3	A_{26}	A_{29}	A_{48}	A_1	A_{40}	A_9
146	A_{36}	A_{22}	A_{47}	A_{38}	A_8	A_{48}	A_{60}	A_{51}	A_{54}	A_3	A_{28}	A_{46}	A_{59}	A_{38}	A_3
147	A_{33}	A_{16}	A_{43}	A_{36}	A_4	A_{20}	A_{47}	A_2	A_{53}	A_3	A_{26}	A_{44}	A_{57}	A_{36}	A_1
148	A_{32}	A_{13}	A_{38}	A_{35}	A_3	A_{42}	A_{46}	A_{43}	A_{49}	A_3	A_{23}	A_{43}	A_{55}	A_{35}	A_1
149	A_{29}	A_{11}	A_{26}	A_{32}	A_{57}	A_{58}	A_{45}	A_{41}	A_{46}	A_8	A_{21}	A_{40}	A_{54}	A_{33}	A_1
150	A_{57}	A_9	A_{45}	A_{30}	A_{50}	A_1	A_{42}	A_{48}	A_{44}	A_3	A_{18}	A_{38}	A_{51}	A_{31}	A_1
151	A_{51}	A_6	A_{40}	A_{25}	A_{44}	A_{58}	A_{37}	A_{45}	A_{26}	A_{59}	A_{16}	A_{36}	A_{48}	A_{26}	A_1
152	A_{46}	A_4	A_{34}	A_{24}	A_{39}	A_{20}	A_{36}	A_{43}	A_{49}	A_{53}	A_{14}	A_{33}	A_{47}	A_{24}	A_{25}
153	A_1	A_2	A_{28}	A_{22}	A_{33}	A_{34}	A_{35}	A_{41}	A_{44}	A_{49}	A_{12}	A_{32}	A_{46}	A_{21}	A_9
154	A_{32}	A_{60}	A_{23}	A_{21}	A_{28}	A_{24}	A_{32}	A_{39}	A_{40}	A_{44}	A_9	A_{29}	A_{45}	A_{19}	A_{18}
155	A_{43}	A_{57}	A_{17}	A_{19}	A_{34}	A_{55}	A_{30}	A_{37}	A_{36}	A_{38}	A_4	A_{26}	A_{43}	A_{17}	A_{12}
156	A_{36}	A_{56}	A_{10}	A_{17}	A_{27}	A_{42}	A_{29}	A_{35}	A_{31}	A_{32}	A_2	A_{25}	A_{41}	A_{15}	A_9
157	A_{29}	A_{54}	A_{12}	A_{15}	A_{21}	A_{46}	A_{27}	A_{33}	A_{29}	A_{25}	A_{60}	A_{22}	A_{39}	A_{13}	A_5
158	A_{20}	A_{52}	A_{10}	A_{13}	A_{14}	A_{34}	A_{25}	A_{31}	A_{28}	A_{22}	A_{59}	A_{19}	A_{35}	A_{10}	A_1
159	A_{54}	A_{50}	A_5	A_{11}	A_{44}	A_{28}	A_{22}	A_{28}	A_{26}	A_{14}	A_{56}	A_{15}	A_{34}	A_8	A_{57}
160	A_{51}	A_{49}	A_1	A_9	A_{41}	A_{30}	A_{19}	A_{24}	A_{23}	A_{10}	A_{54}	A_{60}	A_{59}	A_6	A_{52}
161	A_{59}	A_{47}	A_{58}	A_7	A_3	A_{24}	A_{17}	A_{23}	A_{21}	A_4	A_{52}	A_{55}	A_{57}	A_4	A_{48}
162	A_{57}	A_{44}	A_{53}	A_5	A_{33}	A_{18}	A_{16}	A_{21}	A_{19}	A_3	A_{49}	A_{53}	A_{55}	A_2	A_{43}
163	A_{10}	A_{42}	A_{50}	A_3	A_{29}	A_{15}	A_{32}	A_{20}	A_{18}	A_{56}	A_{47}	A_{51}	A_{54}	A_{59}	A_{39}
164	A_{36}	A_{35}	A_{45}	A_{49}	A_{28}	A_9	A_{30}	A_{18}	A_{16}	A_{51}	A_{45}	A_{48}	A_{51}	A_{58}	A_{34}
165	A_{13}	A_{33}	A_{42}	A_{46}	A_{27}	A_5	A_{29}	A_{17}	A_{14}	A_{26}	A_{42}	A_{46}	A_{48}	A_{56}	A_{30}
166	A_{23}	A_{31}	A_{38}	A_{43}	A_{26}	A_1	A_{27}	A_{15}	A_{12}	A_{41}	A_{39}	A_{44}	A_{47}	A_{53}	A_{25}
167	A_{15}	A_{28}	A_{34}	A_{38}	A_{48}	A_{55}	A_{25}	A_{13}	A_{10}	A_{34}	A_{37}	A_{43}	A_{46}	A_{50}	A_{32}
168	A_{13}	A_{26}	A_{29}	A_{35}	A_{44}	A_2	A_{22}	A_{11}	A_2	A_{29}	A_{35}	A_{40}	A_{45}	A_{49}	A_{23}

(continued)

4 Conclusion

In this paper, we have formulated a web ad scheduling problem to determine an optimal placement of ads that compete to be placed on rectangular slots in a given planning horizon on the various webpages of a news website in order to maximize the revenue generated from ads. The optimization model is a 0-1 linear programming model and restricts selection of an ad on the same webpage more than once at any instant of time. Problem is programmed on LINGO software to get the optimal solution. In case the problem results in an infeasible solution, goal programming method is used to solve the problem. A case study is presented in the paper to show the application of the problem.

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Contents

Multi Period Advertising Media Selection in a Segmented Market

Sugandha Aggarwal, Arshia Kaul, Anshu Gupta and P. C. Jha

Abstract A product passes through different life cycle phases once it comes in the market. During the launch phase it is promoted on mass level, second phase stresses on capturing maximum potential, and in later phases company emphasizes on retention of the product in the minds of the customers until its continuation in the market. The advertising budget and media mix used to advertise the product must be planned according to the current phase of the product. Thus it becomes imperative for a company to look at media planning problems in a dynamic manner over a planning period as the market conditions change and the product moves through its cycle with time. In this paper we have formulated a multi-period mathematical programming problem that dynamically computes the optimal number of insertions and allocates advertising budget in various media channels of a segmented market. The aim is to maximize the reach obtained through each media from all the segments in each time period under budgetary constraints and bounds on the decision variables. The reach in any period for a media is taken as a sum of current period reach and retention of the previous periods reach. Goal programming technique is used to solve the problem. A case study is presented to show the real life application of the model.

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1 Introduction

Companies allocate a huge percentage of their overall promotional budget on advertising. To efficiently use this budget a well thought media plan is developed. Different media exist in the market from television to websites and their usage changes with time. The selection of media mix depends on a number of factors like, specific objectives of the advertisement campaign, customer profiles of different market segments, market and competitive situation, and the product's stage in its life cycle. In the introductory stage, a large portion of advertising budget is allocated to induce trial. In the growth stage, however, advertising efforts are used primarily to capture maximum market potential. And when a product moves to the maturity stage, advertising is primarily a reminder to keep consumers aware of the product. In the decline stage of its life cycle, most of the advertising support is removed. The selection of media mix in a planning period varies according to the product's life cycle stage in the market. This calls for dynamic media planning.

A successful integrated marketing campaign also looks at to which media their target customers get exposed to, as it affect their decisions to buy the product; accordingly the media mix is selected. Advertising in a media is effective only if a significant number of targeted customers are exposed to that media. The impact of media can also vary in different segments and so is the choice of media mix. Distinct segments of the target population respond differently to different media and each medium plays a distinguishing role in advertising the product. Consider a shoe firm that comes up with a promotional campaign targeting female athletes for its new line of women's athletic shoes. In this case advertising would be targeted to the female athletes. The advertisements will be aired in those slots of television in which majority female athletes are expected to get exposed, or placed in that section of the newspaper which is read by most of the female athletes based on previous research. On the other hand if the marketer is advertising for an energy drink meant for school going children then they will target through children's most preferred channels on television. With an aim to capture maximum market potential, firms often look for maximizing the reach of their advertisements from each media in all the segments of its potential market.

Often marketers build media plans based on prior-period advertising response. Making suitable changes in the media mix according to present market scenario can yield significant increase in product performance. In the light of above considerations it becomes important for companies to study its present target market, consumer behavior towards different media, the stage of product cycle and accordingly select and place its advertising in media categories in different time periods. In this paper we propose a media planning optimization model for a segmented market to determine the optimal number of insertions to be given in different media categories maximizing the reach obtained from each media over the planning horizon. The dynamic nature of the target market is captured by dividing the planning horizon into multiple time periods. At the beginning of each period, the market is analyzed to understand the consumer behavior towards

different media in each segment, the changing advertisement cost, media popularity and its circulation. On the basis of this information, the multi-objective optimization problem is formulated with an objective of maximizing reach for all chosen media from all the segments with constraints on total budget allocated to the time period and lower and upper bound constraints on the number of insertions. The reach objective for each media is taken as a sum of current period reach and the retention factor on previous periods reach. The resultant integer programming problem is solved using goal programming approach with aspirations on reach to be attained from different media. A case study of a health insurance company is provided to illustrate and validate the proposed model.

The paper is organized as follows: Sect. 2 gives a brief review of literature on media planning problems. Section 3 discusses the model development and solution methodology. In Sect. 4, we present a case study to illustrate applicability of the proposed model. Section 5 concludes the paper.

2 Literature Review

In the literature lot of research work has been carried on media planning problems [9]. Charnes et al. [3] introduced a Goal Programming model for media selection to address problems associated with the critical advertising measurement of frequency and reach. A media model to get maximum reach in the press media while minimizing the cost was proposed by Kumar [6]. Moynihan et al. [8] contended that the mathematical requirements of the multi criteria decision making model for media selection force the media planner to create an artificial structuring of the media selection criteria. Balakrishnan and Hall [1] developed a computational procedure to calculate the time between the insertions within a pulse in order to maximize the minimum effectiveness level at any point in time with budget constraint. A mathematical programming model that gives the way a given product should be advertised on television in order to achieve the highest rating under specific restrictions was given by Mihiotis and Tsakiris [7]. Bhattacharya [2] developed a model to decide the number of advertisements in different advertising media and the optimal allocation of the budget assigned to the different media. Jha et al. [5] formulated a media planning problem for allocating the budget in multiple media that are found suitable for the advertising of multiple products considering marketing segmentation aspect of advertising with an objective of maximizing the reach. Royo et al. [10] proposed and analyzed a model to optimize the advertising investment for several products on a planning horizon that enables to compute the optimal advertising budget and its optimal allocation. However, the existing research ignores the dynamism involved in media planning. With the product growth in the market and change in the lifecycle stage of the products, impact of media vehicles and consumer behavior towards them also varies. To yield maximum reach from all chosen media it is important to base the selection of advertisements in various media on the current market conditions and

media performance. In this paper we have proposed a multi-objective programming problem to maximize the reach obtained in each media from all the segments and find the number of insertions to be given in different media by dividing the planning horizon in multiple periods. In the beginning of each time period the market is analyzed on the basis of which media planning is done with an aim to maximize reach from each media in all the segments under budgetary and system constraints.

3 Model Development

3.1 Notations

i Index representing segments ($i = 1,2,…,N$)

j Index representing medium of advertisement ($j = 1,2…,M$)

k_j Media option of jth media ($k_j = 1,2,…K$)

l_j Slot in jth media ($l_j = 1,2,…L$)

r Customer profile criteria under consideration for the potential population

T_q Starting point of qth time period ($q = 1,2,…,D$)

T Length of the total planning horizon

$a_{ijk_jl_jq}$ Reach to the target audience for one advertisement in ith segment, jth medium, k_jth media option, l_jth slot/insertion in qth time period

$C_{ijk_jl_jq}$ Average number of readers/viewers/listeners in ith segment, jth medium, k_jth media option, l_jth slot/insertion in qth time period

$c_{ijk_jl_jq}$ Cost of inserting one advertisement in ith segment, jth medium, k_jth media option, l_jth slot/insertion in qth time period

$v_{ijk_jl_jq}$ Minimum number of advertisements in different positions in ith segment, jth medium, k_jth media option, l_jth slot/insertion in qth time period

$u_{ijk_jl_jq}$ Maximum number of advertisements in different positions in ith segment, jth medium, k_jth media option, l_jth slot/insertion in qth time period

$x_{ijk_jl_jq}$ Decision variable corresponding to number of advertisements in ith segment's jth medium, k_jth media option, l_jth slot/insertion in qth time period

$p_{irjk_jl_jq}$ Percentage of people in ith segment who fall under rth criteria and read/view jth medium, k_jth media option, l_jth slot/insertion in qth time period

$\alpha_{ijk_jl_jq}$ Retention factor of $(q-1)$th period advertisement given in jth medium, k_jth media option, l_jth slot of in qth time period

W_{rj} Weight corresponding to rth criteria and jth medium

A_q Total advertisement budget to be allotted to different media in qth time period.

3.2 Problem Formulation

Firms market their products by means of advertising in various media such as newspaper, television, radio, websites, etc. The advertising media mix varies in different segments of the market in different time periods. Here we divide the total planning horizon T for which advertisement planning is to be carried into D time periods. The model proposed here will enable firms to allocate the total advertising budget A_q, in qth time period to M different media catering to the N market segments such that the reach is maximized from each media. The problem is formulated under the budgetary constraints. Upper bound and lower bound are imposed on number of insertions in each media. In the beginning of each time period the market is analyzed to determine the changing impact of media on segments, advertisement cost, its circulation, retention factor of previous period advertisements, etc. on the basis of which the media planning is done for the sequential time periods of the planning horizon. The model is based on the following assumptions

1. The market for the product is divided into N distinct segments.
2. The planning horizon is divided into multiple periods (say D periods, where qth time period starts at time T_q and ends at T_{q+1}).
3. Medias are independent of each other, thus one media has no impact on others.
4. Consumer behavior of segments is independent of each other and advertising in one segment has no impact on others.
5. At the beginning of the planning horizon, retention factor is zero.
6. For a particular time period, the retention factor is taken as a proportion of reach from previous periods advertising.

The multi-objective optimization model for the qth time period for determining the optimal number of insertions in different media that maximizes the reach obtained from each media from all the segments is formulated as follows

$$
\text{Maximize} \quad Z_q = \begin{bmatrix} Z_{1q} = \sum_{i=1}^{N} \sum_{k_1=1}^{K} \sum_{l_1=1}^{L} a_{i1k_1l_1q}*x_{i1k_1l_1q} \\[2ex] Z_{2q} = \sum_{i=1}^{N} \sum_{k_2=1}^{K} \sum_{l_2=1}^{L} a_{i2k_2l_2q}*x_{i2k_2l_2q} \\[2ex] \vdots \\[2ex] Z_{Mq} = \sum_{i=1}^{N} \sum_{k_M=1}^{K} \sum_{l_M=1}^{L} a_{iMk_Ml_Mq}*x_{iMk_Ml_Mq} \end{bmatrix}
$$

$$\text{subject to} \quad \sum_{i=1}^{N}\sum_{j=1}^{M}\sum_{k_j=1}^{K}\sum_{l_j=1}^{L} c_{ijk_jl_jq} x_{ijk_jl_jq} \leq A_q$$

$$x_{ijk_jl_jq} \leq u_{ijk_jl_jq} \qquad \forall\, i=1,2,;\ j=1,2,\ldots,M;$$
$$k_j=1,2,\ldots,K; l_j=1,2,\ldots,L \qquad \text{(P1)}$$
$$x_{ijk_jl_jq} \geq v_{ijk_jl_jq} \qquad \forall\, i=1,2,;\ j=1,2,\ldots,M;$$
$$k_j=1,2,\ldots,K; l_j=1,2,\ldots,L$$

and $x_{ijk_jl_jq}$ takes integral values

where $a_{ijk_jl_jq} = a_{ijk_jl_jq} + \alpha_{ijk_jl_jq} a_{ijk_jl_jq-1}$ and $a_{ijk_jl_jq} = \left\{ \sum_{r=1}^{R} w_{rj} p_{irjk_jl_jq} \right\} C_{ijk_jl_jq}$

Each objective in the multi-objective function maximizes the total reach in current time period q for a media in all the segments. First constraint ensures that the total amount of budget allocated to the medias in different segments in qth time period does not exceed the total amount of advertising budget available for this period i.e. A_q. Second and third constraint ensures that the number of advertisements in each media does not exceed its upper and lower bounds set by the firm. Last constraint ensures that the decision variable takes integral value for the allocated number of advertisements (can be taken greater than equal to zero when lower bound is not specified).

The multi-objective problem formulated here can be solved either by weighted sum approach where weights are assigned according to the relative importance of media or by assigning priorities to the different objectives, i.e. prioritising the goal for more preferable media and using lexicographic approach. Here we have used weighted sum approach to solve the problem.

Management might also wish to target each media so as to obtain maximum reach from all medias collectively under the limited resources. In such a situation one can fix high aspiration goals for those media. To fix goals/aspirations for the media, optimization model (P1) can be solved considering single objective corresponding to each media under the model constraints at a particular time period, which determines the maximum achievable reach for each media. These reach aspiration are expected to vary in different time periods and will depend on the current marketing conditions. For a particular time period q, once we solve and fix the goal or aspirations Z_{1q}^*, Z_{2q}^*,..., Z_{Mq}^* to be obtained from jth media, the resulting problem can be formulated as follows

$$\text{Maximize } Z_q = \begin{bmatrix} Z_{1q} = \sum_{i=1}^{N}\sum_{k_1=1}^{K}\sum_{l_1=1}^{L} a_{i1k_1l_1q}*x_{i1k_1l_1q} \\ Z_{2q} = \sum_{i=1}^{N}\sum_{k_2=1}^{K}\sum_{l_2=1}^{L} a_{i2k_2l_2q}*x_{i2k_2l_2q} \\ \vdots \\ Z_{Mq} = \sum_{i=1}^{N}\sum_{k_M=1}^{K}\sum_{l_M=1}^{L} a_{iMk_Ml_Mq}*x_{iMk_Ml_Mq} \end{bmatrix}$$

$$\text{subject to } \sum_{i=1}^{N}\sum_{j=1}^{M}\sum_{k_j=1}^{K}\sum_{l_j=1}^{L} c_{ijk_jl_jq}x_{ijk_jl_jq} \le A_q \tag{P2}$$

$$x_{ijk_jl_jq} \le u_{ijk_jl_jq} \quad \forall i = 1, 2, \ldots N; \, j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K; l_j = 1, 2, \ldots, L$$
$$x_{ijk_jl_jq} \ge v_{ijk_jl_jq} \quad \forall i = 1, 2, \ldots N; \, j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K; l_j = 1, 2, \ldots, L$$
$$Z_{jq} \ge Z_{jq}^* \quad \forall j = 1, 2, \ldots, M$$
$$\text{and } x_{ijk_jl_jq} \text{ takes integral values}$$

Since high goal/aspiration of each objective has been incorporated into the constraint set of the original problem (P1), the problem (P2) becomes infeasible due to limitation on budget. The problem (P2) is solved to obtain compromised solution using goal programming approach.

3.3 Solution Methodology: Goal Programming

The goal programming formulation of the optimization model (P2) can be formulated using Appendix A as follows

$$\text{Vector Minimize } g(\eta, \rho, X) = \begin{bmatrix} g_1(\eta, \rho, X) \\ g_2(\eta, \rho, X) \\ . \\ . \\ . \\ g_m(\eta, \rho, X) \end{bmatrix}$$

$$\text{subject to } \sum_{i=1}^{N}\sum_{j=1}^{M}\sum_{k_j=1}^{K}\sum_{l_j=1}^{L} c_{ijk_jl_jq}x_{ijk_jl_jq} + \eta_1 - \rho_1 = A_q$$

$$x_{ijk_jl_jq} + \eta_{ijk_jl_jq} - \rho_{ijk_jl_jq} = u_{ijk_jl_jq} \quad \forall i = 1, 2, \ldots N; \, j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K; l_j = 1, 2, \ldots, L$$

$$x_{ijk_jl_jq} + \eta'_{ijk_jl_jq} - \rho'_{ijk_jl_jq} = v_{ijk_jl_jq} \quad \forall\, i = 1, 2, z \ldots N;\; j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K;\, l_j = 1, 2, \ldots, L$$

$$Z_{jq} + \eta_{jq} - \rho_{jq} = Z^*_{jq} \quad \forall\, j = 1, 2, \ldots, M$$

and $x_{ijk_jl_jq}$ takes integral values

$$\eta_1, \rho_1 \geq 0$$

$$\eta_{ijk_jl_jq}, \rho_{ijk_jl_jq}, \eta'_{ijk_jl_jq}, \rho'_{ijk_jl_jq} \geq 0 \quad \forall\, i = 1, 2, \ldots N;\; j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K;\, l_j = 1, 2, \ldots, L$$

$$\eta_{jq}, \rho_{jq} \geq 0 \quad \forall\, j = 1, 2, \ldots, M$$

(P3)

where η and ρ's are the positive & negative deviation variable of the goals for their respective objective/constraint function.

In weighted sum approach, the rigid constraints are first satisfied by minimizing the deviational variables corresponding to them and then, goals on objective function are incorporated in the second stage. In first stage all rigid constraints are weighted equally and in stage II, the objective is expressed as the weighted sum of the deviational variables to be minimized corresponding to the objective function's goal. When all goals have equal relative importance, weight of each objective can be taken to as one. Here we have assumed differential weights for the reach objectives for different media. The problem (P3) can be solved in two stages as follows

Stage 1

Minimize $\displaystyle \rho_1 + \sum_{i=1}^{N}\sum_{j=1}^{M}\sum_{k_j=1}^{K}\sum_{l_j=1}^{L} \rho_{ijk_jl_jq} + \sum_{i=1}^{N}\sum_{j=1}^{M}\sum_{k_j=1}^{K}\sum_{l_j=1}^{L} \eta'_{ijk_jl_jq}$

subject to $\displaystyle \sum_{i=1}^{N}\sum_{j=1}^{M}\sum_{k_j=1}^{K}\sum_{l_j=1}^{L} c_{ijk_jl_jq} x_{ijk_jl_jq} + \eta_1 - \rho_1 = A_q$

$$x_{ijk_jl_jq} + \eta_{ijk_jl_jq} - \rho_{ijk_jl_jq} = u_{ijk_jl_jq} \quad \forall i = 1, 2, \ldots N;\; j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K;\; l_j = 1, 2, \ldots, L$$

$$x_{ijk_jl_jq} + \eta'_{ijk_jl_jq} - \rho'_{ijk_jl_jq} = v_{ijk_jl_jq} \quad \forall\, i = 1, 2, \ldots N;\; j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K;\; l_j = 1, 2, \ldots, L$$

$$\eta_1, \rho_1 \geq 0$$

$$\eta_{ijk_jl_jq}, \rho_{ijk_jl_jq}, \eta'_{ijk_jl_jq}, \rho'_{ijk_jl_jq} \geq 0 \quad \forall\, i = 1, 2, \ldots N;\, j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K;\, l_j = 1, 2, \ldots, L$$

and $x_{ijk_jl_jq}$ takes integral values

(P4)

Let (η^o, ρ^o, X^o) be the optimal solution of problem (P4), and $g_0(\eta^o, \rho^o, X^o)$ be the corresponding objective function value. The stage 2 formulation assigning weights to the reach objectives is as follows.

Stage 2

Minimize $\lambda^T g(\eta, \rho, X) = \sum_{j=1}^{M} \lambda_{jq} \eta_{jq}$

subject to $\sum_{i=1}^{N} \sum_{j=1}^{M} \sum_{k_j=1}^{K} \sum_{l_j=1}^{L} c_{ijk_jl_jq} x_{ijk_jl_jq} + \eta_1 - \rho_1 = A_q$

$$x_{ijk_jl_jq} + \eta_{ijk_jl_jq} - \rho_{ijk_jl_jq} = u_{ijk_jl_jq} \quad \forall i = 1, 2, \ldots N; j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K; l_j = 1, 2, \ldots, L$$
$$x_{ijk_jl_jq} + \eta'_{ijk_jl_jq} - \rho'_{ijk_jl_jq} = v_{ijk_jl_jq} \quad \forall i = 1, 2, \ldots N; j = 1, 2, \ldots, M;$$
$$k_j = 1, 2, \ldots, K; l_j = 1, 2, \ldots, L \quad \text{(P5)}$$
$$Z_{jq} + \eta_{jq} - \rho_{jq} = Z^*_{jq} \quad \forall j = 1, 2, \ldots, M$$

where $x_{ijk_jl_jg}$ takes integral values

$\eta_1, \rho_1 \geq 0$

$\eta_{ijk_jl_jq}, \rho_{ijk_jl_jq}, \eta'_{ijk_jl_jq}, \rho'_{ijk_jl_jq} \geq 0 \quad \forall i = 1, 2, \ldots N; j = 1, 2, \ldots, M;$
$$k_j = 1, 2, \ldots, K; l_j = 1, 2, \ldots, L$$

$\eta_{jq}, \rho_{jq} \geq 0 \quad \forall j = 1, 2, \ldots, M$

$g_0(\eta, \rho, X) = g_0(\eta^0, \rho^0, X^0)$

where λ_{jq} are weights assigned to jth media in qth time period, $\sum_{j=1}^{M} \lambda_{jq} = 1, \lambda_{jq} \geq 0$.

By Solving (P5) we obtain an efficient solution of model (P3) (Lemma 1, Appendix B). A suitable tradeoff amongst the goals (reach targets) for different media can be obtained at the management satisfaction level and resulting solution will be one of the properly efficient solution for qth period. Importance for the different goals can change for different time periods.

4 Case Study

Application of the proposed model is illustrated here with a case study of an insurance company that wants to advertise its health insurance policy through different newspapers, television and radio channels in four metropolitan cities (treated as segments) of India. Based on popularity and the number of audiences, in each city, two newspapers, three television and radio channels have been chosen. In a single newspaper, we may have different possibilities i.e.

Table 1.1 Solution for Newspaper

City	Channel 1		Channel 2	
	PT	OT	PT	OT
Time period 1				
City 1	20	36	12	24
City 2	18	28	15	34
City 3	15	25	12	28
City 4	18	36	15	30
Time period 2				
City 1	3	33	4	26
City 2	20	30	12	32
City 3	15	28	10	30
City 4	15	34	2	32
Time period 3				
City 1	2	36	2	26
City 2	12	32	12	34
City 3	14	28	2	26
City 4	1	32	2	32
Time period 4				
City 1	1	38	1	26
City 2	20	30	15	36
City 3	18	28	8	24
City 4	1	26	1	32

advertisement on front page (FP), last page and other pages (OP) etc. Similarly, two different time slots (prime time (PT) and other time (OT)) for each of television and radio channels has been decided based on the importance and number of viewers/listeners. The target market is divided in accordance with the income levels of population in three groups: low (R1), middle (R2) and high (R3) level income groups. The advertisement planning horizon (one year) is divided into four sub-periods. In the beginning of each quarter, market is studied to analyze the behavior of population towards different media in each city. Data for circulation of the media options, advertisement cost, percentage profile matrix, retention factor in different media is gathered. The aim is to advertise insurance company's product dynamically over a planning horizon, in different media so as to maximize reach in each media in all segments of target market within its specified constraints.

The total advertising budget is taken to be ₹20 crore which is divided into four time periods as ₹7 crore, ₹5 crore, ₹4 crore, and ₹4 crore respectively. Circulation figures for media are given in Tables 3.1, 4.1 and 5.1 in Appendix C. It is the average number of readers (for Ànewspapers)/viewers (for television)/listeners (for radio). Data for per insertion advertisement cost in different media is given in Tables 3.2, 4.2, and 5.2 of Appendix C. In case of newspaper, advertisement cost

Table 1.2 Solution for Radio

Channel 1		Channel 2		Channel 3	
PT	OT	PT	OT	PT	OT
Time period 1					
65	4	50	10	24	10
68	6	20	6	14	5
72	6	34	10	16	10
48	8	19	8	14	8
Time period 2					
18	6	17	12	22	12
72	4	22	8	35	3
14	5	16	10	19	12
26	6	14	6	16	7
Time period 3					
16	5	18	10	18	8
13	7	22	10	13	4
15	8	12	6	19	12
20	6	14	8	14	7
Time period 4					
12	8	20	15	12	7
9	5	18	12	12	4
19	12	10	5	18	10
16	6	13	7	13	6

Table 1.3 Solution for Television

Channel 1		Channel 2		Channel 3	
PT	OT	PT	OT	PT	OT
Time period 1					
120	68	110	20	90	32
118	54	90	42	80	30
124	52	78	24	90	18
130	65	95	20	75	12
Time period 2					
118	64	112	45	86	28
24	30	94	12	75	14
120	10	38	10	32	15
128	8	100	16	78	10
Time period 3					
124	61	110	40	90	33
108	47	98	12	75	18
127	12	90	8	90	19
118	16	98	21	90	8
Time period 4					
130	65	115	38	88	35
89	47	95	18	80	17
129	16	34	11	40	12
22	8	110	25	85	18

Table 2 Reach obtained from media at different time periods

Media	Time period 1		Time period 2		Time period 3		Time period 4	
	Aspired	Achieved	Aspired	Achieved	Aspired	Achieved	Aspired	Achieved
Newspaper	22501770	22501773	24804830	22556566	27776480	22746647	26964420	23281555
Television	55678550	44786987	43191340	30166631	32056380	18480446	28219430	15792821
Radio	23006180	22917331	14034790	12407175	24127410	23659174	15930720	14097089
Total	101186500	90206091	82030960	65130372	83960270	64886267	71114570	53171465

is per column centimetre for a 100 column cm advertisement, for television and radio it is for 10 second spot. Upper and lower bound on the number of advertisements in various media is given in Tables 3.4, 4.3, and 5.3 of Appendix C. The data for customer profile given in Tables 3.5, 4.5, and 5.5 of Appendix C represents the proportion of people in different criteria (i.e. lower, middle and higher income group) who are reading, viewing or listening the advertisement in the media. These profile matrices are based on a random sample of size 200 across all the cities and time periods. The data for retention factor has been given in Tables 3.3, 4.4, and 5.4 of Appendix C. The assignment of weights for a particular customer profile criteria in a media is based on the expert's judgment which is given in Table 6 of Appendix C. The optimization model (P1) is programmed as a single objective problem to obtain reach aspirations for each media. The optimal values so obtained are then set as aspiration level to be achieved for reach corresponding to each media and problem (P2) is solved. This gives an infeasible solution; Goal Programming technique is used to obtain a compromised solution to the problem. First we solve for stage 1 (P4) with rigid constraints and compute stage one solution and then in stage 2 (P5), the deviational variables that become zero in stage 1 are removed and the deviations corresponding to goals are minimized. Weights are assigned (Table 7, Appendix C) to media on the basis of management decisions considering different tradeoff solutions, consumer response to different media and media effectiveness in the market. This process is repeated for time period 2, 3, and 4. All optimizations models are programmed on LINGO software [11] to obtain optimal solutions. Optimal solution is guaranteed as the proposed optimization model is a convex programming problem. The solution obtained for number of advertisements to be given in different media at different time periods is given in Tables 1.1, 1.2 and 1.3 below.

The reach aspired and achieved from different media in different time periods on solving the problem is displayed in Table 2 below.

In time period 1, it can be seen that the total reach obtained is higher than any other time periods, this is because the highest budget allocated to this period. It matches with the fact that it is the initial stage of the product and the firm wants to advertise at large scale and reach maximum people in this period. In every period, there is a compromise from the aspired reach, except for newspaper media in period 1 and total compromise is increasing from period 1 to 4. Reach obtained through television is highest in all the periods possibly due to the visual impact of television. However compromise percentage for television is also highest in every period and from period 1 to period 4, the percentage by which it is compromised keeps on increasing. Higher cost of insertion is the most possible reason for higher compromise. Lot of further analysis of the case is done by the author but is not discussed here due to limitation on pages of the manuscript.

5 Conclusion

In this paper, we have formulated and solved an optimization model which can be applied for planning and scheduling of appropriate media for the advertisement of a product. The model allocates the advertising efforts to each of the media dynamically in the market segments by dividing the planning horizon into small planning periods. The optimal number of advertisements to be given in media in different time periods changes based on the behaviour of consumer towards the media and the position of the media in the market. The objective is to maximize the total reach which comes from the current period reach and the proportional retention of the previous periods reach in each media. This allows us to capture clearer picture of the market by planning according to the current behaviour of the market. The model is formulated under budget and lower and upper bounds on frequency constraint in each media. The problem is solved using goal programming approach. A case is given to illustrate the applicability of the proposed optimization model. The paper offers a lot of scope for further research such as explicit consideration for multiple products, interaction between the advertising of different products of the firm, and fuzzy environment.

Appendix A

Let $f(X)$ and b be the function and its goal respectively and η and ρ be the over and under achievement (negative and positive deviational) variables then the choice of deviational variable in the goal objective functions which has to be minimized depend upon the following rule:

if $f(X) <= b$, ρ is minimize under the constraints $f(X) + \eta - \rho = b$
if $f(X) >= b$, η is minimized under the constraints $f(X) + \eta - \rho = b$ and
if $f(X) = b$, $\eta + \rho$ is minimized under the constraints $f(X) + \eta - \rho = b$

Appendix B

Definition 1[4]: A solution x^0 is said to be efficient solution if $x^0 \in S$ and there exist no other feasible point x such that $F(x) \geq F(x^0)$ and $F(x) \neq F(x^0)$.

Definition 2[4]: A solution x^0 is said to be a properly efficient solution if it is efficient and if there exist a scalar $M > 0$ such that, for each i, we have $\frac{f_i(x) - f_i(x^0)}{f_j(x^0) - f_j(x)} \leq M$. For some j such that $f_j(x) < f_j(x^0)$ whenever $x \in X$ and $f_i(x) > f_i(x^0)$

Lemma 1: Through definition 1 and 2, optimal solution of the problem (P5) will be properly efficient solution to the problem (P3).

Appendix C

Table 3.1 Circulation in Newspapers ('0000)

City	Newspaper 1	Newspaper 2
Time Period 1		
City 1	56	35
City 2	86	67
City 3	75	49
City 4	89	72
Time Period 2		
City 1	54	36
City 2	86	65
City 3	76	49
City 4	88	74
Time Period 3		
City 1	55	38
City 2	90	65
City 3	76	48
City 4	87	74
Time Period 4		
City 1	57	38
City 2	89	67
City 3	77	45
City 4	84	76

Table 3.2 Advertisement Cost in Newspapers('000)

Newspaper 1		Newspaper 2	
FP	OP	FP	OP
Time Period 1			
55	25	37	20
60	29	52	22
55	28	42	21
62	30	53	29
Time Period 2			
53	22	37	24
62	34	48	18
55	35	42	22
58	25	56	32
Time Period 3			
55	24	40	25
65	35	48	20
55	29	41	21
60	32	57	32
Time Period 4			
56	22	44	28
66	36	45	23
56	30	40	23
58	32	60	34

Table 3.3 Retention Factor in Newspapers (%)

Newspaper 1			Newspaper 2	
FP	OP		FP	OP
Time Period 1				
–	–		–	–
–	–		–	–
–	–		–	–
–	–		–	–
Time Period 2				
8	5		5	4
6	5		3	2
7	6		5	2
8	5		6	3
Time Period 3				
5	7		6	8
7	6		4	4
7	6		6	4
8	7		4	5
Time Period 4				
5	7		4	6
4	8		9	5
9	8		4	4
6	7		3	8

Table 3.4 Upper and Lower Bounds on Advertisement in Newspapers

City	Newspaper 1			Newspaper 2	
	FP	OP		FP	OP
Time Period 1					
City 1	[3,20]	[6,36]		[3,12]	[10,24]
City 2	[3,18]	[8,28]		[3,15]	[10,34]
City 3	[3,15]	[8,25]		[312]	[12,28]
City 4	[3,18]	[12,36		[3,15]	[10,30]
Time Period 2					
City 1	[3,18]	[7,33]		[4,12]	[10,26]
City 2	[2,20]	[6,30]		[2,12]	[12,32]
City 3	[4,15]	[8,28]		[2,10]	[13,30]
City 4	[2,15]	[14,34]		[2,18]	[8,32]
Time Period 3					
City 1	[2,18]	[7,36]		[2,12]	[8,26]
City 2	[1,20]	[5,32]		[3,12]	[12,34]
City 3	[2,15]	[10,28]		[2,10]	[12,26]
City 4	[1,130	[12,32]		[2,16]	[7,32]
Time Period 4					
City 1	[1,20]	[8,38]		[1,12]	[6,26]
City 2	[1,20]	[4,30]		[1,15]	[10,36]
City 3	[1,18]	[8,28]		[1,8]	[10,24]
City 4	[1,10]	[10,26]		[1,19]	[7,32]

Table 3.5 Readership Profile Matrix for Newspapers

Newspaper 1			Newspaper 2		
R1	R2	R3	R1	R2	R3
Time Period 1					
.14	.36	.21	.19	.36	.27
.17	.42	.25	.23	.42	.32
.16	.40	.24	.22	.40	.30
.13	.33	.20	.18	.33	.25
Time Period 2					
.17	.40	.25	.23	.43	.27
.16	.38	.24	.22	.42	.26
.20	.48	.30	.27	.52	.32
.14	.34	.21	.19	.37	.23
Time Period 3					
.21	.49	.33	.28	.51	.39
.19	.44	.29	.25	.45	.35
.19	.44	.30	.25	.46	.35
.16	.36	.24	.20	.38	.29
Time Period 4					
.25	.45	.32	.27	.5	.39
.21	.38	.27	.23	.42	.33
.26	.46	.33	.28	.51	.40
.17	.30	.21	.18	.33	.26

Table 4.1 Average Viewership in Television ('0000)

City	Channel 1		Channel 2		Channel 3	
	PT	OT	PT	OT	PT	OT
Time Period 1						
City 1	160	90	120	92	60	25
City 2	175	85	90	32	134	37
City 3	178	85	87	69	125	79
City 4	98	56	150	78	165	84
Time Period 2						
City 1	140	78	160	67	68	41
City 2	180	89	80	32	120	52
City 3	170	90	101	69	108	73
City 4	88	60	160	79	145	88
Time Period 3						
City 1	142	84	156	78	95	45
City 2	167	75	67	27	125	47
City 3	164	94	120	72	98	48
City 4	100	64	154	72	162	90
Time Period 4						
City 1	134	80	86	56	120	75
City 2	170	90	98	46	140	45
City 3	78	42	145	57	97	54
City 4	85	45	128	67	178	96

Table 4.2 Advertisement Cost in Television('000)

Channel 1		Channel 2		Channel 3	
PT	OT	PT	OT	PT	OT
Time Period 1					
105	50	101	43	65	34
106	48	82	45	100	56
120	56	78	38	110	49
69	34	110	52	115	67
Time Period 2					
90	40	120	30	80	40
115	55	75	40	80	65
120	60	80	38	105	30
56	35	120	55	110	70
Time Period 3					
92	40	118	28	88	41
110	40	70	35	81	52
115	60	100	40	85	30
56	35	115	55	120	70
Time Period 4					
124	60	76	25	98	40
136	67	80	30	110	56
89	52	128	70	100	59
86	45	120	70	142	78

Table 4.3 Upper and Lower bounds on advertisement in Television

City	Channel 1		Channel 2		Channel 3	
	PT	OT	PT	OT	PT	OT
Time Period 1						
City 1	[16,65]	[4,36]	[20,50]	[10,24]	[24,32]	[10,20]
City 2	[12,68]	[6,40]	[20,40]	[6,30]	[14,52]	[5,25]
City 3	[14,72]	[6,50]	[18,48]	[10,25]	[16,60]	[10,30]
City 4	[23,48]	[8,48]	[19,62]	[8,35]	[14,75]	[8,40]
Time Period 2						
City 1	[18,60]	[6,33]	[17,54]	[12,20]	[22,35]	[12,24]
City 2	[12,72]	[4,38]	[22,35]	[8,30]	[15,48]	[3,30]
City 3	[14,68]	[5,52]	[16,50]	[10,25]	[19,58]	[12,26]
City 4	[26,40]	[6,28]	[14,65]	[6,40]	[16,70]	[7,42]
Time Period 3						
City 1	[16,54]	[5,34]	[18,58]	[10,22]	[18,39]	[8,26]
City 2	[13,70]	[7,35]	[22,32]	[10,26]	[13,50]	[4,24]
City 3	[15,65]	[8,54]	[12,58]	[6,30]	[19,50]	[12,24]
City 4	[20,45]	[6,30]	[14,63]	[8,38]	[14,72]	[7,45]
Time Period 4						
City 1	[12,50]	[8,30]	[20,38]	[15,20]	[12,69]	[7,35]
City 2	[9,65]	[5,38]	[18,35]	[12,28]	[12,55]	[4,25]
City 3	[19,35]	[12,24]	[10,66]	[5,35]	[18,50]	[10,25]
City 4	[16,49]	[6,25]	[13,55]	[7,30]	[13,75]	[6,45]

Table 4.4 Retention Factor in Television (%)

Channel 1		Channel 2		Channel 3	
PT	OT	PT	OT	PT	OT
Time Period 1					
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
Time Period 2					
5	5	8	8	3	1
7	4	5	5	5	3
6	4	5	3	6	8
5	3	8	5	7	5
Time Period 3					
4	3	7	4	7	5
9	5	6	3	8	2
5	3	1	4	3	3
5	2	7	3	3	4
Time Period 4					
6	4	4	6	3	4
4	7	5	3	6	8
4	4	6	6	5	6
6	4	5	3	8	5

Table 4.5 Viewership Profile Matrix for Television

City	Channel 1						Channel 2						Channel 3					
	R1		R2		R3		R1		R2		R3		R1		R2		R3	
	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT
Time period 1																		
City 1	0.23	0.05	0.25	0.04	0.30	0.05	0.23	0.08	0.28	0.05	0.20	0.05	0.19	0.07	0.23	0.07	0.21	0.09
City 2	0.18	0.11	0.23	0.09	0.25	0.09	0.22	0.10	0.20	0.09	0.18	0.08	0.20	0.08	0.15	0.11	0.18	0.07
City 3	0.19	0.08	0.27	0.11	0.28	0.03	0.19	0.07	0.25	0.06	0.21	0.06	0.18	0.06	0.16	0.07	0.16	0.06
City 4	0.14	0.06	0.19	0.08	0.26	0.09	0.14	0.05	0.18	0.11	0.18	0.09	0.13	0.04	0.09	0.09	0.18	0.05
Time period 2																		
City 1	0.19	0.09	0.25	0.12	0.18	0.09	0.23	0.03	0.26	0.15	0.16	0.12	0.18	0.06	0.30	0.14	0.19	0.12
City 2	0.23	0.10	0.21	0.14	0.24	0.15	0.23	0.08	0.25	0.07	0.21	0.14	0.22	0.07	0.23	0.15	0.24	0.09
City 3	0.17	0.18	0.19	0.12	0.18	0.13	0.20	0.07	0.27	0.19	0.20	0.12	0.19	0.06	0.20	0.17	0.18	0.13
City 4	0.16	0.14	0.23	0.10	0.21	0.11	0.17	0.06	0.24	0.16	0.23	0.10	0.16	0.05	0.19	0.12	0.22	0.10
Time period 3																		
City 1	0.20	0.09	0.23	0.12	0.24	0.09	0.21	0.07	0.22	0.08	0.26	0.11	0.19	0.06	0.28	0.05	0.27	0.06
City 2	0.26	0.11	0.19	0.05	0.21	0.11	0.27	0.09	0.19	0.06	0.19	0.06	0.25	0.08	0.19	0.09	0.15	0.09
City 3	0.18	0.08	0.25	0.11	0.16	0.08	0.19	0.06	0.25	0.12	0.24	0.05	0.18	0.05	0.15	0.04	0.23	0.11
City 4	0.16	0.07	0.27	0.10	0.11	0.05	0.17	0.03	0.24	0.11	0.21	0.08	0.16	0.03	0.16	0.08	0.22	0.08
Time period 4																		
City 1	0.20	0.09	0.23	0.12	0.27	0.14	0.21	0.07	0.19	0.08	0.26	0.12	0.19	0.06	0.18	0.15	0.18	0.13
City 2	0.26	0.12	0.27	0.16	0.23	0.11	0.27	0.09	0.23	0.09	0.30	0.12	0.25	0.08	0.19	0.12	0.26	0.09
City 3	0.21	0.09	0.21	0.13	0.17	0.14	0.21	0.07	0.15	0.05	0.27	0.13	0.20	0.06	0.14	0.09	0.19	0.08
City 4	0.17	0.08	0.15	0.11	0.25	0.12	0.18	0.06	0.21	0.03	0.23	0.11	0.17	0.05	0.24	0.07	0.23	0.05

Table 5.1 Average no. of listeners in Radio ('0000)

City	Channel 1		Channel 2		Channel 3	
	PT	OT	PT	OT	PT	OT
Time period 1						
City 1	44.7	18.67	28.4	13.7	19.78	9.2
City 2	24	1.8	18	7.8	13.5	7.8
City 3	34.5	15	9.7	5.6	14.5	7.6
City 4	27.8	14.35	11	4.5	13.5	3.4
Time period 2						
City 1	3.5	17.8	30	16	14.5	8
City 2	19	9	26	10	9.5	5.7
City 3	25	10	13.5	6.7	22.1	12
City 4	23.45	13.8	16.58	8.9	15.9	7.8
Time period 3						
City 1	38.5	14	19	9.8	29	11
City 2	17	7.2	24	9	14	6.7
City 3	28	1.5	21	8.5	13	5.8
City 4	17	8.79	19	8.7	22	11
Time period 4						
City 1	37.5	14	25	9	28	12
City 2	15	7.2	21	8	17	8.5
City 3	29	11	23	8.5	12	5.6
City 4	24.85	9	21	8.6	19	7.6

Table 5.2 Advertisement cost in Radio('00)

Channel 1		Channel 2		Channel 3	
PT	OT	PT	OT	PT	OT
Time period 1					
95	32	57	25	43	21
78	21	50	19	41	20
97	35	45	15.5	68	26.7
80	28.9	55	24.5	65	26
Time period 2					
87	27.6	63	32	38	18.9
64.2	19	64	22.5	35.5	18.6
86	31	54	18	75	30
74	22	64	32.4	62	28
Time period 3					
89	22	35	12	65	19.8
54.2	13	71	30	42	20
96	33	72	22	58	18
58.9	17.8	69	31	74	34
Time period 4					
87	25	54	12.5	60	22
32.5	1.5	67	28.9	50	22
92	30	72.5	25.8	42	17.5
86	25.6	62	20	48	15.5

Table 5.3 Upper and Lower Bounds on Advertisement in Radio

City	Channel 1		Channel 2		Channel 3	
	PT	OT	PT	OT	PT	OT
Time period 1						
City 1	[15,120]	[6,68]	[34,110]	[13,40]	[48,90]	[25,32]
City 2	[18,118]	[15,54]	[40,90]	[17,42]	[48,80]	[12,30]
City 3	[22,124]	[8,52]	[45,78]	[12,24]	[36,90]	[18,32]
City 4	[23,130]	[6,65]	[40,95]	[20,34]	[30,75]	[12,28]
Time period 2						
City 1	[12,118]	[8,64]	[32,112]	[10,45]	[52,86]	[28,28]
City 2	[22,114]	[18,52]	[36,94]	[12,46]	[52,75]	[14,26]
City 3	[26,120]	[10,48]	[38,82]	[10,26]	[32,94]	[15,34]
City 4	[24,128]	[8,68]	[38,100]	[16,36]	[32,78]	[10,30]
Time period 3						
City 1	[10,124]	[12,61]	[36,110]	[14,40]	[50,90]	[25,33]
City 2	[24,108]	[20,47]	[34,98]	[12,42]	[51,75]	[18,30]
City 3	[25,127]	[12,52]	[34,90]	[8,32]	[36,90]	[19,30]
City 4	[28,118]	[13,62]	[36,98]	[20,42]	[30,90]	[8,36]
Time period 4						
City 1	[12,130]	[8,65]	[30,115]	[12,38]	[52,88]	[23,35]
City 2	[32,89]	[24,47]	[36,95]	[18,40]	[42,80]	[17,34]
City 3	[28,129]	[16,55]	[34,95]	[11,32]	[36,85]	[22,28]
City 4	[22,120]	[8,59]	[37,110]	[25,40]	[32,85]	[18,45]

Table 5.4 Retention Factor in Radio (%)

Channel 1		Channel 2		Channel 3	
PT	OT	PT	OT	PT	OT
Time period 1					
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
Time period 2					
7	6	5	4	3	3
7	2	8	5	4	2
8	4	4	3	6	8
8	4	5	2	4	5
Time period 3					
9	6	6	4	7	6
7	5	8	6	4	2
8	5	5	3	4	3
9	6	8	4	8	4
Time period 4					
8	5	4	4	7	6
6	6	8	4	5	2
8	4	6	2	6	1
7	6	6	3	5	3

Table 5.5 Listenership Profile Matrix for Radio

City	Channel 1						Channel 2						Channel 3					
	R1		R2		R3		R1		R2		R3		R1		R2		R3	
	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT	PT	OT
Time period 1																		
City 1	.24	.08	.1	.07	.18	.03	.29	.07	.27	.02	.18	.03	.23	.05	.19	.14	.25	.10
City 2	.14	.07	.15	.04	.17	.05	.14	.11	.18	.10	.14	.04	.22	.14	.29	.11	.17	.09
City 3	.17	.10	.3	.06	.24	.07	.21	.10	.25	.09	.27	.12	.14	.10	.09	.02	.18	.07
City 4	.22	.05	.26	.10	.16	.10	.28	.06	.11	.06	.12	.03	.19	.05	.16	.12	.22	.10
Time period 2																		
City 1	.1	.08	.13	.07	.13	.09	.16	.06	.09	.08	.12	.07	.09	.06	.08	.07	.12	.09
City 2	.06	.05	.08	.07	.1	.05	.11	.06	.13	.05	.16	.06	.07	.05	.13	.03	.09	.04
City 3	.07	.045	.1	.035	.1	.05	.07	.04	.11	.03	.1	.05	.045	.03	.05	.035	.06	.04
City 4	.15	.04	.11	.036	.18	.04	.09	.03	.15	.028	.056	.032	.14	.028	.11	.02	.11	.04
Time period 3																		
City 1	.25	.03	.29	.10	.17	.04	.25	.04	.26	.10	.25	.03	.22	.03	.17	.12	.19	.08
City 2	.15	.12	.21	.13	.18	.08	.26	.04	.16	.04	.3	.06	.24	.03	.27	.08	.26	.05
City 3	.18	.05	.16	.05	.23	.09	.18	.12	.28	.07	.22	.02	.28	.10	.15	.05	.28	.13
City 4	.23	.02	.12	.08	.13	.06	.25	.10	.14	.12	.14	.03	.11	.08	.11	.02	.29	.05
Time period 4																		
City 1	.2	.07	.14	.06	.12	.07	.08	.07	.07	.06	.2	.08	.1	.07	.11	.06	.2	.1
City 2	.09	.06	.09	.02	.2	.06	.15	.08	.09	.08	.16	.06	.07	.07	.16	.04	.09	.04
City 3	.08	.05	.13	.04	.12	.02	.08	.05	.05	.04	.09	.06	.16	.03	.05	.05	.11	.04
City 4	.06	.03	.09	.04	.09	.04	.16	.04	.14	.028	.19	.03	.04	.032	.15	.03	.15	.02

Table 6 Weights assigned for customer profile criteria

	R1	R2	R3
Newspaper	0.03	0.15	0.12
Television	0.04	0.16	0.11
Radio	0.07	0.2	0.12

Table 7 Weights assigned to media in stage 2 of Goal Programming in different time periods

	Time period 1	Time period 2	Time period 3	Time period 4
Newspaper	0.38	0.30	0.30	0.32
Television	0.32	0.35	0.4	0.31
Radio	0.30	0.35	0.30	0.37

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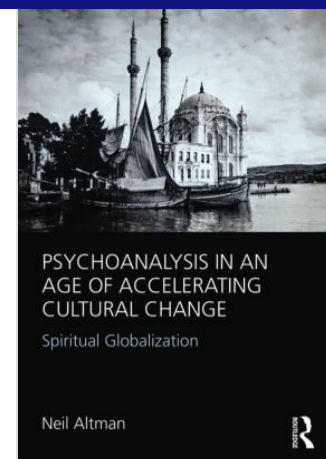
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Description

Psychoanalysis in an Age of Accelerating Cultural Change: Spiritual Globalization addresses the current status of mental health work in the public and private sectors. The careful, thorough, approach to the individual person characteristic of psychoanalysis is mostly the province of an affluent few. Meanwhile, community-based mental health treatment, given shrinking budgets, tends to emphasize medication and short-term therapies. In an increasingly diverse society, considerations of culture in mental health treatment are given short shrift, despite obligatory nods to cultural competence.

The field of mental health has suffered from the mutual isolation of psychoanalysis, community-based clinical work, and cultural studies. Here, Neil Altman shows how these areas of study and practice require and enrich each other - the field of psychoanalysis benefits by engaging marginalized communities; community-based clinical work benefits from psychoanalytic concepts, while all forms of clinical work

benefit from awareness of culture.   Including reports of clinical experiences and programmatic developments from around the world, its international scope explores the operation of culture and cultural differences in conceptions of mental health.   In addition the book addresses the origin and treatment of mental illness, from notions of spirit possession treated by shamans, to conceptions of psychic trauma, to biological understandings and pharmacological treatments.   In the background of this discussion is globalization, the impact of which is tracked in terms of its psychological effects on people, as well as on the resources and programs available to provide psychological care around the world.

As a unique examination of current mental health work, this book will appeal to psychoanalysts, psychotherapists, community-based mental health workers,   and students in Cultural Studies.

Neil Altman is a psychoanalytic psychologist, Visiting Professor at Ambedkar University of Delhi, India, and faculty and supervisor at the William Alanson White Institute.   He is an Honorary Member of the William Alanson White Society and Editor Emeritus of *Psychoanalytic Dialogues*. Author of The Analyst in the Inner City: Race, Class, and Culture through a Psychoanalytic Lens (Routledge, 2nd edition, 2010)

Reviews

"Altman's book will help clinicians free themselves up to deal with the practicalities of situations… all practitioners interested In the transformation of health care systems will be informed by this book and find it enjoyable reading." **– Rebecca C. Curtis, *PSycCRITQUES***

Some might think that psychoanalysis has become an elitist activity – only available to the financially privileged, cut off from the pressing concerns of the majority of those needing help. Neil Altman is a psychoanalyst who would agree…. If any counsellor or psychotherapist is tempted to think that, because 'psychoanalysis' is not their field, they can dissociate themselves from Altman's critique, they are mistaken. This is a book for all of us.- **Chris Rose**, psychotherapist, in *Therapy Today*

Neil Altman's *Psychoanalysis in an Age of Accelerating Cultural Change* is a must read for all students of the mental health field, psychologists, social workers, psychotherapists, psychoanalysts, mental health professionals, and to anyone in interested in the current state and radical transformation of our health care system.   Altman has been a pioneer in exploring and teaching a generation of psychotherapists how to utilize the insights of psychoanalysis for populations who have not heretofore received its benefits, those in our inner cities, the poor, and racial and cultural minorities.   In his new book he pushes his teachings further, bringing into the conversation his expertise in psychotherapy and psychoanalysis, community-based clinical work, cultural studies, all informed by his important critique of globalization and free market capitalism.   Freud and others have called for psychoanalysis to be a "psychotherapy for the people," Altman shows us how to get there and inspires us to make it come true. - **Lewis Aron,** Ph.D. is the director of the New York University Postdoctoral Program in Psychotherapy & Psychoanalysis.

Altman's book opens our minds to the new cultural and social scenario marked by globalization where mental health professionals work and live today. His deep knowledge of cultural differences and their impact on our lives is now contextualized from his experience both in clinical and community settings. Contemporary psychoanalysis is not only a matter of office based practice, but has opened to the community, and as he says, needs to be practiced there if it is to survive with much social relevance, overcomig its roots in elitism and isolation. Facing a present focus on 'evidence based treatments', Altman gives us the opportunity to consider the many proposals and the most influential evidence, cultural and social, where professionals need to learn about opportunities that their countertransference offers in a culture-based practice. – Prof. Alejandro Ávila, PhD, Complutense University, Madrid Training member and honorary president of the Institute of Relational Psychotherapy and chair of IARPP's Spanish chapter

Neil Altman's words flow with ease and grace as the book acquires a vibrancy nourished by real life illustrations of an involved psychoanalyst. The distinction of this extremely important and timely work lies in its ability to make us sit up and question the social injustice which inheres in the practice of mental health including that of psychoanalysis, psychiatry and all modern visions of managed cure. By invoking the need for community work and a reflexive cultural sensitivity, he urges his colleagues to attend to the emotional needs of those relegated to invisible social peripheries. In times of rising capitalism and increasing globalisation, Neil Altman thus speaks to us from the depths of an awakened conscience and emerges as a unique voice, committed to humanising an engaged and relational psychotherapeutic-psychoanalytical approach. – Honey Oberoi Vahali, Dean, School of Human Studies and Director, Centre of Psychotherapy and Clinical Research, Ambedkar University Delhi, India

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About the Author

Neil Altman is a psychoanalytic psychologist, Visiting Professor at Ambedkar University of Delhi, India, and faculty and supervisor at the William Alanson White Institute. He is an Honorary Member of the William Alanson White Society and Editor Emeritus of *Psychoanalytic Dialogues*. Dr. Altman is also the author of *The Analyst in the Inner City: Race, Class, and Culture through a Psychoanalytic Lens,* Second Edition, published by Routledge in 2009.

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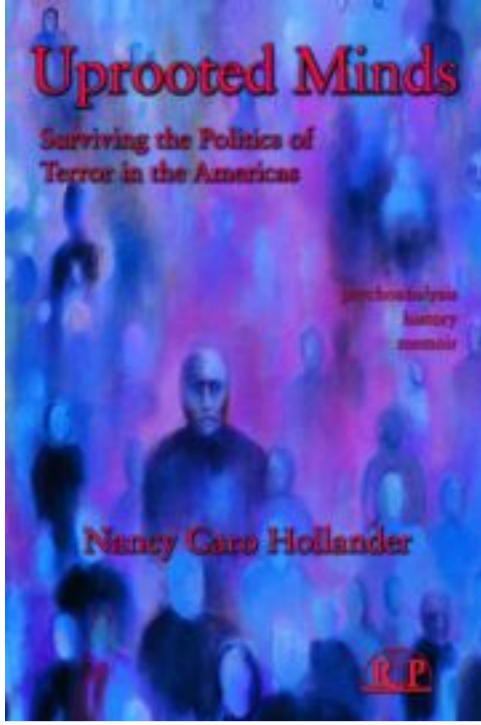
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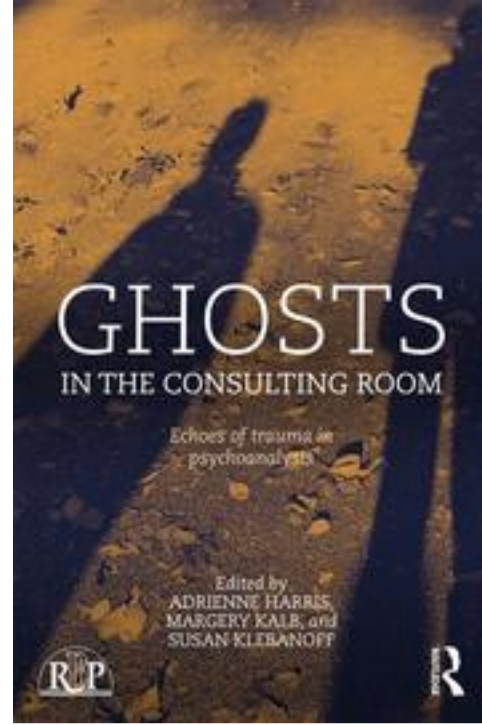
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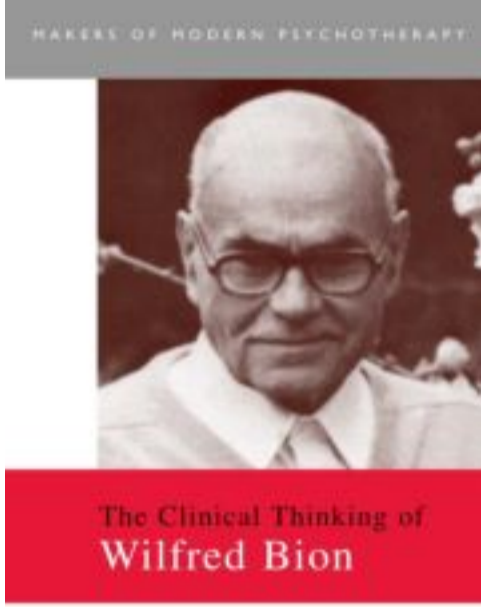
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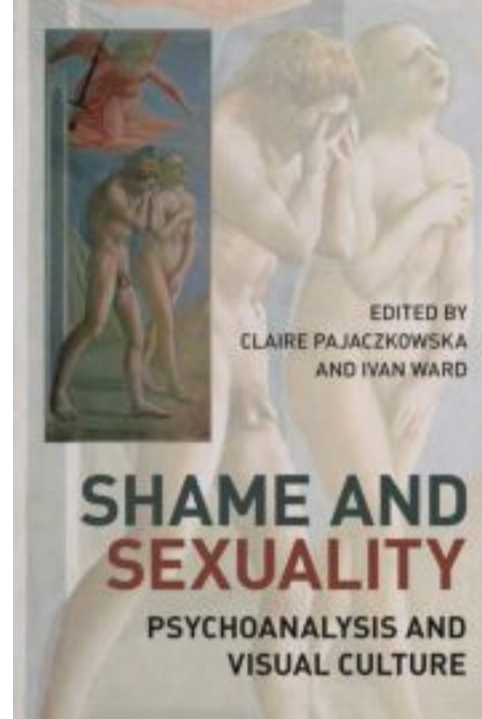
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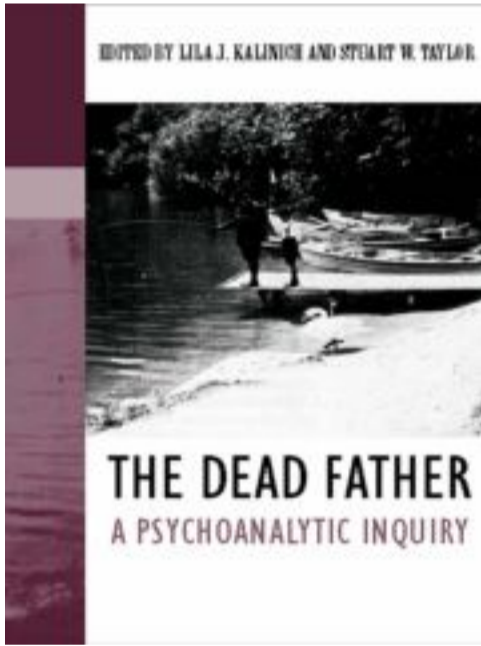
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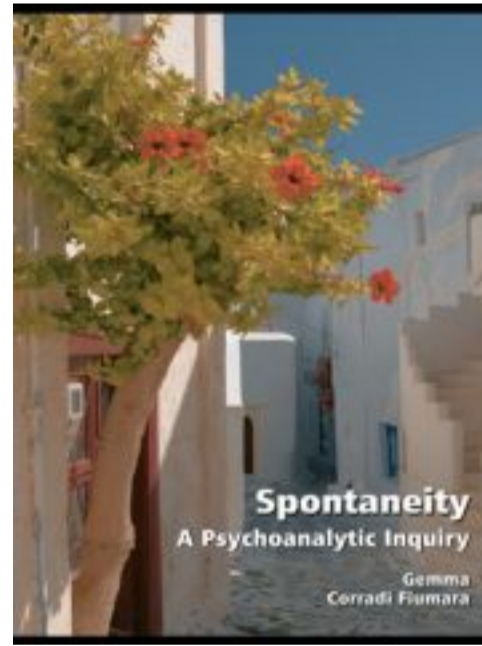
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Contents

PART II
CHOICE AND VALUES

Characterisation of a Second-Best Rationalisable Choice Function with General Domain

Taposik Banerjee*

Choices made from alternatives that one faces in different situations, when described in the form of a function, provides us with a choice function. A choice function, therefore is essentially a description of observed choices. There is nothing inherent in such a description to confirm that the choices made are consistent with the behaviour that one may expect from a rational individual. Such consistency, however, is a matter of great importance to economists and philosophers as it is considered as the hallmark of a rational individual. Several axioms have been proposed in the literature of choice theory to ensure this consistency of a choice function.[1] These axioms (popularly known as *internal consistency conditions*), if satisfied by a choice function, assure us that the choices made are somewhat consistent or reasonable. The reasonableness that we are talking about here, however, is linked with the concept of rationality.

Rationality has been commonly described in the theory of individual choice or social choice as a quality of an individual that enables her to construct a ranking over alternatives she faces, so that she can choose the best one among them. It is assumed that the ranking is constructed only after taking into account all relevant considerations that may affect her choice behaviour. It is understood that with such a ranking at her disposal choosing the best element serves her interest best.

The axioms of *internal consistency* that we were talking about earlier have been designed in order to ensure that the chosen elements are all best elements. Satisfaction of those conditions ensures that the

[1] See Arrow (1959), Blair et al. (1976), Plott (1973), Richter (1966), Suzumura (1977) and Uzawa (1956).

choice function is *rationalisable*, that is, such choices could be realised by choosing the best elements according to some ordering. So one may say that a rationalisable choice function represents choices that could be made by a rational individual. But what if the choice function is not rationalisable? In other words, is it necessary that choices that are not realised by choosing best elements are inconsistent and can only be made by an irrational person? The answer could be given suitably by the classic example provided by Amartya Sen (1993) where he considers the following choices:

$$C(\{x, y\}) = \{x\}$$
$$C(\{x, y, z\}) = \{y\}$$

Alternative x was chosen when y was available, whereas y was chosen when both x and z were available. Clearly the chosen elements cannot be best elements. Yet the choices are not inconsistent. Such choices would be realised if a person with preferences $zPyPx$ chooses second-best elements from the sets of alternatives. This phenomenon of choosing a second-best alternative is not unintelligible either. We would like to go back to Sen's example once again. A person who would otherwise love to have the largest piece of cake (assuming that preferences over cake pieces are determined by their size; larger the size more preferred it is) from the tray may decide not to choose the largest one and instead choose the second largest one if she does not want to be considered as greedy by others (Sen 1993). Choosing the second-best element here clearly is a purposive behaviour and by no means irrational.

The internal consistency conditions that only allow for best elements in the choice set would recommend the choice behaviour (in Sen's example) that we just described earlier as inconsistent. They would do so because in their design it was implicity assumed that choosing a second-best element is not a rational action. As a result, a whole class of purposive behaviour has been classified as irrational behaviour. The existing internal consistency conditions that are popularly used in the social choice theory to assess a choice function, therefore, turn out to be insufficient to analyse several choice patterns. Motivated by the example provided by Sen (1993), this essay makes a modest effort to address this limitation. It would be proper to mention here that some research has already been done to overcome these limitations. Baigent and Gaertner (1996) have characterised a choice function where an individual chooses a second-best element in case there is a unique best element in the set. Gaertner and Xu (1999) have characterised choice functions

where chosen elements are median elements from a preference ranking. This essay would like to characterise choice behaviours where an individual chooses a second-best element when available; otherwise, she chooses a best element. A choice function that describes such choices will be called a second-best rationalisable (alternatively 2-rationalisable) choice function. We are not imposing any restriction on the domain of the choice function which means our choice function may have any non-empty collection of non-empty subsets as its domain. We would call it a choice function with general domain. In the next section, some general definitions and notation have been introduced which are to be used in the essay. Third section describes the characterisation results.

NOTATION AND DEFINITIONS

Let X be the non-empty finite universal set of alternatives. We denote the *power set* of X (that is, the set of all subsets of X) by 2^X. Let Σ be the set of all non-empty subsets of X, that is, $\Sigma = 2^X - \{\emptyset\}$.

A *choice function* is defined as a function, $C : D \mapsto \Sigma$ such that $C(A) \subseteq A$ for all $A \in D$, where $\emptyset \neq D \subseteq \Sigma$. In other words, to every set A belonging to the domain D, which is a non-empty collection of non-empty subsets of X, we assign a set $C(A)$, which is a subset of A itself. $C(A)$ is called the *choice set* of the set A.

For any binary relation R defined over a set S, the asymmetric and symmetric parts of R, designated by P and I respectively are defined as

$$(\forall x, y \in S)[[xPy \leftrightarrow xRy \wedge \sim yRx] \wedge [xIy \leftrightarrow xRy \wedge yRx]].$$

A binary relation R is said to be an *ordering* if and only if it is reflexive, connected and transitive. A binary relation R is said to be a *quasi-ordering* if and only if it is reflexive and transitive.

For any two binary relations R_1 and R_2 on X, a *composition* thereof is defined by

$$R_1 R_2 = \{(x, y) \in X \times X \mid \exists z \in X : (x, z) \in R_1 \wedge (z, y) \in R_2\}.$$

For any binary relation R, we define the following infinite sequence of binary relations:

$$R^1 = R, R^2 = RR, R^3 = RR^2, ..., R^t = RR^{t-1}; \ t \in N - \{1\}$$

Let $T(R) = \bigcup_{n \in N} R^n$. $T(R)$ is said to be the *transitive closure* of R.

A binary relation R on X is *T-consistent* iff,

$$(\forall x, y \in X)[(x, y) \in T(R) \ \rightarrow \ (x, y) \in R \ \vee \ (y, x) \notin R].$$

Aq:iff of if?

Let R_1 and R_2 be two binary relations defined over a set S. R_2 will be called an extension of R_1 iff,

$$[R_1 \subseteq R_2 \wedge P(R_1) \subseteq P(R_2)].$$

Let R be a binary relation defined over a set S. An element $x \in S$ is said to be a *best element* (or *first-best element*) in S with respect to R if and only if, $(\forall y \in S)(xRy)$. Let the set of all such best elements in S be $G_1(S, R)$.

We define that an element $x \in S - G_1(S, R)$ is a *second-best element* in S with respect to R if and only if, $(\forall y \in S - G_1(S, R))(xRy)$. We may say that once we remove all best elements from a set, a second-best element would be a best element of the reduced set. Let the set of all such second-best elements in S be $G_2(S, R)$.

A binary relation R is said to be a *2-rationalisation* (second-best element rationalisation) of a choice function C if and only if

$$\begin{aligned} C(S) &= G_2(S, R) && \text{if } G_2(S, R) \neq \emptyset \\ &= G_1(S, R) && \text{if } G_2(S, R) = \emptyset \end{aligned}$$

for all $S \in D$. Simply put, the chosen elements are the second-best elements of a set. If a second-best element is not available, then best elements are chosen.

NECESSARY AND SUFFICIENT CONDITION FOR A CHOICE FUNCTION TO BE 2-RATIONALISABLE BY AN ORDERING

We define a set λ such that,
$$\lambda = \{S \in D \mid C(S) \neq S\}.$$

For every set in λ choice set is a proper subset of the original set. So in every set in λ there is at least one element which does not belong to the choice set. Intuitively, we can say that if the choice function is 2-rationalisable, then these should be the sets which have a second-best element.

We now define a function,

$$f : \lambda \mapsto 2^X - \{\emptyset\}$$

such that,

$$\text{for all } S \in \lambda, f(S) \subset S \wedge f(S) \cap C(S) = \emptyset.$$

The idea behind the function f is simple and intuitive. If λ is the collection of sets with second-best elements, then for any set S in λ, we would like to see $f(S)$ as the collection of best elements in S.

We define the following sets:

$$A_1 = \{(x, y) \mid (\exists S \in \lambda)(x \in f(S) \land y \in C(S))\}$$
$$A_2 = \{(x, y) \mid (\exists S \in \lambda)(x \in C(S) \land y \in S - (C(S) \cup f(S)))\}$$
$$A_3 = \{(x, y) \mid (\exists S \in D)(x, y \in C(S))\}$$
$$A_4 = \{(x, y) \mid (\exists S \in \lambda)(x, y \in f(S))\}$$

Given the interpretation of $f(S)$, it is clear that for any (x, y) that belongs to either A_1 or A_2, we need x to be strictly preferred to y. However, if (x, y) belongs to either A_3 or A_4, then we need x to be indifferent to y.

Let $A = A_1 \cup A_2 \cup A_3 \cup A_4$. Clearly A is a binary relation over X. We introduce two conditions here:

$$\textit{Condition 1}\colon (x, y) \in A_1 \rightarrow (y, x) \notin T(A)$$
$$\textit{Condition 2}\colon (x, y) \in A_2 \rightarrow (y, x) \notin T(A)$$

where $T(A)$ is the transitive closure of A. Condition 1 and Condition 2 ensure T-consistency of the binary relation A. It is known that a T-consistent binary relation will necessarily have a reflexive, connected and transitive extension.[2] Next we would look for such an ordering extension of A.

Clearly with these two conditions satisfied, $P(A) = A_1 \cup A_2$.

Let, $\Delta_X = \{(x, x) | x \in X\}$.

We define a binary relation $\overline{Q}$ such that, $\overline{Q} = \Delta_X \cup T(A)$.

It can be easily verified that $\overline{Q}$ is a quasi-ordering (that is, reflexive and transitive). Let R be an ordering extension of $\overline{Q}$.

Claim 1. $\overline{Q}$ *is an extension of* A.

Proof: It is straight forward that $(x, y) \in A$ implies $(x, y) \in \overline{Q}$. Suppose $(x, y) \in P(A)$.

$$(x, y) \in P(A) \rightarrow (x, y) \in A_1 \lor (x, y) \in A_2$$
$$\rightarrow (y, x) \notin T(A)$$
$$\rightarrow (x, y) \in P[T(A)]$$
$$\rightarrow (x, y) \in P(\overline{Q})$$

Hence, $\overline{Q}$ is an extension of A.

Therefore, R is an ordering extension of A.

---

[2] See Jain (2007) and Suzumura (1983).

Axiom E: *There exists a function $f : \lambda \mapsto 2^X - \{\emptyset\}$ satisfying conditions 1 and 2.*

Theorem 1. *There exists an ordering R which 2-rationalises the choice function C iff it satisfies axiom E.*

Proof: Suppose a choice function C satisfies axiom E. If $\lambda = \emptyset$, then for all $S \in D$, we have $C(S) = S$. In that case $R = X^2$ is a 2-rationalisation.

Now let $\lambda \neq \emptyset$.

Case 1. Let $C(S) = S$.

$$\begin{aligned}
C(S) = S &\to (\forall x, y \in S)(xAy) \\
&\to (\forall x, y \in S)(xRy) \\
&\to G_1(S, R) = S
\end{aligned}$$

Case 2. Let $C(S) \neq S$.

By construction, we have $f(S) \neq \emptyset$.
Let

$$x \in C(S) \wedge y \in f(S).$$

Clearly, $(y, x) \in P(A)$. As R is an extension of A, it must be $yP(R)x$. Therefore, $x \notin G_1(S, R)$.

Suppose $x \notin G_2(S, R)$. Then for some $z \in S - G_1(S, R)$, we have zPx.

$$\begin{aligned}
zPx &\to \sim xRz \\
&\to z \notin C(S) \wedge z \notin S - [C(S) \cup f(S)] \\
&\to z \in f(S)
\end{aligned}$$

$z \notin G_1(S, R)$ implies that for some w in S, we have wPz. $w \notin f(S)$, as $z \in f(S)$. Also, $w \notin C(S)$ as wPx.

Again, wPx implies $w \notin S - [C(S) \cup f(S)]$.

Therefore, $w \notin S$, which is a contradiction.

$$\therefore x \in G_2(S, R).$$

Now we prove the converse. Let $x \in G_2(S, R)$ and suppose $x \notin C(S)$. Suppose, $x \in f(S)$.

$$\begin{aligned}
x \in f(S) &\to x \in G_1(S, R) \\
&\to x \notin G_2(S, R)
\end{aligned}$$

This is a contradiction. Therefore, $x \notin f(S)$.

$$x \in S \ - \ [C(S) \cup f(S)]$$
$$\rightarrow \exists z \in f(S) \wedge \exists y \in C(S) \wedge (z, y) \in P(R) \wedge (y, x) \in P(R)$$
$$\rightarrow x \notin G_2(S, R)$$

This is a contradiction and, hence, $x \in C(S)$.

Therefore, $C(S) \neq S$ implies that $C(S) = G_2(S, R)$.

The necessary part of the theorem is trivial and comes straight from the intuitive interpretation that was given earlier. For every set S in λ, assign $f(S)$ as the collection of best elements in S and axiom E will be satisfied.

CONCLUSION

Choosing a non-best element from a set of alternatives cannot be automatically termed as unreasonable. On certain occasions depending on the context of choice, one may reasonably choose an element that is not the best element. Internal consistency conditions of choice, therefore, cannot be applied in a context independent way. In order to see whether different parts of a choice function are consistent or not, we need to specifically consider the context of that choice. Standard consistency conditions are applicable only to cases where the chooser is interested in picking the best elements from any set. If, however, chosen elements are not best, new sets of conditions need to be applied to check for consistency of choice. This essay characterises a 2-rationalisable choice function with general domain. The characterisation result of course has a limitation as it involves a condition of existential nature. However, given the complexity of the problem, it appears that an existential condition was unavoidable. Moreover, the essay while constructing the condition also tried to throw some light on the intricate relationships between different components of a choice function and a binary relation that may 2-rationalise it. Although the essay fails to characterise a 2-rationalisable choice function without invoking an existential condition, it may not altogether be an impossible task to perform. The problem, therefore, remains open in some sense and the essay, we hope, would facilitate farther research in the area.

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'Satish Jain ... combined intellectual brilliance, extreme modesty and a unique gentleness in a way that I have rarely encountered since. This volume of essays by many ... leading lights of economic theory ... is an appropriate tribute to this remarkable scholar and human being.'
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This book covers diverse themes, including institutions and efficiency, choice and values, law and economics, development and policy, and social and economic measurement. Written in honour of the distinguished economist Satish K. Jain, this compilation of essays should appeal not only to students and researchers of economic theory but also to those interested in the design and evaluation of institutions and policy.

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Patterns of Codon Usage in Plastidial Genomes of Ancient Plants Provide Insights into Evolution

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Keywords: Codon Bias, Molecular Evolution, Biostatistics, Organellar Genomics.

Abstract: Basal angiosperms are the first flowering plants that diverged from ancestral angiosperms, while magnoliids represent the oldest known angiosperms and are considered to retain the characteristics of more primitive angiosperms. Availability of the plastidial genomes from several members of both these classes of plants provides an opportunity to identify and understand large-scale genomic patterns in organelles of early angiosperms. In this work, chloroplast genomes from nine AT-rich basal angiosperm and magnoliid species were analyzed to unearth patterns, if any, in terms of codon bias and to identify factors responsible for the detected patterns. We were able to distinguish nine optimal codons in basal angiosperm chloroplasts and 18 in case of magnoliids. Our findings suggest mutational bias as the most predominant factor shaping codon usage patterns among the genomes examined, while gene expression, hydrophobicity and aromaticity, were found to have a limited but important effect on pattern determination.

1 INTRODUCTION

Chloroplasts, initially originated by the process of endosymbiosis from cyanobacteria about 1-1.5 billion years ago, are the most important cellular organelles of autotrophs. On account of their small size, high copy number, conservation and extensive characterization at the molecular level, a large number of completely sequenced plastid genomes are now publicly available.

The angiosperms, or flowering plants, are one of the major groups of extant seed plants and arguably the most diverse major extant plant group on the planet, with at least 260,000 living species classified in 453 families. Basal angiosperms represent the first flowering plants that branched off from ancestral angiosperms at successive occasions before the appearance of the "true" dicots Eudicots, and comprise of distinct evolutionary groups, of which the first three to diverge were Amborellales, Nymphaeales and Austrobaileyales (Soltis & Soltis 2004). Magnoliids, on the other hand, are the oldest known angiosperms, represented by a heterogenous group that are neither eudicotyledons nor monocotyledons, and are considered to retain the characteristics of more primitive angiosperms. Economically important products derived from

magnoliids include edible fruits, spices such as black and white pepper *Piper nigrum*, cinnamon *Cinnamomum verum*, and camphor *Cinnamomum camphora* (Soltis et al., 2005). The magnoliid clade contains most of those lineages that were typically referred to as "primitive angiosperms" in earlier classification schemes (Cronquist, 1988).

This work was undertaken with the aim of conducting a genome-wide survey of codon usage patterns across the available chloroplast genomes of Basal Angiosperms and Magnoliids. The term 'codon usage bias' describes the unbalanced usage of synonymous codons during translation of a given genome. Codon usage can vary between species and also between different genomic regions of the same species, so there is much fluctuation observed in genes and genomes. Several factors support this phenomenon, such as genome composition bias (Bernardi and Berbardi, 1986), natural translation selection (Ikemura, 1985), hydrophobhicity and aromaticity.

Previous codon usage studies demonstrate that codon usage bias is a complex phenomenon, which involves various biological factors such as gene expression level, gene length, gene translation initiation signal, protein amino acid composition, protein structure, tRNA abundance, mutation

frequency and patterns and GC composition (Sharp et al., 1993). Ikemura and colleagues found that some specific codons of highly expressed genes are best recognized by the most abundant tRNA isoacceptors (Ikemura, 1985). It is believed that codon usage pattern in chloroplast genomes is similar to that of *E. coli* as the translational machinery in both cases has its own genomic environment that resembles prokaryotes.

Composition bias is the predominant factor responsible for codon bias in chloroplast genome of plants. High A+T content, which matches the composition bias of noncoding regions, is rich in degenerate positions (Morton, 1996), but this fact is not accepted in case of psbA gene, which has high C content at the third position of specific synonymous groups. Selection is thought to act strongly on the codon usage of psbA such that it has a noticeably unique codon usage pattern, and at a very weak intensity on the codon usage of some other highly expressed genes of the plant chloroplast genomes (Morton, 1996).

The main purpose of this study is to gain an understanding of the selection factors that are responsible of codon usage bias by focusing on the data from nine chloroplast genomes belonging to magnoliids and basal angiosperms. We have tried to address questions regarding the change in codon usage pattern during evolution in chloroplast genomes, an event that has not previously been explored in depth. We also attempt to compare our findings with published literature although earlier studies have all been restricted to individual or very few species in plants.

2 MATERIALS & METHODS

2.1 Dataset

Complete chloroplast genomes and collection of coding sequences of nine species of plants representing two major taxa, namely Basal Angiosperms and Mangnoliids were obtained from GenBank, NCBI:http://www.ncbi.nlm.nih.gov.

The nine genomes used as dataset for this study comprised of three basal angiosperms, one each from Amborellales, Nymphaeales and Austrobaileyales, namely *Amborella trichopoda*, *Nymphaea alba* and *Nuphar advena* respectively. The six remaining chloroplast genomes encompassed the magnoliids, namely *Calycanthus floridus var. glaucus, Liriodendron tulipifera, Drimys granadensis, Piper cenocladum,*

Chloranthus spicatus and Illicium oligandrum. Details of these nine genomes are provided in Table1.

Only those sequences were included which comprised appropriate start and stop codons and were of full length. To minimize stochastic variation, a threshold of 100 codons was defined, since there is a negative correlation between codon usage bias and gene length.

Table 1: Summary of Organisms.

Species code Accession No.	# protein coding genes	# Filtered genes used	GC %
BASAL ANGIOSPERMS			
A.tr NC_005086	84	54	38
N.al NC_006050	85	58	39
N.ad NC_008788	85	55	39
MAGNOLIIDS			
C.f.g NC_004993	86	55	39
L.tu NC_008326	84	53	39
D.gr NC_008456	85	55	38
P.ce NC_008457	85	53	38
C.sp NC_009598	86	56	38
I.ol: NC_009600	83	56	39

2.2 Codon Usage Indices & Parameters

A number of codon usage indices were calculated for this study using the program CodonW 1.4.4 http://codonw.sourceforge.net/. All statistical analysis was performed using SPSS version 16.0.

The effective number of codons Nc, independent of gene length is a simple measure of bias in codon usage (Wright, 1990). Equation for the calculation of Enc plot is: $ENc = 2 + S + 29/S2 + 1-S2$ where S is the frequency of G+C i.e. GC3s. A plot of Enc against GC3s NC-plot was effectively used to detect the codon usage variation among genes, for example, if GC3s is zero, then only codons ending in A and T will be used, thus restricting the number of codons used to 20 out of the 61 sense codons. Wright 1990 argued that if a particular gene is subject to G+C compositional constraint, it would lie on or just below the expected curve, as against a gene subject to selection for transitionally optimal codons, that would lie considerably below the expected curve.

Relative synonymous codon usage RSCU value for a codon is simply the observed frequency of that codon divided by the frequency expected under the assumption of uniform usage H0* of the synonymous codons for an amino acid (Sharp, 1986). RSCU values close to 1.0 indicate a lack of codon bias. RSCU values are largely independent of

amino acid composition and are particularly useful in comparing codon usage among genes, or sets of genes that differ in their size and amino acid composition. The formula for RCSU is given by:

$$RSCU_{ij} = \frac{X_{ij}}{\frac{1}{n_i}\sum_{j=1}^{n_i} X_{ij}}$$

where X_{ij} is the number of occurrences of the jth codon for the ith amino acid, and n_i is the number from one of six of alternative codons for the ith amino acid. Relative adaptive-ness of a codon, w^{ij}, is the frequency of use of that codon compared to the frequency of the optimal codon for that amino acid, and it is given by:

$$W_{ij} = RSCU_{ij}/RSCU_{i\ max} = X_{ij}/X_{i\ max}$$

where $RSCU_{imax}$ and X_{imax} are the RSCU and X values for that codon which is used most frequently for the ith amino acid.

Codon Adaptation Index CAI measures the relative adaptation of a gene of the codon usage of highly expressed genes. CAI uses a reference set of highly expressed genes from a species to assess the relative merits of codon and identifies the role of selective pressure in modeling the patterns of codon usage (Sharp and Li, 1987). To calculate CAI, the first step is to construct a reference table of relative synonymous codon usage RSCU values from very highly expressed genes of the organism in question. The CAI values are calculated in relation to the psbA gene of the same genome.

The psbA gene demonstrates atypical codon usage and its codon bias is a remnant of the ancestral bias degrading toward the compositional bias (Morton and Levin, 1997). A CAI values close to 1.0 reflects strong bias in codon usage and potentially high-expression level of the considered gene (Sharp and Li, 1987).

The most commonly used characteristic is the pattern of codon usage itself, defined in terms of optimal codons. An optimal codon is any codon whose frequency of usage is significantly higher than its synonymous codons in putatively highly expressed genes. Significance is estimated using a two-way chi-squared contingency test, with a cut-off at p<0.01. Codon usage was composed using chi-square contingency test of the groups, and codons whose frequency of usage were significantly higher p-value < 0.01 in highly expressed genes than in genes with low level of expression would be defined as the optimal codons.

GC content is calculated as the fraction of nucleotides in a sequence, that are guanine or cytosine. The index GC3s is the frequency of G or C nucleotides present at the third position of synonymous codons i.e. excluding *Met*, *Trp* and termination codons.

Hydrophobicity is measured in terms of gravy score, while aromaticity denotes the frequency of aromatic amino acids *Phe*, *Tyr* and *Trp* in the translated sequences (Kyte and Doolittle, 1982).

To normalize and identify intra-genomic variation with differing amino acid compositions, relative synonymous codon usage RSCU was analyzed for correspondence analysis COA for the 59 informative codons excluding *Met*, *Trp*, and the three stop codons (Greenacre, 1984). This analysis partitions the variation along 59 orthogonal axes, with 41 degrees of freedom. The first axis is the one that captures most of the variation in the codon usage, with each subsequent axis explains a diminishing amount of the variance. The correspondence analysis also reflects the corresponding distribution of synonymous codons. RSCU values are close to 1.0 when all synonymous codons are used equally without any bias. In subsequent part of this work, the terms axis 1 RSCU and axis 2 RSCU will be used to represent first-and second-major axis of COA.

3 RESULTS

3.1 Detection of Codon Usage Patterns

As described in methods, the pattern of synonymous codons usage across the codons in each genome was investigated by the Nc-plot between ENc value and GC3s value. The values range from 20 extremely biased to 61 no bias (Wright, 1990), and the respective plots are shown in Figure 1 for the basal angiosperms, and Figure 2 for magnoliids. Nc-plots of basal angiosperm chloroplast genomes follow a trajectory path, i.e majority of points are on and just below the Nc-plot.

Table 2 lists the Nc and GC3 values for all species investigated and it can be seen that basal angiosperms have very low GC3s values and their Nc values range from about 38 to 61, the lowest being 38.39 GC3s is 0.232 in case of the rps18 gene of *Amborella trichopoda*.

Overall, the majority of genes follow a parabolic line of trajectory indicating G+C mutational bias as the predominant factor for variation in codon usage, although some genes lie well below the expected curve, hinting at additional factors responsible for codon bias in basal angiosperms.
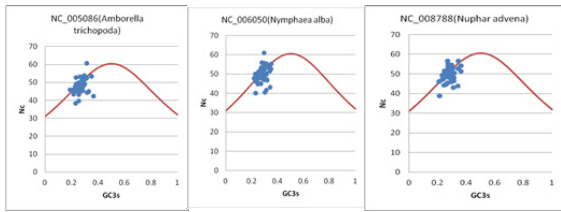
Figure 1: Nc-plots (Nc values vs GC3s) for the three basal Angiosperms. Nc was plotted against GC content at the third codon position. The expected ENc from GC3s are shown as a solid line.

Table 2: Genes with highest bias per taxon (by Nc-Plots).

Species code Accession No.	Gene	NC value (GC3s)
BASAL ANGIOSPERMS		
A.tr NC_005086	*Rps18*	38.39 (0.232)
MAGNOLIIDS		
D.gr NC_008456	*Rps14*	34.86 (0.309)

Although the mean Nc values of basal angiosperms and magnoliids are close to each other as shown in Table 3, and both sets of Nc plots display a parabolic trend, it can be seen from Figure 2 that the magnoliid Nc plots exhibit a wider scattering of points as compared to basal angiosperms, and there are more magnoliid genes lying well below the expected curve.

As can be seen from Table 2, least Nc-value is displayed by *Drimys granadensis* i.e. 34.86 GC3s is 0.309 on rps14 gene. These observations suggest that in case of magnoliids, G+C mutational bias is the predominant factor for codon usage bias but translational selection may also be an important factor.

3.2 Optimal Codons

Table 4 lists the results from optimal codon identification and the data shows nine significantly preferred optimal codons for basal angiosperms $p< 0.01$, while in case of magnoliids, 18 codons were identified as being used more frequently $p< 0.05$ Table 4. These optimal codons are optimal for genes at higher expression level, as estimated from CAI analysis. Only four optimal codons were found to be common between the two taxa.

Table 3: Means of Nc value in each taxon.

No. of Genomes	# Genes	Mean NC
BASAL ANGIOSPERMS		
3	*367*	7.5394
MAGNOLIIDS		
6	*367*	7.2954
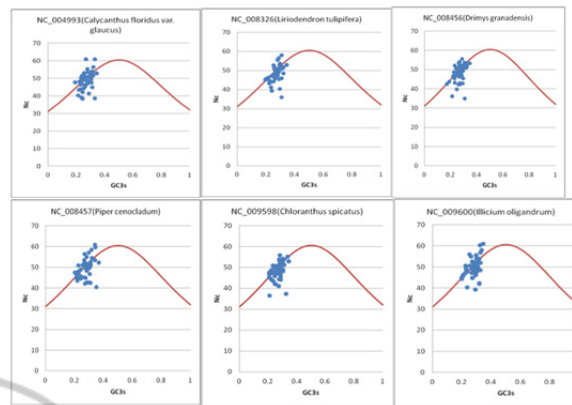
Figure 2: Nc-plots (Nc values vs GC3s) for six magnoliids used in this study. Parameters same as in Figure 1.

As shown in Table 5, plants from both taxa show a higher occurrence of A/U at the third position of their optimal codons. This result is consistent with the AT richness of the third-codon position in chloroplast genes.

Table 4: Occurrence of Optimal Codons (out of 64).

Codon	Basal Ang	Magnolid
AGU (Ser)	1	1
GGA (Gly)	-	2
GCC (Ala)	1	1
GAA (Glu)	-	1
GAC (Asp)	-	1
GAU (Asp)	-	1
ACA (Thr)	1	-
ACU (Thr)	-	1
AUA (Ile)	-	1
AUU (Ile)	-	1
CGA (Arg)	1	-
CGU (Arg)	1	1
CAA (Gln)	-	1
CAU (His)	1	1
CCA (pro)	2	-
UUA (Leu)	-	3
UUG (Leu)	-	1
UGU (Cys)	-	1
UAC (Tyr)	1	-

3.3 Correspondence and Correlation Analysis

Previous studies have shown a significant variation in the codon usage among genes from different species (Ikemura, 1985; Sharp et al., 1988). Thus, in order to understand the variations and trends in codon usage among genes in basal angiosperms and magnoliids, a series of orthogonal axes were generated by performing COA of RSCU.

Coordinates of each gene on the four axes reflected the variation in codon usage. Axis 1 COA/RSCU possesses the maximum variation that diminished with axes 2, 3 and 4 respectively.

Spearman's rank correlation analyses were performed among different indices of codon usage and amino acid composition such as CAI, GC content, Nc, GC3s, hydrophobicity, aromaticity and data from the first four axes are presented in Table 6.

Table 5: Top Ranked Optimal Codons by Species.

Species code Accession No.			
BASAL ANGIOSPERMS			
A.tr NC_005086	CCA (Pro)	CCA(Pro)	CCA (Pro)
N.al NC_006050	UAC (Tyr)	UAC (Tyr)	UAC (Tyr)
N.ad NC_008788	CAU (His)	CAU (His)	CAU (His)
MAGNOLIIDS			
C.f.g NC_004993	UUA Leu)		
L.tu NC_008326	ACU (Thr)	ACU (Thr)	ACU (Thr)
D.gr NC_008456	UUA(Leu)	UUA (Leu)	UUA (Leu)
P.ce NC_008457	UGU(Cys)	UGU (Cys)	UGU (Cys)
C.sp NC_009598	CGU (Arg)	CGU (Arg)	CGU (Arg)
I.ol: NC_009600	UUG(Leu)	UUG (Leu)	UUG (Leu)

As can be seen from this table, basal angiosperms possess more correlation significant values with Nc than magnoliids. Genes in all three basal angiosperms are correlated with Nc with first, second and third axes. Distribution of genes in all magnoliids is correlated with first three axes, except in case of *I. oligandrum*. In basal angiosperms, *Nyphea alba* at axis 4 is correlated with CAI with value r = -.389, p − value < 0.01, and *Nuphar advena* is correlated at axis 4 with value r = .477, p − value 0.01. Magnoliids also showed a significant correlation with CAI at axes 3 and 4.

The distribution of genes on third axis is correlated with CAI in all magnoliids all r < -.282, p-value < 0.05; all r < -.251, p-value < 0.01. GC is significantly correlated with different axes in both taxa except for *Piper cenocladum* of magnoliids. Hydrophobicity showed significant correlation in case of four genomes out of nine.

Table 6: Correlation analysis between codon usage and amino acid usage indices in plastidial genomes.

Species code Accession No.	Axis1	Axis 2	Axis3
	CAI Values		
BASAL ANGIOSPERMS			
A.tr NC_005086	0.041	0.082	0.130
N.al NC_006050	-0.089	0.114	0.176
N.ad NC_008788	0.009	0.073	0.088
MAGNOLIIDS			
C.f.g NC_004993	0.233	0.150	0.148
L.tu NC_008326	-0.011	-0.093	-0.350*
D.gr NC_008456	-0.054	0.211	-0.537**
P.ce NC_008457	-0.200	0.094	-0.351**
C.sp NC_009598	-0.065*	0.276*	-0.318*
I.ol: NC_009600	-0.090	0.232	0.285*

*Represents significance at P < 0.05; **at P < 0.01

4 CONCLUSIONS

Our results strongly suggest mutational bias, gene expression, compositional constraint and hydrophobicity as the selective forces in shaping the variation in the codon usage among genes of these organisms. We analyzed the putative optimal codons and hypothesize that frequencies of preferred codons in genes seem to be correlated with the gene expression, majority of which end with U and may be useful in the detection of gene expression of those genes where this is unexplored.

According to our results codon bias is significantly correlated with gene expression. Our data provide evidence that natural selection can also play an important role in shaping the codon usage in chloroplast genomes. Correlation results strongly support the hypothesis that besides mutation bias, there are some other factors that direct the change in the codon usage frequency in chloroplast genomes.

Among other factors, aromaticity and hydrophobicity have played an important role in shaping codon usage in many chloroplast genomes. This study has provided a basic understanding of the mechanisms for codon usage bias, which could be useful in further studies of their molecular evolution, gene transfer and heterologous expression of these chloroplast genomes from basal angiosperms and magnoliids.

AUTHOR CONTRIBUTIONS

MY and GY developed the analysis pipeline. SB assisted with the statistics. All authors coordinated

to draft, read and approve the final manuscript.

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Role of Libraries in Social Empowerment

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SETTING UP A UNIVERSITY LIBRARY: EXPERIENCE, INNOVATIONS AND CURRENT CHALLENGES

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ABSTRACT

Setting up a new university library is like growing up your own child, where librarian has full responsibility to how to nurture and flourish the library. This can be done by the quality of services and facilities, infrastructure and most important a team of dedicated people.

The journey of AUD's library of past 8 years has been an enriching experience and an opportunity to keep experimenting to meet the expectation of the new age users. A brief account of the journey is being presented in this paper.

KEY WORDS: University Library, setting up, Challenges, e-resources, experiences

The Changed Landscape

The search of knowledge has been a great motivation for the scholars, gurus, preachers of all religions and rulers. The great ancient libraries at Mesopotamia, Egypt, China, Bagdad, Sarajevo of Bosnia have had the numerous stories of fighting to control over the books/resources. In the past, battles had been fought not only to occupy territories of the enemies but also to control the knowledge base of the opponents. (Krummel, 2004) rightly pointed out that "Battles explores how, throughout its many changes, the library has served two contradictory impulses: on the one hand, the urge to exalt canons of literature, to secure and worship the best and most beautiful words; on the other, the desire to contain and control all forms of human knowledge."

Based on the prosperity, libraries got space and resources in every age and have been a center of attraction as well. The structural space and available learning resources get dominated by the ideology/ religion of the state. The vision and purpose of setting up a library gives some special effects on the structural design and materials inside the library. Historically, religious library appears differently from a royal or a scientific research library in the outlook and the service as well. In the recent times, libraries have been transformed to a multi cultural and multipurpose public space and the idea of having a designated space and selective readers have also been challenged with the notion of "the library without walls" (Dahlkild, 2011).

With growing expectations and explosion of knowledge, setting up a new university library today is a tough task, though it's a life time opportunity for some to innovate and keep moving to serve better. In this context, case study of AUD, Delhi is being presented here.

ABOUT AUD

The Bharat Ratna Dr B.R. Ambedkar Vishwavidyalaya (Ambedkar University, Delhi or AUD) got established by the Government of the National Capital Territory of Delhi through an Act of Legislature in 2007 and was notified in July 2008. AUD, Delhi is a campus-based, public university which gives preference in under graduate admissions to students passing out from government schools of Delhi. AUD offers research, postgraduate and undergraduate programmes in the social sciences and the humanities. This an exclusive social science university, guided by Dr Ambedkar's vision of bridging equality and social justice with excellence, AUD considers it to be its mission to create sustainable and effective linkages between access to and success in higher education. AUD is committed to creating an institutional culture characterized by humanism, non-hierarchical and collegial functioning, teamwork and creativity. (www.aud.ac.in)

FROM VISION TO ACTION

The library is being governed by Dr Ambedkar's vision of bridging equality and social justice with excellence and contributes to achieve the mission of access and success in a non-hierarchical manner.

The vision was to setup a world class state of the art library with professional excellence and services and that's why at every step the quality of the services and professional ethics has been the guiding force so the spade work started in March 2009 with a vision to make the library as a center of excellence and innovative in process, resources and management.

A group of experts of this field were brought together to conceptualize the library and few publishing houses/distributors were requested to participate during the first book exhibition on 15th March 2009.

Since the university is an exclusive university of social sciences and humanities so experts were asked to identify the relevant books during the exhibition. Later on suggestions from students were also invited to add on the resources. Publishing houses, distributors and book sellers brought more than 5000 books for the display. Based on the suggestions from experts, Library Committee decided to procure 1800 books for the library.

SEQUENTIAL PROGRESSION

The journey of AUD's library of past 8 years has been an enriching experience and an opportunity to keep experimenting to meet the expectation of the new age users. A brief account of the journey is being presented here -

Year 2009 - Ideas into Action

The Library starts in July 2009 with only 1800 books, 20 National and International print Journals. AUD has 85 students, 20 teachers for 3 post graduate courses. Although the smart card was introduced in the university but no library management software was in place.

YEAR 2009-2010 STEP BY STEP

AUD is guided by the philosophy of Dr. B. R. Ambedkar and always attempt to offer excellent services to the stakeholders. It was a prerequisite to have an effective library management system since the beginning so installation of LIBSYS got done in the library system. New set of 4500 books arrived at the library and the cataloging was done on the LIBSYS software in this period. A reading room equipped with 34 cubicles and computers was established. 50 national and international print journals were added to the resource base.

Jstor was the first online database introduced in AUD library as a part of Associate Membership Program of INFLIBNET. To fulfill the users demand AUD library acquired the membership of DELNET for inter library loan and document delivery services.

YEAR 2010-2011 –PROFESSIONAL MEMBERSHIP FOR EXCELLENCE

After one year, library had 300 users and starts maintaining computerized database of all the users. The number of books reached to 7657. Library equipped with OPAC and Web-OPAC. The subscription of journals reached up to 98 with their print and online accesses.

Under Associate Membership Program of INFLIBNET's, AUD starts subscription of following online publishers' database-JSTOR, Cambridge University Press,Oxford University Press, Springer Link MathSciNet, Nature Emerald and apart from this some other databases were included on the high demand of users like EBSCO-Academic Search Complete, Project Muse, AAAS etc.

YEAR 2011-2012-INCREASED USERS AND RESOURCES

During 2011-2012, library seen a remarkable increase in the number of users, more than 750 users and the collection of books reached up to 11500. In this period, Library had a subscription of 120 print journals.

Library started Remote Access of its all online resources as well as of OPAC. The separate text books section was established for the undergraduate students. This year with subscription of 16 online databases, users get access to 15000 e-journals. The AUD library became the partner in an international conference organised in IEG in collaboration of IEG, SLA, SLP.

YEAR 2012-2013- RECOGNITION FROM UGC

AUD got the recognition 12 (B) under UGC act and this enables library to became a member of UGC InfoNet Digital Library consortium. As a member of InfoNet, AUD library starts receiving 5 international publishers' database free of cost. This was the period when some management databases were introduced for MBA students. Library user database reached up to 1600. To manage the work load at the library, 9 library trainees were appointed to support the users.

YEAR 2013-2014 SYSTEM STRENGTHENING

During 2009 to 2014 AUD had two campuses and two libraries; one in Dwarka and another one was in Kashmere Gate. In June 2014, the building at Dwarka was allocated to some other institute therefore both the libraries got merged at Kashmere gate campus. First stock verification also took place in year 2014. AUD applied for NAAC accreditation and submitted its first Self Study Report. A Seven member's team from NACC evaluated the processes and services at AUD for the accreditation ranking.

YEAR 2014-2015- NAAC RECOGNITION

AUD receives "A" grade accreditation from NAAC and the university added few more courses in the list. The number of users reached up to 2500. The number of books increased up to 30,000 along with 107 national and international print journals. With 190 CD and DVDs, the canvas of the library resources further stretched out.

SPECIALISED SERVICES PROVIDED BY LIBRARY

- In-house/remote access to e-resources: The library has IP authenticated access to e-journals, databases, etc. which can be accessed both in-house and remotely.
- User Orientation: Each session begins with a detailed orientation by the library staff for both student and faculty, to make the library a user-friendly space
- Assistance in Searching Databases: The library staff is available during all library hours to assist in all matters including searching databases.
- INFLIBNET/IUC Facilities: The Library is a member of INFLIBNET. Through the Associate Membership Programme, it subscribes to Cambridge University Press, MathSciNet, Nature, Emerald, JSTOR at consortia prices. As a member of the UGC Infonet Digital Library Consortium, the Library has free access to five e-resources: Taylor & Francis, Wiley, Project Muse, Springer and OUP.

CURRENT STATUS OF THE LIBRARY

Today, AUD library has specialized collection of more than 36000 books, 162 e-books, 52 national and international print journals, magazines and 28 leading online publisher's journals database (more than 32000 full text e-journals) in the area of humanities and social science. AUD Library has air-conditioned stack rooms and reading area for users. AUD library has computerized database of its resources as well as of users. The library database can be accessed by the users through OPAC (Online Public Access Catalogue) with network access across the campus-wide LAN. All the online resources can be accessed from outside of the campus as well. Library remains open all days except 3 national holidays. Library has computerized database of library documents and users. Library has 4 sections; General Section, Textbook Section, Reference Section and Periodical section. Library is now in process of developing a film section, currently library has more than 210 DVDs collection on films and documentaries.

The Working Hours of AUD library is 8.00 am to 8.00 pm Monday to Friday including vacations and 9.00 a.m. to 5.30 pm on weekends and other public holidays. Library has it's own webpage on AUD's website and can be contacted for any details.

Library has individual reading carrels with Wi-Fi access of 1GBPS speed. Circulation of relevant news and authentic source is a regular feature of the library.

SOME PROFESSIONAL ASSOCIATIONS AND SERVICES

Library has the VPN facility which allows users to access on line resources from outside of the campus also. Library Software (LIBSYS) and Web-OPAC is being used for better management, services and record keeping. The library is a member of INFLIBNET (Associate Membership and InfoTech Digital Library Consortium) and gets professional benefits of the consortium. Membership of DELNET (Inter Library Loan, and Document Delivery Service) gives extended reach to resources available in the networked libraries.

THE AVERAGE DATA AT A GLANCE

- Average number of walk-ins in AUD library is around 115 users per day and around 3,450 in a month.
- Average number of books issued/returned in AUD library is around 2,000 and 1,500 respectively.
- Ratio of library books to students enrolled is 20 books per student.
- Average number of books added during the last six years was: Total 30000 books
- added in the last six years (average of 5000 books yearly)
- Average number of login to OPAC is 90 times per day and around 2,700 in a month.
- Average number of login to e-resources: 5,590 per month
- Average number of e-resources downloaded/printed: 5590 approximately per month.

SOME CHALLENGES

Getting young talents in the library profession is a big challenge. Many often, young users, perceive library merely as a support service than a specialized field of knowledge management so periodic orientation of the faculty, students, and researchers should be part of the routine task of the library staff.

Since AUD aims to reduce the social and learning gap, getting quality resource materials in Hindi is still a tough task. The language became a barrier for non-English medium students.

Ideally, library should work round the clock so working students can also get benefited. Some students coming from humble economic background, work at the evening and attend classes during the day. The physical space and materials should be inclusive (Audio books, Brail——) so differently able students can have easy access to resources of their choice.

FUTURE PLAN

AUD is a public University so in coming Years University will be having some more campus and increased demand for super specialised library. Library has to keep pace with expansion of the university so resources would be allocated accordingly. Karmpura campus has just started with enrollment of 200 under graduate students so AUD aim to set up state of the art library from the architectural as well as services point of view. AUD wish to expand the physical space and resources, especially to address the need of differently able users of the university.

Proposal has been submitted for RFID (Radio Frequency Identification) so that with help of intelligent bar codes, particular book can be tracked easily from a big resource pool.

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LIBRARY, SOCIAL MEDIA AND REGULATORY FRAMEWORK

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ABSTRACT

Today social media has become an integral part of our lives; many libraries have been using social media technology as a tool to interact with their users. Indeed social media technology has created new ways of learning and sharing information but it also created some challenges for librarians. So it is important for librarians to identify the emerging issues and challenges along with their solution before launching the social media tool on public platform. A thorough exercise analyzing strengths, weaknesses, opportunities and threats (SWOT) must be done. This SWOT analysis of social media in libraries will give libraries the opportunity to use such media more strategically and smartly to increase the efficiency and services.

KEY WORDS: Social media, tool, technology, policy, framework, library

INTRODUCTION

The enormous growth of social media is a critical factor influencing not only the way of communication but also changing the ways to reach out to the targeted audience/clients. Information technology and platform of social media together has given access to 1.71 billion people to interact, share and use information via face book and other sites. (https://www.statista.com). Similarly when Twitter came in to much notice, within one year, from February2008 to February 2009, Twitter qualified 1,382% growth rate (Burkhardt, 2010).

Though, social media gained wide-reaching appreciation with its very efficient use in the political pitch in US and India as well. The presidential campaign of Barack Obama in US and the prime ministerial campaign of Narendra Modi in India had used the social media effectively to connect with the targeted audience. Now every political party, government, business houses, social activists, university/colleges have created their official page/account to be present in the social media.

The social media and the millions of people who access these forums /tools as element of their routine lives for various things could be a breakthrough for academic library to influence reading habits, knowing the major bottlenecks and communicating effectively with new age users.In a campus

community, off course the academic libraries can use social media tools to interact with faculty, staff, and students in a smarter way.

It has been observed that, students and faculty members both check the social sites more frequently than their official emails .The chances of checking official sites get further reduced once the duty hours are over. So the social media community of the university/library has to find out the quicker and effective path to connect with the community members with in office time and beyond.

Fernandez, (2009) rightly said "Moving from clay tablets to card catalogs and then to digital catalogs, libraries have always played a very important role in purveying information as a social commodity. In an extension to this traditional role, Librarians have become some of the earliest adopters of social networking technologies in order to connect with their users. Although libraries have always connected people with information, social media is beginning to play an important role in marketing information to library users and in branding the library as a community hub".

According to Ezeani, (2012) Social networking tool is a platform where users are both consumers and producers of online content. With these tools, librarians can constantly evaluate and update content to meet the changing needs of users. These tools are used for collaboration and sharing of ideas and it is becoming an integral part of library services. Ezeani, (2012) further said" it also calls for libraries to encourage users' participation and feedback mechanism in the development and maintenance of library services. The active participation of users enables them to contribute content, establish communication links, and stay informed of new developments in the social network space. With information and ideas flowing in both directions – from the library to the user and from the user to the library – library services have the ability to evolve and improve on a constant and rapid basis".

SOCIAL MEDIA AND LIBRARY: THE EXPERIENCE SO FAR

Some libraries are using social media effectively to share new arrivals, new services, and review of books, sharing of articles, relevant news, events, photographs and the job opportunities but following are the some apprehensions of the unregulated use of social media in the academic world-

Content without consent: On social sites, the major hurdle is to identify the authenticity of the text uploaded. Thousands of the photographs are being posted every hour, we really don't know, if the prior permission has been taken from the person, parents of the children, authorities etc before uploading the photographs on the sites and placing the picture in a public domain.

Often a quote gets circulated with a photograph of some big celebrity in favor or in against of an ideology or a country. The celebrity may not be having any idea of who has created this quote and mixed up with his/her picture. By the time, the celebrity would come to know and clarify the unethical conduct of someone; it's too late to rectify the damage.

Posting text without assessment: Majority of the social sites users, keep posting and forwarding text without assessing judiciously. Often messages of hatred, provocation, blame keep floating on the surface and contribute in creating social tension than social cohesion.

Authenticity/ originality of the text: The biggest challenge of the social sites is to know the genuine writer/developer of the content .People just copy and paste the words often without acknowledging the original writer or the person responsible.

Tag without prior permission: In lack of orientation on ethical and legal aspects of cyber space, people just tag any one without their prior permission. Sometimes to damage the reputation, inappropriate videos, messages get posted with tagging you.

Cyber crime: Lack of awareness on cyber crime and vulnerability of excess users have resulted in to a big loss and punishment to some of them.

Identity: A substantial numbers of users have created their social profiles with some pretended name, photo and age etc. These practices should not be allowed for safety reasons.

These are the some common issues of concerns and in the context of library profession; we must evolve a regulatory framework for the use of social media in library. Following are the some specific areas which may lead the social media regulatory framework:

Copyright: Copy right is a serious issue on social sites and users must be made aware on the laws related to copy rights .Library staff should have the framework and a list of do's and don't while posting any information on the social sites.

Disclaimer: There should always be a disclaimer note on relevant sites stating the ownership/ responsibility of the thoughts expressed on a particular issue. It's critical to make a distinction between personal opinions and organizational positioning on policy issues.

The Identity: Social sites must stop users with fake name, photos etc. practices and every social account should be linked to original identity documents so malpractices and cyber crime can be controlled. In the professional community, we must cross check the identity of the users.

Empathy for the Colleagues: Considering the privacy as a value, we should not post videos, photos of our colleagues/neighbors/teachers/students without their prior consent.

Validated Information: Before posting the information online, we should verify the accuracy of the information with supporting references. Is it also wise to evaluate that the particular piece of information that is it worth posting on a social site or should go to a limited number of recipients.

Employer's Guideline: Every organization has HR policy and guidelines so before posting any stuff on social media, staff must be aware with the limitations and responsibilities while performing a responsible role.

Critical Decision: We must be cautious and judicious when posting any image or information on behalf of the organization. Once it will be published online it will be archived. So it is critical for us to publish only appropriate information or images related to the organization.

Significance: The first motto of any library should be to provide significant information to the users, whether it's thoughtful, relevant blog posts, newsy tweets, or homework help. The focus must be on providing this support consistently. Also consider the recommendations offered by social site users to improve the quality of content to value our community (Kroski, 2009)

Accountability: If something goes wrong unintentionally, no need to hide ourselves, we should accept the mistake and rectify the error.

BEFORE GOING PUBLIC

Before launching the social media platform of the library, a thorough exercise analyzing strengths, weaknesses, opportunities and threats (SWOT) must be done. This SWOT analysis of social media in libraries will give libraries the opportunity to use such media more strategically and smartly to increase the efficiency and services. Social media have the potential to pro-duce more user-centered libraries that are constantly evolving to maintain their relevancy as they compete with other online resources (Fernandez, 2009).

Social media offers some attractive services which could be more useful to library professionals-.

- Most of the social media sites are freely available.

- They are easily accessible and easy to set up and ready to use immediately.
- Via social sites, libraries can reach out to their clientele at large in the shortest time and in the most efficient manner. Sending library updates by email gets limited response but maximum number of user's access social sites more frequently and responds quickly.
- Through social sites, users may contribute to their own ideas about services and resources for libraries to consider.
- Social media allows librarians to think outside of the box.
- Site administrators have some control over the content of their social media so it may not free to all sorts of posts.

LIMITATIONS

Social media has some of the limitations which must be set right in coming days to facilitate more professionals and organizations -

- Social media tools have some design restrictions, e.g. if we want to open an account for a library it cannot be done. We are restricted to create either a group or a page attached to individual's account.
- Some social media have limitations on the amount of information which can be uploaded.
- Once any library goes on the social media sites, the libraries must be ready to get open criticism
- Some social media require downloading of apps, which can be a problem in some organizations because some sites may be restricted in some organizations.

Flickr limits the number of pictures and don't permit to post beyond 200 photos; beyond that number a subscription is required. Twitter limits postings to 140 characters per post so these issues should be discussed internally and must be agreed on the way to respond.

MORE OPPORTUNITIES

Going forward, there may be opportunities in social media that the library hasn't been exploiting effectively so some other aspects can be explored. Few elements could be -

- Use social media to market the library services and collections to their clientele.
- Use social media to reach out to a wide range of the users and to attract new users.
- Exploit the opportunity to get reflection and feedback from the users

SOME RISKS

Nothing in the world goes without certain amount of risk. So social media again is not an exception and the potential threats may include following threats-

- Social media may be open to unsavory elements and the efforts made by the library staff can be sabotaged in many ways.
- Social sites are usually beyond the control of the librarians so don't know how they would be using the data base.
- Social media users can easily unsubscribe the page at the click of button and tracking the users periodically would be additional task.

WHAT SHOULD THE LIBRARY SOCIAL MEDIA POLICY FRAMEWORK INCLUDE?

Library may consider a range of social media applications such as blogs, Facebook, and other social networks, and micro blogging services like Twitter, as well as accommodate those emerging technologies. The framework must refer established policies for best practices of social media and networking sites. The framework must classify the suggestions on legal, social, safety, authenticity and quality aspects of the channels and content. Explaining some aspects of cyber crime would be an added advantage.

Code of behavior must be developed for the professionals and users both and should be agreed by the knowledge community members before joining the group. Democratic principles, respect to every member and identity should be the non negotiable values. Considering the social-cultural context, a variation in communication style and language should be allowed to the community members. Users must get space and appreciation for their original contribution so the framework should state the copy right issues and punishment clause under cyber laws. The framework should set some of the standards for the content, periodicity and accountability in the system.

Based on the users' choice, libraries may select the combinations of social sites to be more relevant. Special negotiations can be done with the social sites to add some special features and sharing the library's link to their respective pages and business channels.

Like twitter, a new social site may be developed for the library/knowledge community which may follow the professional norms and post original writings, reviews etc. Social media and traditional media are becoming inextricably intertwined, so library may learn from the experiences and can transform the library services.

In the early days of social media, the advent of new "Web 2.0" social media technologies sparked discussions on what could be the potential implications for libraries. The high rise of social media forums have given opportunities to go global and get connected with millions without knowing them personally. The new ways to get information and share relevant facts worldwide, has given some new challenges for the libraries. A systemic approach can help the library community to evolve further and set the standards in this social technological age

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Emerging Trends and Issues in Scientometrics, Informetrics and Webometrics

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Contents

Authorship Contribution to The Academy of Management Journal (AMJ): Scientrometric Analysis

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Abstract

This scientrometric study is the analysis of some 707 research articles appearing in the journal of Academy of Management. It focused on eleven volumes and 46 issues spanning eleven years [2005-15] analysing on its number, pattern and productivity of author, with key words evaluating collaborative output. Of the 707 papers, 148 are single authored [19.52 per cent] and other having more than one author. The pattern of authorship showed the trend of co-authored output.

Keywords: Scientometrics, Bibliometrics, Journal of Academy of Management, Publication, Author Productivity, Collaboration pattern

INTRODUCTION

The library and information science is the study of scientific observation upon the ideas of scholars and users. So, Scientometric study is a discipline, which analyses scientifically the publications to explore its structure and growth. The scientometric/informetric /bibliometry is the technique applied to analyze various quantitative or qualitative aspects of publication. It is the quantitative method to measure the data on articles published in a given period, the impact of citation. The growth of research includes scientific analysis of contents, History and Philosophy of the source studies related to scattering, and growth, author productivity, obsolescence of documents, distribution of scientific literature by country, by language, etc, which helps in monitoring the growth and pattern of research.

It is the study of measuring and analysing science, technology and innovation (Wikipedia). Modern scientometry is mostly based on the work of Derek J. de Solla Price and Eugene Garfield[1]. Scientometry is a discipline of scientific analyses and explores the structure and growth of publications. The term is used to analyse various qualitative and quantitative aspects of patterns of publication. It is a quantitative measure of scientific information, as the number of articles appearing in given period of time, the impact of citation impact.

The scientometric research is devoted to quantitative studies of science and technology – according to A. F. J. Van Raan [2]. It applies to bibliometric techniques to science and examines their development [3]. Main areas of Scientometry

are individual scientific documents, authors, scientific institutions, academic journals and regional aspects of science [4]. An attempt is being made to analyze the contributions to Academy of Management journal published [2005-15, April] to explore the author pattern, and collaborative research of papers among them, spanning some 707 articles appearing in 46 issues.

The *Academy of Management Journal (AMJ)* is the empirical journal in management field, and has been indispensable reading for scholars for more than five decades. *The* articles test, extend, or build theory and contribute to management practice through empirical methods (e.g., quantitative, qualitative, field, laboratory, meta-analytic, and combination). *These* are regularly cited in major business media, including the *New York Times*, the *Economist*, the *Wall Street Journal*, *The Washington Post*, *Business Week*, and *Fortune*. The impact factor is 4.074. As per report of journal citation 2013, it has been accepted in the 5th position in the top 172 management journals and 3rd in those in the category of business.

The journal was selected as the source for the present research. It was commenced in November 1936 by Professor[s] Charles L. Jamison, the University of Michigan and William N. Mitchell, the University of Chicago, published quarterly, bridging between entrepreneurs, administrators and managers, scholarship and teaching about management and organizations to build vibrant and supportive community of scholars by availing immense opportunities. It contains the original research articles of interest to industry reviews on frontiers of science and technology, articles on management and policies relating to science, technology and industrial applications.

OBJECTIVES

- To map the year wise distribution of papers
- To examine the pattern of author and their productivity
- To determine the degree of collaboration
- To assess the pattern of Co-Authorship
- To identify collaborative pattern
- To find the average keywords (did not find any analysis)

METHODOLOGY AND SCOPE

The study entitled " Authorship Contributions to Academy of Management Journal (AMJ): Scientometric Analysis" is a case study encompassing records output on online. A data sheet in MS-Excel, entered manually has content - number of papers, authors, keywords and their length are collected to fulfil the objectives. It was later analysed using following indicators viz., the extent of authorship pattern (single vs. multiple), degree of collaboration, co-authorship index.

The growth in terms of absolute and relative level are analysed [2005-15, April]. Authorship pattern and their productivity are examined to identify the pattern of research in the field of Management. An attempt is being made to admeasure the performance of researchers and their concentration in the field of management. It was exploratory in nature in identifying the research output in management.

THE REVIEW

This chapter devotes to review those works relating to various aspects of Scientometric studies. It highlights the importance of Scientometric analysis and their applications to Library and Information Science. It enables the researcher identify the research gap in the previous studies. The review avoids any duplication of work already taken place. It helps the researcher study different aspects, identifying unexplored areas, in order to create new grounds for research. The author has presented the literature on the basis of reverse chronological order.

Mulla (2012)[5] has described the bibliometric analysis of 998 articles of on information science and scientometrics (ISS) that appeared in different journals [2005-09]. The study reveals most researchers preferred to publish their output in journals; as such 91.98 per cent of which appeared therein. More numbers [329, 32.97 per cent] of articles appeared [2009]. The authorship trend shows that, out of 1,703 authors who contributed 998 articles, most of them (376, 40.96 per cent) were two authored. The degree of collaboration in ISS was 0.78, and the country wise contribution, India contributed more documents i.e., 83.99 per cent of the overall publications. Year wise distribution of articles, distribution

of types of documents, length of the papers, authorship pattern, degree of collaboration among authors and co-authors, and the different category, rank wise distribution of collaborators, institution wise and country wise, state wise and journal wise distribution of articles.

Karpagam et al. (2011)[6] have analysed the growth pattern of Nanoscience and Nanotechnology literature in India[1990-09]The Scopus International multidisciplinary bibliographical database has been used to identify Indian contributions on the field of nanoscience and nanotechnology. It measures the performance based on several parameters, country annual growth rate, authorship pattern, collaborative index, collaborative coefficient, modified collaborative coefficient and subject profile. Further, it examines national publication output and impact in terms of average citations per paper, international collaboration output and share, contribution and impact of Indian Institutions and impact of Indian journals.

Raja and Balasubramani (2011)[7] have analyzed plasmodium falciparum research publication in India measured from Histcite software and other tools. The results show that the growth of Indian literature in plasmodium falciparum deposition and make the quantitative assessment of research in terms of year-wise research output, geographical distribution, nature of collaboration, characteristics of highly productive institutions and the channel of communication used by scientists.

Poornima et al. (2011)[8] have analysed of 1,060 publications published by Indian scientists [1998-10] and indexed by Web of Science Online Database indicates the output in the Indian research publication. The prolific authors who profiled were from the Central Food Technology Research Institute, BARC, Indian Institute of Technology, Defence Food Research Laboratory. They have tracked the number of papers, scatter over journals, and its effect on output, authors' institutional affiliation and pattern.

Suluimanov, Frolova and Khasenova (2009)[9] have analysed the results of the scientometric analysis of overseas publications by Kazakh authors that reflected in the SCOPUS database[1991-08], through 3,883 documents, the citation index of which was 10 132. The average share in the total worldwide flow was 0.017per cent. The citation grew [1996-00] written in English and published in periodicals of physics and chemistry. The lead partners of Kazakhstan were determined which reflected the growth of Kazakh-Russian scientific cooperation.

YEAR WISE ANALYSES

Table 41.1 shows the distribution of research articles [2005-15]. Some 707 research articles appeared at an average of 56.56 each year. The year 2007 carried 92 [23 articles per issue].

Table 41.1 Year wise distribution of papers
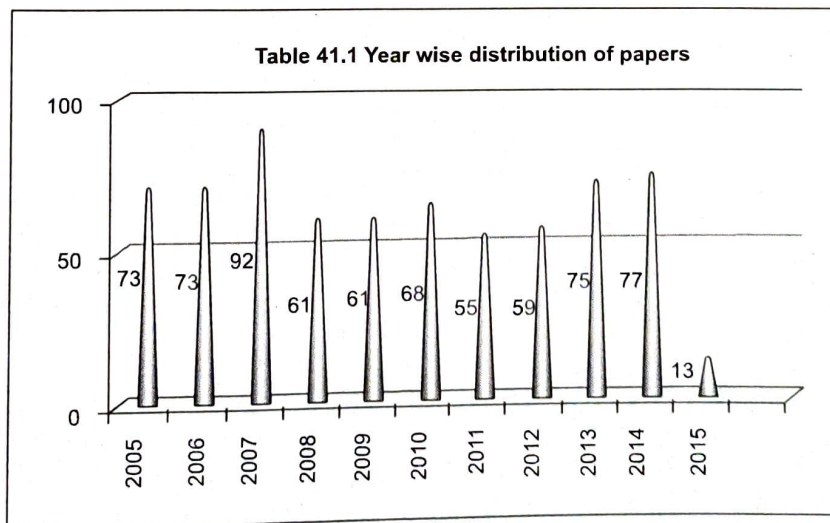
Some 73 articles appeared each in the year[s] 2005 and 2006, 61 articles appeared each in the year 2008 and 2009; 68 articles in the year 2010; 55 articles in the year 2011; 59 articles appeared each in the year 2012 and 2013;; 75 articles in the year 2014; 77 articles in the year 2015; 13 articles [in the first two issues], if we ignore the issues of year 2015, then the lowest number of articles, some 55 articles appeared in the year 2011. The average number of papers per year came to 126 during the gestation period.

Table 41.2: Authorship Pattern

Table 41.2-% No. of Authors in contribution of Articles

■ No. of Authors
■ % of Articles
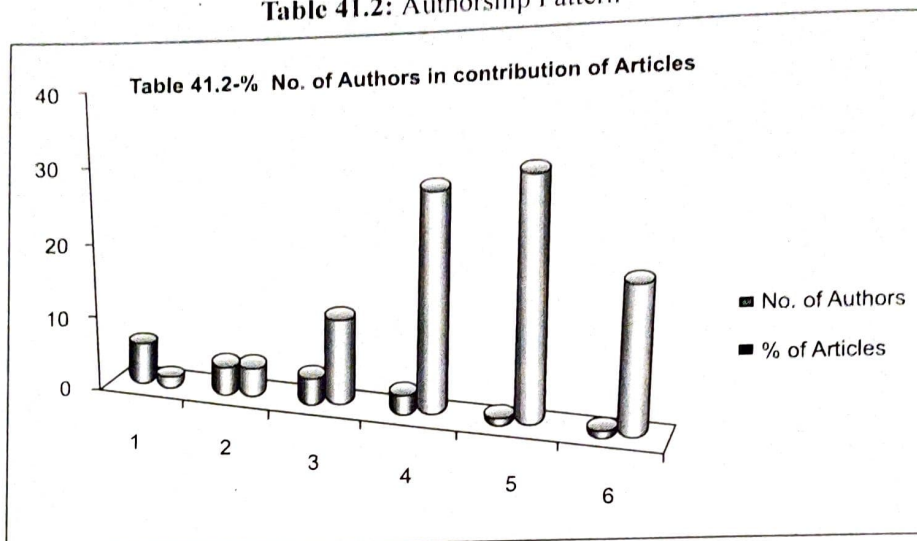
Authorship contribution- the blue bars represent the authors and the red bars represent five of their works. The table reflect maximum number of articles published by more than four or multiple authors.

Table 41.3: Year wise Authorship pattern

Years	Authors	Contribution More than once in a year
2005	167	Three authors have published twice
2006	174	Two authors have published twice with one author is four times in the same year
2007	197	Three authors have published twice and one author seven times in a year
2008	192	Four authors twice
2009	156	Four authors twice and one author thrice in a year
2010	167	Four authors twice
2011	146	Four authors twice and one author thrice in a year
2012	164	Two authors twice
2013	207	All authors published their work only once
2014	220	Six authors twice and one author thrice
2015	41	All authors published only once

The Table shows the maximum number of authors as 220 who have contributed for the year 2014. The lowest number of 146 articles appeared in the year 2011. Otherwise, the journal had had the average number of articles every year. Limited number of authors has contributed twice or more except the years 2007 and 2008. An author has published four times in the year 2006 and another has published seven times in the year 2007. One author has published thrice during the years 2009, 2011 and 2014.

Table 41.4: Year Wise Author Productivity

Year	No. of Articles	Authors				
		1	2	3	4	>5
2005	73	24	19	17	10	3
2006	73	19	22	21	7	4
2007	92	34	26	22	7	3
2008	61	12	18	20	8	3
2009	61	9	23	21	4	4

2010	68	10	29	20	7	2
2011	55	3	26	16	7	3
2012	59	7	17	21	10	4
2013	75	24	9	23	11	8
2014	77	6	26	23	18	4
2015	13(up 30/4/2015)	0	4	3	6	0
Total		**148**	**219**	**207**	**95**	**38**

The data on author's productivity appears in the Table 41.4. The average number of authors per paper was 2.58 for 707 articles. Maximum number of articles appeared with 34 single authors to have contributed in the year 2007. There are only 55 articles in the year 2011. Three authors have individually while more than one about the rest of the work. It was the lowest production. The period 2005-15 found the output of 148 authors as single authors and rest with more than one author. Most of these were written by more than two authors i.e., 219 authors. At the second stage, the frequency of author was 207, to have contributed beyond three times.

Productivity per Author = No. of Papers/No. of Authors

Average Authors per Paper = No. of Authors/No. of Papers

PATTERN OF CO-AUTHORSHIP

Only 148 out of 707 articles were written by single author leaving the rest under co-authorship. To say, 20.9 per cent articles are written by solo authors and the remaining 569 out of 707 i.e., 80.48 per cent were written by joint authorship. The frequency of co-authorship played the prominent role corresponding to the world average.

Table 41.6

Year	No. of Articles	Authors				
		1	2	3	4	>5
2005	73	24	19	17	10	3
2006	73	19	22	21	7	4
2007	92	34	26	22	7	3
2008	61	12	18	20	8	3
2009	61	9	23	21	4	4
2010	68	10	29	20	7	2
2011	55	3	26	16	7	3
2012	59	7	17	21	10	4
2013	75	24	9	23	11	8
2014	77	6	26	23	18	4
2015	13(up 30/4/2015)	0	4	3	6	0
Total		**148**	**219**	**207**	**95**	**38**

Table 41.6 reflected the enriched co-authorship in the form of two contributors. The frequency of more than one author enhanced the productivity of the journal. Some 29 authors have published their output in co-authorship mode during the year 2010. The frequency of more than two authors was less than one or two authors. Only 18 authors have contributed with more than two during the year 2014 and more than five among eight authors. The earlier two issues in the year 2015, no article appeared from more than four authors.

Average key words per article

I found there was no key word in the field of business and management at the international level. None of solo or double contributors have mentioned any key word with the abstract.

Variation in Content pattern

I have also found the editor to have not followed the common format of the bibliographical detail of such contributors. However, some references were found in the content with different formats.

Example

1. Sally Maitlis

   The Social Processes of Organizational Sense making ACAD MANAGE J February 1, 2005 48:21-49; doi: 10.5465/AMJ.2005.15993111

2. Jerayr (John) Haleblian, Ji-yub (Jay) Kim, and Nandini Rajagopalan,

   The Influence of Acquisition Experience and Performance on Acquisition Behavior: Evidence From the U.S. Commercial Banking Industry, ACAD MANAGE J April 1, 2006 49:357-370;doi:10.5465/AMJ.2006.20786083

   In the 2nd title, the author has been quoted in the bracket. This practice is being found only in some cases. It shows that this journal is deficient in some approach in the display of author's bibliography.

CONCLUSION

I have found some important tools and techniques for the areas of scientometric research. I believe it could be helpful to future researchers who want to identify primary sources of such study, especially among library and information professionals.

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INTERPRETATION OF MEMORIES

Literary, Psychological, Cultural and Historical Aspects

Editors

Dr. Syeda Ayesha Ali

Ms. Tayana Chatterjee

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Dr. Syeda Ayesha Ali & Ms. Tayana Chatterjee

CONTENTS

Aurality, Orality and Embodied Memories: Historicizing Caste in Bengal through Namasudra Performance

Benil Biswas

This working paper consists of a description of a specific project and engages with the conference theme of interpretation of Memories, exploring the Oral history— Oral Narratives of Caste and Communities.

The paper documents the development of an ethical and methodological framework for my current PhD project, which attempts to historicize caste in Bengal with a special focus on the cultural dynamics and the identity formation of the 'Scheduled Caste' *Namasudra* community, previously known as the untouchable *Chandala*. I am a performer and a Performance Studies scholar with a background in Literature. My project involves conducting a number of oral history interviews with individuals belonging to the Namasudra community. Methodologically, I also propose to extend the ambit of oral history to include documentation of theatrical and ritual performances, to reveal complex unchartered terrains of embodied memories. In doing so, I hope to provide a lens into a cultural and historical space by creating a rich, textured and vivid narrative while still retaining some of the essential aspects of Oral History and also justify the possibility of imagining 'Performance' as 'Oral History' and vice versa.

Focusing on the challenge of writing history from a minoritarian perspective, I propose to engage with caste-related biases and

lacunae in history writing and historiography in India in general and Bengal in particular, in the larger context of 'Dalit' assertion in both the political and academic spheres[1]. *Dalit* is a Marathi word that literally means things or persons who are cut, split, broken or torn asunder, scattered or crushed and destroyed. The present usage of the term Dalit goes back to the nineteenth century, when a Marathi social reformer and revolutionary, Mahatma Jyotirao Phule (1826-1890), used it to describe the Outcastes and Untouchables as the oppressed and the broken victims of the caste-ridden society of India, specifically in regions in and around present Maharashtra. Under the leadership of Dr. B.R. Ambedkar (1891-1956), this term has gained tremendous popularity and political pertinence in contemporary socio-political discourse.

In this paper, I will reflect on why and how this community from Bengal, which was traditionally called 'Chandala' in Hindu Scriptures and also marked by the same name in the 1871 Census, got to be mobilised under the name of 'Namasudra' in the 1911 census, much before the political mobilization of so called 'Dalits'. Before one grapples with the hierarchies history writing in Bengal, in which the dimension of caste and of Namasudra identity in particular has been neglected, one has to tackle this very same bias in mainstream history and historiography in India. This is what noted historian Devahuti has to say: 'Historiography in modern India has been a kind of Civil war. One group of historians - to include the Imperialists, the Marxists along with a sub-class of pseudo-secularists, and finally, the Muslim communalists justify their widely different stands, by denigrating Indian tradition; the other group includes the nationalists and Hindu communalists who romanticize Indian tradition. However, there is a third set of

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[1] Key contributions to this debate include Susan Bayly, Caste, Society and Politics in India from the Eighteenth Century to the Modern Age (Cambridge, 1999); Nicholas B. Dirks, Castes of mind: colonialism and the making of modern India (Princeton, 2001); Ronald Inden, Imagining India (Oxford, 1990) and Text and practice: essays on South Asian history (Delhi, 2005); Norbert Peabody, 'Cents, Sense, Census: Human Inventories in Late Pre-colonial and Early Colonial India', Comparative Studies in Society and History, Vol 43 /issue 04/ October 2001.

historians who are trying to write objective history with a cruel awareness of the inevitable subjective element in it.[2]

How does one write *objective history* with a cruel awareness of the inevitable subjective element in it? Therefore, in Bengal, for instance, even mainstream socio-political scholarship is relatively silent about caste. As late as the 1990s, Sekhar Bandopadhyay's historical thesis *Caste, Politics and the Raj: Bengal 1872-1937*[3] was the first major work to document the assertion and community building of untouchable 'Chandals' in the form of the devotional membership of the Matua Sect. This sect was initiated by Harichand Thakur (1812-1878), who was born in the Gopalganj subdivision of Faridpur (in present day Bangladesh) to a Vaishnavite peasant family of Chandals. It was under his son Guruchand Thakur (1846-1937) that the sect achieved its doctrinal cohesion and organisational impetus, as it came to be associated with the Namasudra social protest movement beginning in 1872. Though claimed as a 'new' religion, its tenets were selectively drawn from conformist Hinduism, the *Bhakti – Vaishnava* tradition, and folk Islam; but, at the same time, it endeavoured to assert its oppositional stand vis-à-vis the established orthodoxy of institutional religion, being informed by the dominant Catholic missionary presence. In the process, the Namasudras (census 1911); who were previously known as the 'Chandals of Bengal', attempted to affirm their newly acquired social identity and self-respect. Thus, I would argue that a community which can organize itself and get itself registered in the Census[4] cannot be bereft of cultural and social agency. This sphere

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[2]Devahuti (Ed) Problems of Indian Historiography. New Delhi: D.K. Publications, 1979.
[3]Bandopadhyay, Sekhar. Caste, Politics and the Raj: Bengal 1872-1937, University of Calcutta History Monograph 5, Calcutta: K.P. Bagchi & Co., 1990, Caste, Protest and Identity in Colonial India: The Namasudras of Bengal, 1872–1947. Surrey: Curzon Press, 1997 and Delhi, OUP, 2011. Caste, Culture and Hegemony: Social Dominance in Colonial Bengal, New Delhi & London: Sage Publications, 2004. Partition and the Ruptures in Dalit Identity Politics in Bengal, Asian Studies Review (Routledge), 33: 4, 2009, pp. 455- 67.
[4]S. Bandyopadhyay, Caste, Protest and Identity in Colonial India: The Namasudras of Bengal, 1872–1947. Surrey: Curzon Press, 1997 and Delhi, OUP, 2011

of agency may not be dictated by Colonial or Hindu Brahmanic values and customs, but nevertheless it exists as an alternative set of strategies. This is a sphere which is not documented by the District Gazetteer, or print media, which have been the primary sources for historians, political scientists and performance scholars alike. Inevitably, one faces a major historiographical challenge: How does one write histories of people whose performances cannot be categorized as 'theatre', and who in effect, 'lacked papers'? As refugees, they fled to India in 1947 during Partition, and once again in 1971, there was forced migration due to the formation of Bangladesh. How does one write history, document the performances of stateless people, which is the condition of around 3.5 million people identified with the Namasudra and lower caste community, now scattered over 18 states of India? How does one not only fill the gaps in official records, but also expand those records to include the *stories* of people and their *experiences* buried under or excluded from the histories of migration and displacement?

Therefore, interpretation of memories/ oral history become an important tool to document and notate stories which did not find a place in official history of the newly formed nations in South Asia. However, existing oral history archives in India too have their own problems. First of all, they are limited in number. Secondly, in their sparse existence, wherever they exist, recordings available are only of the influential voices. Documentation has been strictly guided by voices considered significant within the paradigm of Nation and National politics. For example the oral history project at Nehru Memorial Museum and Library, New Delhi claims to have oral history interviews such as recollections of important leaders, the Indian politics going back to the partition of Bengal, and the First World War; Satyagraha campaigns, the social reform movements, growth of trade unions and labour relations, activities of revolutionary and terrorist groups, Hindu-Muslim relations, growth of the socialist movement, Indo-British relations in the context of Indian and British politics, and the events leading to

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the partition of India[5]. However, there is no mention of the refugee influx from East Pakistan/Bangladesh except for the interview with Jyoti Basu. That one particular interview again provides just the version of the West Bengal State Government and how its sought to deal with refugee problem, but the voice of the refugee leaders like Jogendranath Mandal and PR Thakur, the 'Homeland' movement, followed by 'Bangabhoomi' movement and subsequently the 'Citizenship' movement all are rendered silent or non-existent.

With these questions in mind, it would be crucial to study the manifestations of the angst of being ostracized and displaced time and again in the Namasudra culture at thematic, textual and visual levels. The angst as forms of resistance need to contextualized in the personal narratives and also within the performative circumstances of Thakurnagar, the *mela* (fair-ground), *kirtan* (congregational devotional singing), *kavigaan* (people's ballads) and the *ekanki (one-act plays)*. One would further need to relate the dynamics of resistance in performance genres to the larger discourse of the Dalit/Namasudra public sphere in Bengal and other parts of India, which are inspired by the life and teaching of Hari Chand-Guru Chand and also based on the autobiographies of various other significant figures such as Pramatha Rajan Thakur (1902-1990), Jogendranth Mandal (1904-1968), B.R.Ambedkar (1891-1956) and others, providing us with an alternative historiography to the Congress-dominated nationalist movement. P.R. Thakur, founder of Matua Mahasangha, along with Jogendranth Mandal, the first Law Minister of East Pakistan, are the key figures in this alternative historiography. Jogendranath Mondal, one should remember, abdicated his seat and recommended the name of Dr. B.R. Ambedkar as a member of the Constituent Assembly; it was on the basis of this strategic solidarity that Dr. Ambedkar was elected to the Assembly from a seat in Bengal. Through this crucial political fact, one needs to probe the interface that both Dalit and Namasudra/Matua identities share.

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[5]http://www.nehrumemorial.nic.in/en/oral-history.html (Accessed on 3 March 2016)

All these narratives come alive in interviews with displaced and migrant lower caste subjectivities who are witness to the above mentioned movements. The narratives and information which are perhaps just a passing reference in official history becomes a passionate nerve centre in these interviews. In a poignant interview with 78 year old Susil Kumar Biswas, the critical awareness about caste in Bengal gets repeatedly underlined. He continuously maintained that experience of the Namasudra is quite different from national circuit of *dalit* experiences. He repeated mentions "do you understand what does it mean to be homeless?, Dalits from Maharashtra will never understand this ostracization."[6] He migrated to India from Bangladesh in 1955, settled at Thakurnagar, North 24 parganas with his family. He went to college here, joined educational service, subsequently retired as the headmaster of Fetepur Higher Secondary School. He was also the General Secretary of the All India Matua Mahasangha. He expressed that the journey of the so-called Depressed Classes of Bengal from Untouchable *Chandala* to Namasudra was of self-rejuvenation and self-pride. A community who were denied history reclaimed the history through the devotional membership of the *Matua Dharma*. He said being called a Namasudra, was not a matter of humiliation, but a matter of pride. As mentioned earlier, the Namasudra community got consolidated from 1872 to 1911, created an alternative epistemology to counter Brahmanic dictates of untouchability and also negotiated representation in various government offices following the communal award. A major blow was however the partition of India, which disrupted and scattered the entire population. In post-partition India, it was probably Matua Mahasangha, located at Thakunagar, which provided some kind an imagined space for the Matua-Namasudra who had lost their epistemological and ontological locateability. In another interview with 75 year old Haribar Bala Thakur[7], one

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[6]Susil Kumar Biswas, Ex-Headmaster, Fetepur High (H.S.) School; Ex-General Secretary, All India Matua Mahasangha. (Interview conducted by Benil Biswas, 1 April 2016) (Audio: Bengali)

[7]Haribar Bala Thakur, Ex-Serviceman, Indian Army, Ex-Acting Secretary, Sri-Sri Hari-

was face to face with vivid memory of how the first refugee colony at Thakurnagar was set up in 1947 under the leadership of PR Thakur. His father Ram Jiban Bala who was among the first settlers, became a significant associate of PR Thakur. Haribar Bala Thakur affectingly remembers the tensed atmosphere in those days, when the local administration was hostile to the refugees and displaced. He remembers the night when certain policeman came to their house and asked for land documents in a bid to oust them:

It was almost midnight in the month of september. We could hear horse hoof sounds outside our house. There were no metaled roads around that time…There were almost 50 men; many of them were on horseback. My father used to sleep on the veranda on a wooden cot. The moment they appeared, he was asked to give all the land papers. My Father refused and said all the papers were with Thakur Masai (PR Thakur). The Bodo Babu (head policeman) shouted at him and asked him to submit the papers or face dire consequences. My father was adamant. The policemen then tried to beat up my father and also had a pistol pointed at him. While he was tried to manhandle my father, my grand ma resisted but was pushed aside and he was hurt. My father got furious at this act of the policeman; he pulled out the axe and lashed the policeman with it. Pistol fell from his hand. He screamed and shouted back at them and all of a sudden in the commotion, the policemen hurriedly left.[8]

Haribar Bala Thakur, who was a 7 year kid then, remembers that it was a dreadful night for the entire family, as they waited for the policemen to come back with more force. The next morning his father was arrested and police filed a case against him. "The Police on horseback dragged my father by his hair. A lot of other people were arrested."[9] It was PR Thakur, who pleaded in favour

Guru-Pramatha Chand Ashram, Ashti, Garhchiroli, Maharashtra. (Interview conducted by Benil Biswas, 1 April 2016)(Audio: Bengali)

[8] Interview (in Bengali) conducted by Benil Biswas on 1 April 2016. English Translation by Benil Biswas

[9] Interview, Ibid.

of Ram Jiban Bala and won the case in his behalf. The accused policemen were suspended, but were later mutually compromised as the accused policemen's family came to Ram Jiban Bala for help. Thus, Thakunagar became the first refuge colony in India for Bengali refugees. Under the leadership of PR Thakur, sections of five maujas (Chikanpara, Simulpur, Badra Krishnanagar, Gaintee) were brought together to create Thakurnagar. Slowly more refugees began to migrate from then East Pakistan and settled around the area. The influx aggravated with rising communal tensions and the formation of Bangladesh in 1971. Such narratives populate the memories of partition, which has now drawn attention of various social sciences scholars.[10] What becomes pertinent is the significance of orality, aurality and embodied memories in the lives of lower caste migrant in Bengal. One common link in these diverse oral narratives is consolidation of Namasudra identity under Matua Mahasangha leadership. Thus, the attempt to understand these pieces of oral history will be incomplete if we do not pay attention to the Matua philosophy and its embodiment in the lives of the subjectivities in question.

The embodiment of memories as forms of resistance can also be contextualized in the personal narratives and also within the performative circumstances of Kavigaan gatherings[11]. To understand the oral and aural magnitudes of Kavigaan of the Matua/Namasudra, one would need to contextualize the ritual and mythological dimensions of the Namasudra belief system in relation to the complex articulation of the self and the community and also the modes of communication in and through art in the contemporary milieu. Kavigaan/Kobigaan is normally sung by two groups. Each group is led by a *lokokobi/loko-kavi (Folk Poet)*,

[10]Haimanti Roy, Partitioned Lives: Migrants, Refugees, Citizens in India and Pakistan, 1947-1965, New Delhi: Oxford University Press, 2012; B. Chatterjee and D. Chatterjee (eds.), Dalit Lives and Dalit Visions in Eastern India, Kolkata: Centre for Rural Resources, 2007

[11]Kobi-gaan/Kavigaan is one of the most significant art form amongst several popular performances genres ranging from kirtan (congregational devotional singing) to the ekanki (one-act plays).

kaviyal or *sarkar (People's Baladeer)*. The accompanying singers called *dohars* often repeat what the leaders sing.[12] Initially, they were popular throughout Bengal, but slowly, Kavigaan has quite vanished from the urban centres, however, it is still very popular in the Namasudra and other lower-caste public performance spheres. The popularity is not because they like the popular culture of obscenity but it was only in Kobigaan and Kirtan, where the lower strata at least have access to religious discourses. Post partition of India, most of the Kavi relocated in the suburban Kolkata along with the relocated population. Famous Kavi Tarakchandra Sarker (1845-1914) and later Kavi Bijoy Sarkar (1903-1985) were major *lokokobi*, people's poet-balladeer of the Matua sect, very popular among the Namasudra and other lower caste communities. Even though these Kavi were from lower strata of the society, but it was through their singing and scholarship that their popularity extended beyond the precincts of their caste origin. It was their performativity which help them to rise in the religious order. This genre which is primarily oral, also help the audience remember, re-enact a history not to be forgotten.

It is this complex web of oral history, myth, faith and belief system which transpires down to engender the oral and aural manifestations of a Kavigaan performance, which is still a very popular mode of infotainment for the marginal Namasudra subjectivities. Della Pollock has extensively dealt with the question of performance and oral history. She has led us to think how do performance analytics change our understanding of and approach to experience narrative (oral history, life history, stories of collective experience).[13] Noted Performance Studies Scholar Dwight Conquergood's assertion on storied/narrative knowledge:

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[12] For elaboration on the names of Kaviyals from East Bengal, genres of performances please see Singh, Dineshchandra. Purbabanger Kobigaan Sangroho – O – Parjaalochona. (in Bangla) Calcutta: University of Calcutta, 1997.

[13] Della Pollock, "Moving histories: performance and oral history" in The Cambridge Companion To Performance Studies. (Ed. Tracy C. Davis), London and New York: Cambridge University Press, 2008.

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Knowledge is not stored in storytelling so much as it is enacted, reconfigured, tested, and engaged by imaginative summonings and interpretive replays of past events in the light of present situations and struggles. Active and emergent, instead of abstract and inert, narrative knowing recalls and recasts experience into meaningful signposts and supports for ongoing action. The recountal is always an encounter, often full of risk. The storyteller struggling for contingent truths – "situated knowledges" – is more exposed and vulnerable than the scientist in pursuit of covering laws and grand theory.[14]

Here Conquergood draws on and contributes to a performance-centered approach to culture more broadly, an approach that emphasizes core patterns of repetition enacted in re-presentation, re-creation, and re-cognition. This pattern is true almost all communities which try to come in terms with cultural crisis. The Namasudra/Matua corpus of experiences too is not an exception. Therefore Kavigaan of the Namasudra repertoire are informed by the angst of being stigmatized as *chandala*, refugee and stateless.

By now it has been well perceived that Namasudra/Matua history is a complex interlocking web of experiences which leads us to rethink and extend our methods beyond traditional notion of literature to documentation of embodied performances of Kavigaan as one of the significant sites of oral history enactments. These gathering lead the audience to remember, re-search, re-present, re-create, and re-cognize themselves about histories and experiences where were rendered absent from public memory and discourse. The oral and the embodied, the spoken and the felt, embodied are enmeshed into each other raising a complex set of narrative remembrance reinvigorating the essence of the traumatic loss. For example, in a poignant performance in front of thousands of audience from Namasudra/Matua community Kavi Uttam Sarkar:

[14]Dwight Conquergood, "Storied Worlds and the Work of Teaching," Communication Education 42.4 (1993), 337, citing Donna Haraway, "Situated Knowledges," in Haraway, Simians, Cyborgs and Women: The Reinvention of Nature (New York: Routledge, 1991), 183–201.

Jodi hoye taar bhokto...Buker taajaa rakto,
Shudro ra dhele dae, Orakandi te kono din,
Tobuo sodh hobena Thakur Guru-chander rin.

[In reverence, by being a devotee.
If Shudras pour their fresh blood, to wash the holy floor of
Orakandi,
Still then, their indebtedness to Thakur Guruchand will never be
quenched.]

Manu r sangbidhane Sudrer jonno, nishedh chilo bhog bilaash,
Onnto kaal thakbe tara tri-borner e seba das,
Tini chire felle eyi shastrer phans, sudra der korlen swadhin,
O tai konodino sodh hobena Thakur Guru-chander rin.

[Manusmriti prescribed the prohibition of material joys for
the Shudra,

They were bound to lie for eternity in servitude of the three
upper castes,

Breaking this knot of this bondage, he bestowed freedom on
the Shudra,

That's the reason; their indebtedness to Thakur Guruchand
will never be quenched]

Tader chokh tulia neya hoto, Jodi shudra veda korto darshan,
Oraa kane dhalto gorom sisha, keu jodi korto srobon,
Eyi phure arbachiner darshan, chire arbachiner darshan,
Korlen sikhsha ke sarbojanin,
tai konodino sodh hobena Thakur Guru-chander rin.(2)

[Their eyes were pulled out, if Shudra even chanced to cast
their eyes on the Vedas,

They used pour molten lead in the ears, if any Shudra tried to
hear the Vedas hymns chanting,

Breaking the shackles of this ruined philosophy, he made
education available to all,

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That's the reason; their indebtedness to Thakur Guruchand
will never be quenched]

Ora Chandal bole dakto sada, dito je grihnaar huutkaar,
O tai broktitae kapalen Guruchand Britisher darbaar,(2)
Bollen shudra ra namashya sabaar, (2)
Karon ora je eti prachin.

[They used to despise us and call out by the name chandals,

That's why Guruchand shaked the entire British
administration by his speech,

He said, Shudra are to be revered (*namasya*) by everyone

As they are the most ancient one,

That's the reason, their indebtedness to Thakur Guruchand
will never be quenched]

tai konodino sodh hobena Thakur Guru-chander rin.
Jodi hoye taar bhokto…Buker taajaa rakto,
Shudro ra dhele dae, Orakandi te kono din,
Tobuo sodh hobena Thakur Guru-chander rin[15].

The poem as mentioned earlier is an apt example of that
recapitulation of individual and community's memories, forming
the corpus of meta-history. These gatherings transform to become
a venue of active interaction and discourse formation. The entire
community relates and relives the atrocity thrashed upon their
subjectivities through ages. It is one such community which
historically relates oneself to *Chandala*. Dr. B R Ambedkar in his
significant work, *Who are the Shudras*, elaborately ponders about
the origin and history of the community. This *kobi-gaan* draws is
perhaps the manifestation of that Ambedkarite thesis, providing
the *Namasudra* community with a sense of agency, but in the process
also it localises the larger grand Dalit discourse about oppression
through mention of Guruchand Thakur and other contemporary

[15]Originally written and sung by Nakul Biswas, renowned folk singer of Bangladesh.

historical developments in Bengal. The specificities of caste discrimination and negotiation undertaken by the community in discussion in the precarious socio-political realm of Bengal is re-enacted, remembered, re-searched, re-presented, re-created, and re-cognized in these kobi-gaan gatherings.

This embodied performance genres of kobi-gaan among many other can now prove one with an adequate insight into the social political, cultural, economic dimensions of the radical alternative aesthetics[16] being proposed in this project. The alternative aesthetics can be understood as the new 'distribution of the sensible'[17] which is literally the conditions of the possibility for perception, thought, and activity. This aesthetics, as the new distribution of the sensible, further engages us to figure out what is possible to be apprehended by the senses. This mannerism of redefining the sensible and aesthetics is required, in bringing on the stage new objects and subjects, in making visible that which was not visible, in making audible as speaking beings those who were merely heard as noisy animals. These redefinitions lead one to set up such scenes of 'dissensus', where politics can be characterized as an 'aesthetic' activity. Thus, the issue 'aesthetics and politics' can thus be rephrased as follows: there is an 'aesthetics of politics' as explained above. Correspondingly, there is a 'politics of aesthetics.' This means that the artistic practices like *Kobi-gaan* take part in the distribution of the perceptible insofar as they suspend the ordinary coordinates of sensory experience and reframe the network of relationships between spaces and times, subjects and objects, the common and the singular.[18] This exploration of the relationship

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[16]In a different context, Isobel Armstrong's clarion call for the project of rethinking the aesthetic is a significant move. Such rethinking has become an intellectual necessity because the politics of the anti-aesthetic rely on deconstructive gestures of exposure that fail to address the democratic and radical potential of aesthetic discourse. These strategies effectively undermine aesthetic discourse but refuse to remake it. The result is culturally impoverishing and politically disabling. For details see Armstrong, Isobel. The Radical Aesthetic. Oxford: Blackwell, 2000.

[17] Ranciere, Jacques. The Politics of Aesthetics: *The Distribution of the Sensible*. London & New York: Continuum Publishers, 2004.

[18]Weizman, Eyel. Jacques Ranciere: The politics of aesthetics, (http://roundtable.kein.

between aesthetics and politics opened up here, leads one to conceptualize an alternative way of approaching arts and encoding aesthetics, looking at sources which bridges the gap between the print culture and lived experiences. This enquiry into alternative forms of embodied history, through memories of lived experiences and resultant mythifications, which operates largely in the realms of the manifestation of religious entity and social life; forms the corpus of the non-conventional political action or in direct resistance. It is this non-conventional political action which should now be read as the realms that influences direct or conventional political actions.

Kobigaan/Kavigaan for the Namasudra is one such illustration of radical alternative aesthetics in practice which interweaves artistic practices, political activism and theory production, transgressing both trivial statements like 'Every art is political!' or 'Art is never political!' and vague claims of a political pedagogy with artistic means. It is precisely these overlaps and reconfigurations of the political and the artistic, which open up a field of transversal practices that potentiate political-aesthetic forms of action, expression and intervention. In a historical moment with a theatrical countenance, Gayatri Spivak once questioned: "Can the subaltern speak?"[19] She further reiterated the thought through her scholarly interventions and concluded that the subaltern cannot speak citing the suicide of Bhuwaneshwari Devi. Thus, the subaltern has to be interpreted through its gestures, movements and memories have to be interpreted. One such occasion would be her translation and analysis of Mahasweta Devi's *Draupadi*. This expression went on to become the bench mark of post-colonial criticism, which led to re-imagination and extension of a new genre of literature. I would want to answer that expression of hers. Answer would be - Yes, the so called, 'subaltern' (here specifically Namasudra), did not want to be called anything or 'subaltern' in the first place, and therefore can-not only speak, but sing, dance, philosophize on

org/node/463) accessed on 7 october 2013
[19] Spivak, Gayatri Chakraborty. Can the Subaltern Speak?: Reflections on the History of an Idea. (Eds.) Rosalind C. Morris. New York: Columbia University Press, 2010. pp. 21-78.

their own about the politics of casteism, reservations, migration, voices of marginality within minority discourse through the prism of memories in Kobigaan/Kavigaan (poet's ballad), in order to have recuperation and ownership of their own history.

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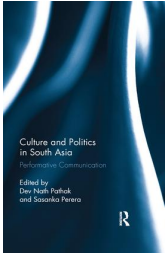
Culture and Politics in South Asia

Performative Communication

Edited By Dev Nath Pathak, Sasanka Perera

Chapter 10 | 18 Pages

Performative politics and the iconography of Gita Press

A critical reading

By Ritu Sinha

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This chapter argues that printed visuals emerged as an important component of performative Hindu religious politics and feature the performative politics of Gita Press of north India by locating it in the rich tradition of the reception of the printed visuals. The religious presses like Gita Press were crucial religio-political organisations that voluntarily surfaced as religious pedagogues for the Hindu masses and strived for silent religious transformation. If Ravi Verma's oleographs produced the religious imagery of Aryanised past, it was presses like Gita Press that recreated and revised such imagery responding to the political necessities of the 1920s. The iconography of Gita Press eschewed the glaring political narrative to produce the cartography of the nation where images of mother goddesses acquired prominence, besides images on the sacrifices of the individuals in the service of mother goddesses; or picturing of historical events narrating political crisis; or the saga of deplorable condition of India under colonial rule.

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CHENNAI

Shopping Motives, Store Attributes and Shopping Enjoyment: A Study of Shoppers in Delhi

Mallika Yadav, Ambedkar University, Delhi
Kartik Dave, Ambedkar University, Delhi

ABSTRACT

In the midst of increasing e-commerce and virtual stores, traditional retail stores face a need to stay relevant and understand the attitudes and behaviour of their target consumers. Even, in the era of increasing inclination towards e-commerce, retail stores have their own charm and are driven by some key factors which differentiate them from virtual stores. The holistic picture of how a shopper derives enjoyment can help in understanding the consumer behaviour and increase satisfaction.

With the Omni-channel shopping behaviour among shoppers, it is interesting to discern how shopping motives and store attributes have an impact on shopping enjoyment. The shopping enjoyment is influenced by internal as well as external predictors. Shopping motives being the internal contributor which is person-specific while store attributes being the external aspect which maybe situational-specific. The understanding of these can help retailers in enhancing the shopping experience which in turn can boost sales and enhance patronage and re-patronage behaviour.

Design/Methodology/Approach: The mall intercepts and store intercept method was used to collect data. A survey on 239 shoppers from Delhi based on 31 items questionnaire is used in the study. It is assessed on a five point likert scale. The major shopping motives and store attributes were identified with the help of literature followed by pilot testing. The shopping motives - Anticipated utility, self-gratification, negotiation, diversion, self and relationship affiliation and socialising are identified. The major store attributes are service orientation, variety and availability, store ambience, safety and payments.

Findings: The internal predictor is self-gratification and external is store ambience which has the highest correlation with shopping enjoyment. However, there is difference in certain shopping motives and store attributes preference on the basis of demographic variables. Further, multiple hierarchical regression model(s) were used to explore predictors of shopping enjoyment.

INTRODUCTION

India has emerged as an attractive retail spot in the world. The Retailers Association of India (RAI) and Boston Consulting Group and, 2015, published a report 'Retail 2020: Retrospect, Reinvent, Rewrite', which states that due to the growth income, people migrating to cities and shifts in the attitudes, India's retail market is going to be double to US$ 1 trillion by 2020 from US$ 600 billion in 2015. Delhi NCR has around 95 malls and around 13 of the malls are performing well in achieving their business objectives while the rest are losing their momentum. According to a Jones Lange Lasalle (JLL) India, 2015, the total number of malls operating in Delhi NCR is highest compared to any other city. The report presents the comparison of malls on their usual vacancy levels and rentals. The best-performing malls in the Delhi-NCR region have around 10 percent average vacancy. According to a survey by DNA, the decline in the number of people visiting malls is really high. As per the study, around 65-70% of the spaces in many of the malls still remain vacant while around 150 malls were launched in the past couple of years. The mode of shopping is influenced by the shopping enjoyment which evolves during the whole experience of shopping (Wong et al., 2012). Several malls are shutting down because they are unable to attract footfalls. As the number of malls in India is increasing rapidly, especially in Delhi, it makes sense to understand the factors that influence the shoppers' enjoyment and thus can be helpful in facilitating the marketing approach.

With online shopping growth it is still crucial to study physical store retail environment. Most customers seek gratification through in-store experience which also helps them validate their purchases. The consumers which make purchases inside a

physical store at least once a week is around 40%, whereas those who do online is 27 percent, according to PwC's annual consumer survey, 2015. There are various malls and multi brand outlets in Delhi. People visit malls just for enjoyment many a times. This footfall is an opportunity that retailers can leverage on as many times impulse buying happens. Researchers and practitioners say that the differentiation in price or location is no more a distinguishing factor that helps in establishing competitive advantage rather for growth in sales and gaining consumer trust it is vital to improve the overall experience the customer has during his visit. This paper aims to study the shopping enjoyment and the effect of motives and attributes of a store on their shopping enjoyment levels. The motives for shopping are more personal while store attributes are more situational in nature. Thus, this knowledge can be helpful in understanding the customers.

LITERATURE REVIEW

An extensive review of literature is carried out to understand the research gap and related intricacies.

Shopping Motives

Westbrook and Black (1985) state the forces that drive behavior to satisfy internal need states are motives. Shopping motives as per Jim and kin (2003) explained the drivers of behavior that take consumers to the marketplace to persuade their internal needs. Rohma and Swaminathan (2004) study states the affective and cognitive motives are aiming at the satisfaction of the individuals. These become the theoretical background to understand why people buy and shop. Consumers are motivated by the ability to derive some utilities implicitly by certain settings in shops (Sarkar et al., 1996). These utilities may include place utility- like location of the store, time utility- extended store hours, quick and efficient checkout, and possession utility- a proficient inventory and distribution system that enables consumers' immediate possession of the goods purchased.

Despite the terms being used in different ways in many researches that have been done in the past, there can be two kinds of shopping motives broadly- one which is based on the functional utility derived out of the product and need to acquire the product and the other of seeking pleasure in shopping (Jin and Kim, 2003). The motive for acquiring product is product oriented and utilitarian. The other shopping motive is enjoying the act of shopping and refers to seeking enjoyment inherent in the retail store visit.

Tauber (1972), in his article "why do people shop" stated that the motive for shopping is not just product acquisition but have many other emotional motives like personal motives or social motives. Apart from this impulse shopping also occurs. The sight of a store may serve as a reminder to purchase needed items as Tauber mentions in his article. Tauber (1972) lays out six motives for shopping which can be mentioned as self-gratification, shopping as an exercise, keeping oneself updated with the new trends, role play, diversion and sensory stimulation. The author mentioned five motives which are social in nature i.e. social experiences, communication with people with shared interest, peer group influence, status and authority, and pleasure derived out of bargaining. Shopping motives that bring a customer to a shopping setting and result in behavior, the way they evaluate a store's attributes which translates to satisfaction in shopping, should differ basis their shopping motives (Groeppel-Klein et al., 1999). Westbrook and Black (1985) study explains the hypotheses' role enactment, negotiation, choice optimization, affiliation, anticipated utility, power and authority, stimulation as factors for female shoppers at department stores. Results state that the factors that influence motivation are significantly related to economic and social dimensions except stimulation. Hence the economic and social setting of the customer has an impact on the motive for their shopping.

In an article on shopping orientation, Sinha (2003) argued that Indian customers are inclined towards shopping because they derive entertainment out of it. He says that purchasing power of the working youth in India has increased. They have emotional association with the process of shopping and not primarily on the functional benefits. Thus on the benefit ladder it translates to emotional and social benefits being higher than the functional benefits for such customers. As the income level

of the customers' increases they spend more on the lifestyle and shopping becomes an integral part of maintaining the lifestyle and keeping up with new trends.

Ruby Roy Dholakia (1999) defines three broad motives for shopping in her research which are shopping as pleasure and interactions with family and utilitarian. Stephanie M. Noble, et al. (2006) in their research claims that gender has an influence on social interaction in shopping. While females intend to maintain interpersonal affiliations, men are less likely to browse through retail outlets just to take time off. According to self-construal theory, women associate with themselves an independent self-construal, visualizing themselves as connected to others. And, Gender schema theory also proposes that females are more expressive, whereas men are more instrumental. Morschett et al. (2005) opined that shopping motives influence how retail store attributes as well as retail stores are perceived.

Shopping Enjoyment

Kim K. P. Johnson et.al (2015) state that major store attributes that influence shopping enjoyment included factors such as ambience, price, leisure, design and service. Shopping enjoyment is a contributor to both place attachment and store loyalty. Moreover, place attachment was found to be an important predictor of store loyalty. Hedonic consumption is those activities that relate to the multisensory, fantasy, and emotive aspects of consumption (Hirschman &Holbrook, 1982).

Recreational shoppers are those people who enjoy shopping and do it as a leisure activity. They browse retail outlets assuming that that they may buy something. Pleasure in shopping impacts the re patronage intentions (Cathy Hart et al., 2007). Shopping enjoyment also has an influence on the time that a shopper may splurge in a shopping setting; it is also deliberated that increased time spent in the retail environment consequences in higher spending (Donovan et al., 1994; Wakefield and Baker, 1998). Thus enjoyment may influence the duration and money spent in a shopping visit. Such shoppers have a higher probability of being in the store for longer time, browse more and spend more if they find the enhancements in a retail setting apart from the basic qualities that is expected out of it. This is the reason various stores make use of sensory stimulation in such settings to enhance the shopping experience. Music, pleasant smell, visual merchandise and so on are used for making the customer stay in for longer duration and check out more products. Lesser and Forsynthe (1989) said that there is a strong association of shopping enjoyment and shopping exploratory behavior.

Store Attributes

Store image is said to be the combination of the various qualities of the store and an impression of them as perceived by the consumer psychologically argued by Martineau (1958). The shoppers experience the store atmosphere mainly through their sensory channels (Zentes et al., 2007). The image of the store affects the patronage and re-patronage behavior of the customers. The more favorable the image, higher the chances of the consumers shop at the store. The layout of the shop, product availability, merchandise variety, payment methods, the operating hours are some of the factors that are important for store image. In a contribution on desire to be in the mall and shopper's excitement, Wakefield and Baker (1998) identified ambient factors, design factors, layout and variety as the major constructs. Yalch and Spangenberg (1990) stated that music style also has an impact on the time that is spent inside a shopping setting. Apart from music, studies of other variable related with time spent in store include color (Bellizzi and Hite, 1992) and lighting (Areni and Kim, 1994). The internal consistency of different store attributes across various markets in USA and the same attribute is of considerably varied importance in different regions (Hirschman et al., 1978). Perceptions of specific store attributes differ among the customer (Groppel-Klein et al., 1999: 68). This makes it essential to study different markets for better understanding of its customer. Also those with varied motives had different preferences. Appeal and convenience, ambience, personnel, Parking and seating amenities and atmospherics are main attributes with respect to shopping malls in Mumbai. (Venkateshwaralu and Uniy 2007)

Lazarus Theory (1991) argues that a thought must come before any emotion or physiological arousal. The influence on a person can be due to the internal factors which are values, personality and belief and external factors like response of the people, product functioning etc. This psychological evaluation initiates the affective experience which in turn affects the behaviour of the response.

OBJECTIVE AND SCOPE

The objective of this study is to find out the motives and store attributes preference across different demographic variables such as gender, income and age groups and measure shopping enjoyment, and the impact of shopping motives and store attributes on it.

A lot of studies have been done on shopping enjoyment in global context. Kuruvilla and Ganguli (2008) studied malls and how they function in India. Singh et al., 2010, studied financing and practices and compared as to how malls in India and USA are different or same (Singh and Bose, 2008). Ghosh et al (2009), gave conclusions on customer expectations of retail store outlet. Dholakia (1999) studied the major determinants of shopping behaviors and motivations to study the impact among married households, of changing social pressures. Hyo Jung Chang et al. (2015) studied effects of store attributes on retail patronage behaviours in US. Mehta et al. (2013) did a study on Indian hypermarket shoppers based on shopping motivation. Basu et al. (2014) studied the store formats and if they mattered to the shoppers'. Major studies also focus on the mall shoppers and their characteristics (Kuruvilla and Joshi, 2010) and what are the attitudes of consumers towards malls (Swaminathan and Vam, 2008). Khare et al. (2014) studied how the perceptions of price and motives for shopping affect the attitude of Indian customers towards the promotions of the retailer in malls. Wong et al. (2012) studied shopping motives, store attributes and shopping enjoyment among Malaysian youth. No relevant study has been found which could measure internal and external predictors of shopping in Indian context. Though there is a study on service environment and patronage intentions (Tripathi and Siddhqui, 2008). This reflects a probable research gap in this context.

RESEARCH DESIGN

The present research is exploratory to begin with followed by descriptive design. The data is examined by using SPSS. A Socio-demographic profile of the respondents is presented using descriptive analysis in this study. Mean scores of male and female respondents are compared on the three major variables including shopping motives, store attribute and shopping enjoyment. The independent samples t test is used. Age wise differences in the dimensions of shopping motives, store attributes and shopping enjoyment were tested using one-way ANOVA analysis. Also the differences between shopping motives, store attributes and shopping enjoyment of married and unmarried people have been assessed using t test. Correlation analysis is used to study the incidence and strength of the relationship between shopping motive factors and store attribute factors to shopping enjoyment respectively.

Further, to identify the influencing predictor variables in explaining the significant variance in shopping enjoyment, hierarchical multiple regression technique is used.

The socio demographic profiling of the sample is shown in Table 1. There were 239 usable responses out of which 47.7% male and 52.3% were female respondents. The total number of married people is 140 which make up 58.6% of the sample. Most of the people are in the age group 18-30 and the second highest in the age group 31-40. Maximum respondents are in the age group 18 to 30 and are females, followed by men in the age group of 31 to 40.

The reason being mostly people in these age groups was found in the shopping centers and malls when they were visited for collecting responses. For equitable collection of sample from all over Delhi the percentage of people from various parts of Delhi is also taken. Since the respondents profile is highly skewed when it comes to education level, it is complex to evaluate the impact of education on any of the factors.

Socio Demographic	Frequency	Percentage
Gender		
Male	114	47.7
Female	125	52.3
Marital status		
Married	140	58.6
Unmarried	99	41.4
Age		
18 to 30	91	38.1
31 to 40	73	30.5
41 to 50	43	18
51 and above	32	13.4
Education		
12th pass	28	11.7
Graduation/Professional degree	119	49.8
Post Graduation and above	92	38.5
Income		
less than 5 Lakhs	33	13.8
5 Lakhs - 10 Lakhs	88	36.8
11 Lakhs - 20 Lakhs	74	30.9
21 Lakhs and above	44	18.41
Location		
North	56	23.4
East	29	12.1
West	49	20.5
South	49	20.5
Central	56	23.4

Table 1: *Respondents' socio demographic profile*

SAMPLE DESIGN

A total of 239 people from Delhi were intercepted at the malls, using convenience sampling method. Mall intercept and shopping centre intercept method were used to target the sample. Pacific and Waves Mall in East Delhi, Select city walk and DLF emporio in South, Westgate Mall in West, M2K and Spark mall in North and people in shops at Connaught place were requested to fill up the questionnaire. The sample is heterogeneous and includes people of different age groups, and income level. A pilot study was done on 30 respondents to check the reliability of questionnaire. The malls were visited on weekend between 3 PM to 7 PM as it expected more people would visit in those hours. The reason of conducting pilot was determine the appropriateness of the questions, to ensure the reliability Cronbach's alpha for each instrument and to ident whether the questions are congruent to find out the answers to the research objectives. On the basis of Pilot study previous researches some factors were identified and responses were collected. The independent variables are age, inco and gender and location.

QUESTIONNAIRE DESIGN

The self-administered questionnaire was designed. The reliability of questionnaire of 31 items is 0.840 based on Cronbach alpha test.

The questionnaire was designed in three parts. First part is based on socio demographic items which include age, sex, marital status, income; location. The second part consists of shopping motives and shopping enjoyment and the last part consists of store attributes.

Westbrook and Black (1985) were referred to adopt the shopping motives items. The shopping motives were further selected based on a pilot study to understand which factors are more important than the others. The responses are measured on a five point likert scale with the extremes being 1-strongly disagree to 5- strongly agree.

As the number of factors was too many, factor analysis was used to combine similar factors together. Seven factors are extracted primarily after applying factor analysis as shown in Table 2. KMO result of 0.780 in shopping motives dimension indicates the usefulness of factor analysis. The instrument consists of factors including of self-gratification, diversion, sensory stimulation, anticipated utility, negotiation, self and relationship affiliation, and socialize. These factors can successfully explain 82% variance. Further, there are 12 items, with five-points scale ranging from 'not all important' (1) to 'extremely important' were developed (Bellenger et al.,1977) and (Ganesh et al., 2007) as presented in Table 3. Quality of store, merchandise quality, convenience, enhancements and price orientation are the factors describing shopping attributes. Five factors are extracted with a total explained variance of 78%. This study has used multi-item scales, to measure shopping enjoyment, developed by Lesser and Forsythe (1989). The responses were recorded on a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The items that gave coefficient greater than 0.9, were combined to measure shopping enjoyment.

Factor labels and statements	Factor loadings							
	1	2	3	4	5	6	7	Alpha
Anticipated Utility								
1. Brand-new item to replace an older one	0.796							.828
2. First to have the latest in new fashions or new products.	0.681							
3. Create a new 'image' for myself or my home	0.876							
Negotiation								
1. Sales discount	0.882							.789
2. Like to bargain with salespeople	0.877							
Self –Gratification								
1.Going to the mall picks up my spirit								
2.Stores and shopping malls are exciting places to visit	0.88							.825
3. I go shopping just to pamper myself	0.543							
Diversion	0.684							

	1 (13.90%)	2 (12.50%)	3 (12.50%)	4 (12.30%)	5 (10.80%)	6 (10.50%)	7 (10.40%)
1. Salespeople would just leave me alone			0.672				
2. Shopping is a hassle			0.763				
3. I only shop when I have to buy something			0.839				.711
Sensory Stimulation							
1. It's especially fun to buy unplanned items				0.891			
2. hustle and bustle of stores and shopping malls				0.517			.602
Self and Relationship affiliation							
1. Shop for the Special people in my life					0.67		
2. I shop just to get some exercise					0.805		.646
Socialization							
1. Shop with friends as a social occasion.						0.578	
2. I talk with salespeople and other shoppers						0.933	
Variance explained	13.90%	12.50%	12.50%	12.30%	10.80%	10.50%	10.40%
Total Variance explained						82.90%	

Table 2: *Factor Analysis of Shopping Motives*

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 8 iterations., Alpha<0.5 hence not reported

Factor labels and statements	Factor Loadings					Alpha
	1	2	3	4	5	
Service orientation						.755
Friendliness	0.819					
Quality of service	0.772					
Operating hours	0.586					.766
Variety and Availability						

	13.90%	12.50%	12.50%	12.30%	10.80%	10.50%	10.40%
1. Salespeople would just leave me alone			0.672				
2. Shopping is a hassle			0.763				
3. I only shop when I have to buy something			0.839				
Sensory Stimulation							
1. It's especially fun to buy unplanned items							.711
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				0.517			
Self and Relationship affiliation							
1. Shop for the Special people in my life							.602
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					0.805		
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Quality of service	0.772					
Operating hours	0.586					
Variety and Availability						.766

	F1	F2	F3	F4	F5
merchandise variety	0.886				
New products availability	0.778				
Product availability	0.553				
Store Ambience					.688
Membership discounts		0.799			
Cleanliness		0.591			
Decor		0.747			
Safety					.731
Safety			0.87		
Safe parking			0.72		
Payments					*
Payments				0.908	
Variance explained	18.80%	17.50%	16.90%	14.70%	10.90%
total variance explained				78.80%	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations. *Alpha~0.5 hence not reported

Table 3: *Factor Analysis of Store attributes*

RESULTS AND FINDINGS

Hypothesis Testing

To test the impact of respondent's demographics on motives, store attributes and enjoyment various hypotheses were formulated and analyzed using appropriate statistical tool.

Impact of age group

H1: With respect to store attributes, there is no difference between different age groups

Hypothesis	Store attributes	Age	Mean	F	Sig.	Result
H1a	Service orientation	18 to 30	0.11	21.808	0.000	*
		31 to 40	0.33			
		41 to 50	0.07			
		51 and above	-1.16			
H1b	Variety and availability	18 to 30	0.46	13.53	0.000	*
		31 to 40	-0.36			
		41 to 50	-0.02			
		51 and above	-0.46			

Role ambience	18 to 30	0.08	0.12	0.000	*
	31 to 40	0.12			
	41 to 50	0.58			
	51 and above	0.46			
safety	18 to 30	0.07	11.474	0.000	*
	31 to 40	0.06			
	41 to 50	0.97			
	51 and above	0.85			
payment	18 to 30	0.15	3.412	0.018	*
	31 to 40	0.22			
	41 to 50	0.17			
	51 and above	0.22			

a significant difference among age groups. The Anova test suggests that there is a significant difference for all the
are significant as all of them have p<0.05 at 95% level of confidence. Thus, we reject the null hypothesis H1.

Shopping motives

With respect to shopping motives, there is no difference between different age groups.

Hypothesis	Shopping motives	Age	Mean	F	Sig
H3	Anticipated Utility	18 to 30	0.28	4.764	0.003	*
		31 to 40	0.28			
		41 to 50	0.03			
		51 and above	0.12			
	Negotiation	18 to 30	0.39	22.735	0.000	*
		31 to 40	0.18			
		41 to 50	0.88			
		51 and above	-0.35			
	Self-gratification	18 to 30	0.03	2.105	0.100	NS
		31 to 40	0.18			
		41 to 50	-0.28			
		51 and above	-0.13			
	Diversion	18 to 30	-0.03	8.179	0.000	
		31 to 40	-0.20			
		41 to 50	-0.16			
		51 and above	0.76			
	Sensory stimulation	18 to 30	0.29	9.468	0.000	
		31 to 40	-0.44			

Hypothesis	Store attributes	Age	Mean	F	Sig.
		41 to 50	0.26		
		51 and above	-0.16		
H2f	Self and Relationship Affiliation	18 to 30	-0.37	7.738	0.000 *
		31 to 40	0.30		
		41 to 50	0.22		
		51 and above	0.09		
		18 to 30	-0.02	13.052	0.000 *
H2g	Socialize	31 to 40	-0.28		
		41 to 50	-0.18		
		51 and above	0.92		

Table 5: *shopping motives among age groups*

*significant at 95% confidence level

Shopping enjoyment

H3: With respect to shopping enjoyment, there is no difference between different age groups

Shopping Enjoyment	Age	Mean	F	Sig.
	18 to 30	-5.524	1.838	0.141
	31 to 40	7.083		
	41 to 50	-1.521		
	51 and above	3.61		

Table 6: *Shopping enjoyment among age groups*

For shopping enjoyment among various age groups, $F(3,235) = 1.838$, $p > 0.05$. We do not reject the null hypothesis H3, there is no difference in shopping enjoyment among different age groups. Hence there is no significant difference am shopping enjoyment in different age groups. Even though the shopping motives and store attributes preference differ enjoyment does not differ across age groups.

Impact of gender

H4: With respect to store attributes, there is no difference between males and female respondents

Hypothesis	Store attributes	Sex	t value	p value	Results
H4a	Service orientation	Male		0.541	NS
H4b		Female	-0.6	0.549	
	Variety and availability	Male		0.352	NS
H4c		Female	-0.93	0.354	
	Store ambience	Male		0	*
H4d		Female	-6.2	0	
	Safety	Male		0.001	*
H4e		Female	-3.31	0.001	
	Payments	Male		0	*
		Female	6.57	0	

Table 7: *Store attributes and gender*

H5: With respect to shopping motives, there is no difference between males and female respondents

	Shopping motives	Sex	t Value	p value	
H5a	Anticipated Utility	Male	1.25	0.21	NS
		Female			
H5b	Negotiation	Male	-5.18	4.9	NS
		Female			
H5c	Self-gratification	Male	-3.03	0.002	*
		Female			
H5d	Diversion	Male	-6.02	8.56	NS
		Female			
H5e	Sensory stimulation	Male	-1.42	0.15	NS
		Female			
H5f	Affiliation	Male	-0.4	0.68	NS
		Female			
H5g	Socialize	Male	2.5	0.012	*
		Female			

Table 8: Shopping motives and gender

H6: With respect to shopping enjoyment, there is no difference between males and female respondents

		t	Sig
Shopping Enjoyment	Male	-2.29	0.022
	Female		

Table 9: Shopping enjoyment and gender

From Table 9, for shopping enjoyment t (237) = -2.29, p<0.05, there is a significant difference in the shopping enjoyment among males and females. Hence, we reject the null hypothesis H6.

Overall, shopping motives are not largely driven by gender. Store attributes have no difference among males and females i preference of service orientation as we see in Table 5. But safety, store ambience and payments show there is a significa difference in males and females. The results were consistent with Seock and Saul's (2008) revealed and proved that motiv are not largely different basis gender. However, the findings are not consistent with earlier studies like Noble et al. (20 and Yue-Teng et al. (2011) which stated that shopping motives are influenced by gender.

The relationship between shopping enjoyment the selected variables

Pearson correlation test is used to predict the nature of predictor variable to shopping enjoyment as given in Table 10 correlation analysis result in the table shows that six of the seven shopping motives show a high correlation with enjoy at the 0.01 significance level. The degree of association falls in the range 0.201 to 0.596. Therefore, it indicates that he shopping enjoyment, the higher the drive of anticipated utility, self-gratification, diversion, sensory stimulation, s elationship affiliation and socialization. Correlation analysis also shows, Self-gratifications score and shopping enj core (r=.596, p=0.0001) show the strongest linear relationship. The subsequent score was seen in anticipated util lopping enjoyment score (r=.435, p=0.000).

| Factors	R	p
Anticipated utility	0.435**	0
Negotiation	0.051	0.43
Self-gratification	0.596**	0
Diversion	0.201**	0.002
Sensory stimulation	0.370**	0
Self and relationship affiliation	0.217**	0.001
Socialize	0.391**	0
Service orientation	0.263**	0
Variety and availability	0.290**	0
Store ambience	0.292**	0
Safety	0.55	0.397
Payments	0.17**	0.008

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 10: *Correlation with shopping enjoyment*

In the same way, the next strong linear relationship is observed in socializing and shopping enjoyment score (r=0.3 p=0.001). Then we see the relationship between sensory stimulation and shopping enjoyment score (r=0.370, p=0.000) and relationship affiliation and diversion are also found to be significantly correlated with shopping enjoyment sc (r=0.217, p=0.00; r=.207, p=0.000)

These were comparable with the study of Dawson et al. (1990) and Lotz et al. (1999) which suggest that there exi positive relationship between shopping motives and shopping enjoyment. If we look at the store attributes, store ambi has the highest correlation with shopping enjoyment score (r=0.292, p=0.000) followed by variety and availability w minor difference in score with shopping enjoyment score (r=.290, p=0.000). They are followed by service orientatior payments (r=0.263, p=0.000; r=0.17, p=0.008).
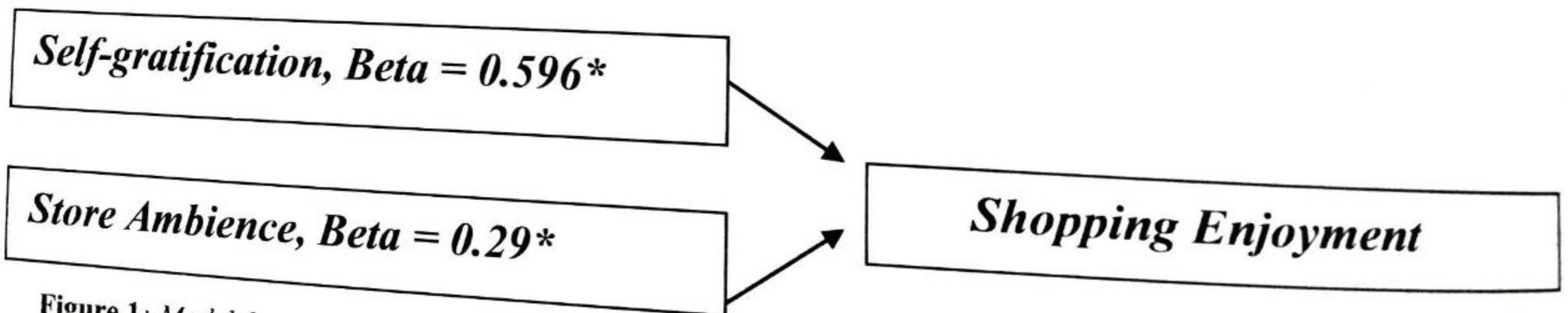
Figure 1: *Model for predictors of shopping enjoyment*

Hierarchical Multiple Regression

By observing the model summary above, using the stepwise method, SPSS has produced eight models. The predictors i model are given below the table. In the first model Self-gratification is the predictor. The model 2 includes Self-gratifi

and anticipated utility. The R square value in Model 1 shows that R square is 0.356, which means that the amount of variance in the dependent variable that is shopping enjoyment can be explained the independent variable that is Self-gratification.

Model		Unstandardized Coefficients		Standardized Coefficients			95%Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	-1.614E-17	.052		.000	1.000	-.102	.102
	Self-gratification	.596	.052	.596	11.440	.000	.494	.699
2	(Constant)	-8.523E-17	.044		.000	1.000	-.086	.086
	Self-gratification	.596	.044	.596	13.582	.000	.510	.683
	Anticipated Utility	.435	.044	.435	9.902	.000	.348	.521
3	(Constant)	-1.019E-16	.036		.000	1.000	-.071	.071
	Self-gratification	.596	.036	.596	16.631	.000	.526	.667
	Anticipated Utility	.435	.036	.435	12.126	.000	.364	.506
	Socialise	.391	.036	.391	10.903	.000	.320	.462
4	(Constant)	-2.635E-17	.027		.000	1.000	-.052	.052
	Self-gratification	.596	.027	.596	22.429	.000	.544	.649
	Anticipated Utility	.435	.027	.435	16.353	.000	.382	.487
	Socialise	.391	.027	.391	14.704	.000	.339	.443
	Sensory stimulation	.370	.027	.370	13.906	.000	.317	.422
5	(Constant)	2.982E-17	.022		.000	1.000	-.044	.044
	Self-gratification	.596	.023	.596	26.483	.000	.552	.641
	Anticipated Utility	.435	.023	.435	19.309	.000	.390	.479
	Socialise	.391	.023	.391	17.362	.000	.347	.435
	Sensory stimulation	.370	.023	.370	16.420	.000	.325	.414
	Self and Relationship Affiliation	.217	.023	.217	9.656	.000	.173	.262
6	(Constant)	1.060E-17	.018		.000	1.000	-.036	.036
	Self-gratification	.596	.018	.596	32.555	.000	.560	.633
	Anticipated Utility	.435	.018	.435	23.736	.000	.399	.471
	Socialise	.391	.018	.391	21.343	.000	.355	.427
	Sensory stimulation	.370	.018	.370	20.185	.000	.334	.406
	Self and Relationship Affiliation	.217	.018	.217	11.870	.000	.181	.254
	Diversion	.201	.018	.201	10.959	.000	.165	.237
7	(Constant)	1.913E-17	.018		.000	1.000	-.035	.035
	Self-gratification	.596	.018	.596	33.048	.000	.561	.632
	Anticipated Utility	.435	.018	.435	24.095	.000	.399	.470
	Socialise	.391	.018	.391	21.666	.000	.355	.427

				20.490	.000	.334	
Sensory stimulation	.370	.018	.370	12.050	.000	.182	.405
Self and Relationship Affiliation	.217	.018	.217	11.125	.000	.165	.253
Diversion	.201	.018	.201	2.841	.005	.016	.236
Negotiation	.051	.018	.051	.000	1.000	-.035	.087
(Constant)	2.445E-17	.018		33.296	.000	.567	.035
Self-gratification	.603	.018	.603	24.264	.000	.408	.639
Anticipated Utility	.444	.018	.444	21.756	.000	.354	.480
Socialise	.389	.018	.389	20.001	.000	.349	.425
Sensory stimulation	.387	.019	.387	11.981	.000	.179	.425
Self and Relationship Affiliation	.215	.018	.215	11.410	.000	.177	.250
Diversion	.213	.019	.213	3.411	.001	.027	.250
Negotiation	.064	.019	.064	-2.303	.022	-.091	.101
Variety and availability	-.049	.021	-.049				-.007

Table11: *Hierarchical multiple regressions coefficients*

In model 1, the independent variable 'Self-gratification' accounts for 35.6% variance in the scores of shopping enjoyment. The R value (0.596) is the multiple correlation coefficients between self-gratification and shopping enjoyment. The independent variables 'self- gratification', 'anticipated utility', 'socialize' 'sensory stimulation, 'self and relationship affiliation', 'diversion' ,'negotiation' and 'variety and availability' together, account for 92.6 % variance in the scores of shopping enjoyment which is very high. The un-standardized coefficients column gives us the coefficients of the independent variables in the regression equation for each model.

Model1: -1.61 + .596 Self-gratification

Model 2: -8.5+ .596 self -gratification + .435 anticipated utility

The standardized coefficients column gives us the coefficients of the contribution that an individual variable makes to the model.

CONCLUSION

The contribution of the study is towards understanding of shopping enjoyment among customers in Delhi. It also helps us understand why do people in Delhi shop and how their shopping experience can be improved in context of malls and shopping centers. This study gives an understanding on the question of why people shop and cam help retailers in identifying their target and know their needs. The overall influence of the internal factors and external factors in this paper has an influence on behavior. A more holistic picture on how to derive shopper enjoyment gained. Self-gratification and store ambience have the highest impact on the amusement that a shopper derives. Shopping mall management therefore should offer entertainment and experience mix to their customers so that their needs are fulfilled under one roof. The self-gratification can be in entertainment, pass time, self-expression and so on. In such as case the customer is likely to indulge in impulse shopping to a greater extent. Also, the store ambience being a major external influencer. shops should really focus on enhancing the store in visual and environmental appeal. The music, visual merchandise, colors, light effect, music, smell temperature of Air conditioner are some of the factors that need to be taken care of. Again it really depends on the kind of products and the target segment they are catering to, so as to decide how the store ambience should be. The retailers should

focus more on creating ambience and increasing convenience for the customers which is similar to the result given by Singh and Sahay (2012) in their study on malls in Delhi NCR.

MANAGERIAL IMPLICATIONS

Consumer behavior has been a topic of great interest when it comes to retail management. We proposed a model in this research by identifying internal and external predictors of shopping enjoyment in Delhi. The study has identified five significant store attributes (i.e. service orientation, variety and availability, store ambience, safety and payments) that predict shopping enjoyment externally. Shopping motives that were identified are - anticipated utility, negotiation, self-gratification, diversion, sensory stimulation, self and relationship affiliation, and socializing motive which are the internal predictors of shopping enjoyment.

These findings provide a linkage among internal and external predictors of enjoyment which otherwise we also have an intuition about. The suggested model also presented an intricate picture of how consumers' behavior is affected by both their internal needs and external appeal when in a shopping environment. With the changing scenario in Omni channel retail environment, retailers need to improve more than just functional aspects. Our findings suggest that, self-gratification is the most crucial internal motive and hence they need to work on various aspects to improve their overall experience. For example, shoppers' enjoyment can be enhanced through understanding their requirements and praising them and improving the store ambience so that they stay for longer duration. To attract customers retail stores should not only centered on pricing competiveness and the service quality but also the experiential aspects of shopping within the store. Apart from advertising and right communication strategies these factors must also be considered. Reaching out to customers with customized offers and other advertisements using real time intelligence and location based marketing. Digital marketing and digitization can actually be leveraged by *the mall culture as malls are the 'alls'-with not just options for shopping but recreation as well. It is a crucial finding in India because this can further be explored and compared among people in metro cities and those in tier II and tier III cities to understand if there is any difference among the two. And if there is a difference then which factors differentiate between the two.

LIMITATIONS AND SCOPE OF FURTHER RESEARCH

This study is based on an assumption that the shopping enjoyment is affected by internal and external factors. Although the study has highlighted some factors, there are a few limitations to the study.

Firstly, there are various other components to the ambience and retail setting that many of the external factors are not included for example, visual merchandise, window display, impact of layouts and self-service technologies and so on.

Secondly, not all the formats have been studied. It is likely that the perceptions of store ambience may differ across different type of formats. Each format may offer a certain mix and the hence the perception may also differ.

Also, this study used convenience sampling to find out people who shop. So, the sample from a particular age group is more than the others. A judgment sampling or a probabilistic sampling can be deployed to achieve better representation of the population.

Lastly, we are not focusing on particular product category. Even though the samples have been taken from people who were in a setting where they were near apparels or accessories. But as the study has no specific question on the product it is difficult to generalize. The motives and store attributes also differ across product categories. Therefore, future research can be done by narrowing it down to a particular product category.

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Employability Challenges in Indian Service Sector – Present and Future

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ABSTRACT

VUCA – Vulnerability, Uncertainty, Complexity and Ambiguity has caught the imagination of thinkers and practitiones from literally all walks of life. Changing customer preferences, rapidly evolving technology and dynamic economic environments decide the nature of jobs and the skills required. Among the many challenges caused by the rapidly changing environment, the challenge faced in creating professionals for future jobs is becoming increasingly complex as the changes in employability criteria outpace the changes in skill-building processes. Suddenly 'Employability' is the focal discussion of most economies in the world. Academicians, policy-makers and corporate leaders are commenting on the status of present and future employability. Employability has risen to be an issue with direct impact on the society and economy in India and other developing countries.

This paper focuses on understanding the skills for the future and identifying the challenges in building an employable workforce, especially in the context of Indian service sector.

Design/methodology/approach: *Literature review, expert interviews and authors' own experiences and understanding.*

Findings: *Literature on Employability research is evolving at a heightened pace due to the surge in the relevance of the issue in most parts of the world. The changes in technology and customer preferences are giving rise to new job categories. The future job is predicted to demand higher order thinking, customer service and skills to predict user preference. While the employability models have spoken about Knowledge, Skills and Attitudes, new-age futuristic employability shall revolve around soft-skills rather than technical knowledge and skills. Increased user-friendly products based on artificial intelligence shall demand innovation, customer-orientation, agility and technology oriented employees.*

Indian education system; like many others worldwide; focus on knowledge acquisition rather than prepare students for present and future developments. Cognition, social intelligence, emotional intelligence, technology appreciation are the skills predicted for the future and certain educational systems are already focusing on developing academic curricula for new-age skills.

Social implication: *Owing to its present and future relevance Employability discussion is crucial for policy makers. With increasing economic importance, the Indian economic sector demands heightened attention in terms of appropriate workforce supply. This study provides the direction for academic policy thinking for curriculum and pedagogy re-design.*

Keywords: *Employability, Skill-Building, Indian Service Sector, Workforce Supply, Human Resource Development.*

INTRODUCTION

Colin Clark (1940) in his book Conditions of Economic Progress came up with an explanation for evolution of changing employment trends across the growth patterns of an economy. His graphical representation of growth and decline of types of employment was proof enough to show that nature of employment varied with time. The variance could have stemmed from changing nature of production, evolving nature of jobs, and suitable skills to accomplish the jobs. 'Survival of the fittest', 'Adaptability' of the people to changing needs; the intervention of the government or administering agency to pre-empt the industrial development and development of suitable manpower could be the chief methods through which the changes have taken place. This condition can be visualized in today's VUCA world too.

According to Katy Hull, 'employment', 'production' and 'social growth' are related. (Hull, 2009). Today, jobs are growing (notwithstanding the fluctuated rates), skills are diversifying, demand for earnings is growing but the skills mismatch is also growing. As per the ILO report (2014) on Global Trends on employment, a large part of the developing world is inching towards becoming an employable youth population, job growth is recovering and unemployment is simultaneously growing. Understanding the inter linkages among employment, production, jobs and social development are inevitable in such contexts. The demand and supply of various abilities (Ronald & Lindsay, 2005) and skills along with the factors affecting them is critical to decipher the skills demand-supply equation.

Across the world, skill development has been addressed with considerable seriousness. Employers are facing difficulty in finding skilled workforce to the extent of 85 per cent in Japan, 68 per cent in Brazil, 39 per cent in US and 35 per cent in Germany (Manpower Group, 2013) and the global average is 32 per cent. These numbers raise the questions on the processes through which the world produces its manpower. According to figures of 2008, the percentage of workforce receiving skills training is 96 per cent in Korea, 80 per cent in Japan, 75 per cent in Germany, 68 per cent in UK and 10 per cent in India (Chenoy, 2012). Moreover, it is estimated that 75 per cent of the new job opportunities to be created in India will be skill-based. As per the figures of 2015, India's employment trends are in the order of - engineers (28.9%), management graduates (22.24%), and other graduates (23.12%). From the point of employability research, understanding the changing nature of 'skills demand' over the different phases of socio-economic development is important for the present, and future.

EMPLOYABILITY

William Beveridge in his book: Unemployment: A Problem of Industry (Beveridge, 1912) stated that employability meant to distinguish between people those that are and can be employed versus those that cannot be. Until 1940s this was the understanding of employability. Gradually, other versions of employability were released by researchers. McQuaid, Green and Danson (McQuaid, W., Green, & Danson, 2005) suggest that "employability remains a contested concept in terms of its use in both theory and policy, and throughout the past century has been used as both a predominantly labor supply and a labor demand concept."

The concept has gained importance through various instances in economic and social development across the history of the world. With growing demand for production and labor, the concept has evolved in meaning and dimensions. Broadly, employability has come to be understood as the ability of securing gainful employment. It also includes sustaining and growing on a job. The ability is a combination of knowledge, skills, attitudes and other attributes.

Different authors and researchers have developed various constructs for employability. These constructs include skills, factors of age, employment opportunities, employer perceptions, gender, educational qualifications, occupational expertise, anticipation and optimization, corporate sense, personal flexibility, pay attractiveness and so on (Beatrice van der Heijden, 2009).

Graduate employability or employability of those who participate in Higher Education (HE) has been stated as (Knight & Yorke, 2002)

The educational conception related to the ability of graduates to tackle 'graduate' jobs. This means that employability of graduates is dependent on their job equipment and employment capability, rather than job acquisition.

The ability of a graduate to get the job.

The second concept is used by the Government in the construction of the Employability Performance Indicators (EPIs), (Section 12.0), but it is the first concept that most practitioners in HE are primarily concerned with. Good student learning and the curriculum, teaching and assessment that goes with it, describes 'education for employability' well. This implies that curricula designed to enhance students' employability are also desirable on purely educational grounds. It is possible to see both the traditional academic education and key skills as being subsets of 'employability'.

From the above, it can be seen that skills form the major construct of the employers' requirement and specification of employability. To avoid generalization of workforce, based on social orientation, judgmental abilities, thinking styles and other personal attributes uniqueness of an individual's employability can be ascertained.

Employability: Indian context

While technology has defined the growth of the human development, yet, education was the baseline. In India, initially, most of the schooling was through religion. (www.mu.ac.in).Gradually and steadily various rulers established universities and research institutions across the world. The universities allowed the students to pursue their areas of passion. However, alongside, students also learnt the skills of performing the related duties. They were taught skills necessary for social living. The learning oriented ways of the universities shaped the caliber of the student for professional expertise. The nature and rigor of the courses demanded that the student learnt a balanced set of functional and life skills. Such learning created a pool of candidates who were suitable for corporate and service functions. Knowledge and skill transformation has been a role of the universities. Today, transforming the educated youth into effective labor force remains a challenge for an effective higher education system (Gopalakrishnan, 2011).

During the 19th and 20th Centuries, India took strides as an English speaking population with a strong orientation towards Mathematics, Science and Arts. Gradually, the evolution of the academic system ensured the supply of educated youth for administration. Literacy and awareness increased. However, the lopsidedness of literacy growth caused a large unskilled and semi-skilled workforce in the Indian manufacturing and infrastructure industries. Post-Independence, India has been riding predominantly on British academic and political systems. The country has tried to keep pace with technological and economic challenges, both internally and externally.

India has a large population of university educated youth. As per an UNFPA report, presently, 356 million youth are enrolled into the various levels of education system (Gupta, 2014). Despite having made giant strides in industrialization and technology, the human aspect needs attention. We have a vast educated population but also enormous problems of skills mismatch (Roy, 'Skill premium: What caused the 'mismatch?', 2008). A labor force with inappropriate skills match is a cause for concern. Understanding the composition of employability and assessing the elementary factors that influence the development of an individual's employability skills is the aim of this paper.

According to reports from India's Ministry of Labor, the unemployment rates have consistently fallen in the last 6 years. Though this gives some relief to the policy makers, it is essential to understand the dynamics of employment in India. India's

population, education system and social setting have an impact on the unemployment rates. According to United Nation's reports, India's growing youth population along with impact of education system has created a spillover effect on the employment scenario. The unemployment rate in India in 2016, stands at 4.9 percent, but the concern is the high volume of employable population. Initiatives like Skill India are capable of generating high employment, provided investment inflows strengthen. On the other hand, only about 25-30% of educated population including graduates and other professionals is employable. India's young population is turning to be both, a boon and a bane.

Looking at the broad range of impact of employability, it is evident that there are numerous stakeholders involved. Key stakeholders of employability are:

- Government
- Industry
- Education System, Teachers/ Educators
- Parents and Family
- Self

All the stakeholders have been involved at various points in time through different initiatives and interventions.

The first Skill Development policy in India was floated in 2009 by the Ministry of Human Resources Development and then the skill development framework was devised in 2015 by the government. With an aim to provide thrust to skill development and employability, a dedicated ministry for skill development and entrepreneurship was set up by the government of Mr. Narendra Modi. The National Council for Vocational Training (NCVT), a body set up in 1956 was renewed to provide official apparatus to training of skills. National Skills Qualification Framework (NSQF) was notified in 2013 and after the fifth anniversary (27.12.2018) date of the notification of the NSQF-

It shall be mandatory for all training/educational programs/courses to be NSQF-compliant

All training and educational institutions shall define eligibility criteria for admission to various courses in terms of NSQF levels.

Additionally, bodies like All India Council for Technical Education (AICTE) and University Grants Commission (UGC) and other agencies under MHRD are to ensure quality education. Teacher's training programs by NCERT and other public and private agencies to build strong pipeline of skill and talent. As an advanced measure, every Indian citizen has been provided with 'right to education'. These measures, if implemented in the right spirit with appropriate budgetary allocation, should reduce the gap between demand and supply of manpower.

Embedding a suitable academic curriculum and ensuring the development of skills through the curriculum is the responsibility of the education system of a country. The popular USEM model calls for 'Understanding', 'Skills', 'Efficacy' and 'Meta cognition' (Knight & Yorke, 2004). These skills are developed through long practice and through the teaching-learning process. Besides technical skills, heightened importance to Soft skills, willingness to learn, basic computation and numeracy skills, interpersonal skills, adaptability and other core skills must be given. Recent studies by Ambili Gopalakrishnan, Aspiring Minds and many other agencies show that in the Indian context, employability of graduate students, especially of engineers is as low as 25 percent.

Maslow (Maslow, 1970) and prior to that Rosenberg (Rosenberg, 1965) defined motivation and self-esteem in ways that point inwards to a person rather than outwards to define a state of mind. The individual reasons for motivation and aspiration are basic elements to one's self-development. To build a positive attitude to one's own self, it is essential that the person should see one's own abilities and achievements. Being emotionally aware of one's personal feelings towards self and others is a factor that aids building a positive attitude. Another element of one's own contribution to employability is self-efficacy. This is a metacognition skill that arises out of combination of behaviors. This skill is in fact a set of behaviors and attitudes that give a person control and confidence in him/her.

Apart from the set of behaviors, every individual has a pre-defined talent and capability. Effort to identify the capability is a joint effort of the student and parents. At most stages of personality development, as shown by psychologists, individuals need support of parents, peers, teachers and others in the environments. But, it is the individual's need to achieve and willingness to learn that go a long way in creating employability of the self.
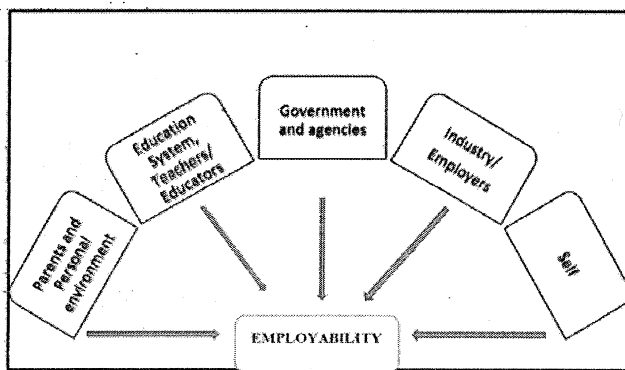

Figure 1: *Holistic perspective of Employability*
Source: Compiled by the Authors

The complexity of skilling for employment was delineated in the paper Skill premium: What caused the 'mismatch'? (Roy, Skill premium: What caused the 'mismatch'?, 2008). The development of a technology based economy where the population was not meeting the rate of change in skilling has led to the mismatch. With specific reference to services, the sudden spurt in growth of the technology sector compared to the 2002-2004 period has increased the skill gap. Owing to the differences in growth patterns of the sectors of the economy, skilling has remained behind. To summarize this, 'the rise of skill complementary technology as an endogenous response to supply of skills might not outpace the rising supply of skilled workers in developing countries such as India since firms are left with options other than technology advancements in order to reduce per unit cost of inputs. Hence, conceiving a virtuous circle of up-scaling of skills for the aggregate workforce with rising share of skilled workers together with a rise in skill premium that further accelerates supply is a distant possibility for countries such as India. (Roy, 'Skill premium: What caused the `mismatch?', 2008)'

The Ministry of Skill Development and Entrepreneurship plays a lead role in developing and directing policies throughout the country. This ministry aims to accomplish the mission of 'India 2020' with the help of the National Skill Development

Corporation, National Skill ·Development Agency and National Skill Development Fund. Of these, National Skill Development Agency is a nodal agency for training and quality assessment of the programs.
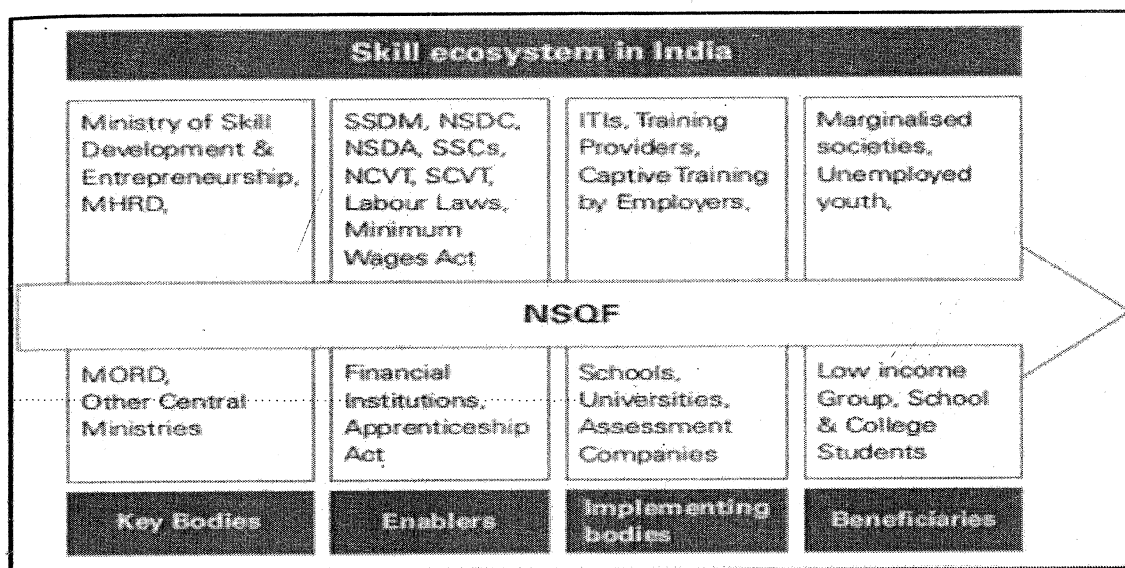
Figure 2: *Structure of Skill India Mission*
Source: NTTA, Chandigarh

As per "Wheebox India Skills report 2016" -a joint publication by Wheebox, Confederation of Indian Industries (CII), Linkedin, Peoplestrong and Association of Indian Universities, it is currently estimated that only 2.3% of the workforce in India has undergone formal skill training as compared to 68% in the UK, 75% in Germany, 52% in USA, 80% in Japan and 96% in South Korea. Large sections of the educated workforce have little or no job skills, making them highly unemployable.

India's employability challenge is to meet the demands of new-age industries. Despite recent schemes that have been launched to push the manufacturing and core engineering sector, graduate employability is expected to revolve around service sector. Graduates, both engineering as well as non-engineering, are expected to possess broad ranging skills along with specific job-related skills. Numerical Ability, English communication, soft-skills for the workplace are paramount.

India's economic development and Service Sector

In contrast to the manufacturing industry, India's service sector is growing at an encouraging pace. India's Service sector is growing faster than ever, to outshine the growth of all other sectors. The services sector of India remains the engine of growth for India's economy and contributed 53.8 per cent of India's Gross Value Added in 2016-17. With 28.6 per cent of its population employed in the services sector in 2016-17, services registered a 7.7 per cent growth in 2016-17. Services primarily include Banking and Financial, Travel and Tourism; IT enabled services, Railways, Telecom, Healthcare and Knowledge base services. The notable feature of this growth is that this type of employment offers growth to both genders and caters to the growing urban population. This sector is characterized by the heterogeneity of the skills and qualifications

required. The variation ranges from 'low' to 'high'. In 2014, India had the largest service sector in the world, with almost the lowest share of employment contribution to GDP. The consistent growth of India's service sector emphasized the consistent need for suitably skilled manpower.
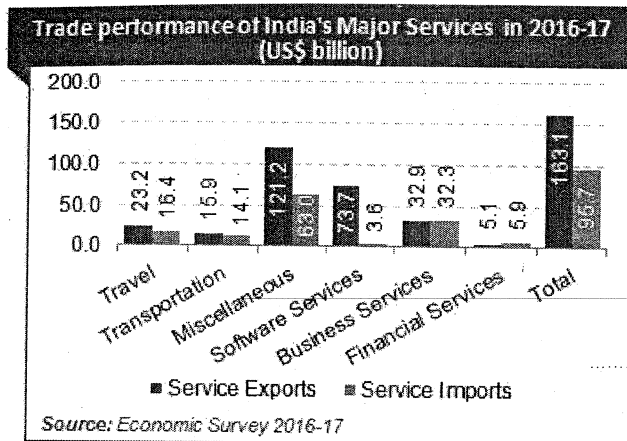
Figure 3: *Contribution of various segments of India's service sector in 2016-17*
Source: www.ibef.org

Services sector growth is governed by both domestic and global factors. The Indian facilities management market is expected to grow at 17 per cent CAGR between 2015 and 2020 and surpass the US$19 billion mark supported by booming real estate, retail, and hospitality sectors (www.ibef.org, 2017).

*Service sector Jobs and skills in the present horizon (2015-2020)*

Service sector jobs demand high amount of soft skills as these jobs involve client facing. In case of service exports, skill in English language communication is essential. The large English speaking population of India is the base to this industry. The internationalization of the service industry has put enormous pressure on developing skills for appropriate manpower supply. The key skills required across service sector organizations are a mix of Domain Expertise, Integrity & Values, Result orientation Interpersonal skill and Learning agility. The proportion varies among sectors. Pre-dominantly, Banking, Hospitality, IT and BPO industries rely heavily on domain expertise and communication. Manpower group claims that the employers around the world are finding it hard to find the right talent for their requirements.

Figure 4: *Availability of Talent across Global Economies*
Source: Talent Survey Report 2014 by Manpower Group

Employable graduates and higher education qualified individuals with the right combination of technical skills, generic/core skills, attitudes and behaviors are the most suitable for service sector. However, such individuals are hard to find. The new-age skills required are studied and complied in India Skills Report.
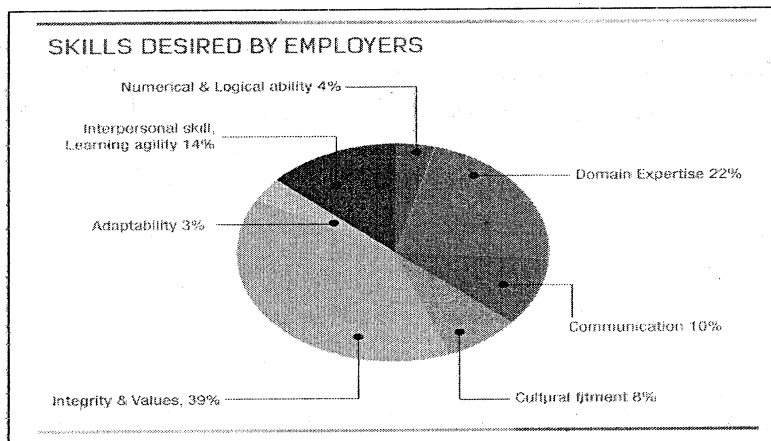
Figure 5: *Overview of Skills demanded by industry*
Source: Wheebox" India Skills Report 2015"

This figure is an indicator of skills that are expected in the potential employees across industry sectors. The skills vary in proportions with specific reference to particular industries and sectors. While the service sector could expect higher sot skills, the manufacturing and construction sectors could expect higher amount of domain specific skills. This is a good indicator to assess the skills being cultivated through education and training so that the suitable manpower supply pipeline is created. The figure below summarizes the overall employability situation.
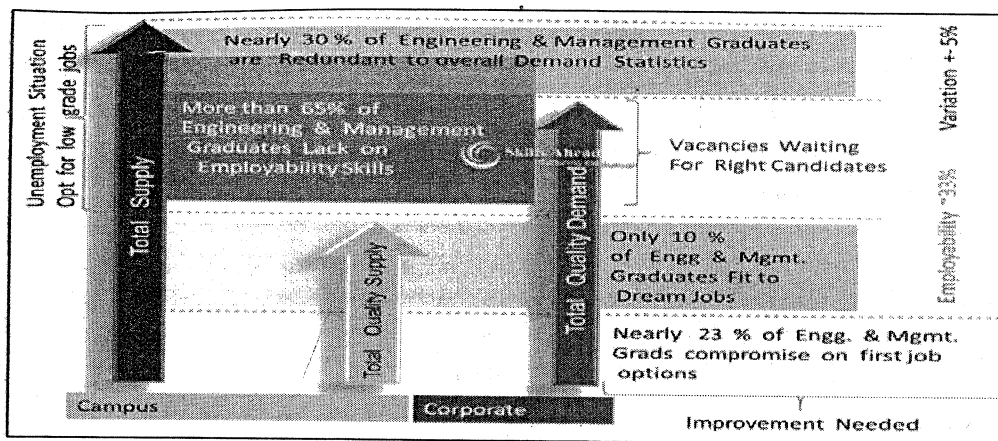
Figure 6: *Overall employability situation in 2015*
Source: www.skillsahead.net/job-market-india-2015-an-essential-report/
Service sector Jobs and skills trends in the future (2020 onwards)

Technology is gradually but definitely the deciding agent in jobs for the future. As much as jobs were earlier meant to simplify work, future jobs are trending towards connecting people and predicting cognitive requirements. While computers were earlier devised and made to bring speed and efficiency, computers shall be used as the core of a business. Industry 4.0 is the generation where computers, cyber systems and automation shall interact directly with physical systems. This disruption shall create a new wave of jobs that will displace and replace human intensive jobs. Work shall be performed largely through data collected in the past and ever moving present. Cognitive analytics shall move in as Predictive analytics to engage with human interactions. Medical, surgical, space, leisure and financial services shall see exponential use of technologies. Banking and financial services have seen the maximum influence of technology in their processes. Therefore, new skills are becoming imperative for the changing paradigms. In 2016, the world economic forum had predicted that new skills shall be required for the future employees and human resource functionaries and government agencies should think of creating systems where skilling can be handled with delicate ease. Internet of things and Internet of people shall bring about an interesting and unavoidable state of human life being conducted by technology.

In this transitioning phase, challenges are seemingly insurmountable due to the pace of change and abilities of human beings (Forbes.com, 2016). Additionally, the older generation (predominantly the current workforce) was trained to use computers, whereas the new technologies use human beings and that too smartly and minimally. Heightened amount of monitoring through software and transparency shall pose Psychological challenges of acceptance and individual importance (Institute for the Future, 2016). All these changes are progressively diminishing the distinction between products and services.

Some key skills that will be in demand in the future are cognitive thinking, emotional intelligence, linguistic skills, computing abilities, social intelligence, multifunctional thinking, and ability to seamlessly move across manufacturing and services. While these skills are not entirely new to mankind, developing them specifically in the transitioning phase; rapidly moving across manufacturing and service industries are the challenges.

Initiatives taken by IBM in tying up with colleges to build analytics skills pipeline, tie-ups between Banks with Technology and Academic companies pave the way for developing a skill based economy. Collaborations between government agencies, universities and large corporations to give rise to social interventions for change and skill development is the need

CHALLENGES

Total enrolment in higher education has been estimated to be 34.6 million with 18.6 million boys and 16 million girls as per the reports of Ministry of Human Resources Development (mhrd.gov.in, 2017). With such high rate of enrolment in higher education, India ranks among the largest population in higher education. It is commonly understood that higher education enrolment is an indicator of higher standards of student expectation and this needs careful cultivation by the socio-economic and political environment (Green Ashton, 1996).

What does this high rate of educational enrolment mean?

1.   It signifies a growing social awareness for the need of education and qualification.
2.   It is significant of a large population with rising social and individual aspirations.
3.   Progressive duress on the industry to accept the talent.
4.   Risk of dissatisfied youth turning into anti-social entities.

Education is usually expected to give economic returns to individuals and thus the nation. These returns are translated through the skills output (Weale*, 2003). Enrolment in education beginning with primary enrolment

Every college educated graduate has myriad aspirations. Associated with the aspirations of the students are the dreams and hopes of their families. To find suitable employment with options for economic advancement is the natural progression. College education is deemed valuable when it produces candidates with abilities and skills that could take him/her into the jobs. The issue now is how many of these graduates are acquiring skills and ready for jobs? It has been noted that 17% of the total college going age group is capable of being productive on the jobs. The mismatch between abilities and aspirations creates a negative bulge on the employable population.

In a country of growing qualified population and increasing numbers of youth, it is essential to study the factors that facilitate employment for the educated. These factors play an impinging role on the effectiveness of the systems that create the supply of employment. It is in fact interesting to examine how the academic as well as non-academic environment affects the students. The economic, social and cultural surroundings set the tone for the individual's attitudes, values and life goals. Understanding the impact of the factors involved in the upbringing of an individual could prove helpful in identifying the supporting and hindering factors. In this regard, various questions have arisen at various points in time. Some of them are –

•   Is the primary school education focusing heavily on rote learning?
•   Is the middle and high school education focused on developing application and analytical skills among students?
•   Is the higher education developing vocational skills among the students?
•   Are there sufficient numbers of career focused or vocational training schools in the country?

- Is the quality of education imparted in the existing schools and colleges suitable to deliver entry level skills among the students?
- Is the industry playing its role in updating the academic system of their current and future needs?
- Are the psychological and physiological factors in all sections of the society suitable for development of the individual?
- Is holistic human development a focus area of education at school and college level?
- Is benchmarking against global education systems and standards suitable for development of Indian youth, keeping in mind the diverse nature of the population?
- Are there suitable measuring criteria in place to assess the effectiveness of government programs to enhance employability?

The answers to the above questions will provide a few indicators to the solution of 'employability' issue. Research has been done in these areas. Some inputs from Indian researchers have been gathered from the psychological perspective and few others from economic and sociological perspectives. Predominantly, research on this issue with a management and human resources perspective has been extensively conducted in the United Kingdom. Studies based on the Indian context are evolving. Studying the factors influencing the development of employability is critical to estimate the value in the workforce potential of the country.

Skilling, as is being treated is preparing an individual to acquire a job or a livelihood. These skills can be further divided into various categories in the order of difficulty, relevance and importance. Professions like electricians, plumbers, computer technicians and computer operators are purely vocational and elementary in nature. The candidates who succeed these training programs develop the ability to begin a career purely on the hard or technical skills. Desk and office jobs which are preferred by university educated youth require a combination of hard and soft skills. The hard skills are those that qualify a person to be able to deliver on the job and the soft skills facilitate a person to perform his role in an organization. Thus, developing for employability involves the cognitive and physiological development. The question is how fully understood the composition of employability skills with reference to an individual's aspirations and the demands of specific industries. Understanding the composition of employability and assessing the elementary factors that influence the development of an individual's employability skills is the need of the hour.

Employability development- the way forward

Employers, globally, have commented about the lack of availability of suitable manpower. Globally, industry-academia interface has been working towards improving the preparedness of the graduates for workplace (Kevin Lowden, 2011). The industry being the demand side of the employability continuum specifies skill requirements. This specification though is not explicit. Many a times the requirements vary within short intervals of time. In such cases, it is challenging for the prospective employees to prepare for jobs. As cited in the paper, 'Role of industry in employability', it will be indeed helpful, if businesses could tie-up with academic partners and educators to conduct innovation exercises in the university campuses and pre-empt skill needs so that the time lag between supply and demand for skills can be minimized.

The world economic forum 2014 at Davos came up with a report that stressed on the importance of improving educational-system responsiveness to labor market needs, and ensuring that students complete their schooling with skills needed to find work, require collaboration between employers and public authorities. Governments should support student participation in education at least through upper-secondary schooling, for example by introducing schemes with financial incentives to attend school. Actions on national and regional level are also needed to avoid creating isolated policies and to ensure a greater synergy between economic growth and innovation plans on the one hand, and education and labor market policies on the other. Forms of Skills Mismatch (Towards an OECD Skills Strategy, 2011).

Skill shortage	Demand for a particular type of skill exceeds the supply of people with that skill at equilibrium rates of pay
Qualification mismatch	The level of qualification and/or the field of qualification is different from that required to perform the job adequately
Over-(Under-) qualification/education	The level of qualification/education is higher (lower) than required to perform the job adequately.
Skill gap	The type or level of skills is different from that required to perform the job adequately.
Over-(Under-) skilling	The level of skill is higher (lower) than required to adequately perform the job.

Table 1: *Forms of Skills Mismatch*
Source: https://www.oecd.org/edu/47769000.pdf

In today's context, the world is facing almost all the above types of mismatches. While the amount of jobs is growing post the economic crisis, the number qualified (both over and under) too is growing. This means that the choice per job among candidates is rising. The analysis by Deloitte University Press goes on to say that in addition to the skills mismatch explanation there are several reasons why employers may be keeping positions vacant for longer periods despite workers being available. Employers might be skeptical about the long-term outlook of the economy and so are hesitant to hire even though they have posted vacancies. The number of qualified candidates applying for a position may be high, making it difficult for employers to choose the 'best candidate.' Also, the reduced mobility of workers (especially homeowners with negative home equity) may make them less likely to apply for and accept positions in places away from where they currently reside. While all of these factors are likely to play a role in vacancies rising faster than hires, it will take more time before we know if any one explanation currently dominates or will dominate in the years to come.

The two major problems with the existing workforce that is already supposed to be skilled are:

1. Quality of skilling possessed
2. Quantity of the right nature of skills, i.e., mismatches in numbers required and numbers available.

This supply-demand mismatch and the quality problem will have to be addressed over the course of the next decade simultaneously with a very sharp quantitative expansion in capacity of those to be educated or vocationally trained. Though the quantitative challenge might appear reduced from 500 million to 291 million by 2022, the quality-related challenge (in

respect of the 143 million in the workforce who already have either general education up to secondary level or VT or technical education of graduate level and above) remains considerable (Mehrotra, Gandhi, & Sahoo, 2013). Experts in the fields of education and training feel that the upcoming generations of students exhibits a drastically different behavior pattern. In interviews conducted with experts in the Delhi, issues like location mobility, self-esteem perception in jobs and family culture influences in skill training came to the fore as affecting factors when students and employment candidates made decisions for career preparation.

In addition to the figures stated above, the skills needed in the sectors are inherently vocational and engineering in nature. But owing to internationalization of technology and production facilities, the standards of education for skilling are expected to meet global expectations. Unlike what is typical of the present Indian education, the education for the future generation has to be open, application and practical based rather than theoretical. This lays a huge cost implication for the infrastructure requirements.

CONCLUSION

Renowned Sociology Professor, Kalleberg in a recent conference said that the extent to which different categories of jobs—such as "routine" jobs or "service occupations," required higher or lower skills, reflected deeper disagreements about how to define "skill." He then reflected on debates about the factors determining wages for various jobs, including skills, the supply of labor, institutions, and other factors, noting that the research is unclear on this point. This statement is critical for Indian context as developing specific skills for certain industries may not be the permanent solution, as skills needs could change with ever-changing technology. This mismatch can be avoided by cultivating India as a technology research hub and involving researchers from the grass root level, which implies enhancing research facilities across universities in all states and universities.

While the 'skills' group being percolated through the education and training systems may need to be relooked, a matter of greater importance could be the ability to use the skills capably in various contexts. 'Adaptability', 'willingness to learn' and 'aspirations for self-reliance' may be deeper needs that could drive better application of individual skills and abilities. Administrators, Policy makers, Psychologists, occupational sociologists, trainers, academicians and technology specialists may have to come together to identify solutions to devise new teaching-learning pedagogies for the newer social needs.

By attempting to resolve the problem of employability, we may end up trying to look at an economic ailment at the symptoms rather than diagnose and treat the cause to the ailment. The need of the times to treat the causes could be:

- India's slow paced change in education systems

- Need for drastic changes in administering an education –policy at par with developed countries so as to match technology that is transferred into the country.

- Drive social change in involving all sections of the society in useful forward looking research.

- Change in cultural outlook towards children and younger generation and enable them to become self-reliant.

- Rather than create stereotypes for individual development, provide psychological support to children to develop and do different things.

IMPLICATIONS

Social implication: Owing to its present and future relevance Employability discussion is crucial for policy makers. With increasing economic importance, the Indian economic sector demands heightened attention in terms of appropriate workforce supply. This study provides the direction for academic policy thinking for curriculum and pedagogy re-design. It can be concluded that India's challenges are not unique, but may have to be dealt with uniquely to cater to our socio-cultural setting. The society at large will have to look at developing through various initiatives that the Indian government rolls out from time-to-time. Rather than dealing with employability, it appears deeper changes in the mindsets of the stakeholders of employability is the need. The emphasis of development needs to viewed from a long term and strategic perspective, rather than short-term.

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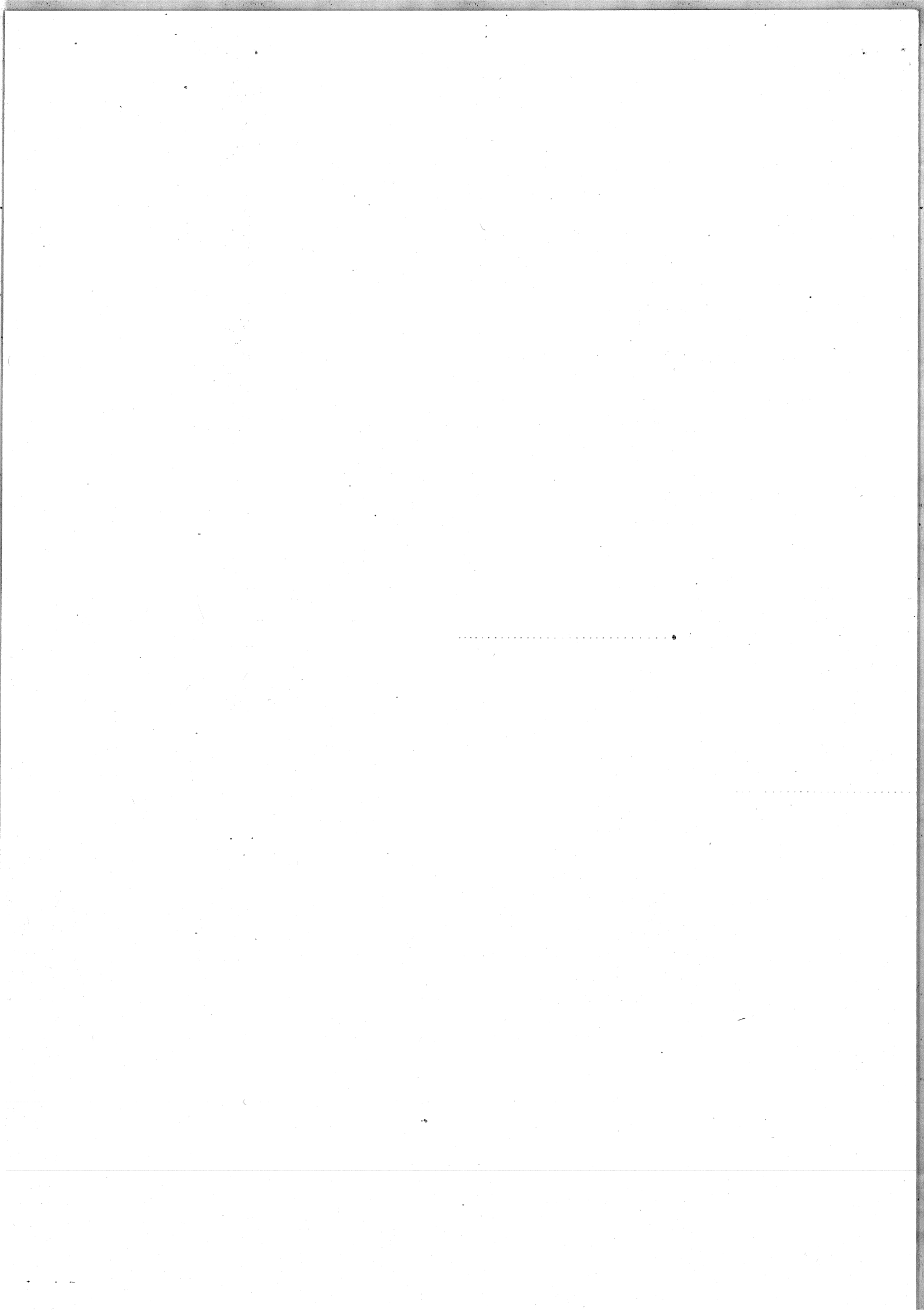
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8   Academic freedom and the ownership of knowledge

Lawrence Liang

The assault on academic freedom via the use of speech curbing laws, the rise in the 'structural adjustment' of higher education to make it more professional (a thinly veiled euphemism for making it more market-friendly) and the increased privatization of learning are the common complaints that one hears of the threat to knowledge practices and to the independence of universities as critical spaces. What we do not hear enough of is how the ownership of academic knowledge and the politics of academic publishing are also seriously corroding an ethos of collegiality and knowledge sharing, which was critical in shaping the imagination of the university. Using the example of the recently concluded Delhi University photocopy case,[1] I will argue that what was at stake was more than just a technical question of the scope of copyright or fair dealing exceptions in copyright law. Given that the case was initiated by three respected academic publishers, two of whom are associated with the oldest and most acclaimed universities in the world, the case raised fundamental questions of what a university is and how higher education can be imagined in the time of intellectual property. I will also draw attention, after a discussion of the case itself, to a genealogy of how the language of intellectual property fundamentally redefines academic practices, transforming the idea of academic freedom into a market-driven understanding of freedom.

In 2011, three publishers – Oxford University Press, Cambridge University Press, and Taylor and Francis Routledge – sued Delhi University and a photocopy shop on its premises for unauthorized distribution of course packs to students – claiming $100,000 (6 million rupees) in damages. The shop, Rameshwari Photocopiers, was given space on the campus of the School of Economics following an open tender, with an agreement that it would copy 3000 pages free of cost

for the college library in lieu of payment of a licensing fee. The faculty, in turn, could prescribe course material which could be taken from the library (or other sources) by students and submitted to the photocopy shop. The shop would then circulate the combined photocopied materials to the students at a rate of Rs. 0.40 per page. While the initial defendants were Rameshwari photocopy services and Delhi University, subsequently two other associations, Society for Promoting Educational Access and Knowledge ("SPEAK") and Association of Students for Equitable Access to Knowledge ("ASEAK"), consisting of academics and students respectively, impleaded themselves as defendants in the case.

The first decision was given by Justice Endlaw in September 2016, dismissing the petition in its entirety on the grounds that no question of copyright infringement arose as Section 52(1)(i) of Copyright Act 1957 was explicit that reproduction of works in the course of instruction was not an infringement of copyright. On appeal, the division bench (Justices Pradeep Nandrajog and Yogesh Khanna) affirmed in most parts the prior decision on questions of law, but disagreed with Endlaw that no dispute on facts arose and directed that specific reproductions of books could be determined on whether they were for the purposes of instruction.

After the division bench's decision dismissing their appeal, the primary petitioners in the case decided in March 2017 to withdraw their suit and not prefer an appeal. In a joint statement, the three academic publishers (Oxford University Press, Cambridge University Press and Taylor & Francis) acknowledged the importance of course packs for education and stated that rather than continue the legal battle, they would "work closely with academic institutions, teachers and students to understand and address their needs".[2] The Indian Reprographic Rights Organization ("IRRO") decided to continue with an appeal to the Supreme Court, but a division bench of the Supreme Court[3] refused to admit the appeal on the grounds that the original petitioners had withdrawn from the case while IRRO was merely an intervener – thereby bringing an end to a keenly contested case that had galvanized immense public interest and stimulated sharply divided opinions on what constitutes an equitable system of copyright in the sphere of education. With the dust having settled on the immediate case, it is time to take a step back to evaluate the two decisions and to situate their relevance for future disputes about copyright and access to knowledge.

It is pertinent to note that the proceedings in the courts were preceded by innovative activism by a diverse set of players with varied interests in the case. If for the publishers this was an important test

case that would determine the scope of the 'educational use' exception in copyright law and establish whether universities are bound to obtain a licence from reprographic societies to create course packs, for academics and students the case entailed the future of equitable access to knowledge. The global interest in the case was also understandable, coming as it did in the wake of a decade of activism around the idea of access to knowledge ("A2K"). In her intellectual genealogy of the A2K movement, Amy Kapczynski argues that the A2K movement fundamentally reframed questions of intellectual property away from the focus on rights management to a larger normative debate on the nature of the knowledge economy and access to ideas, knowledge goods and services (Kapczynski 2008). But even while tracing the rise of the A2K movement, scholars have commented that the A2K community does not really constitute a mass movement, and Gaëlle Krikorian, for instance, maintains that A2K "does not rely on massive street demonstrations as a constitutive means to confront the power structures that it challenges" (Krikorian 2010: 70). The DU photocopy case rebuts this presumption and demonstrates how A2K activism in the global South straddles traditional sites of activism along with demands for legal and policy reform.

In their complaint, the publishers argued that Rameshwari was reproducing and issuing unauthorized copies of their publications for a commercial purpose and that such circulation did not amount to "fair dealing" under Indian law. Unlike US law, where "fair use" involves a process of triangulating among different factors such as the "purpose and character" of the use (e.g., parody or educational use), the substantiality of the reproduction, and the effect on the commercial market for the original, Indian "fair dealing" follows the UK tradition in requiring specific statutory language for exceptions. The case quickly became a litmus test for what constituted fair dealing when it came to photocopying academic materials. The case turned largely on interpretation of two provisions in the Indian Copyright Act. The first is the fairly wide educational exception provided under Section 52(1)(i) which allows for "the reproduction of any work by a teacher or a pupil in the course of instruction, or as a part of questions or answers to questions". The second is Section 52(1)(a), which allows for fair dealing with any work (except computer programmes) for the purposes of private or personal use, including research. The two provisions anchored the university's argument that it was within its rights (and students were, accordingly, within their rights) to photocopy academic texts and articles and to create course packs in the course of instruction.

Because the case dealt with specific instances of copying particular texts,[4] it was relatively easy to determine whether the copying involved a large percentage of the works in question. In most cases, the page counts represented under 10 percent of the work – though in a few, this number climbed to between 20 percent and 30 percent. The overall average was 12.5 percent. If the accepted US "fair use" threshold of 10 percent is used, 11 out of the 19 books fell within the limit. In the absence of statutory guidelines, the question for the Indian court was whether a fair-minded person would consider 12.5 percent of a book to be "substantial". It is worth emphasizing the irrelevance of the counter-factual, in which students actually buy all of the books in the offending course pack – some 17 with a total retail price of around $1700. This is a sum slightly larger than the average per capita GDP in India. The Delhi case was not about getting the students to buy physical copies of the book, so much as creating pressure on the university to impose a reprographic fee for photocopying excerpts as well as clarifying quantitative restrictions on the amount that can be legally copied from a book.[5] The problem with this proposal is that the envisaged licence fee roughly triples the price of photocopying from its current level (40 paisa or around 0.5c) to a rupee per page (currently around 1.5c).

The publishers argued that this is a relatively small amount that will not affect the students – the licence fee, in an often-repeated argument, amounts to around one expensive meal. However, this assumes the perspective of the richest students rather than that of the poorest students who are the real beneficiaries of photocopying. Rather than measuring the fee against imaginary meals, it may be more useful to compare this to the average fees paid at Delhi University. At the Master's level, a student pays approximately $150 (Rs. 10,000) per semester (depending on the college that s/he is enrolled in). At one rupee per page, the cost of photocopying materials just for course packs would amount to around a 10% increase in fees.

The decisions

In September 2016, the Delhi High Court (through a single judge bench) delivered its judgment in the Delhi University photocopying case (Chancellor, Masters and Scholars of the University of Oxford v. Rameshwari Photocopy Services). The single judge bench (Justice Rajiv Endlaw) dismissed the 2012 copyright infringement petition, much to the relief of the students, teachers and photocopiers who had been closely tracking the judgment.

In his considered and sharply reasoned judgment, Justice Rajiv Sahai Endlaw examined the range of arguments made by both sides and in a stinging observation that gestures to the abuse of copyright for monopolistic purposes which were against public interest, Justice Endlaw held that

> Copyright, specially in literary works, is thus not an inevitable, divine, or natural right that confers on authors the absolute ownership of their creations. It is designed rather to stimulate activity and progress in the arts for the intellectual enrichment of the public. Copyright is intended to increase and not to impede the harvest of knowledge. It is intended to motivate the creative activity of authors and inventors in order to benefit the public.
>
> (2016a: 79–80, Para 80)

This is a very pertinent observation given the 'naturalization' of intellectual property claims in the past two decades. In a clear statement of the philosophical basis of copyright law, Justice Endlaw rejects the populist and uni-dimensional assumption that copyright is about the protection of the property rights of owners. If copyright was always about maintaining a balance between competing ideas of private and public interest, the Delhi High Court has restored to copyright jurisprudence a clear mandate for the future, one which is cognizant that the end goal of technology is the improvement of our lives (material and intellectual) and "no law can be interpreted so as to result in any regression of the evolvement of the human being for the better" (ibid.: 85, Para 87).

By locating it clearly as a creature of legal policy, the judgment lays down the foundation for articulating a jurisprudence of limitations explicitly recognizing that any right that is granted to owners is also limited by exceptions carved out by law. Explicating the relationship between copyright and fair dealing exceptions, Endlaw held that the nature of Section 52 of the Copyright Act is such that any act falling within its scope will not constitute infringement. As we have seen, Sec. 52(1)(i) allows for the "reproduction of any work i) by a teacher or a pupil in the course of instruction; or ii) as part of the questions to be answered in an examination; or iii) in answers to such questions".

The petitioners had argued for a narrow reading of the Section, claiming that at best what the Section allows for is the provision of

materials in the course of a lecture and spatially restricted to a class-room. According to the court,

> [t]he crucial question for adjudication is, when does the impart-ing of instruction begin and when does it end. Whether in the classroom or tutorials only, as suggested by the counsel for the plaintiff or it begins prior to the classroom and ends much after the classroom interface between the teacher and pupil has ended, as contended by the counsels for the defendants.
>
> (ibid.: 66–7, Para 62)

The court, while rejecting this claim, argued that 'instruction' can-not be narrowly understood, and relying on a number of precedents from commercial law, it concluded that the test to be applied by courts should include a temporal understanding of an activity that sees it through a prism of continuity in time as well as in purpose, and this test when applied to copyright would necessitate a wider reading of the word 'instruction'. In Para 72, the court holds that

> 'in the course of instruction' within the meaning of Section 52(1) (i) supra would include reproduction of any work while the pro-cess of imparting instruction by the teacher and receiving instruc-tion by the pupil continues i.e. during the entire academic session for which the pupil is under the tutelage of the teacher and that imparting and receiving of instruction is not limited to personal interface between teacher and pupil but is a process commencing from the teacher readying herself/himself for imparting instruc-tion, setting syllabus, prescribing text books, readings and ensur-ing, whether by interface in classroom/tutorials or otherwise by holding tests from time to time or clarifying doubts of students, that the pupil stands instructed in what he/she has approached the teacher to learn.
>
> (ibid.: 73)

It then locates the question of education within a changing technologi-cal environment and argues that "when an action, if onerously done is not an offence, it cannot become an offence when, owing to advance-ment in technology doing thereof has been simplified" (ibid.: 75, Para 75). To make this point, Justice Endlaw contrasts his own experiences as a law student where photocopying was very limited and studying entailed students copying by hand, scribe-like, pages after pages of books. Photocopiers have just made the task simpler and faster but if

the act of copying for a particular purpose is itself not illegal, and 'the effect of the action is the same, the difference in the mode of action cannot make a difference so as to make one an offence'.

In the times when I was studying law, the facility available of pho-tocopying was limited, time consuming and costly. The students then, used to take turns to sit in the library and copy by hand pages after pages of chapters in the books suggested for reading and subsequently either make carbon copies thereof or having the same photocopied. The photocopying machines then in vogue did not permit photocopying of voluminous books without dismem-bering the same. However with the advancement of technology the voluminous books also can be photocopied and at a very low cost. Thus the students are now not required to spend day after day sitting in the library and copying pages after pages of the rel-evant chapter of the syllabus books. When the effect of the action is the same, the difference in the mode of action cannot make a difference so as to make one an offence.

> (ibid.: 75–6)

While the immediate beneficiaries of the Delhi High Court's judgment in the Delhi University photocopy case were obviously the university, the photocopy shop and the students and academics who filed interven-tion petitions supporting the right to photocopy, the import of Justice Endlaw's finely reasoned judgment goes well beyond this specific case as well as its impact on access to knowledge in India. The judgment and its treatment of educational exceptions in copyright law are in many ways unprecedented and should serve as a model of how national laws should be interpreted. The judgment has immense consequences beyond India and is a bold articulation of the principles of equitable access to knowledge – and one that deserves to be emulated globally. For a while now, the globalization of copyright norms through inter-national law (Berne convention, TRIPS Agreement) has been accom-panied by the globalization of copyright standards that have primarily emerged from the global North. Aggressively pushed by the copyright lobby such as Hollywood, the music industry and the publishing car-tels, copyright law has effectively been hijacked by narrow commercial interests (albeit always speaking in the name of authors and crea-tors). Thus even when it came to discussing fair use exceptions and limitations, countries have found themselves constrained by judicial precedents from the US and elsewhere that have defined quantitative restrictions on photocopying.

In a radical move, the Delhi High Court, rejecting the adoption of US standards, concluded that if Indian lawmakers have allowed through statute for the reproduction of a copyrighted work in the course of instruction, they have done so on the basis of a purpose (that is, teaching) and with the conviction that this does not unreasonably prejudice the legitimate interest of the author. Further, this flexibility is provided to it through international law and it is not the place of courts to impose artificial restrictions by way of quantitative limits. Justice Endlaw, while arriving at this conclusion, is acutely aware of the specific needs of countries like India, where libraries and universities have to cope with the needs of thousands of students simultaneously and it would be naïve to expect every student to buy copies of every book. This aspect of the judgment could almost be read as an instructional manual for countries which find themselves straitjacketed under international copyright laws, and yet want to ensure the greatest flexibility in the way they design a system that addresses their specific needs.

The division bench decision

The publishers were understandably less enthusiastic about the judgment than those interested in access to knowledge, and they immediately filed an appeal before a division bench (two judges) of the Delhi High Court. The division bench (Justices Pradeep Nandrajog and Yogesh Khanna) delivered their judgment in December 2016, upholding in substance most parts of Justice Endlaw's orders while making a few distinctions. Aware of the fact that this case is keenly followed by many non-lawyers who may get lost within the thicket of technical legal arguments, the court – towards the end of the judgment – provides a helpful musical analogy which succinctly summarizes the jurisprudential backbone of the judgment.

> 76. A lay person may question as to how a provision in a statute results in an interpretation where a right conferred on a person to use the work of another without any compensation would be just and fair. The question would obviously arise: Is it possible that a provision in a statute partially drowns another provision. This lay person would obviously desire, and perhaps logic would feed the desire, that no provision should be drowned or partially drowned. After all, in the melody of the statute all notes should be heard.

> 77. We therefore answer this question, which certainly arises, using the imagery of music. A melody is the outcome of the sounds

created when different instruments, such as a lute, flute, timbale, harp and drums are played in harmony. The notes of the instruments which are loud and resonating have to be controlled so that the sound of the delicate instruments can be heard. But it has to be kept in mind that at proper times the sound of the drums drowns out the sound of all other instruments under a deafening thunder of the brilliant beating of the drums. Thus, it is possible that the melody of a statute may at times require a particular Section, in a limited circumstance, to so outstretch itself that, within the confines of the limited circumstance, another Section or Sections may be muted.

(2016b: 32)

Translated into the Copyright Act, what the judges are making clear is that, if the predominant purpose of the law is to provide exclusive rights to owners of copyright, this right sometimes has to be muted to serve other equally important purposes such as education. In particular, for the true essence of Section 52 to be heard, the judges make a clear argument for the need to mute the 'exclusive rights' presumption of copyright law. They rejected the contention of the publishers and the reprographic rights organizations that the word 'instruction' has to be read narrowly, and the judges referred to the parliamentary debate which led to the enactment of Act No. 27 of 2012 – where the Minister piloting the Bill clearly told the House 'Of course, non-profit libraries should not be charged. Many of these copyrighted materials can be used, should be used and must be used in non-profit libraries' (ibid.: 18, Para 28).

Echoing the policy intentions of the legislature, the judges chose to ignore the technical distinctions sought to be made between education and instruction, and between textbooks and course packs and held that

> The importance of education lies in the fact that education alone is the foundation on which a progressive and prosperous society can be built. Teaching is an essential part of education, at least in the formative years, and perhaps till post-graduate level. It would be difficult for a human to educate herself without somebody: a teacher, helping. It is thus necessary, by whatever nomenclature we may call them, that development of knowledge modules, having the right content, to take care of the needs of the learner is encouraged. We may loosely call them textbooks. We may loosely call them guide books. We may loosely call them reference books. We may loosely call them course packs. So fundamental is education to a society – it warrants the promotion of equitable access

to knowledge to all segments of the society, irrespective of their caste, creed and financial position. Of course, the more indigent the learner, the greater the responsibility to ensure equitable access.

(ibid.: 18–9, Para 30)

They clarify that fairness is an essential aspect of the statute especially when there is an exception being carved out of a person's legal rights. But what is a principle of fairness? In a crucial paragraph, the courts clearly state:

In the context of teaching and use of copyrighted material, the fairness in the use can be determined on the touchstone of '*extent justified by the purpose*'. In other words, the utilization of the copyrighted work would be a fair use to the extent justified for the purpose of education. It would have no concern with the extent of the material used, both qualitative or quantitative. The reason being, '*to utilise*' means to make or render useful. To put it differently, so much of the copyrighted work can be fairly used which is necessary to effectuate the purpose of the use, i.e. make the learner understand what is intended to be understood.

(ibid.: 19, Para 33)

The significance of this interpretation is that it explicitly rejects the adoption of American standards (the four factor test) into Indian copyright law and grounds the principle of fairness within a philosophy of education, rejecting any claim that there should be either a quantitative or a qualitative restriction imposed. The significance of not laying down any restriction can be best appreciated in light of all the previous discussions in this chapter on the incredible restrictions that students face while accessing learning materials.

The court also rejected the contention of the publishers that Section 52 allows for reproduction of a work, but by making it available through photocopies it is no longer a reproduction but a publication. The court held that publication has an element of profit (for instance, in mass publication) and neither the use of a photocopy machine nor the use of an intermediary (a photocopier) qualifies automatically as publication and the only relevant test is whether copying is "in the course of instruction". The test to see whether copying is "in the course of instruction" involved "considering whether the inclusion of the copyrighted work in the course pack was justified by the purpose of the course pack i.e. for instructional use by the teacher to the class" (ibid.: 25, Para 56), and hence it would be inaccurate to claim that the word reproduction is limited to a single copy.

One crucial difference between Justice Endlaw's judgment and the present one is that, while the former found absolutely no fact that was worthy of being tried since there was no prima facie infringement, in the present judgment the court has held that the specific question of whether the reproduction of full works is in the course of instruction is a matter that can be determined in a trial and has consequently remanded that issue back to a trial judge.

The judgment rightfully rejects the rather ominous attempt by the publishers to lock education within a straitjacket of property, and it is befitting that the appellants who are the university presses of two of the oldest and most prestigious universities should be provided a reminder of what the scope of education is. The significance of this judgment is that while it arose out of a seemingly narrow question of whether the photocopying of course packs was allowed in copyright law, this question could only be answered by returning copyright to its normative foundations in copyright law.

In the wake of the Delhi High Court decision, a number of students and academics created petitions urging the publishers not to appeal against the verdict. Of particular note was an appeal by students at Oxford University to OUP welcoming the decision, which according to them "affirms the right of students to access photocopied copyrighted materials, so long as this is justified by the purpose of educational instruction" ('Open Letter' 2017: 1). The petition further observes that with the increasing privatization of knowledge goods across the world, the cost of education has reached prohibitively expensive levels and even resource-rich universities in developed countries are reeling under the impact of this sharp increase in prices. Citing the instance of Harvard University urging their faculty members to publish in more open access journals, because of the exorbitant cost of subscriptions, the petition hailed the decision as a much-welcomed development, particularly for resource-constrained developing countries such as India.

They reserved their sharpest criticism for collecting societies, arguing the following:

The history of collecting societies in India has been riddled with instances of mismanagement and malfeasance – and the IRRO itself has come under attack multiple times for its opacity and lack of good governance. This does not lead us to have confidence in the proposed licensing regime. In any case, the IRRO proposal limited the copying to only 15% of a copyrighted work. Much higher proportions have been held to constitute an educational "fair use" even in the world's largest capitalistic economy, namely

the US. Further, when a similar system to the one proposed by the publishers was implemented in Canada, collecting societies ratcheted up their licensing fees to exorbitant levels, causing some universities to walk out of these licensing arrangements. The evidence indicates that the alternative suggested in court will most likely fail to secure the objectives it seeks to achieve.

In the light of these issues, we are truly dismayed that a progressive publisher like OUP would endorse the IRRO as the way forward at this stage. A consideration of the IRRO as a feasible option might be possible in the future, where the institutional malaise that it suffers from is remedied. However, a policy decision as to whether or not to go in this direction is the prerogative of the sovereign republic of India, in much the same way that amending the law to provide for more equitable economic appropriation of the proceedings of publishing might be. As of now, the law is clear, and given the nature of India's stratified educational constraints, we urge you to adhere to it.
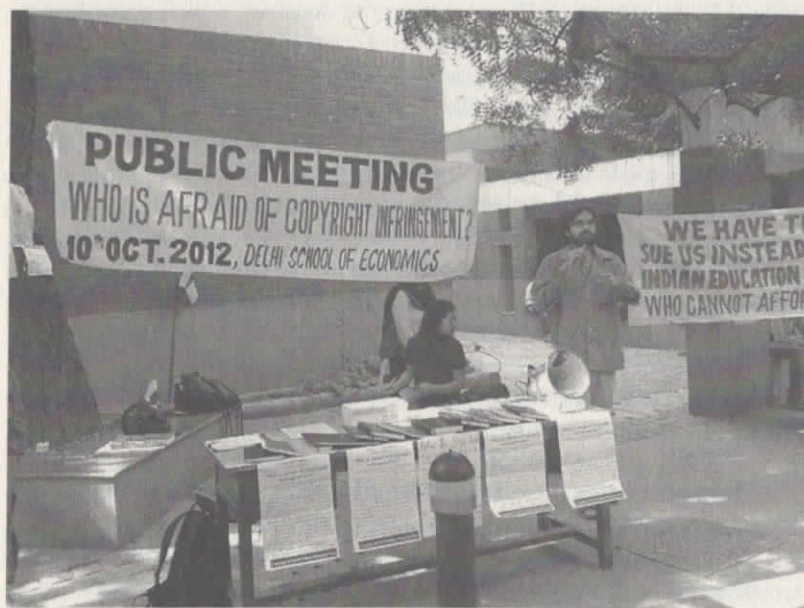
(ibid.: 3)

Figure 8.1 Protest in Delhi University, against the copyright case filed by leading publishers

Photo courtesy: Lawrence Liang

Knowledge as/in economy

While the legal case has largely been based on an interpretation of the fair dealing exceptions under the Indian Copyright Act, the case has thrown up a much wider set of issues about the ownership of academic knowledge and its control at the hands of a small set of publishing oligarchies. In a protest organized by students at Delhi University, a large number of academics and authors (including those whose copyright – according to the petition – had been infringed) signed photocopies of their texts and handed them over to the librarian. It also prompted Aditya Nigam to demand the bootlegging of education as one of the ways of fighting against the privatization of academic knowledge by academic publishers.

In a public meeting on the Delhi University photocopy case, Sudhanva Deshpande, an independent publisher, noted that the model of academic publishing had completely transformed in the last decade. If earlier the idea was to produce books which would be bought by students, the first shift was to move away from a low cost high volume model to a high cost low volume model where the main buyers would be institutions such as libraries and research centres rather than individuals (Deshpande 2012). The publishing industry is marked by an opacity which is troubling and while working on the Delhi University case, we received an anonymous email from an insider working with a leading academic press which revealed more damning practices to us (Anonymous 2012).

The gist of the received critique is as follows:

1   Publishing companies have no qualms about violating copyright when it serves their interests. Aspiring – but unqualified – authors in positions of influence at Indian universities routinely get published by leading publishing companies. Some of these books are heavily plagiarized from books by other publishers and even, without attribution, from Wikipedia – which publishers so readily dismiss with contempt – a fact which everyone in the industry chooses to ignore. Publishers publish these manuscripts with minor changes in language to skirt the issue of copyright; this involves re-writing sentences. This is tantamount to copyright violation in spirit, if not in letter.

2   Education boards are corrupted by the influence of sales managers from publishing companies. It is not uncommon for unpublished books, only in the manuscript stage, to appear in the recommended list of university syllabi. It used to be the case that the

syllabus for a course was framed first, and then books matching the syllabus are recommended. These days, the reverse happens – syllabi are framed from the contents of a book by a favoured publisher. What goes in the book is dictated by self-appointed editors at these publishing companies.[6]

3   Publishing companies are concerned with selling their books to the syllabus review committees and not the students. Prices are sometimes kept artificially high for the simple reason that multinational companies do not want to be seen selling their books at the "cheap price-points" of their Indian competitors.

The writer concluded that academic publishing, as it stands, is a fundamentally unethical business. Nowhere is this more evident than in journal publishing, where the publisher collects money from the author for publishing, gets it peer-reviewed for free, and collects more money from the readers. While this may appear to be a problem that particularly plagues the global South, even in the most elite universities in the world there is a recognition of the crisis. The historian and librarian at Harvard University Robert Darnton disclosed that Harvard could not afford the price of electronic journals and the pricing strategy of databases made universities "fiscally unsustainable" and "academically restrictive" (Sample 2012). According to Darnton, "We faculty do the research, write the papers, referee papers by other researchers, serve on editorial boards, all of it for free . . . and then we buy back the results of our labour at outrageous prices". Darnton has since become a champion of open access publishing and made a compelling case for why leading universities which are subsidized by public money ought to ensure that all their academic production should be available in the public domain. Citing Harvard's experiment with open access as a success, Darnton calls it an attempt "to realize an old ideal, a republic of letters in which citizenship extends to everyone" (Darnton 2008).

Darnton's invocation of the idea of academic restrictions invites us to think about what academic freedom may mean in the context of the rise of intellectual property norms governing the sphere of knowledge production, and how we need to rearticulate the radical potential of the university as a space of freedom, not just of thought – but also freedom from property norms that threaten to convert all universities into factories of thought. This is the key question that animates Corynne McSherry's examination of the politics of IP in universities.[7] McSherry turns to the original ideals of a university and locates it within a Kantian ideal, in which what mattered the most in a university education for Kant was the idea of freedom. It is a freedom defined in terms of freedom of

thought, and freedom from control, initially from the state and partisan political interests, but she also defines the idea of freedom in the contemporary context as one that needs to be freed from business interests.

In his *Conflict of the Faculties* (1794), Kant positioned the university as the embodiment of thought as 'action toward an ideal' – the ideal being the production of a national culture and a reasoning subject to serve as its vehicle. This basic formulation would serve as the template for the creation of the modern university system. For Kant, philosophy, which was the site of pure, rational and disinterested reason, was the necessary grounds on which one had to build the vision of a university, and the production of the autonomous liberal citizen depended in turn on the existence of the university as an autonomous, freely reasoning entity.

According to Kant, only reason can critique reason, so no outside body, including the state, could possibly judge the university. "It is absolutely essential that the learned community at the university also contain a faculty that . . . having no commands to give, is free to evaluate everything" (Kant 1979: 27). The university for Kant was a critical site for the creation of the public domain, and he interestingly contrasted this with art, music and literature which for him transformed common resources into privately owned expression, moving from the public to the private and back again. University research, on the other hand, concerned itself with the transformation of the common (e.g. nature) into the specific (e.g. facts about nature).

McSherry traces the development of the Kantian ideal of the university from the German universities through the emergence of the American research university in the nineteenth century, which unites the Germanic principles of reason and autonomy with a commitment to empirical social inquiry drawn from English liberalism. This union was facilitated by the emergence of a new vision of liberal education.

In the post-World War I period, we begin to see the instrumentalizing of the university, with university research being enlisted in war efforts – but that enlistment was still a sporadic one, organized by individual scientists rather than by institutions. But the period does herald a closer relationship between academic science and business, with departments relying on financial aid from business and philanthropic foundations to supplement the meagre financial resources they were allotted. There were significant concerns expressed about what this meant in terms of the rise of instrumental research, and what would happen to the Kantian ideal of 'pure reason' and most scientists tended to decry the turn to utility in their work. It is, however, with the Cold War that we see the greatest integration of the university towards

instrumental research, and by now it is widely accepted that many universities act as the laboratory of technical and scientific invention which feeds almost directly into corporate exploitation. A representative example is Yale's licence of the compound d4t to BMS for the manufacture of anti-retroviral drugs which has earned BMS up to 15 billion dollars and Yale received 40 million dollars in royalties.

A citizenship of letters?

What is interesting for me is how the ideals of the university seem to map on to concerns that we see in intellectual property as well. The two institutions share a common epistemic regime, and like the fundamental dualisms upon which they rest (public/private, idea/expression, fact/artefacts, reason/utility), a change in one necessarily results in the reconstitution of the other.

What significance does the expansion of IP as a mindset and as a business model within universities mean for our exploration of the question of Open Access and the academic 'Community'? Lewis Hyde, in his revisiting of Marcel Mauss in the context of knowledge production, cites Jonathan Kind, a geneticist at MIT who remarked that

> [i]n the past, one of the strengths of biomedical science was the free exchange of materials, strains of organisms and information. . . . But now, if you sanction and institutionalize private gain and patenting of micro-organisms, then you don't send out your strains because you don't want them in the public domain. That's already happening now, people are no longer sharing their strains of bacteria and their results as freely as they did in the past.
>
> (Hyde 2007: 126)

There are two things that seem to be invoked in Kind's observations about the change in the nature of knowledge production, a loss of a spirit of 'collaboration' or 'collegiality', on the one hand, and the threat to a way of doing science which depended on an ethos of generosity.

One of the primary virtues valued within the academic community has been that of academic freedom and collaboration; what does this consist of, and in what ways is it related to the question of openness? David Downing says,

> Collegiality has been historically linked to academic freedom. The implicit premise seemed to be that we had to be 'free' to be

collegial: free to pursue truth and knowledge as liberal subjects seeking our own self-development, and free to manage our own time with respect to the autonomy granted our teaching and research efforts. To this extent, collegiality was a non-contractual but widely shared value of respecting those freedoms among our many different colleagues.

> (Downing 2005: 57)

One of the prerequisites of this space of freedom was also a freedom from the constraints of property, since property spoke the language of hostile takings and appropriation. Downing says, a permanent space of non-property was created, a 'knowledge commons' that could legitimate private property in expression and invention – remembering that the (re)creation of a private domain of intangibles was and is justified by the existence of a public domain. Downing traces the shift that has happened in recent times where collegiality becomes standardized as a depoliticized meritocracy and where commoditized knowledge (as intellectual property) and its ownership became the barometer for measuring academic freedom. With the decrease in state funding for research, academics are encouraged to be more 'innovative', to be more 'productive' and to generate more resources for themselves which will assist them to buy time and consequently freedom from the university.

For Downing, this narrow conception of freedom via a negative liberties framework of non-interference and ownership has totally evacuated the idea of academic freedom and collegiality of any radical potential that it has. Produce academic knowledge as intellectual property according to 'our' standards, and you will be rewarded with tenure and promotion, and you will be free. But genuine forms of freedom are not something awarded after the fact of teaching or research. It is the other way around: freedom is actively produced by inquiry, learning, imagination, interaction. Freedom is constitutive of genuine education, not a reward for the good behaviour of educators.

The signposts of our times include the rise of "academic capitalism", the commonplace existence of Intellectual Property Agreements that facilitate technology transfer from university to corporations, and the use of law to grant universities the right to seek patents in the same way as private enterprise. As the public domain shrinks under the increasing pressures of capital, both collegiality and academic freedom, which have historically provided for the defence of a realm of non-property and non-capital, are now being turned around: the discourse of intellectual property and the ownership of

knowledge are now being used to "define and defend academic freedom" (McSherry 2001: 35).

According to Corynne McSherry,

> The contest for the meaning of academic freedom is taking place on shifting ground according to novel rules . . . the conflation of property rights and 'academic rights' participates in a set of discourses which offer to replace the hierarchies of the academy with the inequalities of the free market, discourses in which freedom can only be understood to mean 'individual free enterprise'.
>
> (ibid.: 221–3)

Those who have the most academic freedom are those faculty who own the most intellectual property: knowledge workers are subordinated to knowledge owners; "academic freedom is increasingly treated as commensurate with ownership of intellectual property" (ibid.: 2). Downing urges us to resist acceding to these destructive forces and suggests that we reclaim a politics of collegiality – rhetorically and politically – to articulate a new politics of the production of knowledge and ownership. We need to urgently acknowledge that amongst the various terrains of contest over higher education in India, we are increasingly going to see a rise in this American style reward system.

In 2008, for instance, the Indian parliament introduced "The Protection and Utilization of Publicly Funded Intellectual Property Bill, 2008", or what was popularly referred to as the Bah Doyle Act of India. Like its US counterpart, the Indian law was introduced with the presumption that there was a need "to provide incentives for creativity and innovation", to facilitate "commercialisation of intellectual property created out of public-funded research and development", to "increase the responsibility of universities, academic and research institutions to encourage students, faculty and scientists to innovate, to raise royalty income" and to "minimise dependence of universities, academic and research institutions and other recipient organisations for Government funding" (GoI 2008: 8).

If one of the rallying cries of the free software movement was the idea of free as in free speech and not free as in free beer, it is time for us to articulate a radical politics of freedom in academic practice, or free as in academic – and where would one begin, if not with our own knowledge production?

Notes

1 The Chancellor, Masters & Scholars Of The University Of Oxford & Ors. V. Rameshwari Photocopy Services & Anr. The single judge bench decision is available at http://lobis.nic.in/ddir/dhc/RSE/judgement/16-09-2016/RSE16092016S24392012.pdf and the division bench decision is available at https://indiankanoon.org/doc/114459608/ (accessed on 31 December 2017)
2 http://fdslive.oup.com/asiaed/News%20Items%20and%20Images/Joint%20Public%20Statement.pdf (accessed on 31 December 2017)
3 Comprising Justices Ranjan Gogoi and Navin Sinha.
4 Including numerous works on the history of India by Oxford University Press, as well as some more general 'classics' such as Foucault's *The Order of Things*.
5 After the initial hearing, an email from the lawyers representing the publishers was leaked online in which it was clearly asserted that this is a test case to establish stronger enforcement of reprographic rights and fees in India.
6 See also Garga Chatterjee, "Free knowledge versus freedom of the market", available at www.millenniumpost.in/NewsContent.aspx?NID=7803 (accessed on 31 December 2017)
7 Corynne McSherry, *Who Owns Academic Work?: Battling for Control of Intellectual Property*. Harvard University Press, 2001.

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9 Between disciplines and interdisciplines

The university of *in*-discipline

Debaditya Bhattacharya

Very concretely, interdisciplinarity is usually the slogan and the practice of the spontaneous ideology of specialists: oscillating between a vague spiritualism and technocratic positivism.

> Louis Althusser, 'Philosophy and the Spontaneous Philosophy of the Scientists' (1974)

I was beginning to understand that 'other' is not simply a matter of imaginative geography but also of discontinuous epistemes.

> Gayatri Chakravorty Spivak, 'Foreword', *Other Asias* (2008)

It is not without a certain deliberateness of purpose that I begin this essay on a contrapuntal note, with the two preceding citations framing a crucial debate around the history of the modern university's relationship with 'discipline'. It also needs to be emphasized that I use the word 'discipline' here, in all its etymological fecundity – coming as it does from the Latin root *disciplina*. In its originary sense, *disciplina* refers to both a practice of regimenting the minds and bodies of disciples engaged in the pursuit of wisdom, as well as the carefully segregated bodies of intellectual discourse that are thus institutionalized through limited rights of access and divisions of labour.

This essay begins with an attempt to chart the institutional histories of disciplinarity (in taking off from Simon Schaffer's hypothesis around its intersections with the colonial enterprise). The machineries of docilization – of both the objects of knowledge and the knowing subject – that the 'invention' of the discipline performs will be looked at, before I move into the mistakenly conjoined tales of specialization and interdisciplinarity within the university. Pitted against an unfolding archive of palpable threats against certain fields of interdisciplinary research, and a contradictory move towards co-opting certain others