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Lung CT scans for the management of COVID-19 pneumonitis and the diagnosis of COVID-19

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Preview

Abstract

There are many inherent limitations to CT imaging, due to the need to follow standard operating procedures and for scanning to follow the 'as low as reasonably achievable' (ALARA) principle, avoiding extensive patient exposure to high levels of radiation. In addition, proper decontamination after each use of the CT scanning facility is recommended, which limits the output per facility. An issue

of false positives arises due to the existence of diseases with overlapping features; and non-involvement or non-reactive immune responses in the lung parenchyma can yield false negative results. This chapter is an attempt to compile these findings and to present the possibilities and limitations associated with this approach.

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Surfactant Protein D in Immune Surveillance Against Cancer

Gargi Thakur, Lakshna Mahajan, Anuvinder Kaur, Roberta Bulla, Uday Kishore, and Taruna Madan

Introduction

Pulmonary surfactant protein D (SP-D) is a multi-functional, pattern recognition molecule involved in resistance to pathogen challenge and pulmonary inflammation including allergy (Madan et al. 1997a, b; Borron et al. 2002; Brinker et al. 2001; Takeda et al. 2003; Pandit et al. 2016). The immunomodulatory properties of SP-D are reliant on its the domains: the C-terminal globular region, also called as carbohydrate recognition domains (CRDs), and the collagen-like region (CLR) connected through an α-helical neck region (Kishore et al. 2005; Waters et al. 2009). SP-D directly interacts with monocytes/macrophages and enhance or suppress inflammatory mediator production depending on the binding of either of these two domains (Gardai et al. 2003; Ledford et al. 2014). Experiments using murine models of allergy of pulmonary hypersensitivity showed that SP-D (or a recombinant fragment of human SP-D containing trimeric neck and CRD region; rfhSP-D) treatment reversed hypersensitivity response by lowering blood and pulmonary eosinophilia specific IgE levels and a shift in cytokine profile from Th2 to Th1 type in the spleen cell culture (Madan et al. 2001; Singh et al. 2003). This was further confirmed by the negative regulation of allergic eosinophilic pulmonary inflammation and airway function with intratracheal administration of SP-D in the ovalbumin-induced murine models of lung allergy (Takeda et al. 2003). The eosinophilic inflammation of the

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airways has been directly correlated with the severity of asthma (Winqvist et al. 1982; Duncan et al. 2003; Bousqeut et al. 1990). SP-D knock-out (SP-D$^{-/-}$) mice showed elevated peripheral and pulmonary eosinophilia. Reconstituting the levels of SP-D by intranasal administration in the SP-D$^{-/-}$ mice reduced eosinophilia considerably. The susceptibility of SP-D $^{-/-}$ mice to allergen sensitization was consistent with severe pulmonary eosinophilia (Madan et al. 2005). These observations implicated a direct interaction of SP-D with the eosinophils.

Eosinophil Leukemic Cells

Interaction of SP-D with Human Eosinophilic Leukemic Cell Line

Direct interaction of SP-D with human eosinophils inhibited eotaxin triggered chemotaxis and eosinophil cationic protein (ECP) degranulation stimulated by Ca^{2+} ionophore in the eosinophils derived from healthy donors (von Bredow et al. 2006). Our group also showed a CRD and dose dependent binding of SP-D (and rfhSP-D) to human eosinophils (Mahajan et al. 2008a, b). SP-D resulted in a significant increase in oxidative burst and CD69 expression in eosinophils derived from symptomatic allergic asthmatics; in addition, SP-D treatment induced apoptosis in these activated eosinophils *in vitro*. The viability of eosinophils from healthy donors was not affected following SP-D or rfhSP-D treatment. However, eosinophils from healthy donors, following priming with IL-5, showed apoptosis with rfhSP-D treatment (Mahajan et al. 2008a, b). AML14.3D10 cell line, an advanced differentiated eosinophilic leukemic cell line, exhibits autocrine activation of the intracellular IL-3/GM-CSF/IL-5 signaling pathways (Baumann and Paul 1998; Paul et al. 1997). The interaction of SP-D with AML14.3D10 cells was examined in view of the ability of SP-D to selectively induce apoptosis in the sensitized eosinophils. Native SP-D, purified from the lung lavage obtained from alveolar proteinosis patients, as well as rfhSP-D both showed dose and calcium dependent binding to AML14.3D10 cells. This binding was inhibited in the presence of cellular debris (known to interact with CRD of SP-D) suggesting the involvement of CRD region of SP-D in binding to AML14.3D10 cells (Mahajan et al. 2013).

Cell Cycle Arrest of Leukemic Cells

The hypotonic propidium iodide (PI) assay was used for cell cycle analysis by flow cytometry. The assay is based on measurement of DNA content by staining with PI. The rfhSP-D induced nuclear changes in the AML14.3D10 cells and led to accumulation of cells in the G2 phase. There was more than 20-fold increase in the G2 population of cells suggesting G2/M cell cycle arrest (Mahajan et al. 2013). The treatment also increased the sub G1 peak, i.e., the presence of fragmented DNA, suggestive of the cell apoptosis. The constant presence of rfhSP-D was required to induce cell apoptosis and the sustained downstream events leading to the cell death (Mahajan et al. 2013).

Induction of Apoptosis

rfhSP-D treatment for 24 h caused significant G2/M cell cycle arrest in AML14.3D10 cells; however the cell viability was not significantly affected at this time point. Thus, Annexin V-FITC assay (Zhang et al. 1997) was used to allow the direct evaluation of Phosphatidylserine (PS) externalization, a very early stage marker of apoptosis; a significant increase in the annexin-V positive cells was observed following treatment of AML14.3D10 cells with rfhSP-D at 48 h (Mahajan et al. 2013). Other assays including 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay as well as Trypan blue dye exclusion also showed a dose- and time-dependent decrease in the viability of rfhSP-D treated AML14.3D10 cells. NAD(P)H-dependent enzymatic reduction of MTT to MTT-formazan by Mitochondrial succinate dehydrogenase indicates well-being of the cells with respect to respiration and mitochondrial level (Mosmann 1983). The mitochondrial respiration efficiency of AML14.3D10 cells started to decline significantly by 48 h. At 72 h, nearly half of rfhSP-D-treated AML14.3D10 cells showed decrease in viability by MTT assay. At this time point, the rfhSP-D treated cells started to show DNA fragmentation, suggesting the progression of cells towards apoptosis (Riccardi and Nicoletti 2006). The trypan blue staining demonstrated that ~20% cells had lost the membrane integrity by 72 h. Thus, analysis of rfhSP-D treated cells by different assays at various time points such as release of intracellular oxidative burst, G2/M cell cycle arrest, increased levels of activated p53, cleavage of caspase-9 and PARP, and PS externalization suggest the sequential induction of events observed during rfhSP-D induced apoptosis in AML14.3D10 cell line (Mahajan et al. 2013) (Table 1).

Deciphering the Proteome and Phosphoproteome of SP-D Treated Eosinophilic Leukemic Cells

SP-D has immunomodulatory effects on a range of immune cells, including B- and T-lymphocytes, macrophages, dendritic cells and eosinophils (Singh et al. 2017; Lin et al. 2010; Brinker et al. 2001; von Bredow et al. 2006; Mahajan et al. 2008a, b). The large-scale molecular changes initiated by SP-D in a human cell were thus studied, for the first time, using proteomics approach. Comparative analysis of rfhSP-D (10 μg/mL for 48 h) treated AML14.3D10 cells showed a total of 134 proteins with

Table 1 Sequential events on rhSP-D (10 μg/mL) treatment of eosinophilic leukemic cells (AML14.3D10 cell line)

Increased oxidative burst	Decrease in HMGA1 level	Increased p53 phosphorylation	Subsequent observations/ outcomes →	G2/M cell cycle arrest	MTT assay	Annexin-V FITC assay	Sub-G1 peak (DNA fragmentation)	Trypan blue staining
Induced at 24 h on treatment of AML14.3D10 cells with SP-D			Time points (h)					
+	++	++	24	+	+	—	–	–
—	++	—	48	++	++	+	+	±
+	—	—	72	+++	+++	—	+++	++

Key:
+: Results positive
++/+++: Further increase in results
–: Results negative
±: Low yet significant levels
——: Results not observed

a three-fold or more change in the expression (Mahajan et al. 2014). The important observations on proteomic profile of rfhSP-D treated AML14.3D10 cells included increased expression of oxidoreductases and stress-related molecules, and decreased expression of survival related proteins such as high-mobility group A1 (HMGA1) (Mahajan et al. 2014). In addition, the mitochondrial anti-oxidant defense system was found compromised in the rfhSP-D treated cells. There was a decreased expression of Ubiquinol-cytochrome c reductase (complex III of ETC), Peroxiredoxin 3 isoform b and Mitochondrial matrix superoxide dismutase. This is likely to cause mitochondrial dysfunction, and hence, triggering of the intrinsic pathway of apoptosis (Turrens 2003).

Elucidation of Apoptotic Mechanisms

An important mechanism by which SP-D contributed to anti-leukemic activity was the reduced expression of survival related proteins, HMGA1, an oncogenic transcription factor that is over-expressed in various high-grade malignancies (Chiefari et al. 2013; Pierantoni et al. 2007; Hillion et al. 2008; Fedele et al. 2005). Inhibition of HMGA1 expression has been shown to block phenotype transformation in many cancer cells (Scala et al. 2000). HMGA1 is known to inhibit the function of p53 family members, i.e., oncosuppressors, in cancer cells (Pierantoni et al. 2007). p53 is a tumor suppressor protein and plays a major role in cellular response to DNA damage or other genomic aberrations. Activation of p53 may lead to either cell cycle arrest and DNA repair, or apoptosis (Chen 2016; Wang and El-Deiry 2007). The decreased expression of HMGA1 in the rfhSP-D treated cells correlated with an increased level of p53 activation, i.e., phosphorylation of p53 at Ser15 (Mahajan et al. 2013). Another protein, heterogeneous nuclear ribonucleoprotein K (hnRNP K), known to be induced by stress, was found to be upregulated. hnRNP K is required for the induction of p53 target genes (Moumen et al. 2005; Mahajan et al. 2014). An increased level of p21 was also observed in rfhSP-D treated AML14.3D10 cells. The increased levels of activated p53 and p21 expression are known to inactivate cyclin B-cdc2 complex that regulates G2/M transition and leads to either DNA repair or apoptosis (Stewart et al. 1995; Bunz et al. 1998). The rfhSP-D treated cells also showed an increased Tyr15 phosphorylation of cdc2, suggesting activation block of the cdc2 (Li et al. 2011).

Treatment of AML14.3D10 cells with rfhSP-D resulted in the activation of caspase-9, a hallmark of the intrinsic pathway of apoptosis (Elmore 2007). Once initiated, caspase-9 goes on to cleave procaspase-3 or procaspase-7, which in turn, cleaves several cellular targets, including Poly (ADP-ribose) polymerase (PARP), a well-known marker of apoptosis (Walsh et al. 2008). Although, PARP was found to be cleaved in the rfhSP-D treated cells, cleavage of caspase-7 was not observed (Fig. 1). This indirectly suggests that an intermediate activation of caspase-3 may be leading to the cleavage of PARP.

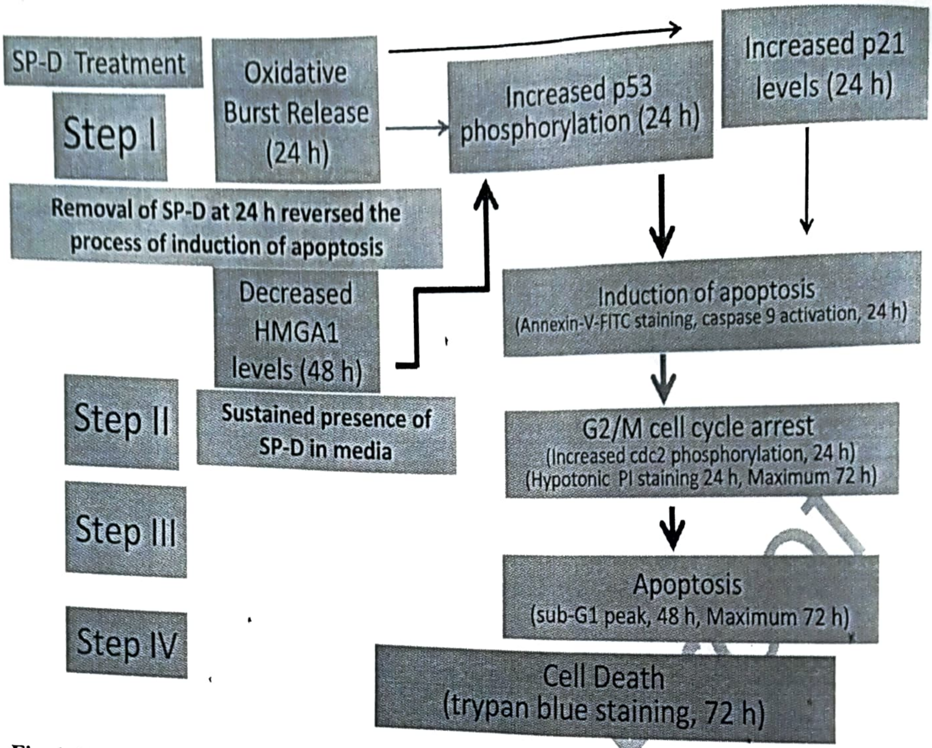

Fig. 1 Predicted steps of SP-D induced apoptosis of AML14.3D10 cells. Treatment with rfhSP-D leads to oxidative stress and reduction in the levels of HMGA1. Consequently, there is increased phosphorylation of p53 (Ser15) and p21 levels. Cdc2 phosphorylation contributes to inhibition of Cdc2 leading to arrest of cells in G2/M phase followed by apoptosis and cell death

Validation of Anti-Cancer Activity of SP-D in Other Cancer Cells

HMGA1 is over-expressed in various high-grade malignancies, including AML (acute myeloid leukemia), ALL (acute lymphoid leukemia) and Burkitt's lymphoma (Fusco and Fedele 2007). We found that the cell lines with reported increased HMGA1 expression, AML (AML14.3D10 cell and THP-1 cell line), ALL (Jurkat and Raji) and human breast epithelial cell line (MCF-7) demonstrated a significant decrease in the viability of cells on treatment with rfhSP-D, although, rfhSP-D treatment did not affect the viability of PBMCs isolated from healthy donors. The study indicated that rfhSP-D specifically exerted its apoptotic effect on the cancer cell lines.

Pro-apoptotic Effects of rfhSP-D on Pancreatic Cancer Cell Lines

In view of the above-mentioned observations, rfhSP-D has been examined for its importance in pancreatic cancer. The fluorescence analysis revealed that rfhSP-D binds evenly in clusters on the cell membrane of three pancreatic cancer cell lines, Panc-1, MiaPaCa-2 and Capan-2. No CY5 fluorescence was detected in the untreated controls suggesting the rfhSP-D binding observed in the treated cell lines was protein-specific. To determine whether rfhSP-D influences the cellular morphology and epithelial-to-mesenchymal transition (EMT) phenotypic expression, we treated a highly invasive pancreatic cancer cell line (e.g., Panc-1) with exogenous rfhSP-D (Kaur et al. 2018a).

rfhSP-D Induces Morphological Alterations in the Pancreatic Cell Line Panc-1

The optimal dose was determined by observing the effects of rfhSP-D on cell morphology and cell division of Panc-1 cells incubated with 0, 5, 10, and 20 µg/mL. Images of colonies of 10–15 cells were taken at 0, 6 and 24 h. Panc-1 cells, treated with rfhSP-D (5 µg/mL) and untreated cells, acquired spindle type cell morphology, reduced cell-cell contact, and continued to divide in a time dependent manner. No such alterations were seen in Panc-1 cells treated with rfhSP-D (10 and 20 µg/mL) and they appeared to be static. However, cell morphology at 10 µg/mL overcome these static effects by 24 h but not at 20 µg/mL dose. Interestingly, some dead cells were also seen at 20 µg/mL as compared to the other dose conditions. Subsequently, possible effects of rfhSP-D on EMT induction in Panc-1, MiaPaCa-2 and Capan-2 cells were investigated (Kaur et al. 2018a).

rfhSP-D Suppresses the Invasion Ability/Capacity in Pancreatic Cancer Cell Lines

The effects of rfhSP-D (20 µg/mL) on the invasion were analysed by incubating the pancreatic cancer cells in the upper surface of the matrigel chamber pre-coated with extracellular matrix proteins and serum containing media as a chemo-attractant in the bottom surface for 22 h. Both high grade Panc-1 (50%) and MiaPaCa-2 (65%) cell lines, treated with rfhSP-D (20 µg/mL), showed significantly reduced invasion in the matrigel; however, almost no invasion occurred in low-grade Capan-2 (Kaur et al. 2018a) since Capan-2 is a non-invasive cell line.

rfhSP-D Reduces the Expression of EMT Markers

EMT induction is characterized by morphological alterations, enhanced motility, reduced cell-cell contact (Ellenrieder et al. 2001), and upregulation of mesenchymal markers, such as Vimentin (Maier et al. 2010), Snail (Peinado et al. 2003), and Zeb1

(Wellner et al. 2009). Most pancreatic cancer cells overexpress TGF-β, which suppresses immune surveillance and facilitates the escape, migration and increased resistance to anti-tumor immune responses (Sun et al. 1994; Beauchamp et al. 1990; Reiss 1999). rfhSP-D (20 μg/mL) treatment significantly downregulated the gene expression of TGF- β in the treated Panc-1 and MiaPaCa-2 at 12 h whereas no difference was seen in Capan-2 as analysed by qPCR and western blot. Fluorescence microscopy analysis revealed that TGF-β expression at 24 h diminished considerably within the cytoplasm of the treated Panc-1 and MiaPaCa-2 cell lines. During TGF-β induced EMT pathway, Smad2/3 are phosphorylated in the cytoplasm, followed by translocation into nucleus; however, Smad2/3 staining appeared very weak in the cytoplasm of the rfhSP-D treated Panc-1 and MiaPaCa-2 cell lines. Furthermore, gene expression of key markers of EMT, regulated by TGF-β such as Vimentin, Zeb1 and Snail, was also downregulated in all cell lines treated with rfhSP-D at various times ranging between 1 h and 12 h. Fluorescence microscopy and flow cytometry analysis also confirmed a significant decrease (~50%) in the cytoplasmic presence of these proteins in the treated as compared to untreated cells. Interestingly, blocking TGF-β via neutralizing antibody reduces the expression of EMT markers in a similar fashion as rfhSP-D. Interestingly, the effect was even more prominent when rfhSP-D and rabbit anti- human TGF- β were added together (Kaur et al. 2018a). Similarly, visual assessment of cell proliferation and migratory capacity of ovarian cancer cells, SKOV3, following treatment with rfhSP-D (10 μg/mL) for 24 h also revealed inhibition of growth as compared to the untreated cells (Kumar et al. 2019). These observations suggested that rfhSP-D interfered with EMT, therefore, we investigated the static affects occurred due to cell cycle arrest.

rfhSP-D Induces Cell Cycle Arrest in G1 Phase

Panc-1, MiaPaCa-2, Capan-2 cell lines treated with rfhSP-D (20 μg/mL) for 24 h were subjected to DNA quantitation using DNA binding dye, PI, to determine whether the cytostatic effect seen was due to growth arrest. rfhSP-D treatment inhibited the DNA synthesis during G1 phase in treated Panc-1 (68%) and MiaPaCa-2 (50%) as compared to untreated Panc-1 (3%) and MiaPaCa-2 (2%) cells, respectively. The untreated cells for all cell lines as well as treated Capan-2 remained unaffected as cell cycle into next S and G2 phase continued (Kaur et al. 2018b).

rfhSP-D Induces Apoptosis in Pancreatic and Ovarian Cancer Cells

The fluorescence microscopy revealed that the cell membrane was no longer intact and the propidium iodide bound to DNA in the rfhSP-D (20 μg/mL) treated pancreatic cancer cell lines, Panc-1, MiaPaCa-2 and Capan-2 as compared to untreated cells, where no fluorescence was detected, indicating that cells were undergoing apoptosis at 48 h. The quantitative flow cytometry analysis was carried out by measuring the Annexin V/FITC binding to phosphatidylserine (PS), a cell membrane phospholipid, which is externalized during early apoptotic stage and PI, a DNA stain, passes through the porous cell membrane into the nucleus. It showed that rfhSP-D induced apoptosis in ~70% of Panc-1 and MiaPaCa-2 cells and ~43% in Capan-2 as compared to ~80% unstained, viable cells in the untreated samples at 48 h. A significant percentage of Panc-1 cells (~43%) and some MiaPaCa-2 and Capan-2 (~12%) were positive for PI alone, suggesting that these cells were either dead or in late apoptotic stage (Kaur et al. 2018b). The quantitative and qualitative analysis of ovarian cancer cells, SKOV3 treated by rfhSP-D (20 μg/mL) for apoptosis induction revealed similar trends as seen in pancreatic cancer cells. Approximately, 68% cells underwent apoptosis at 48 h of treatment (Kumar et al. 2019). Then, activation of apoptosis pathway was determined by assessing key markers of both intrinsic and extrinsic apoptosis pathway.

rfhSP-D Activates Apoptosis via Extrinsic Pathway in Pancreatic and Ovarian Cancer Cells

The treatment with rfhSP-D (20 μg/mL) activated cleavage of caspase 8 and 3, in addition to upregulation of pro-apoptotic gene, Fas at 12 and 24 h in all the cell lines. Moreover, both TNF-α and NF-κB mRNA expression levels showed a significant up-regulation in all the rfhSP-D treated cell lines at 12 and 24 h. Fluorescence microscopy of Panc-1, MiaPaCa-2 and Capan-2 cell lines showed that NF-κB was translocated to the nucleus at 24 h, which was not seen in the untreated cells (Kaur et al. 2018b). TNF-α and NF-κB are crucial factors in the apoptotic pathway and they can regulate Fas expression (Fulda and Debatin 2006). Therefore, it appeared that apoptosis occurred via extrinsic pathway as upregulated TNF-α binds to TNF type I receptor (TNFR1), which is internalized and forms a complex with TNFR1-associated DEATH domain (TRADD) (complex I), stimulating the upregulation of NF-κB. Then, a complex II is formed upon binding of complex I to Fas-Associated protein with Death Domain (FADD), which is formed when Fas is activated. NF-κB upregulation promotes Fas upregulation as it acts as a transcription factor for Fas Subsequently, Complex II activates downstream caspase cascade, which causes the cleavage of caspase 8 followed by effector caspase 3 cleavage, which brings about apoptosis. These findings indicated that cell death is likely to occur via TNF-α/Fas-mediated apoptosis pathway (Kaur et al. 2016; Liu et al. 2012; Ashkenazi and Dixit 1998). Intrinsic markers such as caspase 9 and pro-apoptotic gene, Bax, remained unaffected. Moreover, the survival pathway such as mTOR is often deregulated in pancreatic cancer (Semba et al. 2003) and its activation is associated with poor prognosis (Kennedy et al. 2011). Upon treatment with rfhSP-D (20 μg/mL), mRNA expression of mTOR was downregulated in Panc-1 and MiaPaCa-2 cell line at 12 h, however, no difference was seen in Capan-2. In addition, fluorescence analysis revealed significant decrease in the cytoplasmic levels and an increased accumulation of mTOR in the nucleus of the treated cells in comparison to the untreated cells, where it has been shown to be present in its inactive form in previous studies (Betz and Hall 2013). Interestingly, ovarian cancer cells, SKOV3, also appeared to undergo apoptosis via extrinsic pathway as pro-apoptotic gene Fas and TNF-α were upregulated and survival pathway mTOR was downregulated (Kumar et al. 2019).

Anti-prostate Tumor Effects of SP-D

SP-D Expression in Prostate and Correlation with Gleason Score

Although the lung remains the major site of SP-D synthesis, its presence has been reported in non-pulmonary human tissues, including trachea, brain, testis, salivary gland, heart, prostate gland, kidney, and pancreas (Madsen et al. 2003). Elevated levels of SP-D were observed at inflamed sites in the prostate, manifesting protection against bacterial infection (Oberley et al. 2005). Testosterone withdrawal showed upregulation of TLR4 pathway and improved SP-D-mediated bacterial clearance in rat prostate cells (Quintar et al. 2012; Oberley et al. 2005). Differential SP-D protein expression in the glandular structures of inflamed malignant and non-malignant human prostate tissues has also been reported. A significant correlation between lower expression of SP-D and increased Gleason score and prostate tumor volume has been noted earlier (Kankavi et al. 2014). A low level of SP-D, a known anti-inflammatory molecule, may contribute to the development and/or progression of the human prostate cancer (Kankavi et al. 2014).

SP-D expression in LNCaP (androgen dependent) tumor cells was significantly lower in comparison to DU145 and PC3 (androgen-independent) tumor cells and primary prostate epithelial cells. Furthermore, treatment with Dihydrotestosterone (DHT) upregulated levels of SP-D transcripts in Primary epithelial cells, LNCaP, but not in PC3 tumor cells, suggesting that SP-D expression was regulated by androgens (DHT) in an androgen-dependent cancer (Thakur et al. 2019). Similarly, SP-D expression was weaker in seminoma compared to normal testicular tissue that may contribute to reduced immunomodulatory and rheology processes in germ cell tumor (Beileke et al. 2015).

SP-D Binds Prostate Tumor Cells and Induces Apoptosis via Intrinsic Pathway

A significantly higher calcium dependent binding of rfhSP-D was observed with the androgen independent prostate cancer cells (DU145 and PC3) than the androgen-dependent prostate cancer cells (LNCaP). Primary prostate epithelial cells showed comparatively less binding to rfhSP-D than any of the prostate cancer cells, suggesting an involvement of certain interacting cell membrane proteins that are upregulated or differentially expressed on prostate cancer cells (Thakur et al. 2019). rfhSP-D caused a dose- and time-dependent reduction in the viability of prostate cancer cells (LNCaP, DU145 and PC3) irrespective of their androgen sensitivity. This effect was also observed in primary prostate cancer epithelial cells isolated from the metastatic PCa patients. Various attributes of apoptosis such as PS externalization, mitochondrial dysfunction and DNA fragmentation were evident in the rfhSP-D treated prostate cancer cells (Thakur et al. 2019). Anti-prostate cancer activity of rfhSP-D via induction of apoptosis in tissue explants from metastatic prostate cancer patients has also been demonstrated.

Mechanisms Involved in Anti-prostate Cancer Activity of rfhSP-D

p53 pathway plays a crucial role in the transmission of pro-apoptotic signals (Gottlieb et al. 2002). rfhSP-D treated LNCaP ($p53^{+/+}$, androgen dependent) cells showed significant upregulation in phosphorylated p53 (Thakur et al. 2019). rfhSP-D treatment led to a decreased level of Bcl2, with a concomitant increase in Bax, cytochrome c and cleavage of caspase 7, confirming induction of intrinsic apoptosis pathway (Thakur et al. 2019).

PC3 cells, a p53 null and highly metastatic prostate cancer cell line, also showed significant apoptosis following treatment with rfhSP-D, which suggested involvement of a p53 independent mechanism of apoptosis. Among 25% prostate cancer cases, diallelic deletion of the Phosphatase and tensin homolog (PTEN) gene and the associated increase in Akt phosphorylation correlates with hormone refractory prostate cancer (Sircar et al. 2009). A significant downregulation of phosphorylated Akt was observed in both rfhSP-D treated PC3 ($p53^{-/-}$, androgen independent) and LNCaP cells (Thakur et al. 2019). Decreased levels of activated Akt may lead to decreased levels of phosphorylated Bad (Bcl-2 associated death promoter). Dephosphorylated Bad interferes with interaction of activated Bcl2 with Bax. Thus, an increased release of Bax triggers apoptosis (Ruvolo et al. 2001; Oltvai et al. 1993). Our studies suggested that besides activation of p53 pathway, rfhSP-D also inhibited Akt-PI3K pathway leading to Bax mediated apoptosis. Thus, this study unraveled PI3K/Akt, an anti-apoptotic pathway, as a novel target of rfhSP-D mediated anti-prostate cancer activity (Thakur et al. 2019) (Fig. 2).

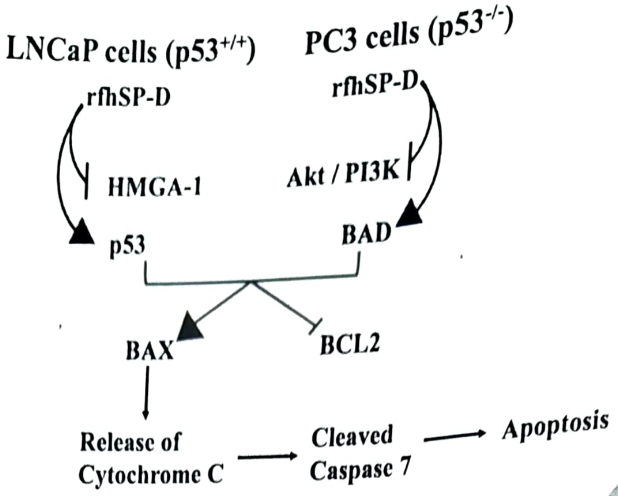

Fig. 2 Proposed mechanisms for rfhSP-D mediated apoptosis in androgen dependent (LNCaP) and independent (PC3) prostate cancer cells. rfhSP-D (20 μg/mL) treatment for 24 h upregulates p53 and downregulates pAkt, resulting in upregulation of Bad, Bax and release of cytochrome c leading to cleavage of caspase 7 in prostate cancer cells. SP-D interaction with some key molecules like HMGA1, CD14, SIRPα and EGFR has been reported previously and may be relevant as part of the proposed mechanisms of p53 and Akt

Table 2 Multiple signaling pathways targeted by rfhSP-D in various cancer cells

Cancer	Source of cancer cells	Targeted pathways	References
Eosinophilic leukemia	AML14.3D10	Intrinsic apoptosis, p53 upregulated	Mahajan et al. (2008a, b)
Lung	A549 cells	Reduced viability, EGF signalling inhibited by binding to EGFR	Hasegawa et al. (2015)
Pancreatic	Panc-1, MiaPaCa-2, and Capan-2	Extrinsic apoptosis, induction of Fas	Kaur et al. (2016)
Pancreatic	Panc-1, MiaPaCa-2, and Capan-2	Inhibited invasion, reduced TGF-β	Kaur et al. (2018a, b)
Ovarian	SKOV3 cells	Extrinsic apoptosis, induction of Fas and TNF-α	Kumar et al. (2019)
Prostate	LNCaP, PC3, DU145, Primary tumor explants/cells isolated from biopsies of metastatic prostate cancer patients	Intrinsic apoptosis, p53 and pAkt pathways	Thakur et al. (2019)

Conclusions and Perspectives

A great advantage associated with the anti-cancer activity of SP-D (especially a recombinant fragment of human SP-D, i.e., rfhSP-D) is induction of apoptosis by simultaneous targeting of multiple cellular signaling pathways including transcription factors, tumor cell survival factors, protein kinases, resulting in the efficient and selective killing of cancer cells (Table 2). SP-D has been shown to inhibit the proliferation, migration and invasion of A549 human lung adenocarcinoma cells by binding to N-glycans of epidermal growth factor receptor (EGFR) via its CRD region, and thus, interfering with EGF signalling (Hasegawa et al. 2015). In UV treated apoptotic Jurkat T cells, SP-D enhanced membrane and nuclear blebbing, suggesting involvement of SP-D in induction of apoptosis (Djiadeu et al. 2017). rfhSP-D induced apoptosis in pancreatic adenocarcinoma cells via Fas-mediated pathway in a p53-independent manner (Kaur et al. 2016). Exogenous treatment of SKOV3 cells (an ovarian cancer cell line) with rfhSP-D led to increased caspase 3 cleavage and induction of pro-apoptotic genes, Fas and TNF-α (Kumar et al. 2019). Recently, Kaur et al. reported that rfhSP-D can suppress the invasive-mesenchymal properties of highly aggressive pancreatic cancer cells by inhibiting TGF-β expression in a range of pancreatic cancer cell lines via Smad2/3 signaling (Kaur et al. 2018a).

Bioinformatics analysis of SP-D presence/levels in normal and cancer tissues was performed to assess if SP-D can serve as a potential prognostic marker for human lung, gastric, breast, and ovarian cancers. Cancer tissues with significantly higher levels of SP-D compared to their normal tissue counterparts are more susceptible to SP-D-mediated immune surveillance mechanisms via infiltrating immune cells (Mangogna et al. 2018). In view of these poignant evidences, SP-D is likely to act as an integral component of the human innate immune surveillance against cancer cells.

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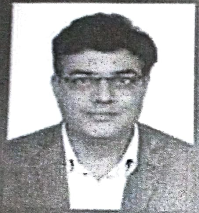

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Contents – Part V

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Autoclassify Software Defects Using Orthogonal Defect Classification

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Abstract. Software systems have become an integral part of all the organizations. These systems are performing many critical operations. A defect in these systems affects the product quality and the software development process. Prediction of the impact category of these defects helps in improving defect management process as well as taking correct decisions to fix defects. Orthogonal defect classification is a popular model for classifying defects and it provides an in-depth analysis of the defects. In this study, we proposed an auto classify approach to classify the defects into impact categories as defined by Orthogonal Defect Classification (ODC). Bag of words, term frequency-inverse document frequency and word embedding have been used to represent the textual data into numeric vectors. For experimental work, we have used 4,096 reports form three NoSQL databases. We have trained and tested the proposed autoclassify approach using Support Vector Machine (SVM) and Random Forest Classifier (RFC). We achieved maximum accuracy 94% and 85.99% using SVM and RFC respectively.

Keywords: Orthogonal defect classification · Bag of words · Term frequency inverse document frequency · Word embedding

1 Introduction

Business organizations are using software to record and maintain data about their employees, products and various operations such as financial and database management. Predicting the impact of these defects can help us to save cost and time in software development as well as in improving software defect prediction and classification models. ODC [1, 2] is a well-defined framework for analysing and classifying defects during software development. It is a systematic approach that provides a valuable feedback method for assessing the different phases of the software development. ODC can be applied in any phase to capture the semantic of each defect quickly. It characterizes the defects into eight attributes by knowing cause and its effect on the quality of software product. The ODC attributes include defect type, impact, trigger, activity, target, source,

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qualifier and age. Defect type denotes change made to solve or correct a problem. The change can be in a function, condition and assignment. Impact refers to an experience of a user when the defect was surfaced. Impact can be capability, reliability, usability etc. Activity refers to the action performed when a defect was disclosed. Code inspection and function test are the actions fall under the activity attribute. Target refers to the object of the correction i.e., the build scripts or package. Trigger is a condition which makes a defect to occur. Qualifier describes the code point before a correction was made. Source refers to the origin of the defect i.e., the location of the defect where it was initially occurred. Age refers to the occurrence of a defect to the correction of another defect.

ODC is a systematic approach which helps in prioritizing the defects and assigning defects to the experts. It also enables managers to take correct decisions after they know the category of the defect. It helps in improving software defect prediction techniques. The systematic classification of software failures allows us to know the impacts on the software product quality. ODC further divides the impact attribute into 13 categories to understand the nature of impact. Impact category includes usability, performance, capability, installability, documentation, capacity, migration, serviceability, standards, integrity/security, serviceability, and reliability.

Bridge and Miller [3] presented a methodology that successfully applied the ODC to classify the defects found in Motorola GSM division. They successfully applied the orthogonal defect classification to software development group. Zheng et al. [4] applied ODC to analyse the software defects by adopting defect type attributes with the development process.

The limitation of the ODC is the manual classification of defect reports which is a time taking process and involves high cost. This process of manual classification becomes a complex task when the number of defect reports increases. Hence, there is a need to automate this process. Therefore, we propose an autoclassify classification approach to automate the process of defect classification based on ODC impact attributes.

The important highlights of the proposed autoclassify approach are:

- Defect reports classification using textual description of the defect;
- Model the classification approach into a multiclass text classification;
- Bag of words, term frequency inverse document frequency and GloVe word embedding were employed;
- 4,096 defect reports from Hbase, MongoDb and cassandra;
- Synthetic Minority Over Sampling Technique (SMOTE) for balancing the data distribution among ODC impact categories;
- The proposed approach evaluate the performance of SVM and RFC;
- SVM and RFC classify the defects with accuracy of 94% and 85.99% respectively.

The remainder of the paper is divided into six parts. ODC based related work has been introduced in Sect. 2. Proposed approach and results are discussed in Sects. 3 and 4 respectively. Section 5 presents the threats to validity of the work and finally work is concluded in the last section.

2 Related Work

ODC defect type and impact have been widely used in literature to classify the defect reports. Some proposed studies have used a single attribute such as impact or type while others have focused on multiple ODC attributes. A common problem is that the defects are manually classified by the experts or researchers in the field which is very tedious and time consuming process. Hence, there is a need to automate the process of classification. A classification approach has been introduced in literature, which classifies defects automatically by grouping ODC defect types in categories like non-functional, control and data flow and structural [5]. The categories Algorithm/Method, Assignment/Initialization, Checking, Timing/Serialization are grouped into control and flow. Function/Class/Object, Interface/O-O Messages and Relationship are grouped into Structural. Remaining defect types are grouped as non-functional. Total 500 defect reports were collected and labeled manually. The proposed approach achieves an average accuracy of 77.8% using support vector machine. The authors used the expert's experience to label the defects and evaluate the performance on minimal labeled data.

In another study [6] an active semi supervised approach has been proposed to minimize the effort of manual labeling. Out of 500 defect reports, only 50 defect reports were manually labeled. The proposed approach achieved a weighted precision, recall, f-measure and area under curve (AUC) score of 65.1%, 66.9%, 62.3% and 71% respectively.

In [7], authors suggested a method for automatically classifying software bugs based on attributes retrieved from the Abstract Syntax Tree (AST) of the source code. The approach was assessed by labeling the 1,174 defect reports into four categories, Computational, Control or Logic, Data and Interface. The experimental results show the highest accuracy, precision and recall of 79%, 75% and 73% respectively. With minimum number of classes, the classification task seems to be easy as compared to the eight ODC attributes and their sub-attributes.

An Auto ODC technique to classify the software defects according to ODC defect impact attribute has been presented in [8]. The technique combines ODC expertise with domain knowledge. The authors also proposed an annotation framework to assign a category with justification.

In [9], the authors presented a software defect classification approach using crowd labeling for 1,444 defect reports from two datasets compendium and Mozilla, and labeled according to ODC defect impact by set of 5 annotators having no expertise in the field. The authors used 4 out of 14 impact categories to train the classifier.

Recently, in [10] authors presented an automatic classification of software defects using supervised machine learning algorithms. For experimental work, Authors collect and manually labels the 4,096 defect reports according to all ODC attributes. As opposed to the previous work, we have generated a new word embedding along with pre trained embedding GloVe by Stanford. Similar work [11] discusses the effectiveness of word embedding techniques to envisage the intensity of defect in the software product. Similarly authors [12] presented a bug severity assessment to predict the forecity of the bug reports in the context of cross project. The previous research has employed multiple ODC defect attributes to automate the process of defect classification. Moreover, the exiting works use the Tf-Idf or Bag of Words (BoW) model to represent the words in numerical vectors. In this work, we generate numerical vectors for defect corpus using GloVe word embedding [13]. Word embedding represents the similar words into similar vector representation and hence able to capture the semantic of the words. Recently word embedding techniques have been used in [14–17].

3 Proposed Approach

The proposed approach can be viewed as a 5 step process from collecting dataset to get the results shown in Fig. 1.

Step 1: Collecting the dataset
We have collected a dataset consisting of 4,096 defect reports from http://odc.dei.uc.pt/. The dataset contains software defect reports from Hbase, Cassandra and MongoDB. The defects are labeled by the researchers by considering the six orthogonal defect attributes, namely defect type, Trigger, Activity, Impact, Target and Qualifier. For this study, we use the impact attribute that is further divided into following categories- Capability, Usability, Installability, Maintenance, Integrity/Security, Documentation, Serviceability, Performance, Reliability and Requirements.

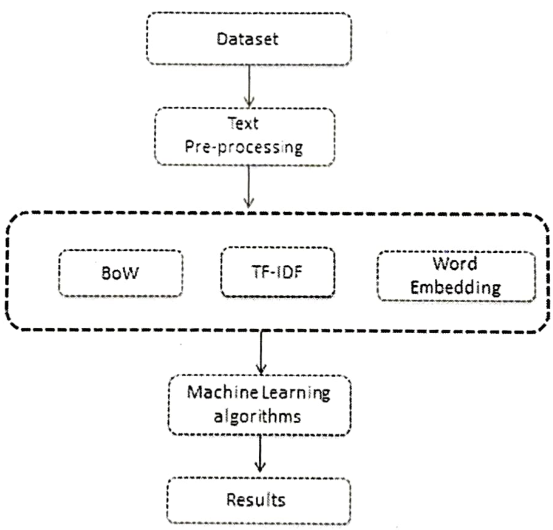

Fig. 1. Overview of the proposed approach

Step 2: Text Preprocessing
The dataset contains two fields summary and impact categories. Each defect report contains a textual description about the defect. For example, a defect report with summary "*misspelled columsort attribute* results *deleted commit logs db files*" has been labeled with "*Reliability*" category. We preprocess the text by applying text mining techniques such as removing punctuation and stop words, converting into lowercase and tokenize the text. Stop words were removed using stop word provided in NLTK library. Finally, we get the cleaned and tokenized text.

Step 3: Text to numbers
We have used three schemes- Tf-Idf, GloVe word embedding and BoW, to construct the numeric vector from tokenized corpus. In bag of words, a binary vector is created for each word in each report. If a word is present in the report, it is assigned 1 otherwise 0. Bag of words is a count based method.

Tf-Idf is frequency based method which specifies the importance of a word in a report. Tf refers to the term frequency and calculated using Eq. (1). The inverse document frequency is calculated using Eq. (2). Finally, Tf-Idf is the product of Tf and Idf score as shown in (3).

$$Tf_{i,j} = \frac{\#times\ \ a\ \ word\ \ i\ \ appear\ \ in\ a\ \ document\ \ j}{\#total\ \ document} \tag{1}$$

$$Idf_i = log\frac{\#total\ document}{\#document\ containingi} \tag{2}$$

$$TfIdf = Tf \times Idf \tag{3}$$

Word embedding is a process to represent the text into word vectors of fixed size. The idea behind word embedding is that words having similar meaning have similar representation. We use GloVe word embedding in this work. GloVe'word embedding model [13] is based on the word occurrences. We downloaded the GloVe pre trained word2vec model from http://nlp.stanford.edu/data/glove.6B.zip. It contains 1.2 million word embedding. Pre trained GloVe word embedding is used in many classification tasks [18, 19]. It has been used recently for text classification [25–28].

Step 4: Machine learning algorithms
In this work, we have used two classifiers SVM and RFC. SVM [20, 21] is most widely used supervised classification algorithm. SVM is a binary classifier that separates two classes by finding the optimal hyper plane by minimizing the cost function between the feature points using Eq. (4) and (5).

$$min\frac{1}{2}\left\|w^2\right\| + C\sum \xi_i \tag{4}$$

$$\text{s.t } y_i\left(w^T x_i + b\right) \geq 1 - \xi_i \tag{5}$$

where C is the parameter between margin and error. ξ_i represents the measure of training. But it can be extended to a multiclass classification problem by using the combination of several binary support vector machine classifiers. Many methods exist for modeling a multiclass problem into a series of n binary sub problems. For this study, we have used one against all approach (OAA) in which the i^{th} classifier is trained to differentiate the examples belong to i^{th} class from rest of the examples. Because of the variety of kernel functions utilized, SVM can handle the high volume data. SVM has been utilized in variety of investigations.

A set of random trees is used in the Random Forest classifier (RFC) [22]. It selects the features at random to create distinct trees. The bagging method [23] is proposed in which, distinct trees are trained parallelly depending on the supplied information.

Bootstrapping aggregation guarantees that each tree in the random forest is distinct lowering the classifier's variance. RFC can accurately classify massive amounts of data. Because of its random character, it is less prone to over fitting. In comparison to other algorithms, RFC yields more consistent results.

Step 5: Results
The classification performance is presented using four evaluation metrics, namely accuracy, precision, recall and F1 score.

4 Experimental Setup

This section presents the dataset details and performance evaluation.

4.1 Dataset

For the experimental work, we used the same dataset as used in [10]. The dataset is publically available and it is verified by the two researchers. The agreement between these researchers is calculated using kohen kappa agreement. For the impact ODC attribute, the kohen kappa value is 82% which is almost perfect. The dataset details are outlined in Table 1. The impact attribute is further divided into 13 categories. In this study, we have used only 6 categories- capability, integrity/security, performance, reliability, requirements and serviceability. The rest of the categories have assigned to very few reports.

Table 1. Dataset details

Defect impact	#Reports
Capability	2,165
Integrity/Security	87
Performance	199
Reliability	988
Requirements	227
Serviceability	156

Comments, title and description are the part of the defect report which helps in defect report classification manually into orthogonal defect classification impact attributes. Researchers have assigned the capability category to 50% of the data. The defect impact categories are varying proportionally and lead to an imbalance problem. To tackle this, we use Synthetic Minority Over Sampling Technique (SMOTE) [24] for balancing the data distribution for the defect impact categories.

4.2 Evaluation Metric

We evaluated the efficiency of our proposed approach using four metrics like F1 score, precision, accuracy and recall. A confusion matrix consisting of actual and predicted values is used to calculate these four metrics: accuracy, Precision, Recall and F1 score are calculated as follows;

$$\text{Accuracy} = \frac{tp_c + tn_c}{tp_c + fp_c + tn_c + fn_c} \tag{6}$$

$$Precision = \frac{tp_c}{tp_c + fp_c} \tag{7}$$

$$Recall = \frac{tp_c}{tp_c + fn_c} \tag{8}$$

$$F1 = 2 * \frac{Precision_i * recall_i}{Prcision_i * recall_i} \tag{9}$$

where tp_c and tn_c represents the true positive and true negative which is the number of instances correctly and not correctly respectively classified as class c; while they belong to some other classes. fp_c represents the false positive which is the number of instances correctly not classified as c; tp_c represents the true negative which is the number of instances assigned to some other classes while they belong to class c.

5 Results

We evaluated the performance of two classifiers SVM and RFC by learning features using three methods BoW, Tf-Idf and GloVe word embedding. The results obtained by these classifiers in terms of accuracy, precision, recall and F1 are presented in Table 2. In Bag of words method, each defect report is represented as numerical vector consists of total count i.e. the number of times a word present in a particular defect report. A total of 23,530 unique words are present in the defect corpus and forms a feature matrix where row represent the defect reports while columns are the unique words. The proposed approach achieves accuracy of 64.03% for RFC and 62.15% for SVM. Tf-Idf is a frequency based method to convert text into numeric vectors. The Tf-Idf score is inversely proportional to the occurrence of a word in the document. Our approach achieves an accuracy of 85.99% and 94% for RFC and SVM. We have used GloVe pre trained word embedding to get the real valued vectors of fixed dimension. The dimension for each vector is taken as 300. We downloaded the GloVe word embedding from http://nlp.stanford.edu/data/glove.6B.zip. We fed our defect corpus to GloVe to generate the numerical vectors for the words present in the corpus. Using these vectors, RFC and SVM are able to achieve 72.26% and 81.43% accuracy. There are some tunable parameters associated with classifiers to get the optimum results. GridSearchCV is used to search the best parameter for both the classifiers- RFC and SVM. For RFC, we search for the number of trees. The number of trees for all the experiments varies from 128 to 1,024. For SVM, we search for C and for C = 1 we get the highest accuracy, precision, recall and F1 score. We carried out all the experimental work in Python.

Table 2. Accuracy, precision recall and F1 (%)

Method	Classifier	Accuracy	Precision	Recall	F1
BoW	RFC	64.03	60.28	58.81	54.61
	SVM	62.15	59.64	54.09	52.82
TF-IDF	RFC	85.99	86.21	85.20	82.68
	SVM	94	95.08	93.99	93.85
GloVe	RFC	72.26	71	62.24	60.11
	SVM	81.43	79.67	74.56	71.38

6 Threats to Validity

In terms of external threats, an obvious threat is the training from word vectors which is generated for the thousands of defect reports. But the word vectors can be further improved. The distribution of the classes in the datasets is not uniform. The chance of biased learning is high. We attempted to eliminate the bias. The external threat is also concerned about the size of defect reports and brief description of each defect is also a concern to the external threat. In the future, this hazard can be mitigated in the future by using a larger dataset to provide more accurate results. In terms of construct validity, the issues in defect repositories such as defect duplication must be addressed. Only description of defect is extracted for all the three datasets Cassandra, Hbase and MongoDB. Moreover the dataset is transformed into 6-class classification problem due to the assignment of remaining classes to fewer defect reports. However more techniques should be adopted, to deal with multiclass imbalance problem. The internal validity is related with how the examined systems are represented and how well the classifiers function on the combined datasets. However, they differ for every combination of the datasets. That may be due to the discriminant ability of textual description of the defect. It can also be affected by the word embedding produced by pre trained word embedding model. As a result, machine learning algorithms must react to different contexts.

7 Conclusion

We present an autoclassify approach to automate the defect classification into impact categories as defined by ODC. For evaluating the efficiency of the proposed approach, we test the performance of support vector machine and random forest in terms of accuracy, precision, recall and F1 score on 4,096 defect reports collected from Hbase, MongoDb and Cassandra. We model the autoclassify approach as multiclass text classification problem. We represent the text into numeric vectors using pre trained word embedding GloVe, Term Frequency Inverse Document Frequency and Bag of Words. Word embedding is generated for the defect corpus using GloVe. SVM and RFC achieves highest accuracy 94% and 85.99% while learning form the frequency based method i.e. Tf-Idf. However the proposed approach can be further improved on large number of defect reports. In future, we will also evaluate the performance of proposed approach on other machine learning classifiers including Naïve Bayes and XGboost.

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2022

LESSON 6

CLASSIFICATION OF DOCUMENTS USING TABLE 1 AND TABLE 2

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STRUCTURE

1.1 LEARNING OBJECTIVES

You have already been done with the introductory part of DDC and Seven Tables. The present unit introduces you to how to give call numbers to the documents using Table 1 and Table 2. This unit further describes extending any number in the Schedules by adding any of the Two Tables.

1.2 INTRODUCTION

A classification scheme gives a systematical system to organize knowledge in similar or identical entities/groups. The table numbers are never used alone. "Table 1: Standard Subdivisions and these standard subdivisions should be added only when the work in hand covers the whole, or approximately the whole, subject to the number in the schedules. "Do not add one standard subdivision to another standard subdivision unless specifically instructed". Never use more than one zero in applying a standard subdivision unless instructed to do so. "If the 0 subdivisions of a number in a schedule are used for special purposes, use notation 001-009 for standard subdivisions"; "if the 00 subdivisions also are used for special purposes, use notation 000 for standard subdivisions". Table 2 deals with Geographic Areas, and Biography. These numbers are also never used alone.

Number	Name	Abbreviation	Pages in Vol.1
Table 1	Standard Subdivisions	s.s.-	1-13
Table 2	Areas	area-	14-386

1.3 METHODOLOGY OF NUMBER BUILDING WITH THE USE OF TABLES

It is very much clear and may be noted also that these numbers in Table 1 and Table 2 are never used alone in any case. "These are only attachable to a number in the Schedule and can be further extended on specific instructions only". It may also be noted that "the addition of a number from "Table 1 Standard Subdivisions can be done without any instruction to do so. Table 2 areas can also be added on your own through the *ss-09*" (Satija, 2013).

ACTIVITY

Visit any university or college library in your area and write down the names of schemes used for classification of documents.

1.4 TABLE 1: STANDARD SUBDIVISIONS

A *standard subdivision represents* a recurring physical form, for example, a dictionary, encyclopedia, periodical, index and so on or moves toward history or research and "this applies to any subject or discipline that covers or approximates the whole of the meaning of the number"(Mortimer,1998).

A few examples:

150.1	Philosophy and theory of psychology
230.003	Dictionary of Christianity
340.02573	Directory of lawyers in the U.S.
405	Periodical on language
624.0285	Computer applications in civil engineering

1.4.1 Qualities of Standard Subdivisions

- The notation for such recurring concepts always starts with a zero and they have meaning only when attached to some class number.
- They cannot be used independently.
- These were earlier termed as form divisions, as mostly they stood for the form of the document.
- In the seventeenth edition (1965) these form divisions were veritably renamed as "standard subdivisions", as these recurring non-subject divisions gathered there had outgrown the form divisions.

- Now, they include some recurring viewpoints, and even facet indicators, as they stand in the nineteenth edition.
- They are called "standard" because their meaning and notation remain the same wherever they are used (DDC, Volume 1, pp. 2-13).

1.4.2 Use of Table 1: Standard Subdivisions

Library classification in effect deals with knowledge as contained in documents. To account for such physical attributes of the documents, Melvil Dewey in the second edition (1885) separated such non-subject common forms of the documents and listed them at the beginning of each Division. "These tables could be attached to any class number and always remained the same in name and notation. This table could be attached to any class number and always remained the same in name and notation. The notation for such recurring concepts always starts with a zero and they have meaning only when attached to some class number". They are called "standard" because their meaning and notation remain the same wherever they are used. The standard subdivisions as they stand in DDC-19 (Volume 1, pp. 2-13) may broadly be categorized as under:

01, parts of 02, 07 and 09	Viewpoints
02 partially, 03, 05 and 06	Internal forms of treatment of subjects
04. 08 and to some extent 09	Facet indicators to introduce a new facet

1.4.3 Rules for adding Standard Subdivisions

"Rules" for adding standard subdivisions to a class number have been provided in Sections 5.24, 8.5.3 and 8.7 of the "Editor's Introduction" in Volume 1. Here rules have been explained to use Table 1, and some advice is given for the situations where the classifiers may feel plotted. Some brief instructions to apply them and the Order of Preference also precede the actual Table 1 (page 1. Volume 1).

"Standard Subdivisions are added to the ultimate class number of the document in question. Having reached the most specific class number, we do not necessarily need an invitation to add any standard subdivision"(Comaromi,1978, p.404).

Encyclopedia of Islam

297+03-297.03

(Here Islam is the subject and Encyclopedia is the standard subdivision)

History of the Ahmadiya Movement

297.86+09 297.860 9

(Here we have added standard subdivisions 03 and 09 respectively, though there are no instructions to do so at these class numbers).

Note: "Two standard subdivisions are not applied in succession to a class number. If a subject poses two standard subdivisions, then only one is to be applied. on a preferential basis, and the other is to be ignored. The table of preference is prefixed to Table 1. If we examine, the preferential order, it becomes obvious that facet indicator general special is followed by viewpoints, and the real form divisions come in the end. It means internal forms are to be preferred over external forms"(Volume 1, pp. 2-13). For example,

Encyclopaedia of Organisations on Applied Psychology

Here "Encyclopaedias and "Organizations" both are standard subdivisions with notations 03 and 06 respectively. Therefore, only one of them is to be added. As per the preferential table. "06" is to be given preference over "03". Therefore, the correct class number is 158.06 and not 158.03 or any number combining the two ss viz. 158.0306

Therefore, whenever there are two standard subdivisions, this table must be consulted to know which of them is to be applied, and which is to be ignored.

Note: "If any of the ss, when applied to a class, gets some local name in that context, then in that schedule all such proper standard subdivisions are to be used in all such cases, the notation is compatible with Table 1, but the nomenclature is somewhat modified" (Volume 1, pp. 2-13).

For example,

610 Medicine

In Table 1, we have 073 students, learners, apprentices, and beginners, when it is added to 610 to make 610.73, it gets the meaning "Nursing and other activities auxiliary to the medical profession.

The Standard Subdivision 013 value in the context of 331 labour economics has been the meaning: "Freedom, dignity and value of labour".

Note: An extension of the standard subdivisions 01 does not exist elsewhere.

Similarly, the ss 08 Anthologies have been given the extended meaning of Rhetoric and collections of literature (irrespective of the language) which have further been subdivided as per need:

808	Rhetoric and collections
808.02	Authorship and editorial techniques
808.025	Writing for publication

1.4.4 Application of Standard Subdivisions at Irregular Places

Going beyond the extended meaning some standard subdivisions are shown as subject divisions and consequently moved to a division in the array. It happens if that compound subject has a subject value and considerable literary warrant. Such treatment allows further extension of such subjects. This happens usually for the geographical and historical treatment of a subject:

331.2	Wages (Labour economics)
331.29	Historical and geographical treatment of wages, Instead of 331.209

Note: "To avoid cross-classification cross-reference is provided from the probable class number likely to be looked at by the classifier to the actual number used in the schedules. For example, in the above case, the not used class number [331.209] is enclosed in square brackets, and a cross-reference here directs the classifier to 331.29".

Similarly. techniques, apparatus, and material for art metal work are 739 instead of 739.028. Though techniques, apparatus etc., is a here they have been enumerated like a subject.

534.9 is Table reviews, exercises in sound physics

Instead of 534.076.

Again in 535 optics 535.9 is Reviews and exercises in optics instead of 535.076.

720.9 is a Historical and Geographical treatment of Architecture. But the architectures of specific ages. Instead of being provided in 720.901-.905 have been shifted to 722-724. Accordingly, at [720.901-.905] one reads the instructions "Do not use, class in 722-724."

Note: Another irregularity occurs in the case of Technology

666.3 Pottery Ceramic technology. Here, we are asked to add ss at 666.31-39, instead of at the usual place viz. 666.301-.309.

Not only this, there is one exception to this exception viz. The ss "Techniques, procedures, apparatus, equipment, the material is to be placed at 606.4. Instead of placing at the usual 666.328

Note: "Some other irregularities also occur in the case of the use of a Chronological Table. In usual cases, any chronological period division is to be taken from Table 1. where the "ss" "09" has been further subdivided as 0901 0905 enumerating all periods of history. These are attachable to any class number, but for some classes, for example, 800 Literature, and 900 History, some special "Period Tables" have been provided. Therefore, in such cases, these tables are to be used. Instead of the general one. e.g. at ss 09. In fact, in the case of Main classes, the 800 and 900 periods is a subject facet. Instead of being merely an auxiliary".

For example:

20th Century English Poetry 821.91 instead of 821.0904
Elizabethan English Drama 822.3 instead of 822.09032

Note: Extending the irregular use of the standard subdivisions a bit further, we find numerous cases, where a geographical facet is made inbuilt in the structure of the class number. In such cases, the geographical facet is not added through the ss 09.

For example:

General Statistics of Europe
314 instead of 310.094
General Statistics of France
314.4 Instead of 310.0944
General Statistics of India
315.4 instead of 310.0954

Note: "Many a time, a classifier finds two places for the historical and geographical treatment of the subject. Both of them have their meaning. We must learn to perceive the subtle difference between the subject as an academic discipline, and the actual practical conditions in that field".

For example:

320	Political Science where
320.09	Historical and Geographical treatment of
320.9	Political science, and Political situations and conditions
	The correct class number for Political conditions in India will be 320 954

592	Invertebrate Zoology
592.009	Historical And geographical treatment of the study of Invertebrates
592.09	Geographical treatment of Invertebrate Zoology
592.0954	Invertebrates (found in India)

1.4.5 Use of Zeroes in Standard Subdivisions

In Table 1 every standard subdivision begins with a featured zero, which is essentially a facet indicator marking the transition from subject divisions to the form division in the class number. Sometimes a featured zero may seem missing, while at others standard subdivisions may begin with one, two or even three zeroes. Wherever the position for standard subdivisions has been occupied by subject divisions, therefore, in such cases, the standard subdivisions are so designated as to precede subject divisions. This is done by denoting the standard subdivisions with two zeroes or three zeroes as the case may be.

For example:

Dictionary of Human Diseases

616.003

Journal of Constitutional Law

342.005

In the case of 350 Public Administration ss are to be added with three zeroes, as the subject division starts both with one zero or two zeroes.

Study and Teaching of the Subject of Central Government

=351.007

Journal on Central Governments =351.0005

1.4.6 Other rules for adding Standard Subdivisions

Subject to the above rules, a standard subdivision may be added to any class number.

- If the ultimate class number is the Main class or a Division 1.e. ends with two zeroes or one zero, the filler zeroes are to be removed before adding a standard subdivision.
- The digits are so reshuffled that the dot is placed after the first three digits.

For example,

Encyclopedia of Science Science is 500, and Encyclopedia is an ss with notation 03, Since in 500 there are two formal zeroes, therefore these are to be removed. The synthesized class number is = 500+03 503

1.5 USE OF TABLE 2: AREAS

Whenever a subject is studied within the context of a geographical area, the ultimate class number from the schedules may be qualified by the area number taken from Table 2. It is mandatory to add area notation in the subjects of social sciences and humanities because in these subjects the treatment and practice of a subject vary from place to place. Here the area is more or less an essential part of the subject. "Some other disciplines may also occasionally need the area facet. Where a schedule does not authorize us to add from the area table. The area table can still be added through the ss 09 from Table 1"(Satija, 2013).

This is the largest of all the auxiliary tables (pp. 14 to 386 out of the total of 452 pages). Its length consists not in any variety of subdivisions as it is in detail. A brief paragraph of Instructions (p.14) precedes the enumeration of area numbers. All areas of the world's natural geographical divisions, political or administrative units, or some scattered geophysical divisions of earth or some non-continuous conceptual based on various people who habitat them, have been accommodated in divisions 1 to 9. "Area 1 stands for the scattered regions bound by some geophysical or some social characteristics, for example, plane regions, forests, deserts, oceans, socio-economic regions, and so on". "Number 2 has been allotted to persons regardless of area, region place. "The modem world as divided into various continents, countries, provinces, and cities have been denoted by the notation 4 to 9. The geographical subdivisions of area number for USA 73 are far more detailed than that of any other country" (Comaromi,1978, p. 407).

The Area number is always added to the definitive number in the schedules while some classes are directly based on the geographical characteristics, so the number for areas is inbuilt there; for example,

> In the class History
> 954 is the History of India,
> 973 is History for the USA,
> as-54 and -73 are area numbers as taken from the Area Table
> similarly,
> 314 is General Statistics of Europe and 315 is General Statistics of Asia
> where 4 and 5 respectively are the area numbers of Europe and Asia

The use of "Table 2 for Areas" does not create any difficulty. "Whenever a class number needs extension by some geographical area, there are sufficient instructions there in the schedules to do so. Generally, a division usually at "9" in the array is left for the geographical and historical treatment of the subject" (Satija & Comaromi, 1998, p.143) :

> Political conditions:
> 320.9
> (As per instructions, this class number is to be further subdivided by the area numbers 1 to 9 from Table 2)
>
> Political conditions of India
> 320.954 (T2)
> = 320.954
> Political conditions in Rajasthan

320.9+544 (T2)

= 320.954 4

Political conditions in Christian Countries

320.9+1761 (T2)

= 320.91761

1.5.1 Adding Area Notation through the SS 09

Where there are no instructions but the subject of the document under classification requires the addition of an area number from Table 2, then the area number is added to the class number via the ss 09, which works as a facet indicator:

Child labour in India: an economic study

331.31+09 (T1)+ 54 (T2)

= 331.310 954

Civil Rights in Communist Countries

323.4+09 (T1) + 1717 (T2) = 323.4091717

Note: Sometimes, an area number may be added through "0" instead of 09. For example, 920.03-09 Biographies by specific geographical areas.

Biographies of persons living in India

920.0+ 54 (T2)

= 920.054

Here as per instructions, the area number 54 for India has been added to the base number 920.0

Biographies of persons living in Rajasthan

920+0+544(T2)

= 920.054 4

Note: Sometimes an area may be further extended by the special subject divisions as in the cases of 340 Law and 350 Public administration:

Miscellaneous Public Law 343 Income Tax Law 343.052 The Indian law of Income Tax 343+54 (T2)+052 (from 343.052) = 343.540 52 Here 343 has first been divided by country (India-54) then the resulting class number has been further extended by the subject division 052 Income Tax of 343.

Note: "A separate provision of the area table since the 17 edition has not only allowed more details in subdivisions for various countries but has also made possible the division of the earth and population clusters from various conceptual viewpoints These are various physio geographic and socio-economic regions shown as subdivisions of 1"(Volume 1, pp. 2-13):

Atmospheric pressure in Forests 551.54+09 (T1)+ 152 (12)-551.540 915 2 Here "152" is forests from the Area Table added through the 56 09.

Note: As per instructions, each subdivision of 1 area is susceptible to be qualified by any region 3-9 from the same table. This has increased the versatility of the scheme:

Standard of Living in Indian Villages 339.47+ 09 (T1)+ 1734 (T2) +0+54 (T2) =339.470 917 340 54 Atmospheric Pressure in Indian Forests 551.54+09 (T1) +152 (T2) 0+ 54 (T2) =551.540 915 205 4

Note: In the schedules, many a time Instructions specify that "add areas notation 3-9 from Table 2". It only means that the areas denoted by subdivisions 1 and 2 falls outside the Jurisdiction of such instructions. In such cases, we cannot add directly areas from subdivisions 1 and 2 (Table 2). needed we can add such class numbers via the ss 09 (Volume 1, pp. 2-13):

For example:

> The foreign policy of non-aligned nations cannot have the following number:
>
> 327.1716
>
> The correct number is 327+09 (T1)+ 1716 (T2)=327.091

1.6 SUMMARY

The 19th edition of the DDC contains seven tables given in volume 1. Table 1 records viewpoints, mode of presentations, and internal forms of a document, for example, bibliography, encyclopedia, history, and philosophy, which are all standard subdivisions. These standard subdivisions are attachable to any class numbers in the schedules with the help of zero. In some cases, they are added with one, two or three zeros. Usually, filler zeros are removed while adding a standard subdivision to the main class to avoid contrary to the instructions.

Table 2 is a list of political, geographical, geophysical areas and population clusters of the world. Numbers from Table 2 can be added directly on instructions or through *ss-09.*

1.7 GLOSSARY

Schedules: It is a long list of classes arranged systematically along with their notations

Standard Subdivisions: These are non-subject recurring aspects of a subject usually represents the viewpoints of presentation of subject or the medium and form of the document. For example, philosophy, history and research Auxillary Tables and Devices 107 Page 3 Classification-DDC-19th Edition.

Tables: It is a long list of auxillary non-essential aspects of a document. In DDC-19th Edition there are Seven Tables have been listed in Volume 1.

1.8 SELF ASSESSMENT QUESTIONS

1. Build class numbers for the following titles:
   a. Social change in Indian Villages
   b. Social change in Hindi Speaking areas of India
   c. History of the Third World
   d. Political Conditions in Non-aligned Countries of Africa
   e. History of Third World during 1990-1999
   f. History of English-speaking nations in the 19th Century
2. Classify the following titles using Table 1:
   a. The Journal of Public Administration
   b. The Journal of Aptitude Tests
   c. Research in Central Government in India
   d. Dictionary of Algebra in Spanish
   e. Statistical Principles of Biology
   f. Contribution of Indians to Library Classification
3. Classify the titles given below using Table 2:
   a. Migration of people from India to the U.S.A.
   b. Migration of Buddhists to Europe
   c. Exchange Rate between the US dollar and Indian Rupee
   d. The British Colonies in Asia
   e. British financial investment in the Third World
   f. Emigration from India to English-Speaking Countries
   g. Foreign relations with British Commonwealth Countries

h. Labour Workers from Nepal in India

i. Public Libraries in Developing Countries

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LESSON 7
USE OF RELATIVE INDEX

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STRUCTURE

1.1 LEARNING OUTCOMES

Assigning a class number to a particular document is not an easy task in libraries because it is an intellectual activity and takes lots of effort to understand the main subject first. In this process Relative Index plays an important role in likewise Tables (Volume 1) and Schedules (Volume 2) of DDC-19th Edition. The present unit introduces to you the definition, nature and characteristics, need and importance, organisation and structure of the Relative Index.

1.2 INTRODUCTION

The present unit explains how to analyse any subject of a particular document and then how to assign a class number to the specific subject with the help of the Schedules (Volume 2) and Tables (Volume 1) of DDC 19th Edition. The Relative Index (Volume 3) is an important source of information for assigning numbers because it plays an important role in guiding and getting the appropriate Class Number from Schedules and Tables.

1.3 IMPORTANCE AND USE OF RELATIVE INDEX

The Relative Index has always been a significant part of the Dewey Decimal Classification system."It is an alphabetical Index to every key term occurring in the schedules and all the tables. It is just not an aid to the use of schedules, but an entity itself and has a value like schedules. In addition to the explicit terms, some terms/concepts implied or obtainable through the number building process, and popular synonymous terms have also been included" (Dewey,1971 & Dewey 2012, p.1221). Similarly, in the 19th edition Index, the total number of more than 80.000 entries is far more than the total of 29,528 enumerated entries in the Schedules and Tables combined.

"The Index is called relative as it reverses the pattern of collocation of subjects. In the schedules the first division of the knowledge is by broader disciplines" (Miska,1980, p485). A classifier can see a glimpse of the different features and implications of a subject. It is called relative as it also depicts the relation of one aspect of a subject to another. It is useful and a quick key to the classes and topics for those classifiers who are not very much familiar with the whole structure and pattern of DDC.

1.4 STRUCTURE OF RELATIVE INDEX

The Relative Index is structured in a way that the proper names have been indexed under their AACR-2 form. Its essential to determine the subject of the document then only you can consult the Relative Index. The subjects are arranged in alphabetical order/position. When the term is treated in three or more fields of study the number opposite the heading is to be used in the interdisciplinary number. The arrangement is word-by-word; and entered in first-word capital as under :

Abra, Philippines
Abrading tools
Asia Minor
Asian
New York
Newark

Phrases have been entered in "Adjective+ Noun" form without any inversion as a matter of rule:

Agricultural banks
Colour television
F-region Iconosphere
Fabian socialism
Facial bones
Festive music Indian Desert
Indian hemp
Indian Ocean
Inorganic chemistry

Compound (hyphenated) words have been treated as if they were a single word, for example, a hyphen is ignored.

Franco-German war history
Franconia Ger.
Franconian
Highboys
High-calorie Cookery High-carbohydrate

High compression-Ignition
High-energy
Higher

1.4.1 Terms not Included in the Relative Index

The terms not listed in the Schedules or Tables are as follows:

i. Names of all places, minerals, plants, diseases, and so on.

ii. Persons, except for heads of state who are used to identify historical periods, for example, Louis XIV: founders of religions

iii. Names of art or literary forms for particular languages and countries, for example, American short stories. English poetry, Russian drama, Italian architecture, French cooking and so on

iv. General concepts that occur in most fields and are represented by standard subdivisions, for example, educational administration, language laboratories, mathematical
tables, agricultural research, and business education.

1.4.2 Structure of the Index Page

As a structural format of an Index in DDC, the pages of each entry have been divided into two columns by a vertical line in the centre.

For example,

Architecture
Assam India
720

Or area-541 62

- The Index is highly structured both semantically and typographically.
- Maximum use of indentions and typographical devices has been made to depict rank relations and to show different aspects of the concept Indexed.
- A cross-reference has been defined as "An instruction note leading from the point at which comprehensive works on a subject are classed (whether stated or implied) to subdivisions of the topic located in numbers other than those subordinate to the number used for comprehensive works."

It means that apart from the Bible aspect of Exodus the readers are instructed to see under Historical books (O.T.) for other aspects of Exodus. In the 19th edition, the most important of the FOR references is see also type, transcribed in abbreviations in the schedules as s.a. This mostly refers to the aspects not covered under the main heading

Habits	
Child rearing home econ	649.6
Customs see social customs	
Psychology	152.33
animals	156.233
schildren	155.412
s. a. psych of other specs. groups	
s.a. Behavior	

It means that some related material on habits may be found under the term Behaviour. So we must explore the term Behaviour. Also an "s. a." Instruction appears under psychology, which in turn appears under Habits, It means that two aspects of habit psychology namely children and animals have been given.

"Under each entry, the coordinate and subordinate relations have been shown by Indentions. This is rather a very fine and efficacious device. Understanding these Indentions is very essential to the technical reading of the Index, for example,

Ecology	
Elementary Education	372.357
Life science	574.5
Animals	591.5
Man	573
Microorganism Plants	576.15
Plants	581.5

s. a. other spec organisms

Soc. theology

Christianity 261.836 2

Comp. rel 291.178 362

s.a .other spec. rel

sociology 304.2

Analyses,

Ecology has four main aspects namely:

a) Elementary Education,

b) Life Sciences,

c) Social Theology and

d) sociology with equal ranks among themselves and formed an array and been shown typographically under the term ecology" (page 331 of the Index, 19th edition).

Abbreviations for the various Tables as used in the Index are as follows:

Table Number	Full Name of the Table	Abbreviations used
Table 1	Standard Subdivisions	S.S.
Table 2	Areas	*Area*
Table 3	Subdivisions of Individual Literature	*Lit. sub.*
Table 4	Subdivisions of Individual Languages	*Lang. sub.*
Table 5	Racial, Ethnic, and National Groups	*r.e.n.*
Table 6	Languages	*lang.*
Table 7	Persons	*Pers.*

1.5 SUMMARY

In this Unit we have discussed the need value, scope, entry format and use of the Relative Index: The Relative Index:

- contains a word-by-word sequence of all the key terms in the schedules, the Seven Auxiliary Tables and some of the synonymous terms;
- provides an independent approach to the Universe of Knowledge;
- help to understand knowledge classification.
- provides a quick look at the various subjects/disciplines;
- provides synonymous terms, see cross-reference, which directs to unused terms and key to the abbreviations.

1.6 GLOSSARY

Entry: A term or phrase followed by information in the form either of a number or a referenceto another term or phrase, or both.

Indentation: Typographical setting in which subheadingsare printed leaving a space to the left of the line of the first letter of the main heading.

Index: Ordinarily an alphabetically arranged list of topics/concepts in the book giving information for each item is to be traced using a number. In some indexes, the arrangement may be other than alphabetical.

Relative Index: An alphabetical index to a classificationscheme in which all relationships and aspects of a subject are brought togetherunder each index entry.

Scatter Reference: A cross-reference in the index not referring to a specific term but suggesting a variety ofpossibilities. This is done by *see also* references.

See: A direction note from a not used term to theused term. A direction note referring the user to related topics.

s.a.:: This refers to related topics scattered in theIndex under different terms.

Word-by-Word Alphabetization: In it, terms/concepts which have the same first words are arranged in the alphabetical order of the subsequent word. Here the word(not the letter) is the unit. It is also called thenothing before-something method. This method is also recommended by the British Standards Institution.

1.7 SELF ASSESSMENT QUESTIONS

1. What is the structure of the Relative Index in DDC 19th Edition?
2. Which terms are not included in the Relative Index?
3. Why is the Index of DDC called the Relative Index?
4. What do you understand by an entry in the Relative Index?
5. Spell out the following abbreviations.
   i. ed.____________________
   ii. gen.wrks____________________
   iii. govt____________________
   iv. spec.____________________
   v. O.T.____________________
   vi. s.a.____________________
   vii. vet.sci____________________

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LESSON 13

E-MARKETING

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STRUCTURE

1.1 LEARNING OBJECTIVES

The present lesson defines the concept of e-marketing in the field of LIS. The power of "E" has profoundly affected the way of marketing. The entry of "E" helps marketing by anyone, from anywhere and anytime with just a click of the mouse. Basically, "E" refers to the paperless exchange of business information using electronic gadgets. Generally, libraries are service-oriented not profit-making organizations but special products and services need to be promoted through an exchange of price for a fund which helps towards the growth and development of document collection in libraries. Still, in the 21st century, the concept of e-marketing is not fully understood by many library professionals. Each library and library professional needs to identify the primary target markets and the composition of needs that it would like to serve as its key constituency. After reading this lesson you will be able to understand:

b) to establish the need and significance of e-marketing for information products and services; demonstrate your understanding of the related terms in e-marketing;

c) to describe the benefits of e-marketing both for the users and the providers of information products and services;

d) to explain the classification of e-marketing activities and how these are different from other types of e-marketing;

e) to address the key issues in the development of e-marketing strategies in the LIS field.

1.2 INTRODUCTION

Like all other spheres of life, the electronic has profoundly affected the way marketing is adept today. In the earlier lessons, you have learned the promotional activities, communication channels, and promotional strategies to promote LIS products and services. It is proven that marketing in libraries is primarily concerned with the objective of creating user value. The users, towards whom the products and services of the modern-day libraries and information service providers are directed, change their lifestyles and methods of utilising, storing and retrieving information. "Use of the World Wide Web and rapid developments in broadband connectivity, supporting back room technologies, and constant endeavours to aide programme integration of communication and information technology have broadened the perspective of access to information and the possibilities of the search for it to undreamt of levels". Providers of information products, therefore, need to think in terms of a new paradigm, that of an empowered and informed consumer, with several choices, and an ever-widening reach of enabling tools, like the internet and web browsers. Research suggests that the application of the massive powers of the internet and supporting technologies to the practice of marketing is referred to as electronic marketing or e-marketing.

In this lesson, we would see how the electronic age has influenced the planning, designing and implementation of strategies for promoting LIS products and services.

1.3 E-MARKETING IN LIBRARIES

The idea of marketing library services is not new. At ALA Conference in 1896, Lutie Stearns talked about advertising the library. Thereby the word advertising was added to the librarians' vocabulary. Fialkoff (2006) focused on the problems by which libraries are failures in marketing. "Library authorities to some extent neglect the things and fail to communicate with their users and their requirements, especially now that their audience is being attracted or to expect a wide range of sources and services. By keeping these things in mind, libraries can utilize computer technology to improve marketing efforts or to promote their sources and services. But first, a library must need to get a better understanding of the requirements of the users with the help of market research. In the process of market research, they can use transaction log analysis, circulation records, user surveys, focus group interviews, and informational interviews"(Krishnamurthy, 2005). This research process will be helpful to get an insight that what your users expect from your library. In several environments, e-business has increased, and the value of digital information in the process of e-marketing has increased. One of the features of information is that when it is demanded as a product it creates a new marketing approach and that is information e-marketing.

"E-marketing refers to the application of marketing principles and techniques via electronic media and more specifically the Internet. E-marketing allows librarians to help patrons (users) access information in a virtual environment, using various methods such as e-mail, chat, website, and so on. Three main factors, namely the information explosion, the technology revolution, and growing library costs are responsible for encouraging the library profession to develop an e-marketing approach in its operations and services. One essential role of e-marketing is to create a series of exchanges.

"The prefix `e-`, is generally attached to any application that is associated with the revolutionary tool of the internet. "In the context of e-marketing of information products and services for a modern-day library let us first try to understand the various related terms and concepts".

E-marketing is a process of planning, executing, and promoting products and services by using Information Communication Technologies (ICT) to meet the users' needs. "The concept, E-marketing of information and services of libraries is quite innovative because the traditional concept has been changed from marketing to 'E', for example, E-marketing". Now, today's "world is preferring to have a digital environment, and libraries are also no exception and trying to achieve their goals"(Marcial,2013, p.336). This lesson focuses on how libraries can adopt and implement e-marketing aspects to utilize and improve information products and services more effectively by applying different information communication technologies.

ACTIVITY

Visit your local public libraries, campus college and university libraries to collect the information how these libraries promote their sources and services using e-marketing strategies?

1.4 PROCESS OF E-MARKETING IN LIBRARIES

1.4.1 Planning of E-marketing

In the LIS field before preparing an e-marketing plan libraries should research their user groups' needs and demands. Then they can use this information to develop a plan for the targeted group of users. In an electronic era of information, libraries can't stand and work alone. They work closely with consortia, vendors, suppliers, other libraries, and their users to meet their responsibilities not only in the library but also out of fancies. Regularly library professionals are researching that in a world where the majority of our users are not coming into physical libraries, how do we build strategies to meet the users where they are and get them to good resources? Where are users on the web and how can we get to them?

1.4.2 Requirements for E-marketing

The first requirement for successful e-marketing in library and information services is a clear appreciation for what marketing is and what it can do. Satisfying the users is the primary concern in the marketing/e-marketing process. "Users will only come back for more service if they are satisfied; if they are not, they will find a different resource. Thus, the philosophy of the library should value user satisfaction, and everyone should have a role to play in reproducing maximum satisfaction"(Haruna, Madu & Adamu, 2017). A library has to have a sufficient understanding of existing and potential users to create superior value for them. This value comes through increasing the benefits to the users. "One way to do this is at a user orientation, which requires that the library understands the value to the user as it is today and as it will evolve. This makes e-marketing more than just finding users for the available information sources, services, and technologies. It makes marketing a partnership with the user, who becomes a central part of the total service efforts.

The Ohio Library Council defines the e-marketing process:

- Begin the marketing process by examining your library's mission or purpose;
- Assess library capabilities with a marketing audit and an internal assessment.
- Find out what products (services) your users want, and how they perceive the library, through market research.
- Develop goals and objectives based on your mission and the results of your internal audit and external research into what customers want.
- To meet goals, select strategies to promote your products that will work best, be affordable, and reach your customers.
- Create a plan of action that describes all the steps needed to carry out the strategies for meeting goals.
- Evaluate how well you have done, for example, in a digital public library, the first part of your plan is to arrange a statement of your library's mission or purpose.

To fulfil this purpose you need to:

- select one service or one user group for this sample plan, for example, an annual event,
- pre-schoolers, non-English speaking users, and retirees;
- describe how the marketing of this service or to this group will contribute to the library's mission". For example, if part of your mission is to serve the community, you could say that marketing will let the community know how you can serve them.

1.5 SOURCES OF E-MARKETING IN LIBRARIES

There are several sources of e-marketing :

i. **E-mail:** Using this tool library can provide virtual reference services, selective dissemination of information (SDI) and so forth.

ii. **Users' opinion:** Through such services, users' opinions, as well as feedback, can be easily and speedily determined.

iii. **Newsletter:** Providing general information about activities and news of the library. Also, this plays a current awareness service (CAS).

iv. **Websites:** Websites can be the best source to attract users to the sources and services.

v. **Library Blog/Social sites:** These are useful to inform and entertain readers.

vi. **Viral marketing:** To do this, visitors are asked to introduce the library site to others.

IN-TEXT QUESTIONS

1. Libraries can utilize computer technology to improve marketing efforts or to promote their sources and services. True / False
2. E-marketing more than just finding users for the available information sources, services, and technologies. True / False

1.6 FUNCTIONS OF E-MARKETING IN LIBRARIES

At the functional level electronic media, websites, e-mails, and social media/blogs cover the whole process of marketing.

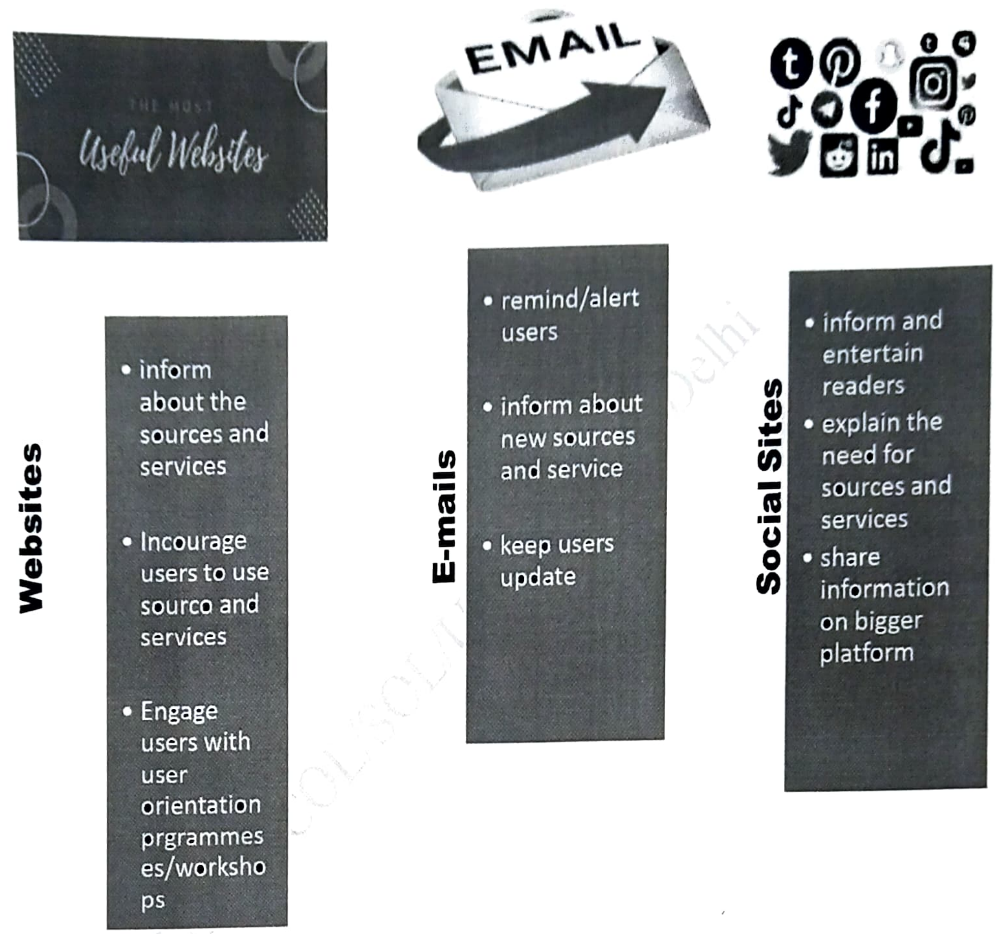

Fig 1.1: Process of Marketing

1.7 SUMMARY

So with the help of recent advancements, libraries have a provisioned to move information products and services out of the restrictions of physical barriers. Now sources and services are fully utilized by users with electronic gadgets. Libraries can offer more services effectively. However, e-marketing requires a fresh look or widening the vision of the components of the marketing mix and the implementation of the marketing effort. E-marketing in libraries for the promotion and utilization of sources and services is an essential component of value-added services.

Young library professionals find innovative methods of promotion through 'engaging' library users using online social media such as blogs and webinars. Marketing is more than library displays and designing library websites for new professionals; "it involves all characteristics from book selection, professional "stock arrangement" and social media in addition to new add-on services like refreshments and entertainment facilities". Librarians need to consider many aspects of marketing including library branding, providing quality service, sustainability issues and e-marketing.

Libraries and other organisations that are dealing with information society must be trained and learn new skills to promote their library sources and services similar to the other product marketed. "Traditional methods in libraries, for example, newsletters, display boards, announcements and others can go together with social marketing using Facebook, Twitter, RSS Feeds, blogs and YouTube to engage with the target group of users in the library"e Bonde & Khande, 2015,p.3). "Social media provides a collaborative virtual community, a two-way dialogue that is facilitated by "Virtual Community Managers", elevating the services and activities of the library to "design robust, enjoyable and memorable experiences for their community" (Neville, 2014,p. 366).

It is recommended for any academic library desiring to improve the promotional activities of their library. "The discussion of e-marketing using blogs, online advertising, viral marketing, webinars and other types of social media is especially useful for the library professionals hoping to engage younger library patrons using innovative, low-cost methods". E-marketing can be relatively cost-effective and as simple as the use of online promotional calendars that highlight new resources, services, news items and activities that complement the core services.

1.8 GLOSSARY

E-business: Electronic business is any kind of business or commercial transaction that includes sharing information across the internet.

E-marketing: E-Marketing (a.k.a. electronic marketing) refers to the marketing conduct over the internet.

E-gadget: An electronic device has transistors or silicon chips which control and change the electric current passing through the device.

Physical Barrier: Physical barriers are structural obstacles in natural or manmade environments that prevent or block mobility (moving around in the environment) or access.

1.9 ANSWERS TO IN-TEXT QUESTIONS

1. True
2. True

1.10 SELF-ASSESSMENT QUESTIONS

1. Define E-marketing in libraries. Elaborate with suitable examples.
2. What is the process of e-marketing in libraries?
3. What are the sources of e-marketing in libraries? How do sources of e-marketing function in libraries?

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LESSON 12

PUBLIC RELATIONS

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STRUCTURE

1.1 LEARNING OUTCOMES

This lesson aims to make understand the role of public relations in the promotion of LIS products and services. After reading this lesson you will be able to understand:

- How PR works in LIS education;
- role of national and international organizations to project the image of libraries;
- role of media in PR work, and
- sources used for PR

1.2 INTRODUCTION

The aim of public relations in libraries and information centres is to build up a strong connection with users, make users active, forward-looking, quickly responsive to public demands, interested in progressive methods and economy, operated by devoted and highly skilled staff and busy in helping more citizens in every category. Public relations helps to discuss your success/achievement, distinguish you from the competition from the other information providers, and also provide a stream of ideas for the audience/users. It also explains the objectives and vision of the library, problems, plans, projects, personnel, standards and accomplishments.

1.3 PUBLIC RELATIONS IN LIS FIELD

1.3.1 Public Relations in Libraries

The Public Relations Society of America defines public relations as "a strategic communication process that builds mutually beneficial relationships between organizations and their publics".

In LIS education public relations means the act or process of putting the library into a friendly and understanding relationship with users of all categories, for example, faculty members, research scholars, students and other staff of the organization. It helps to understand every citizen about the functions, policies and procedures, the extent and warmth of the community's goodwill toward the library, and its appreciation for the quality and morale of the library's staff and services.

1.3.2 Objectives of Public Relations in Libraries

So, the main objectives of the library PR programme are:

1) to create library consciousness among the people of the community;
2) to spotlight the existence of libraries, where they are located what they contain, and
3) to identify the services they provide to help people in their learning and teaching;
4) to make constructive use of their leisure hours,
5) to help people remain well-informed;
6) to increase their theoretical knowledge of their resources.

1.3.3 Prominent Forms of the Common Core Information

The common core information is often publicized in the form of :

1) Press release;
2) all types of information flyers;
3) advertisements for open positions;
4) announcements of new appointments and retirements;
5) media advertisements;
6) articles;
7) manuals;
8) programme announcements

ACTIVITY

Make a list of activities that an academic library might carry out locally in users interest to obtain goodwill. Look around your campus and in the newsletters of colleges/universities for ideas.

1.4 PUBLIC RELATIONS ON NATIONAL AND INTERNATIONAL

1.4.1 Public Relations on National Level

Looking at the national level, one finds that the governments own national, parliament, state assemblies and departmental libraries. They also give financial aid directly or indirectly for the maintenance and development of public libraries. They also provide financial aid to academic libraries. "Therefore, becomes obligatory that the members of national, parliament and state assemblies and the bureaucrats be kept informed on the vital role of the libraries. Financial stringencies must be opposed.

At their national level library association like ALA and Library Association (London) have magnified library images at the international level" (Russo,2001,p.3). They have promoted participation in international conferences, the establishment of fellowships for librarians of developing countries, making arrangements for visiting librarians, and publications of international value.

1.4.2 Public Relations on International Level

International bodies like UNESCO, FID, and IFLA have played a vital role in projecting library image on the international scene. UNESCO has been playing a vital role in the development of libraries in many parts of the world. Even though, Unesco is concerned with all kinds of libraries it has paid special attention to the development of public libraries in those countries which have been fortunate enough to have them. "The initiation of the pilot public library projects at Delhi, Enugu (Nigeria), Medellin (Columbia), and Latin America demonstrate Unesco's faith in public libraries as institutions where everyone can obtain knowledge in the way one ikes best. Unesco has generated the idea that public libraries can bring about an intellectual, social and economic revolution through the dissemination of knowledge and information"(Russo, 2001, p.2). As a result of this transformation of the human mind, librarians, particularly in the less privileged countries, have gained a better idea of the great potentialities of the public 'library'; while the government authorities and the decision-makers are convinced of the utility of these institutions in life-long education and as effective information centres for the whole community; hence their greater support for these institutions of public mental health.

IFLA operates sections for national and university libraries, public libraries, special libraries, parliamentary libraries and administrative libraries. "There are also subsections working for libraries in hospitals, children, astronomical and geographical libraries. IFLA Committees perform work relating to library education, rare books, periodicals, statistics and library buildings. LIBRIS is a powerful journal. Similarly, FID has made great contributions to spreading the latest developments in documentation, information science and UDC throughout the world"(Baldock, 1993, p.7).

1.5 PUBLIC RELATIONS AT UNIVERSITY LEVEL

The support of the Directors and other library administrators can be powerful advocates for a library's resources, programmes and services. Everyone on the university campus must be kept informed about the library's sources and services.

1.5.1 Vice-Chancellor/President

The librarian has to inform the Vice-Chancellor of the university about the library's progress and problems. If the library is poorly or brilliantly organized, the Vice-Chancellor will come to know about it from the faculty, students or even the alumni. But if the librarian requires new types of equipment for initiating new services, he/she must keep the Vice-Chancellor informed. The Vice-Chancellor is also kept informed about:

1) book funds;
2) means employed in integrating the library with instruction, teaching and extension programmes;
3) the library costs involved in starting new courses;
4) building's expansion for accommodating new acquisitions, and new types of equipment;
5) new activities like the computer application to libraries which call for modifications or extension of buildings or unusual expenditure of funds;
6) the advantages and disadvantages of decentralising collections and services;
7) the wisdom of separate undergraduate libraries:
8) the money earmarked for the purchase of special and rare collections;
9) the quality of staff and costs involved to operate a first-rate library; and
10) the aspirations of staff for recognition and appropriate faculty status, etc.

To get wholehearted support from the Vice Chancellor of the University the librarian should be careful to present all sides of his recommendations and problems.

1.5.2 Library Advisory Committee

Library Advisory Committee is another possible way for the librarian to interpret his sources and services. Advisory committees should be advisory, and consultative for the library and can be greatly helpful in promoting the source of the library. The library advisory committee can be representative and can collect the requirements of the students and faculties.

1.5.3 Faculty

In addition to library committees, the librarian must work in close cooperation with the faculty for projecting the library image in the university and among students. Since faculty and students are the primary users of a university library, their needs must be extremely important to the library in setting goals. Faculty dependence on recorded knowledge in their teaching and research is the foundation of university librarianship. This dependence can be translated into appreciation or criticism. A wise and visionary librarian would make an effort to turn constructive criticism of collections or services towards greater library support. As a participant in the university educative programme, the librarian operates the library on the teaching and research level.

For faculty, the common denominator of the library lies in getting the books they want and getting them as fast as possible. The daily association of library staff with faculty and students is more important than any other type of library interpretation. Courtesy, conscientiousness, understanding, sympathy and adaptability at reference and loan desks are the pre-requisites for selling the library idea.

IN-TEXT QUESTIONS

1. UNESCO playing vital role in the development of libraries. True/False
2. UNESCO has generated the idea of Public Libraries. True / False
3. FID has made great contribution to the spreading the latest development in documentation, information science and UDC throughout the world. True / False

1.6 GET OTHERS (OFF-CAMPUS GROUPS) INVOVED IN PR

The off-campus groups, for example, alumni, professional friends, and professional forums, associations and organizations can be a powerful source for set public relations

1.6.1 Alumni

The Alumnus is given a special status; he/she should always be welcome for brief periods. Alumni who live near the university may make use of its library directly; others may seek by mail; they may also ask for reference and bibliographical services. "The PR with the alumni assumes greater importance when the librarian is interested in build-up a library through their help. The alumni can be of vital help to the library by forming a 'Friends' Group, making donations, and listing the support of persons in a position to be of genuine assistance to the librarian. To cultivate friendly relations with the alumni, the librarian may organize exhibits for Alumni Day and try to meet as many alumni as possible and keep them informed about library services and needs, outstanding acquisitions, memorial book gifts, special services, and news likely to be of interest to the alumni"(Baldock,1993,p.6).

The alumni groups, to a large extent, represent their college and university libraries; public library groups contain a cross-section of members of the community. The former generally carry on efforts to aid the growth of the library collections using gifts or contributions, the later is more concerned in:

1) stimulating increased awareness and resulting use of the library;
2) stimulating increased financial support-public and private;
3) coordinating the effort of all groups and individuals interested in the library;
4) promoting the greatest possible use of the library; sponsoring cultural and related programmes for the community: and
5) sponsoring and stimulating voluntary service for the library.

1.6.2 Professional Friends

Friends look upon the library as an informational and cultural force in the community, as a source of inspiration and as a tool to promote individual, civil, and national development. Friends organizations are established for promoting understanding of the library-its limitations, its services, its physical facilities, and its resources. More specifically, they may and frequently do promote and encourage gifts to the library either in kind or cash.

1.6.3 Participation of Librarians in Professional Associations/ Organizations

Wilson and Tauber enumerate five groups of organizations, with which the university librarian has at one time or another, worked. These are:

1) Library association-local, state, regional, national, and international;
2) Educational associations;
3) Government offices and departments;
4) Educational foundations; and
5) Learned societies.

The type of activities of these organizations which appeal most to the librarians include the following:

1) the development of international cultural relations;
2) the compilation and publication of major catalogues and union lists;
3) the establishment of regional union catalogues and bibliographical centres;
4) the description of the holdings of individual libraries and groups of libraries;
5) the improvement of college and university book collection;
6) the improvement and support of education for librarianship,
7) the development of physical facilities for the photographic reproduction of materials;
8) the reduction of costs of library technical operations;
9) the accomplishment of other undertakings-all of which are intended to contribute to the promotion of research and the advancement of scholarship and librarianship.

So, the participation in professional meetings of the state or the national associations or the learned bodies may encourage and refresh the participants and they may return home with new experiences, new vision, new ideas and new methods to try, which ultimately improve services having their impact on the educational role of the library. Confident and enthusiastic staff members, receptive to hopeful professional thought and the latest techniques of operating libraries and disseminating information, gain the confidence and respect of their teaching colleagues.

1.7 SUMMARY

The public relation and extension programme aims at converting the library into a dynamic part of community life. The librarian discloses the sources, analyses the contents of documents for the uninitiated and leads them to use the documents for themselves. Having done this the librarian enters the fields of PR and extension services to spread the news of his service to make his library a living force in lifelong education and the intelligent use of leisure. All the way through public relations the librarian wants to announce the purpose of the library.

1.8 ANSWERS IN-TEXT QUESTIONS

1. True
2. True
3. True

1.9 SELF-ASSESSMENT QUESTIONS

1. Explain with examples, how Public Relations works on a National and International Level.
2. How do Public Libraries Work at University Level?
3. How others (off-campus groups) can be helpful to set up Public Relations in libraries?

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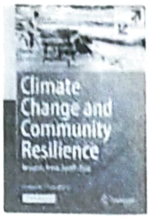
Book Chapter



Climate Change and Community Resilience pp 257–273

Valuing the Role of Mangroves in Storm Damage Reduction in Coastal Areas of Odisha

Saudamini Das

Chapter | Open Access | First Online: 22 October 2021

Abstract

Mangroves help in building coastal resilience as effective natural safeguards against cyclones. The state of Odisha is the most cyclone prone region in the east coast of India and was endowed with nearly 500 km^2 of mangroves until 1940s, which has now been reduced, through destruction, to 227 km^2. This chapter attempts to value the storm protection provided by these remaining mangroves during the 1999 super cyclone and examines whether it is

LESSON 11

ADVERTISING, SALES AND PROMOTION

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STRUCTURE

1.1 LEARNING OUTCOMES

Advertising in very common definitional term is "any paid form of non-personal communication of information about products or ideas by an identified sponsor through the media to persuade or influence behaviour of the people in such a manner as to induce them to buy". You will be able to understand:

- principles and practice of advertising;
- understand the advantages;
- objectives and limitations of advertising;
- help facilitate the use of different media and techniques of advertising;
- analyse the various appeals used in advertising;
- apply various advertising concepts and models, and
- plan and evaluate advertising effectiveness.

1.2 INTRODUCTION

Advertising is considered a creative marketable message aimed at selling products and services. It can also be used to increase sales or publicise social messages. It is the means of support of media for their continued existence. At the same time, some people think that advertising is just a waste of money and manpower. The very common terminology of advertising is "any paid form ofnon-personal communication of information about products or ideas by an identified sponsor through the media to persuade or influence behaviour of the people in such a manner as to induce them to buy".

A question is arrive to mind despite so many other forms of promotion, why do we need advertising of products and services in libraries? The answer is that production is incomplete without consumption and in libraries, there is no value in products and services if users don't utilize them. Library professionals need to make aware of the availability of the sources and services. Through advertisements,library professionals draw user attention to the product.

1.3 ADVERTISING AND PUBLICITY IN LIBRARIES

Communication is an important aspect of marketing especially in libraries because it is a two-way process between the user and the library. It assists to develop a better understanding of users, their needs, and requirements. Interactive sessions with users consist of important dialogues and allow one-to-one contact with the user. AIDA model for advertising includes the following four elements in the context of the library:

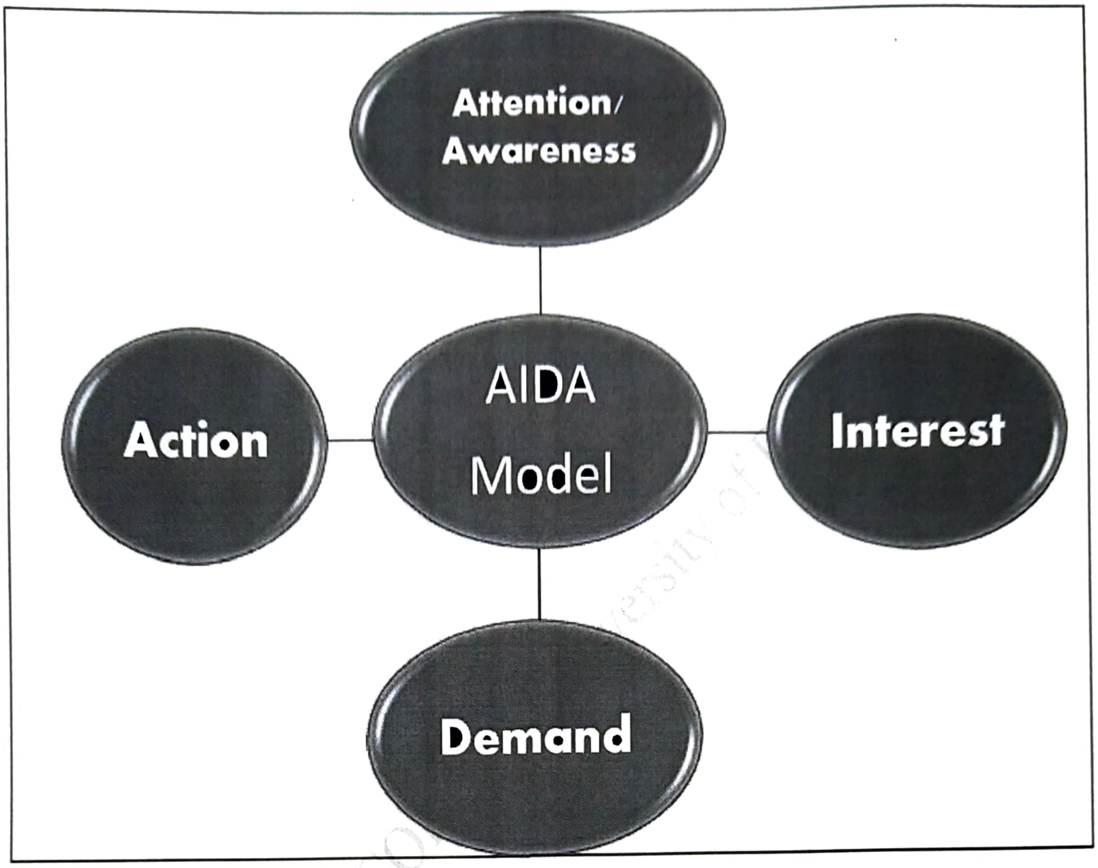

Fig 1.1: AIDA Model

AIDA Model was developed by Elias St. Elmo Levis in 1898 and defines as "an advertising effect model that identifies the stages that an individual goes through during the process of purchasing a product or service".

- Awareness: When users are aware of all sources and services of the library.
- Interest: When the users are interested in the products and services of the library.
- Demand: When the customer develops an insist on/want for the service.
- Use: When users use the sources and services.

ACTIVITY

Visit any public library in your locality and college/university library in your campus and collect the information regarding that how these libraries use AIDA model for advertising their products and services? How they attract users to use the library?

1.4 USE OF VARIOUS MEANS OF ADVERTISING IN LIBRARIES

In libraries, advertisements work for publicity and create awareness among the users and also use for image building of the library. Advertising can be defined "as any paid form of non-personal promotion "(Kotler, 2000). There are several ways for advertising, for example, printed and non-printed flyers, instruction manuals, broachers and booklets, posters and leaflets, directories, reprints of ads, billboards, display signs/signboards, audio-visual material, PowerPoint presentations, symbols, logos and so on.

In libraries, most advertisements are placed in magazines and newspapers, on notice boards, websites and bulletin boards. With the help of such media, users can select what are their requirements, what is available in the respective library and how to use them. Libraries can develop simple advertisements with short messages, using bold headlines and captions.

Table 1: List of Tools for Sales Promotion in Libraries

Advertising	**Sales Promotion**	**Publicity**
Print advertisements	Sampling	Press release
Radio jingles	Discounts on books	Seminars
Inserts/pamphlets	Increase timings of the library	Workshop
Movies	Rebates	Online meet
Magazines	Demonstrations	Alumni meets
Manuals		Videoconferencing
Booklets		Community relation
Logos		

Brochures		
Prospectus		
Annual Reports		

Source: Kotler, P., & Armstrong, G. (1994). *Marketing management, analysis, planning, implementation, and control, Philip Kotler*. London: Prentice-Hall International.

1.5 SALES PROMOTION IN LIBRARIES

1.5.1 Meaning and definition of Sales Promotion

"Sales promotions are those incentive schemes which aim at encouraging product/service usage at the consumer level" (Chopra, 1998, p.476). "A sales promotion is a marketing strategy in which a business uses a temporary campaign or offer to interest or demand its product or service" (p.477). In the marketing environment, the most frequently used tools in this category are "contests, games, exhibitions, sweepstakes, lotteries, demonstrations, premiums, gifts, sampling, fair and trade shows, rebates, low-interest financing, entertainment, trade-in allowances and trading stamps etc".

In libraries, an exhibition of rare books, and manuscripts of historical importance can enhance the use of such collections. Display of online services, bibliographical services, abstracting services and the use of online gadgets can be helpful in sales promotion.

1.5.2 Prominent Media for Sales Promotion

1) **Atmospherics:** Kotler and Andersen define it as "the conscious design of space to create or reinforce specific effects on buyers such as a feeling of well-being, safety, intimacy or awareness" (Kotler & Armstrong,1994). The library building should be well maintained with a service orientation atmosphere, comfortable furniture, research cabins, user-friendly lights, decorative inners, and so on. This type of atmosphere provides a positive and satisfying environment. The inner ambience should have basic facilities, adequate signage (signs) system which promotes the utility of a library.

2) **Brochures, Flyers, and Posters:** In libraries, professionals can use brochures, flyers, catalogues, posters, manuals and so on. These are effective communication, and media with user groups. It is observed that we get

various brochures inserted in newspapers. Often we find them quite attractive and attention-grabbing, and directly or indirectly motivating one to see and read them. "The language and message wording, used for a brochure, should beso absorbing that it motivates the reader to read till it ends" (Rowley, 1998, p.3385). Posters should be displayed prominently throughout the organization.

3) **Newsletters:** Libraries can bring out periodical newsletters to inform their users regarding forthcoming activities or information. "The newsletter must contain information about the latest books/information, any new services added, any library event organized, workshops/seminars/ conferences held or planned, computerization of services, and so on. "Newsletters should represent their professional style and may also cover professional information"(Rowley, 1998, p.3385), for example, new appointments, promotions, and award presentations.

4) **Extension Activities:** All libraries especially academic libraries should act as active centres for various academic and cultural activities to promote their membership. They can organise different programmes like user orientation, information literacy, lectures, workshops, seminars, debates, quiz competitions, book exhibitions, etc on a regular mode. "Regularly hosted activities can quickly catch the users' attention and improve the image of the library. Exhibitions of products and services during conferences/seminars, etc. are helpful to publicize the initiatives taken by the library for their users" (Rowley, 1998, p.3387).

5) **Mail Shots:** Mail shots are "a dispatch of mail, especially promotional material, to a large number of people/user. It is a personal approach to reaching prominent users of the library" (Rowley, 1998, p.338). It can be a piece of information, announcement/reminder, alert and so on. Publishers usually send mail shots to users about their new sources.

6) **Personal Selling:** Personal selling is a type of face-to-face interaction with users to maximize the usage rate of sources and services. This type of interaction is best for products and services which are worthy, for example, sales promotion, sales meetings, incentive programmes, samples, fairs and trade shows, free browsing hours for online searching, and samples of CD-ROM searches may help in attracting more subscribers.

7) **Personal Talks:** It is the best technique to develop good personal relations with users in the library. This two-way beneficial approach will not only help the libraries and the library professionals to improve their image but also create a place among the users for wider acceptance.

8) **Sponsorship:** Although libraries happen to be social institutions, it is very important for getting sponsorships that the library creates awareness among the users about the need and importance of various sources and services they have for them to use, especially due to dynamic changes taking place in the world of information and knowledge to keep aware of the users with the help of organizing several activities. "As the librarydeals with numerous books, periodicals, electronic resources, suppliers, booksellers, vendors, and publishers, and they are being the beneficiary of library purchases come forward willingly to financially support the libraries to give momentum to the use of information resources" (Gedenk, Neslin, & Ailawadi, 2010, p.293).

9) **Press Conferences and press releases:** "A press conference is nothing but a meeting in which representatives of the media participate in learning and publicizing the event or new item they are representing and a press release is a written communication sent to a selected set of press and broadcasting media" (Blattberg & Neslin, 1993, p.553). So, a library and when organising a press conference should provide media written/printed support material, photographs etc. to attract the attention of the larger people. Therefore, a well-presented press release which is timely, interesting and accurate has a wider impact on promoting the image of the library among the ample of users.

1.6 SUMMARY

Users are an important part and parcel of any library and the ultimate satisfaction is important for library professionals. Advertising may play a significant role in its performance and user satisfaction. This may possible when the libraries have a positive sales promotion attitude based on the user's requirements and deliver value to their information needs and expectations. Thus, we can conclude that advertising and sales promotional activities can improve the image of libraries and also help to increase the use of library sources and services in a very effective way.

1.7 GLOSSARY

Advertising : It is a means of communication with users of a product or service.

Brochures : A small book with pictures/illustrations and information about something.

Promotion : Things or activities you do to advertise a product and increase its sales.

Sales : The action of selling or being sold or the occasion when something is sold.

Sponsorship : This is a form of advertising where a company will sponsor some event or organization.

1.8 SELF-ASSESSMENT QUESTIONS

1. Explain the concept of Advertising. Discuss the factors that influence advertising in libraries, with suitable examples.
2. Define the term Sales Promotion. Discuss some effective means of sales promotion in libraries with relevant examples.
3. Discuss the extension activities that libraries used to promote users.

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LESSON 10

PRICING, DISTRIBUTION, CHANNELS AND COMMUNICATION STRATEGIES

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STRUCTURE

1.1 LEARNING OUTCOMES

After reading this lesson, you will be able to understand:

- Pricing and LIS Products and Services;

- Market Library Products and Services;
- Key Approaches to Pricing in LIS Field;

1.2 INTRODUCTION

The concept of marketing, promotional activities, distribution channels, and so on are not new but LIS professionals have only recently become aware of the need to market their products and services. The products and services of the library are now being recognised as commodities that can be purchased, sold, exchanged, borrowed and passed on. Today, the " survival of a library depends among other things on its image in the minds of the users and fund allocators"(Narayana, 1991, p.187). Libraries must also communicate with existing and potential users to make them aware of better and more competitive products and services offered, and also to build and maintain the best relationship. However, to communicate effectively library professionals must understand the user's field of knowledge because users' needs are varied subject to subject. Distribution channels and communications strategies play an important role in identifying the prominent users, and their needs and developing effective relationships.

The use of distribution channels and communication strategies is very much applicable to libraries and information centres as they are service providers. But it is also important to select an effective means of communication. So that libraries adopted several methods of communication to promote their sources and services. Apart from traditional methodologies, library services can be channelised with the help of smartphones, mobile apps, e-mails, blogs, social platforms, websites, and many more. Librarians should make a habit of writing a daily column in the newspaper to give information about new sources and services and update users as well.

1.3 WHAT IS PRICING?

In general, the cost is a fact and the price is a policy. "Price is the amount of money charged for a product or service"(Kotler, et.al.2010,p.247). Price is important in every sphere of life because you need money/price to promote your products and services, and to establish the channels of distribution and survival.

Price is the most flexible marketing mix element in the marketplace. "Price can be expressed in currency; however, it can use goods or services. In the library, the price can be used to express the value of information sources and services, for example, online databases, e-journals, e-books, e-magazines and so on, other online services like digital reference services, ask a librarian service, web forms, online document delivery, interlibrary loan, online help, online information skills tutorials, online current awareness bulletins, email-based services, online scholarly journals and other sources, physical products like a CD-ROM and many more (Brindley,1993).

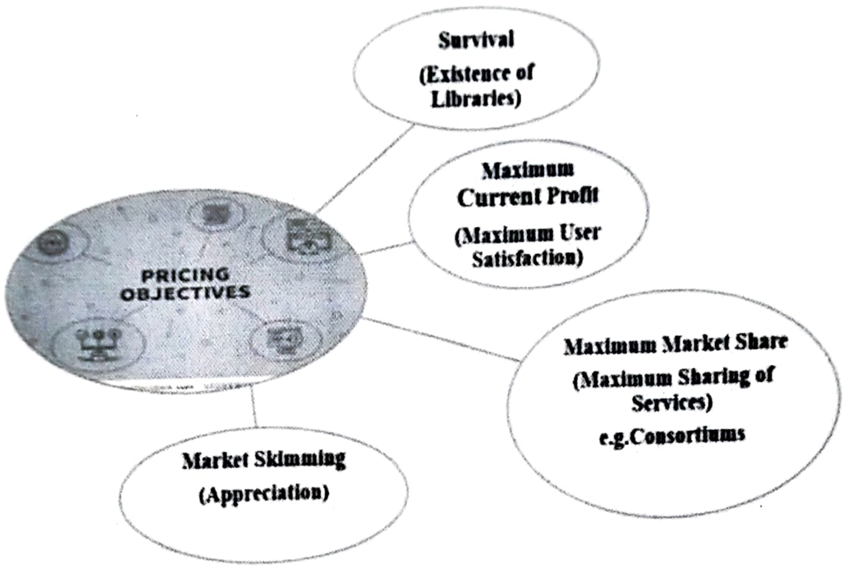

Fig 1.1: Pricing Objectives in Market and Libraries

1.4 PRICING AND LIS PRODUCTS AND SERVICES

Libraries are known as service-oriented organisations, not profit-making organizations, but these days the increasing cost of sources like online databases, scholarly journals and others forces libraries to sell their products and services. "Marketing is only an instrument through which the objectives of the library can be achieved"(Brindley, 1993,.p.298).

1.4.1 Income-Generating Activities in Libraries

On average about 10-20% of funding for academic libraries comes from income generation activities. Libraries can charge for the below-given services:

1) Reprography/photocopy
2) Inter Library Loan like DELNET

3) Online database service
4) Training courses
5) Indexing service
6) Publications charges like NISCAIR and other organizations

Some organizations like INFLIBNET, DELNET and many more are charging money for their sources and services, such as organizational publications including newsletters, magazines, and so on. A wide range of factors should be taken into account when determining price and moving towards pricing such as:

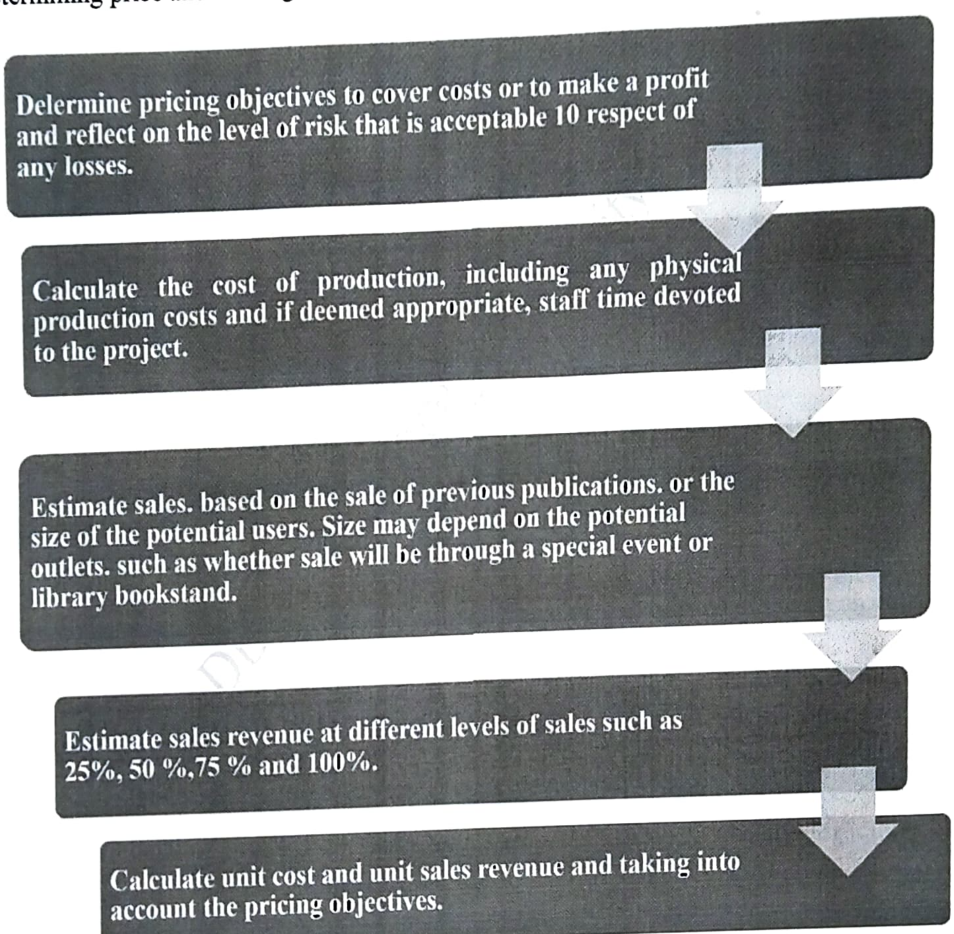

Fig 1.2: How to price a library publication

1.4.2 How to Market Library Products and Services?

Typically, the organization will use some of these in complex pricing models designed to achieve the pricing objectives of the organization. For "some products, such as books or the user market for CD-ROMs, there will be a list price for the item, which is set after consideration of the pricing objectives, including financial and marketplace performance objectives. Pricing strategies for e-resources are particularly more complex, and several approaches to pricing and payment for access to databases and electronic document delivery have been tried. The early online search services based pricing on combinations of connect time charges, display/print charges, telecommunication charges and charges for special services"(Brindley,1993,p.302). This model has to some extent been outmoded by approaches based upon subscriptions, contracts with consortia, and pay-as-you-go. Another very significant difference between print-based information products and electronic information products, where payment is based on access (rather than subscription), is that the customer pays for the print product in advance; online information on a pay-as-you-go basis is paid for when it is retrieved, or after.

1.4.3 Key Approaches to Pricing in the LIS Field

1) Item-Based Pricing

It is very common in the information market that the price of any document or service can be varied based on different prices in different countries, and different versions (for example a large-print version or a talking-book version). It is very evident in the market for e-resources that, different publishers/suppliers may set their prices differently and based on different negotiations. So, even though the price level may vary, and different prices are set for different versions and different market segments, the /library consumer pays an agreed price for the item.

2) Pay-For-Use

Pay-For-Use is basically set up for electronic resources in libraries. "A variation on item-based pricing that is used for e-resource is where the user pays for the information when it is accessed. Open access or google, for example, may provide access to some information free, but should an individual wish to download a list of several thousand addresses for marketing purposes, the user will be charged for this based on the information that has been downloaded" (Synder & Davenport,1997). Similarly, document delivery services allow consumers to order journal articles through their Web-based services. The end-user or library will be charged for the item ordered/accessed, for example,

a) Dialog Alert Service

Charges for Dialog Alert profiles vary, depending on the source database, frequency of Alert run (e.g., daily, weekly), and delivery method. Up to 20 prints per profile per update are included. except as noted in the Database Rates section of the Price List (https://dialog.com/commercial-databases/).

b) Dialog Interactive Alerts

"Dialog provides an interactive alerting service with subscriptions to predefined strategies covering top publications and newsletters. "The pricing for this service has two components: the 'Flat Delivery Fee for distributing Interactive Titles Lists' and articles to recipients' e-mail boxes and the 'Article Fees for the specific articles ordered'. Dialog Interactive Alerts charges are part of your total Dialog usage and are billed on the monthly Dialog invoice. See our Web site for more information" (https://dialog.com/commercial-databases/).

3) Contracts with Publishers

Access to e-resources, such as bibliographic databases, e-journals collections and other databases, is increasingly provided to the end-user through libraries or consortia which are increasingly functioning as powerful mediators in negotiation with publishers. "Contracts, which hold price and licensing arrangements, and specify how the information that has been acquired may be used, are agreed upon and reviewed, typically on an annual basis. Individual libraries then have contracts with the consortia for access to all the negotiated products, or an agreed subset. The advantages of such contracts to the publishers are guaranteed visibility in the marketplace through association with significant academic and public libraries. In addition, licensing arrangements include controls on the use of the information, which ensures the protection of intellectual property"(Mu & Benedetto, 2011). For libraries and their users, the advantages of the consortium arrangement are wider access to electronic information and support in its acquisition and use from the consortium and other members of the consortium.

4) Open Access/Free Information

Academic libraries may offer basic access free to registered users but charge for other more personalized services." Many publishers have commercial reasons for providing free information resources/open access. Increasingly information is provided to consumers as part of the augmented product, or to lubricate the wheels of the relationship between the consumer and the retailer or producer" (Weingand,1999). The use of information in building communities and attracting attention is most evident in the Web portals that are being established by increasing numbers of organizations. Such portals are interested in increasing traffic to their site and use information among other features to entice consumers to make repeat visits.

5) Promotional Pricing

Special pricing tactics may be adopted in association with a promotion that is designed to draw attention to a product. From the customer relationship point of view, promotional pricing is designed to encourage switching from a competitor's products. Major current awareness services based on the contents pages of journals are offered free to encourage the purchase or acquisition of journal articles or books from the document suppliers.

ACTIVITY

Visit libraries of your area or campus and make a list of sources and services which have cost/price in market.

1.5 DISTRIBUTION CHANNELS IN LIBRARIES

Distribution is a type of marketing activity concerned with distributing the products from the manufacturer to the customer, making the product available and easy to buy. So, distribution channels are the methods or intermediaries by which companies deliver products and services to end users. Some companies directly reach their end users, while others might use a retailer or wholesaler to serve as an intermediary. Companies may also use agents or brokers to facilitate the movement of products to distributors that sell those wares to the customer. Past time remembered when promotion was done through government-claimed 'Radio Stations' where a little bit of sound used to be played about the item.

There are some prominent channels and distribution are as follows:

1) Interpersonal delivery
2) Direct selling/Inhouse dissemination
3) Selling through intermediaries
4) Dual distribution and reverse logic
5) Local depositories

6) Mass media
7) Mail

In libraries, the marketing and promotion of the library services have a huge impact on the users and that is going to remain for many years. The information provided to the user within the time using different modes of communication defines the way we do the marketing of the LIS products and library services. This process involves technology, machinery and manpower. The technology does not dictate everything to the librarians to serve the users because it is merely a medium which supports the LIS products and services.

Usually, the librarians use the following distribution channels :

1) Annual Reports

The annual report of the library is a written document submitted by the librarian to inform the users keep informed on the aspects of the library's services, achievements or regress along with possible reasons for shortcomings.

2) Handbook

Small handbooks are a valuable device to instruct and assist users. It contains factual information, a diagrammatical representation of the main services, the locations of main collections and service points, the location and arrangement of books, the method of issuing returning documents, the rules and regulations of the library and so on.

Printed Catalogue/OPAC

A printed catalogue/OPAC is an important means of publicising library content. It may include total holdings of the central as well as branch libraries or may be restricted to special collections of the library.

3) Websites

Those librarians who cannot even afford the promotional expenses may promote their sources and services through websites. They can highlight news regularly related to the latest 'additions', statistics of readers and issues, changes in the issue methods, changes in the working hours, special and collections, improvement in the facilities to the public, arrangement of exhibitions and occurrence of events about which special bibliographies may be prepared.

4) Posters and Bulletin Boards

A striking poster may have an appeal comparable to that of a beautiful piece of sculpture or a nicely printed book. Posters, pictures, book jackets, maps, slogans, and notes on special days, authors, and events, constitute the display material for the bulletin board. An effort should be made to connect national, educational, scientific, and local campus events with the use of library materials. To command attention, and to be more effective, displays should be neat, simple and visible.

5) Personal Talk

Direct personal talk is the simple and the least expensive method of publicity. It can convert non-users into regular users of the library. Oral publicity is in effect PR tool for acquainting the people with the contents and services of their libraries, and also the informational and bibliographical works undertaken by their staff. The university and college librarians are expected to talk about libraries to new entrants, students' organizations, faculty members, and often to outside bodies as well.

With the traditional methods of promotion, libraries these days are using social media for the marketing of their products and services. Today, social media (below given) alone can handle promotional activities to advertise products and services. Some prominent examples are as below:

- Facebook
- Twitter
- Blog
- LinkedIn
- YouTube
- Instagram

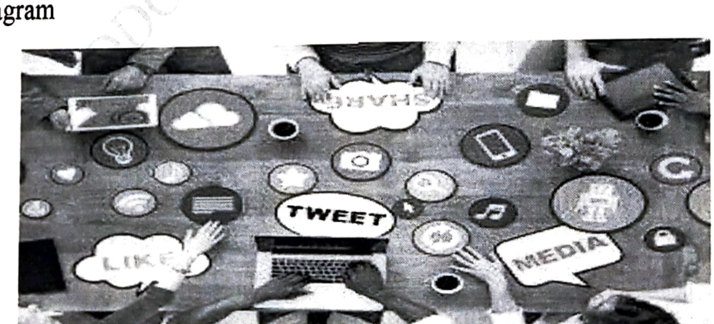

Fig 1.3: Social Networking Sites

1.6 COMMUNICATION STRATEGIES IN LIBRARIES

Libraries must inform their users about the latest and existing sources and services and try to maintain a holistic approach between the library and the user. First of all, it is important to know the need, desires and requirements of library users because they are too varied which affect their needs.

In libraries, modern marketing calls for more than just developing good sources and services. Also, library professionals must communicate with current and potential users, and what they communicate should be well arranged. Communication works as a central element of the way users relate to and cooperate because it is concerned with sending and receiving knowledge, ideas, facts, figures, goals, emotions and values. In libraries, communication is more than a marketing tool because it's not just sending and receiving information to cooperate but equivalent to that they are constantly communicating their self-images to all around them. A marketing communication strategy helps to create clearer, sharper messages appropriately directed to users in the libraries. Different stages in the design of communication strategies :

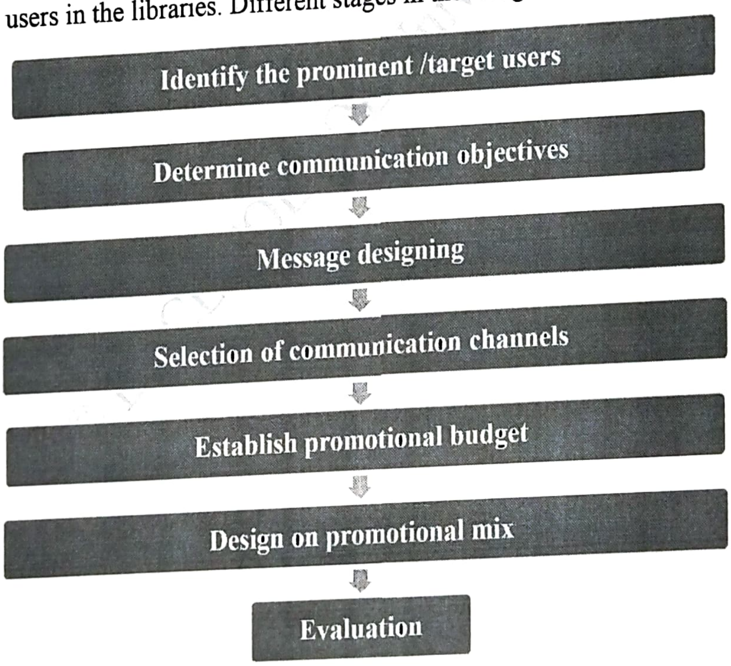

Fig 1.4: Stages in Designing Communication Strategies

Stage 1 Identify the target/prominent users:

The first stage in communication is to identify prominent/target users. Library professionals must find the prominent categories of users, the sources and services they want and the benefits they are looking for. However, users always require an easy, comfortable, and convenient way to get what they want. The libraries also recognize the user's needs for a place where they can meet other users with the same interest or people from different backgrounds and skills.

Stage 2 Determine Communication Objectives:

Once the target user has been defined, the library professionals must decide what response is sought. They need to know the level of user's awareness, knowledge, liking, preference, conviction, and so on. The user may be unaware of the availability and how to access the sources and services in the library. Ideally, they should get attention, hold interest, and obtain action. In addition, library professionals have to figure out the product and service that will produce the desired responses.

Stage 3 Message Designing:

Each communication strategy should have a message that is consistent with its communication objectives. The essentials of the message that need to be considered are:

- Content of the message: It should be clear what message to communicate, for example, the Library is going to organise a book fair;
- Structure of the message: How to express the message, for example, want to learn how to browse the web for free?;
- Format of the Message: How to represent the message in symbols for example, whether to include pictures, more complete text details, embedding the message in catalogues, posters, or presentations);
- Source of the message source: Who should communicate the message, or act as the spokesperson, either in person or by signature; the options are another user, significant public figures, or the service agent, for example, would you like to try our new Web service?.

Stage 4 Selecting of Communication Channel:

There are two types of communication channels: (a) personal communication channels, and (b) non-personal communication channels. In personal communication channels, two or more people communicate directly with each other. They might communicate face to face, over the telephone, through the mail, or even through the internet "chat". "Non-personal message channels are media that carry messages without personal contact. They include major media (newspapers, magazines, direct mail, radio, television, billboards, signs, posters, online services, websites), atmosphere (designed environments that create the client's leanings toward buying a product), and events are staged occurrences that communicate messages to prominent users" (Rowley,1998,p.3384). Libraries can design media prints, such as booklets, leaflets, notices and posters. They can propose a nice and comfortable atmosphere to satisfy their users. Some special events like user orientation, short-term courses, books exhibition, discussions on specific topics, and so on programs should be organised regularly to make their users aware of the library.

Stage 5 Establish a promotional budget

The available budget has a noteworthy effect on the range of communication activities that can be pursued. For many libraries marketing budgets are extremely limited, but commercial organizations in the information marketplace have marketing budgets that are consistent with (if not sufficient for) the market segments with which they need to establish and maintain communications. Managers must be aware of the costs of communication activities, even when they do not generate a separate invoice, and should continually monitor the value and impact associated with marketing communications activities.

Stage 6 Decide on promotional mix

The promotional mix will normally include a selection of strategies from more than one of the following: advertising; direct marketing; sales promotion; public relations and publicity; personal selling; and sponsorship. The factors that should be considered in establishing an appropriate promotional mix include:

- The available budget
- The marketing message
- The complexity of the product or service
- Market size and location
- Distribution of the product
- The stage in the product lifecycle
- Competition

So, libraries will use a combination of these strategies, indeed, one promotional strategy may be used to support another promotional activity or event.

1.7 SUMMARY

Libraries are being forced to promote and market their sources and services and to explore the possibilities of cost recovery and profit potential for their survival. Libraries need to develop inspiring ways of communication and a feedback mechanism to improve service. Even though the concept of marketing of information as a marketing item particularly in India, is a difficult task, libraries must consider what, how and where funds can be generated this way. It must be carefully considered which services can have only a minimum price, which one covers a reasonable share of the cost, and which generates revenues. The impact of the information technology and the adoption of the marketing approach will help improve services for users and enhance the reputation of the library and information services and professionals.

1.8 GLOSSARY

Advertising: Advertising is a marketing communication that employs an openly sponsored non-personal message to promote or sell a product service or idea.

Approach: To begin to deal with a problem, a situation and so on.

Channels: To make something move along a particular path or route.

Communication: The act of sharing or exchanging information, ideas or feelings.

Market: A place where people go to buy and sell things

1.9 SELF-ASSESSMENT QUESTIONS

1. What is Pricing? How libraries can generate income?
2. Define Key Approaches of Pricing in the LIS field.
3. What do you understand by Distribution Channels in Libraries. Elaborate with suitable examples.
4. How do you define Communication Strategies? How it can be applicable in LIS Field?

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UNIT-III: PROMOTION OF LIS PRODUCTS AND SERVICES

LESSON 9

LIS PRODUCTS AND SERVICES AS A MARKETABLE COMMODITY

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STRUCTURE

1.1 LEARNING OUTCOMES

The concept of promotion is widely acceptable and applicable in the LIS field. This concept has a different meaning in different environments even in library and information science. In recent time library and information centres are facing unprecedented changes and challenges and trying to create new forms and platforms of information. In this technological era, there has been a lot of pressure to mobilize sources and services to become self-reliant. The present lesson will indicate how the library and information products and services are marketable commodities in the present environment. After reading this lesson, you will be able to understand:

- the meaning of the promotion of LIS products and services;
- how LIS professionals mobilize resources;
- how are promotional activities applicable to LIS;
- how to focus on users' issues and resolve them via the promotion of LIS products and services.

1.2 INTRODUCTION

Now the day's library users are transforming into customers with rising expectations, diverse needs, wants and choices. Now the real challenge for library and information professionals is not only to manage the collection, staff and technology but to turn these resources into services. The notion of services has also changed from basic to value-added, from staff assisted to self-service, from-in house to out-reach, from free to priced, from reactive to proactive, and from mass-customization to individualized service. They, as the information service providers are under pressure due to various reasons such as they have to mobilise resources, compete with the Internet and Internet support services and meet the rising user's expectations, improvise their professional image and so on. Therefore, libraries and information centres need to evaluate their activities concerning the external environment, get in touch with the users' needs and integrate them into the day-to-day working of the library as well as offer / adapt services as per users' needs to integrate the concept of marketing in libraries. "The first requirement for effective and successful implementation of the promotion of library and information sources and services is that the librarian should have a clear appreciation for what marketing is all about and how it can enhance the value of library and information services. People usually relate marketing to an increase in sales, profit, market share, etc"(Carpenter,1999,p.258).

As you know that libraries and information services are non-profit services, therefore, "there is a general perception that libraries do not need marketing. But the fact is that marketing is all around us and it is essential for all kinds of organisations and individuals. Professionals like lawyers, accountants and doctors also need to use marketing skills to create and manage the demand for their services"(Dongardive,2013,p.238). Therefore, the libraries and information service providers should make efforts to:

- inform users about their role as an information service provider;
- attract users, understand users and their needs;
- motivate users to use the resources and services in different formats; and
- educate users with the help of the latest tools and techniques in managing information in libraries and information centres.

If a librarian is performing all the above-stated functions, one can say without any doubt that s/he is thoroughly involved in the marketing of information services.

1.3 LIS PRODUCTS AND SERVICES: A MARKETABLE COMMODITY

These days World Wide Web (WWW) is the biggest challenge for all library professionals. Libraries are facing competition not only from other information service providers but also from Google. Users get information which they required get with a simple click on the mouse. So, library professionals need to make daily decisions on the form and formats for acquiring and archiving information. Library professionals are struggling with the increasing expectations of the users. They are implementing promotional techniques to be more efficient managers and effective information service providers.

Library sources and services are valuable in themselves but are underestimated because of their lack of visibility among users. "LIS products and services are marketable commodities these days because only promotion can help in improving the image of libraries and information centres. For a long time, LIS professionals had engaged primarily with suppliers and thus lost interest in working for the users/customers. But it must be kept in mind that only satisfied users come back and there are greater chances that dissatisfied users will find some other suppliers of information to meet their information needs"(Arumuru,2015).

1.3.1 LIS Products and Services

The products are a cluster of both documentary and non-documentary sources of information traditionally the service such as information service resources sharing service, current awareness service, learners' advisor service, circulation services, and online catalogue services. The LIS products are issued and distributed by Libraries, Information Centres, Information Analysis Centres, Referral Centres, Documentation Centres or similar organisations, as promotional materials for their user groups. These products are newsletters, house journals, reports, magazines, bulletins, prospectus, manuals and so on. These sources and services are demanded by users like other commodities. The demand for products and services is affected by factors like preferences, price, income, expectations, population, seasons, technology, and the price of other goods. The information sources and services are demanded only when there is a value or utility to the user (Coote,1994).

Some important LIS products are as under:

1) Books (Print and Electronic)
2) Journals (Print and Electronic)
3) Directories (Print and Electronic)
4) Dictionaries (Print and Electronic)
5) Encyclopedia (Print and Electronic)
6) Yearbooks (Print and Electronic)
7) Newspapers (Print and Electronic)
8) Magazines (Print and Electronic)
9) Monographs (Print and Electronic)
10) Reports (Print and Electronic)
11) Manuals (Print and Electronic)
12) Online Database
13) Offline Database

ACTIVITY

Visit University/College library of your area and list the sources and services provided by them.

1.3.2 How is Marketable Commodity?

Commodity means a product or material that can be bought and sold. Library functions as a knowledge organisation, for example, purchasing/acquiring knowledge resources after theses are suitably identified and located, organised and disseminated, analysed, interpreted and granted the outcomes to its users in the way they like other than exhibiting the units of the knowledge/resource as they may need, demand and require. The tusk of "Putting knowledge to work" deals with the task of marketing/promoting a service.

In the LIS field, the role of marketing manager/information provider can be linked with the job of library professionals like buying vs acquisition of library documents, selling vs dissemination or circulation of products and services, marketing vs promotion, transporting vs access to knowledge resources, storing vs preservation and conservation of documents, market information function vs. statistics and reports and so on.

Table 1.1: Marketing Functions of the Library (*source: Halder & Saha, 2017*)

Marketing Functions	Library Functions
Buying	Acquisition
Selling	Circulation/Dissemination
Transporting	Access to knowledge resources
Storing	Preservation and Conservation of information sources
Standardisation and grading	Organising
Financing	Financing
Risk-taking	To meet the future demands of the users
Market information function	Statistics

1.3.3 Who to serve: Users or Customers?

To meet users' needs satisfactorily, the first thing the LIS professionals need to understand that, Whom are they trying to serve? What are the user's interests? What can the librarians provide to serve these interests? Under what conditions can the librarians offer services and products? How do the librarians communicate with the users? How do users communicate their needs to the LIS professionals? Librarian knows well about the library in terms of its resources, facilities, services, products, and so on.

In the marketing concept, the libraries and librarians want the user to come again and fully utilize their resources and services. But here marketing attitude plays a vital role as library professionals, we need to understand that the users will come again only if their present needs or requirements are well met.

Every day the information world is changing dramatically and moves faster, relies on technology and competes more intensely. In this connection, there is no harm if library professionals ask every user of the library how may I help you in achieving your desired information. However, librarians must capitalise on their expertise in meeting users' needs through the available resources. It is to remember that no library "owns" its users to the extent that it determines their likes and dislikes.

IN-TEXT QUESTIONS

1. What do you understand by the term 'Promotion'?
2. What do you understand by the term 'Commodity'?

1.4 CONCEPT OF MARKETING IN LIS FIELD

1.4.1 What is Marketing?

Library professionals are using different techniques and strategies of marketing for the promotion of LIS products and services over the globe.

Philip Kotler opines that "marketing is an act of planning, analysis, implementation and control of carefully formulated programmes designed to bring about voluntary exchanges of values with target markets to achieve organizational objectives" (Kotler & Armstrong,1996).

14.2 Information Marketing and LIS Field

Traditionally libraries and information centres disseminate a variety of services, for example, information service, resource sharing service, current awareness service, circulation service, online catalogue service, CD-ROM database service, reprographic service and many more. Now with changing world the expectations of the users are diverse they expect a wide range of choices, easy access, and speedy delivery of information in the desired format. They want to access ample services, such as Online Public Access Catalogue (OPAC), Web OPAC, electronic information systems like bibliographic as well as full-text online databases, current awareness in dept enquiry and research services, user education programs, and information skill enhancement programs.

Marc Porat defines that "Information is a collection of many heterogeneous goods and services that together comprise an activity in the economy". Information as a commodity is thus, represented by the products, services, and channels that carry information. Like other goods in the market, LIS products and services are also based on demand and supply rules.

Philip Kotler presented the five types of demands which can also apply to the LIS field :

1) **Functional requirement:** Basically, this type of need is generated by task-related activities like a researcher needs information for research activities.
2) **Emotional requirement:** Emotional requirements may arise when a person has strong attachments to a particular discipline, author or publisher.
3) **Problematic need:** Problematic need is not absolute but conditional upon a set of situational contingencies or antecedents, for example, textbooks are relevant primarily for a particular text or subject.
4) **Social requirement:** Social requirement is created not because of its intrinsic value, but because of its association with certain social roles and stereotypes.
5) **Epistemic requirement:** This type of requirement arises when a user requires information to further his knowledge base.

IN-TEXT QUESTIONS

3. Write down the names of prominent sources and services of an academic library.
4. What is marketing? Elaborate with some examples.

1.5 PROMOTION OF LIBRARY SOURCES AND SERVICES : NEED OF THE HOUR

As we all know that there have been many developments at the national and international levels, which have directly or indirectly added marketing to the LIS field. It is not a new concept it is as old as modern librarianship. Even Ranganathan's Five Laws of Library and Information Science have been seen in the light of today's marketing concept. Some important reasons for promoting/marketing library sources and services identified are as under:

1) founding missions are increasingly ill-suited for the demands of the marketplace;
2) budgets are becoming tight;
3) the recruiting and fund-raising arenas having become extremely competitive;
4) the rising competition among similar information service providers;
5) an introduction and availability of freely and openly sources and services.

So, we can say that there is always a need for library professionals to develop a more responsible attitude towards their users because it helps in managing libraries in a better way, also brings a commitment to the users, and publicize the utilities of library sources and services." It brings the users close to the library and feels better that they use the library on regular mode, at last, it improves the image of the library because it ensures credibility and a positive attitude to face increasing challenges as well as opportunities.

1.5.1 How academic organisations like NISCAIR (now NIScPR) promote their Sources and Services

Not only in India but over the globe, libraries and information centres are realising the need for marketing their information products and services. They are paying more attention to the identification of user needs and the promotion of information products and services. NISCAIR (now NIScPR) for example, has taken significant steps in this direction.

Some important products in form of their publications are as follows:

1) Annals of Library Science and Documentation (ALSD)
2) Directory of Scientific Periodicals
3) Directory of Science and Technology Awards in India
4) Directory of Scientific Research in India
5) Indian Science Abstracts (ISA)
6) National Union Catalogue of Scientific Serials in India (1998) (CD-ROM version available with latest data)
7) Union Catalogue of Scientific and Technical Conference Proceedings: Banglore 1977-90)

Some important services are as follows:

1) Chemical Abstract keyword Index service (CAKIS)
2) Competitor Watch Service (CWS)
3) Global Tender Watch service (GLOBTEND)
4) Literature Search
5) Translation Services
6) Reprographic Services
7) Full-Text Journal Service (FTJS)
8) Standing Order Abstract Services (SOAS)

Organisations like NIScPAR use different promotional activities, for example, training and education, direct marketing, personal sales, advertising and participation in exhibitions/book fairs for creating awareness among users regarding their products and services".

1.6 SUMMARY

In the present lesson, we have seen that:

- the meaning of promotion/marketing;
- how LIS products and services are a marketable commodity;
- how LIS professionals mobilize sources and services;
- how are promotional activities applicable to LIS;
- how to focus on users' issues and resolve them via the promotion of LIS products and services;
- how academic organizations promote their sources and services.

1.7 GLOSSARY

Commodity : A product or material that can be bought and sold

Consumer : A person who buys things or uses services

Marketable : A thing that can be sold easily because people want it

Marketing : Marketing refers to all activities a company does to promote and sell products or services to consumers

Product : Something that is made in a factory or that is formed naturally

Promotion : Things that you do to advertise a product and increase its sales

1.8 SELF-ASSESSMENT QUESTIONS

1. How promotion is helpful in LIS Field?
2. How do academic organisations promote their sources and services?

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2022

UNIT-II: DEWEY DECIMAL CLASSIFICATION (LATEST EDITION)

LESSON 4

INTRODUCTION, STRUCTURE AND ORGANISATION

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STRUCTURE

1.1 LEARNING OUTCOMES

The introductory part of this unit explains the basic structure, organization, and notational features of the major three volumes of the Dewey Decimal Classification (DDC) system. This unit further describes the important features of the scheme and properties of the decimal fraction notational system.

1.2 INTRODUCTION

Broadly we can say that classification provides a system for organizing knowledge and modern library classification systems only begin with the Dewey Decimal Classification (DDC) which was developed by Melvil Dewey in 1873. Soon after its publication in 1876, its popularity was admired across the globe and is still the most popular one. "At present, it is in its 23rd edition (2011) and constantly keeps itself abreast of the ever-advanced frontiers of knowledge to cater to the increasing demands of its varied users. In every revision, it has been expanded, modified, rectified and made more modern in methods by applying the results of the latest research in library classification".

1.2.1 Text of Three Volumes

The very first edition (1876) of the DDC was a thin pamphlet of 44 pages, and the second edition (1885) was seven times as large as that. The bulky size of the 14th edition (1942) became a cause of concern for all concerned. "The 15th edition (1951) was an exercise to trim the system to a standard edition. To deal with the disturbingly increasing size, the sixteenth edition (1958) was issued in two volumes. The second volume contained the form divisions, areas table and the index. First time only the eighteenth edition (1971) was issued, for the first time, in three volumes" (Comaromi and Satija, pp.17-18).

The nineteenth (1979) edition contains three volumes, volume 1 contains the introduction and related aspects and the various auxiliary tables. "The second volume contains the schedules and the entire third is dedicated to the relative index. A companion volume to DDC-19 is the

Manual on the Use *of Dewey Decimal Classification Edition 19* (Forest Press, 1982, 551p. ISBN: 0-910608-32-6. The purpose is to provide a tool for uniformity in interpretation based on the Library of Congress practice. For a skilful operation and efficient use of the DDC, it is a measure to understand the physical structure of the text of three volumes as it stands in the 19th edition"(Comaromi & Satija 1998, pp.19-20).

- **Volume 1:** The first comparatively thinner volume of 482 pages contains the prefatory material by the Publisher (pp. xi-xiii), the Chairman DCEPC (xv-xvii) and "the most important of all "Editor's Introduction" (pp. xxi-xxv). It also contains a (pp. xxvii-xxxii), a valuable feature of the DDC introduced in the eighteenth edition. "The Glossary sufficiently explains all the technical terms used in the Editor's Introduction, as well as implicit in the making and understanding of the system. The second part of this volume contains the seven auxiliary tables. End material contains a list of relocations and reused numbers are given in a classified sequence" (Chan Lois & Mitchell 1997, pp.8-10).
- **Volume 2:** The second volume of 1574 pages contains the Schedules of class numbers given in numerical order from 001 to 999.

"There are a variety of notes of "explanations and instructions" under each class to locate and build a new class number". Some of them are as under:

- **Definition Notes**

This type of note defines the scope and jurisdiction of the class number.

For example,

379.11 Financial administration in public education

This class number contains a note: "Costs, expenditure, allocation and management of funds, budgets, budgeting, financial reports". This scope note connotes the areas which may not be too obvious from the heading given against the class number. Some definition notes are explained through examples under 343.0742 specific kinds of (economic) assistance, one reads the note: "Example: loans, price supports, subsidies, mortgage insurance".

- **Inclusion Notes**

Sometimes some subtopics are not necessarily part of a given number but are given a standing room, maybe temporarily, with the broader number.

For example,

530.41 Solid-state physics contains the note: "Including thin films, electron theory of metals". It means that the topics such as thin films are not essentially a part of solid state physics and yet these do not have a separate number of their own. "No standard subdivisions are to be added to such class numbers. However, such notes do not apply to the subdivisions of the topic (Mortimer, 1998, p.88).

- **"Class Here" Notes**

The "Class here..." notes are placed for some convenience and usually violate the canon of helpful sequence.

For example,

343.08 Regulation of trade (Law), one reads the instruction: "class here commodity exchanges and exchange transactions".

- **"Class Elsewhere" Notes**

These "Class Elsewhere" notes are in direct contrast to "class here" notes. This is in direct contrast to class here notes. "When a topic seemingly forming a part of a broader class is granted an independent class number, the broader class number affixes a note in the form: "Class ... in ...".

For example,

181.12 Philosophy of Japan contains a note "Class into philosophy in 181.095 61".

Similarly,

379.11 Financial administration in public education contains a second note: "Class sources of funds in 379.13. Such a note may also be given for related topics having independent class numbers.

For example,

181.4 India (philosophy of), one reads a note "Class Philosophy of Pakistan and Bangladesh in 181.95". Such a note corresponds to the "See also" cross reference in an alphabetical index".

- **"Formerly" Notes**

As we know the library is a growing organism and when a new edition came into existence this note marks the changes because the main purpose of this note " Formerly" is to mark the changes between two successive editions. The former class number is enclosed within square brackets with the prefix "Formerly".

For example,

287.5 Methodist Churches in the British Isles, also contain a note within square brackets [*Formerly* 287.97).

This note has a dual purpose first it explains the changes between the previous edition and the new edition and second, it provides clarity of information 'that there has been no mistake or omission in printing but the number has been surely reallocated'. "The vacant sections have also been enclosed in square brackets, indicating the previous edition when the number was filled with some subject meaning in the schedules" (Satija, 2007, p.206)

- **The Centered Headings**

Sometimes a subject instead of being assigned a single class number is spread throughout numbers, the two terminal numbers are connected by a hyphen. These are always given in the centre of the page and on the left margin, a pointing triangle indicates a centered heading.

For example,

> 383-384	Specific kinds of communications.
> 384.1-384.7	Telecommunication

Under> 384.1-384.7, one reads the instruction "Class comprehensive works in 384" Hence the single class number for telecommunication is 384. The device of centered headings is very useful for the hospitality and brevity of notation.

- **Dot and Spaces**
  "This dot is only a pause and must not be misunderstood as the decimal point. It has no purpose except to psychologically break the monotony of numerals. These spaces and dots give relief to the eyes and facilitate short while retention of the class number in the memory during the passage from the catalogue to the stacks" (Mortimer,1998, p.88).

For example,

"Bose-Einstein Statistics" is rendered as 530.133 2 and not as 530.1332.

- **Number Building Notes or Instructions**

Almost every class number in the DDC can be further extended whether there are instructions or not. For example, Table 1, of Standard Subdivisions may be added to any class number. In addition to such intrinsic provisions many class numbers are provided "Add..." notes which may further be subdivided into two kinds:

- **Individual Instructions**

Under many, a class number is provided instructions for extending a given number with some other full number or part thereof a class number existing elsewhere in the schedules.

For example,

547.35 "Quantitative Chemistry" is given the instructions "Add to base number 547.34 the number following 544 in 544.01-544.98".

1.2.2 Instructions common for a series of numbers

Sometimes a series of cognate class numbers is further extendable by another number. "Instead of providing individual instructions, "for convenience and simplicity, as well as for briefness of the schedules, instructions are provided in one place, while the headings of the class numbers to which such instructions apply are marked with an asterisk". Then at the foot of that page, a footnote is given reminding the meaning of the asterisk.

For example,

547.4	*Aliphatic compounds
547.41	* Hydrocarbons
547.411	*Paraffins (Alkanes)
547.412	*Olefins (Alkenes)
547.413	*Acetylenics (Alkynes)

In the footnote on the same page is given the instruction: "Add as instructed under 547". On going to class 547 one reads the detailed instructions: "Add to notation for each term identified by as follows" *

04	Special topics of general applicability
044	Theoretical Chemistry
045	Physical chemistry
046	Analytical Chemistry
0464	Qualitative
0465	Quantitative

Synthesis

Theoretical Chemistry of Hydrocarbons
547.41+044 547.410 44
Analytical Chemistry of Hydrocarbons
547.41+046 547.410 46

- **Volume 3** Comprising 1217 pages contains exclusively the Relative Index. Brief instructions (p. x) and a key to the abbreviations used in the Index (pp. xi-xiii) precede the columns of the index.

ACTIVITIES

I. Visit University/College library of your area and list the sources and services provided by them.

II. Visit a few college and university libraries on your campus and find out which classification scheme is used by them

1.3 STRUCTURE AND ORGANISATION OF DDC

We can classify any format of documents (area of knowledge) with the help of DDC. As we all know that the Universe of Knowledge is divided into three subjects mainly a) Sciences, b) Social Sciences and c) Arts/Humanities. These three great divisions of subjects are divided into nine main areas of knowledge that are themselves divided into disciplines or sub-disciplines, for example, notations 0 to 9, from 0000001 to 9999999.

The ten main classes of DDC are as follows:

0.0 Generalia
0.1 Philosophy and related disciplines
0.2 Religion
0.3 Social sciences
0.4 Language
0.5 Pure sciences
0.6 Technology (Applied sciences)
0.7 The arts
0.8 Literature (Belles-lettres)
0.9 General geography, history and their auxiliaries.

1.3.1 Notation and Division of Main Classes

The division of main classes is as under:

000 Generalia
100 Philosophy and related disciplines
200 Religion
300 Social sciences
400 Language
500 Pure sciences
600 Technology (Applied sciences)
700 The arts
800 Literature (Belles-lettres)
900 General geography and history and their auxiliaries.

So, we have 10 main classes and 90 divisions.

For example,

600	Technology (Applied sciences)
610	Medical sciences
620	Engineering and allied operations
630	Agriculture and related technologies
640	Home economics and family living
650	Management and auxiliary services
660	Chemical and related technologies
670	Manufactures
680	Manufacture for specific uses
690	Buildings

Each of the 90 divisions has been further divided into nine Sections. For example, in 610 Medical sciences, Medicine has been divided as:

610	Medical Sciences, Medicine
611	Human anatomy, cytology, tissues
612	Human Physiology
613	General and personal hygiene
614	Public health and related topics
615	Pharmacology and therapeutics
616	Diseases
617	Surgery and related topics
618	Other branches of medicine
619	Experimental medicine

Continuing the decimal pattern, each section can be divided Into what we may call Subsections, all being four-digit numbers.

614.1	Forensic medicine (Medical jurisprudence)
4	Incidence, distribution, control of disease
5	Incidence, distribution, and control of specific diseases
6	Disposal of dead
	The subsections may be divided into Sub-subsections:
614.51	Salmonella, bacillary, enteric, influenza) diseases
52	Eruptive diseases (Exanthemas) and rickets) diseases
53	Protozoan diseases
54	Miscellaneous diseases
55	Parasitic diseases
56	Zoonoses
.57	Bacterial and viral diseases
.59	Other diseases

1.3.2 Chain Structure

As noted above, the scheme is hierarchical. It not only collocates the related material but also depicts through its notation the whole-part relations of subjects.

For example,

300	Social Sciences
330	Economics
332	Financial economics
332.1	Central banks
332.11	Banks and banking
332.110952	Central Bank of Japan

So, the subjects denoted from 300 to 332.110952 build a chain of concepts, as they are in progressive subordination and specificity. In the schedules, the chain of decimal digits is not depicted typographically, as it is otherwise quite visible through the increasing length of the class number at each step.

1.3.3 Array Structure

An array is a sequence of mutually exclusive cognate entities of equal rank arranged in some chosen order". The Main classes. Divisions and Sections of the DDC are three different arrays of classes. Array formations can be carried forward to any depth.

For example:

The class numbers 531.1 to 531.9 form the array of 531 Mechanics.

1.3.4 Pattern in the DDC Structure

The first subdivision of an array is generally given over to generalia topics, and the last division usually either expounds on the historical and geographical treatment of the subject or is reserved for the rest of the un-accommodated topics, which are dumped together as "others". Thus the 9 "others" is a great hospitality device with the scheme.

For example,

320, we see that the 320.0 array represents the generalia topics of political science, and the 320.9 represents the historical and geographical treatment of the subject.

1.3.5 Hospitality

"The hospitality of classification is defined as its ability to accommodate the emerging topics in their proper places without dislocating the already existing ones" (Shokeen & Kaushik, 2003, p. 72).

For example,

510 Mathematics and 520 Astronomy

Here the problem is to allot a proper place for a new discipline. To handle such types of problems and to avoid a situation, one way is to leave some gaps in the notation that describes an array.

For example,

511-519 of Mathematics, 517 and 518 have been left unassigned. "In the Third Summary (the third level of subdivision in the DDC) there remain 86 unused classes; these are shown in the schedules by having their three-digit figures enclosed in square brackets" (Satija, 2013, p.19).

1.4 19TH (1979) TO THE 23RD EDITIONS OF DDC: A JOURNEY

The DDC is one of the most popular systems for classification. It is not only used in academic libraries but also public and special libraries across the globe. Moreover, it strongly holds this position because of its defined revision policy, sound revision machinery and proactive marketing network. Since 1885 it is constantly and regularly been revised. The latest edition always incorporates new topics at appropriate places that have emerged since the previous edition and also deletes some of the obsolete subjects.

1.4.1 Salient Features of DDC-19 (1979)

- **The Phoenix Schedule**

The 19th edition (1979) of the DDC was the last edition edited by Mr Benjamin A Custer (1912-1997), who first edited DDC-16 (1958). "The DDC-19 (1979) carried forward the trends of the last three decades, though it did not bring up as many changes as were seen in the DDC-18 (1971). The major revision (Phoenix Schedule) was a new Schedule of 301-307 "Sociology" (Mitchell, 2003,p.17).

- **Changes in Tables**

There were some changes in the Standard Subdivisions, especially in the discontinuation of the *ss*-08; and an extremely useful "Table of Precedence provides standard guidance in case of choice between two, standard subdivisions There was a 17-18% increase in the Area Tables (Table 2). As a major change, the area number of the UK as a whole was shifted to 41 from 42" (Satija, 2013, p.26).

- **The DDC Manual**

A landmark for the DDC practice standardization came in 1982 with the publication by the Forest Press of the *Manual on the Use of Dewey Decimal Classification, Edition 19.* "It guides classifying in difficult areas and distinguishes one number from other related numbers. The Manual is a blue colour book on the DDC numbers interpretation and application policies. With maps, flow charts and elaborations in detailed form point by point. It has been incorporated into the system since the DDC-20 (1989) (Mitchell, 2003, p.18).

- **Computerisation of the DDC**

The DDC-19 was published for the first time through computerized photocomposition. Later from the electronic tapes and then in 1984 from these tapes a computerized Editorial Support System (ESS) was developed by Inforonics, Inc for the Forest Press.

- **The Relative Index**

The relative index continued only exception was that the bold typeface for entries that were subdivided in schedules was eliminated.

1.4.2 The DDC-20th Edition (1989)

The DDC -20 came into existence in 1989 with several changes which proved to be a trendsetter. Since July 1988 ownership of the Forest Press has been transferred to the OCLC, Dublin, Ohio. "For the first time, DDC was published in 4 Volumes running to 3383 pages compared to 3361 pages in DDC-19. Also splitting the schedules into two volumes.

- **New Changes**

The DDC-20 contained more changes as compared to the previous two editions. The changes are as under:

- A new schedule for 780 Music was incorporated.
- Incorporated 004 -006 Data processing and computer science, which was earlier issued as a "separate" between DDC-19 and DDC-20.
- Minor changes took place in subjects like Christian religion, Television, Adult education, Electronics, Civil rights, Civil history and Gymnastics" (Singh & Rai, 2019).

- **Major changes in the Tables**

The new Area table reflected changes in the administrative and political setup of different countries and their units. "Table 3 was further refined, modified, and spilt into three subtables: T3A, T3B, and T3C. Table 3C is used on instructions from Table 3B or in 808-809 in the Schedules" (Satija, 2013.p.23)

- **The Dewey in Electronic Format**

The DDC-20 came into existence as *Electronic Dewey* on CD-ROM in 1993. It was the first CD-ROM version available commercially. It contained the Schedules, Tables, Index and Manual as well. It could be searched by words or phrases, numbers, index terms and Boolean operations.

Format and Presentation of DDC 20th Edition

The format and presentation of the DDC-20 text were improved. Some changes are as follows:

- Three main summaries were relocated to the second volume.
- Many more multilevel summaries were introduced, for example, schedules such as 370 Education, 620 Engineering and 630 Agriculturica.
- Area tables of Europe and North America were also changed.
- Centred headings were indicated typographically by the symbol ">" in the number column.
- Optional numbers were given in parenthesis, for example, (828.9935).
- The "Editor's introduction" was simplified and brief.

- **The Index**

  The DDC-20 introduced a simplified and trimmed index with 730 pages. All the " See" references had been replaced by direct entries.

1.4.3 The DDC-21st Edition (1996)

In July 1996 the new edition (21st) of DDC was released. Soon after is known as *Dewey for Windows (Dfw).* Presently it is available on the internet http://www.oclc.org/fp. The text in four (4 volumes) has been edited by a new editor Ms Joan S Mitchell.

- **Structure of DDC-21 :**
  - **Volume 1:** Prefatory material, Editor's introduction Glossary, Table 1-7 and information on the changes in the new edition.
  - **Volume 2:** Schedules 000-599
  - **Volume 3:** Schedules 600-999
  - **Volume 4:** Relative Index, Manual

  The above-given four volumes contained 4126 pages into nine sections marked A/I.

- **The Schedule**

  The major new schedules are as under :

004-006	Data processing
296	Judaism and 297 Islam
342-349	Branches of Law
350-354	Public administration
368	Insurance
370	Education

376	Education of Women
377	Schools of religions
420-490	Specific languages
560-570	Life sciences
790	Theatre
810-890	Literature of specific languages
940-990	General history of the modern world

1.4.4 The DDC 22nd Edition (2003)

The 22nd Edition was introduced in 2003. It is the first edition in the web environment.

- Its electronic versions Web Dewey (2003) and Abridged Web Dewey (2004) are now available on the internet only for licensed users.
- The content of Table 7 persons has been shifted to the standard subdivisions T111-08 and for the rest use of add from 011-999".

Some Examples,

Artwork by scientists changed as 704.08 704.08 + 8 (from 088 T1) + 5 (001.999) = 704.0885 earlier it was 704+5 (T7) = 704.5.

Ethics of historians 174.9 + 9 +90720 (from 907.20) + 2(T2) = 174.9907202 earlier it was 174.9 + 97(T7) = 174.997

Collection of English poetry about lawyers 821.008035208834 earlier was 821.0080352344

1.4.5 The DDC 23rd Edition (2011)

The entire gamut of changes in the 23rd edition of DDC is as listed on pages xxv-xiii, volume 1 Some major changes are as under:

004-006	Computer science and parallel provisions in 621.39 Computer engineering, and 025.04 Information storage and retrieval;
155	Differential and development psychology;
160 and 513	Logic and Symbolic logic
200	Religion updated for 281.9 Orthodox church and 297 Islam.
390	Social sciences and a few languages have been updated in Table 6
400 and 800	have been incorporated as
491.489	Divehi (Maldivian languages)
491.42	Eastern Hindi languages
491.496	Pahari languages

- The headings for the three main summaries have been edited, for example, 500 Natural Sciences and mathematics appear simply as Science;
- 600 Technology (Applied Science) appear as Technology in the first summary;
- 320 political science (politics and government) appear only as 320 political science in the second summary" (Singh & Rai, 2019).
- The uneven span of numbers has been balanced such as 420.1 -428 has been changed to 420.1-420.9. Similarly, 305.805-.89 is now rendered as 305.805-809 and 305.81-.89.
- Elimination of dual headings, for example:

532 Fluid Mechanics	Liquid Mechanics
570 Life Sciences	Biology
954 South Asia	India

- Table 1 is used differently in the schedules, for example, 331.01 Philosophy and theory (of labour economics) Notation 01 from Table 1 is modified as :

331.01	Rights and position of labour
331.0112	Industrial democracy

1.5 SUMMARY

This Unit deals with the introductory part of Dewey Decimal Classification and further explained the structure and organization of the three volumes of DDC. Next, it presents a long journey of different editions of DDC (1979 -2011).

Some specific points discussed in the present Unit are as under:

1. The first edition (1979) of DDC was a thin pamphlet of 44 pages.
2. The sixteenth edition (1958) of DDC was issued in two volumes.
3. The eighteenth edition (1971) of DDC was issued, for the first time in three volumes.
4. The first part of Volume 1 contains 42 pages and a glossary and the second part contains seven auxiliary tables.
5. The second Volume of DDC is 1574 pages. It contains schedules of class numbers given in numerical order from 001 to 999.

1.6 GLOSSARY

Classification : It is a scheme of arranging materials according to their degree of similarity to one another. It is also an arrangement based on systems and logic.

Chain System : It is a method of hierarchy. Every progressive step of the unpeeling of a topic is go along with the addition of a least one digit to the immediately superior number.

Digit : The smallest individual unit in a notation system. For example, the notation 559 has three digits, 5,5 and 9.

Ordinal Symbols : The symbols which simply indicate the order and are devoid of any fundamental value.

1.7 SELF ASSESSMENT QUESTIONS

1. Write down the ten main classes of DDC?
2. What contains the second part of the first volume of DDC contain?
3. What do you understand by Centered Headings in DDC? Explain with examples.
4. What class 500 and 600 are devoted for?
5. Identify two numbers most recently used in the 16th Edition of DDC.
6. Write down the properties of a decimal fraction. Enumerate with some examples.
7. What Chain Structure in DDC? Explain with some examples.
8. What Array Structure in DDC? Explain with some examples.
9. What is the pattern of DDC? Explain with some examples.
10. What do you understand by Hierarchy in DDC?

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LESSON 5

STEPS IN CLASSIFICATION

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STRUCTURE

1.1 LEARNING OBJECTIVES

This lesson will describe the instructions through which you can classify documents in the library.

It will help you to arrive at a specific number. After reading this unit you will be able :

- to identify the subject and to explain the meaning of various types of notes and instruction while doing classification;

- to describe the concept and utility of different instructions and centred headings in the schedule; and
- to reach your final destination of classifying different documents accordingly.

1.2 INTRODUCTION

Classifying any document or an entry is a self-contained unit in the schedule. It is mentioned in the seven tables, volume 1. Several times it seems easiest, as to the designated base number it is required to add another whole number from the schedules.

1.3 HOW TO ASSIGN CLASS NUMBERS IN THE DDC?

Work of practical classification consists of two distinct phases: intellectual work in sorting out the specific subject of the document under classification; and the craft of assigning the appropriate notations to the ascertained specific subject-yes, it is a craft, a mechanical work.

1.3.1 Subject Analysis

The specific subject of a document may be determined by examining the document under classification through its title, sub-title, preface, blurb, table of contents, and the text Itself. The name(s) of the author(s), subject index and the cited references may also provide some valuable clues. After determining the subject, the classifier must then select the proper discipline or field of study.

1.3.2 Locating Class Numbers

To enter the Decimal Classification, the better way is through its structured ladder. Many a time we straightway reach the section concerned through our knowledge of the scheme bypassing the scanning of Ten Main classes and its 100 Divisions. Class a work dealing with interrelated subjects/disciplines that is being acted upon. This is called the rule-of-application and takes precedence over any other rule.

For example:

To illustrate this, say our subject is "Money". In the first instance, we need to determine the discipline, by examining whether the core subject of the book is the minting of money or the economics of money. On going to 330 Economics in the Third Summary (Volume 1. p. 476) we see that it pertains to 332 Financial economics. At this stage, we shift to the schedules proper at class number 332 (Volume 2, p. 261). Examining the summary of subsections 332 (Volume 2. p. 263) we find that subsection 332.4 Money matches squarely with the subject of the given document. By assigning, class number 332.4 to the document our search for the appropriate and specific class number ends successfully.

"Anatomy of human lungs. The book deals with a human body organ, so in a twinkling, a practised classifier can tell that it belongs to the main class Applied sciences, and then to its Division medicine, which deals with the human body machine, its parts and functions. Looking through Division 610 Medicine, we find that Anatomy (which is the science of human organs) is 611, which is the desired section. At this stage, we shift our search to the schedules at 611 (Volume 2, p. 828). Looking through the summary of the subsections of 611 (on page 829) we find that 611.2 Respiratory system is the next appropriate choice. Examining the further divisions (subsections) of 611.2 (page 830) we find the "Lungs enumerated at 611.24, which is our specific number. If the subject is "Study and teaching of lungs anatomy" the Dewey classifier will know that "Study and teaching" is an auxiliary aspect of the core subject "Lungs anatomy", and the notation for the auxiliary aspect is to be taken from the Table 1: Standard subdivisions. Both the notations are to be combined as per the rules.

"If two subjects receive equal treatment, and are not used to introduce or explain one another, class the work with the subject whose number comes first in the DDC Schedules". This is called the first-of-two rule" (paragraphs 7.16 and 7.20 -7.21.).

1.3.3 Practical Number Building

Synthesis through "Add to...." Instructions from the schedules.

(a) Add from 001 to 999

(b) Add to from a designated base number taken from some other small portion of the schedules.

(c) Add to from the same division/section.

(d) Add to through special provisions (facet indicator) including the 04 General special:

1.3.4 Addition of any number from the whole schedule, Viz, 001-099

It seems easiest, as to the designated base number it is required to add another whole number from the schedules. It is as easy as that.

025.46 is the Library classification of specific disciplines and subjects. For library classification of any discipline, one finds that to the base number 025.46 add 001-999. It means we are to add the class number of that subject to the class number 025.46, for example, classification of books on Mathematical analysis:

025.46+515-025.46515

(515 is the class number of Mathematical analysis) Similarly, "Library Classification of Indian Philosophy" will get the class number

025.46+181.4 =025.461 814

(181.4 is Indian philosophy)

Similarly, 026 libraries devoted to various specific disciplines are to be further subdivided into 001-999 for the class number of any library devoted to any specific subject Science Libraries

026+500 026.5

Terminal zeroes being redundant in a decimal figure have been removed in the ultimate class number.

Libraries of library and Information Science

026+ 020 026.02

Libraries devoted to Indian Philosophy 026+181.4 = 026.181 4

069.9 Museums devoted to specific discipline and

subject are subdivided into 001-099 as per instruction for a museum devoted to specific subjects.

Museums of Zoology

069.9+590=069.959

Museums on Space flight

069.9+629.41 069.962 941

Science Journalism

070.449+ 500-070.449 5

331.124 Job vacancies and opportunities (Labour economics)

331.1241 Job opportunities in occupations other than extractive, manufacturing and construction industries. For Job opportunities in Military service: to the designated base 331.1241, as per Instructions, we are to add the class number of Military science taken from the schedule.

33 1.124 1+355 - 331.124 135 5

Job opportunities in Library and Information Science

331.1241+020 331.124 102

Job opportunities in Public Libraries

331.1241+027.4 331.12410274

Student Organizations in specific fields

371.84

It is to be further subdivided by 001-999 for student societies on specific subjects. We are to add the class number of that subject to the base number 371.84.

Students Chemical Societies

371.84+540 = 371.845 4

Society of Library Science students.

371.84020-371.8402

Literary Societies formed by students

371.84+ 800= 371.848

Educational Curriculum

375

As per instructions under 375.01-09, curriculum for any specific subject is to be got by adding to the base number 375 any appropriate number falling between 010-990

Curriculum in Library Science

375+020-375.02

Curriculum in Dewey Decimal Classification

375+ 025.431 375.025 431

Take another example:

778.53 Motion Pictures photography

778.538 Photography of specific subjects To this base number we are required to add the class number of the subject concerned for its Cinematography.

Motion-picture Photography of Birds

778.538+598 778.538 598

One thing quite obvious is that whenever a class number admits further division from 001-999, Standard subdivision (SS), if required, for that subject is added with three, zeroes, as two zeroes may be used sometimes for a subject class number. In such cases, instructions exist for the addition of a standard subdivision with the required number of zeroes.

Curriculum in Library Science

375.02

Directory of Curricula

375.000 25

Here directory is a standard subdivision.

Similarly,

History of libraries disciplines devoted to various specific

026.0009

General libraries: A Journal

027.005

Adding to some designated base a portion of the class number from some smaller area of the schedules

Instead of admitting a whole class number from somewhere in schedules, a designated base may require addition from some specific part of the schedules, from a single Main class or

Division or a Section or even smaller than that. It is only a specialized extension of instructions "Add to ...from 001-999. In such a case instead of adding the whole class number to the specified base number, a portion of a smaller number is added to avoid ambiguity. For example,

181 Oriental Philosophy

181.04-09 Oriental Philosophy is based on specific religions.

To derive the class number for any specified religious philosophy, we are instructed under 181.04-.09 to add the number following 29 in 294- 299 to the base number 181.0. For example,

Buddhistic philosophy The number for Buddh religion is

294.3

Here the digits after 29 are "43". These are to be added to

181.0

The derived number thus is:

181.0+ 43 181.043

Similarly,

Confucious Philosophy

Confucianism is a religion having the class number:

299.512

Hence the Confucious philosophy will get the class number

181.0+ 9512-181.095 12

Let us take another example:

331.2 Wages... of labour

331.204 In specific industries

331.2042-2049 In extractive, manufacturing construction Industry.

For a class number for wages/condition of working in any specified Industries related to manufacturing, extractive or construction, we are required to add to the base number 331.204 the number following 6 in 620-690

Wages of Agricultural Labour

The number for Agriculture is 630 and the digits which follow 6 are 30. So 30 is to be added to the base number 331.204. Hence

331.204 +30 331.204 3

Working conditions in Mines

331.204 +22 331.204 22 (The class number for mining is 622)

395 Etiquettes

395.1 Etiquette for specific ages and sexes.

The class number for Etiquette of a specified sex or age group is to be got by dividing 395.1 (Base number) by 170.2022 170.2024 It means we are to add to the base 395. 1, the number following

170.2102 in 170.2022 170.2024

Etiquette for Men

395. 1+232 = 395.123 2

Etiquette for Children

395.1+22 395.122

Whereas the class number for Ethics of Men and Ethics of Children are

170.202 232 and 170.202 22 respectively.

Classwork on three or more subjects that are all subdivisions of a broader subject in the first higher number that includes them all (unless one subject is treated more fully than the others). This is called the rule of three. For example, a history of Portugal (946.9).

Take another example:

578 Microscopy in Biology

578.4 Use of Microscopes:

For the use of specific types of Microscopes, we are to extend 578.4 like the subdivisions of 535.332. which enumerates the kinds of microscopes:

535.332 Microscopes

535.3322 Simple Microscopes

535.3323 Compound Microscopes

535.324 Ultramicroscopes

535.3325 Electron Microscopes

Therefore, the corresponding numbers of Microscopes in Biology are:

578.4+2 578.42 Use of Simple Microscopes in Biology)

578.4+3578.43 Use of Compound Microscopes

578.4+4 578.44 Use of Ultramicroscopes

578.4+5= 578.45 Use of Electron Microscopes

Some more examples: Wheat trade

380.141+311 (from 633.11 wheat) = 380.141 311

Air conditioning in Secondary School Buildings

697.93+72 (from 727.2) = 697.937 2 Air conditioning in law school buildings

697.93+7434-697.937434 Reviews of documents in Microforms

028.13+6 (from 011.36) = 028.136

Reviews of Braille books

028.16+3 (from 011.63) = 028.163

- "Add to..." from the same Division

There is a slight difference between "add to instruction from the same Division/Section, and the number being added from some remote part of the schedules. "This difference lies not in the method, but in the part of the number added. These personality facets from sections XX3-XX9 are further divisible by the facets of XX1 or XXX2; thereby giving the general citation order as personality followed by action. Exceptions are however there to this citation order. Therefore, it is an addition of a secondary facet. One can say without reservation that this technique has made the scheme multifaceted. There seems not much difficulty in adding such a facet. It is quite easy because one has not to flip many pages of the schedules. Frequently occurring characteristic of such a facet is that this "add to..." Instruction occurs not alone but one finds instructions to add a part of particular numbers to a series of topics. Therefore, instead of repeating instructions at every class number, the editors give instructions in one place, and the class numbers or base numbers in this context susceptible to such a facet are marked with an asterisk. The meaning of asterisk (*) is explained in the footnote of every page where asterisked base numbers occur"(Mitchell, 1994.p.8).

For example,

take the title: Cotton Harvesting. Here cotton is the concrete subject, so will form the base number. This is a subject of agriculture: going to 630 Agriculture we find the number for Cotton at

633.51 Cotton (Gossypium)

It is marked with an asterisk which at the page footnote explains: "Add as instructed under 633-635". Going back to the instructions given on page 1041, we find a series of Instructions. The very first instruction is relevant to our purpose. We are asked to add to the base class number the digits following 631.5 in 631.51-631.57. The class number for Harvesting is 631.55. It means that as per instructions we are to add to 633.51 the number following 631.5 Le. 5 only. Therefore, the complete class number for Cotton Harvesting is: 633.51 +5= 633.515

Similarly, we can add to 633.51 the whole series of numbers from 631.51-57

Soil preparation for Cotton

633.51+1-633.511

Cotton Seeds

633.51+21=633.512 1

New varieties of Cotton 633.51 +23 = 633.512 3 Cotton Yield

633.51+58 633.515 8

Cotton Storing

633.51 +68= 633.516 8 Take another example:

Reproduction in Protozoa

In this case, protozoa with class number 593.1 will form the base number. Here we are told to add as instructed under 592-599 (p. 795). Instruction relevant to our purpose is 04 General Special, it means for general principles l.e. (action facet) we are to first add 04 to the designated base and further add the number following 591 in 591.1-591.8.

In 591 the number for reproduction is 591.16. Therefore we are to add only "16" to the above compound. number

593.1+04+16= 593.104 16

Here "04" acts only as a facet indicator. The general principle that emerges is that we can add all the subdivisions of 591 to all the class numbers from 592-599 through a facet indicator either 0 or 04.

Reproduction in invertebrates

The class number for Invertebrates is

592

The general principle of Invertebrates

592.01-.08

For a specific general principle, we are asked to add to 592.0 (Zero being, a facet indicator) the number following 591 in 591.1-591.8. Class numbers for "reproduction" is

591.16

Thus we are required to add 16 to 592.0. The complete class number therefore for Invertebrates Reproduction is

592.0+16 592.016

Similarly, we can build a series of class numbers on the base 592.0 for general principles of invertebrates.

Physiology of Invertebrates

592.0+1 592.01

Biophysics and Biochemistry of Invertebrates.

592.0+ 19 (from 591.19) 592.019

Evolution of Invertebrates

592.0+ 38 (from 591.38) 592.038

Anatomy of Invertebrates

592.0+4 (from 591.4) 592,04 and so on.

It may be noted that since 0 is a subject facet indicator, so all the standard subdivisions from Table 1 should be added with a double zero:

Dictionary of Invertebrates

592.003

Journal of Invertebrates

592.005

Experimental Research in Invertebrates

592.007 24

But wherever the General Principle facet is added through "04" the standard subdivision can be added with the normal zero:

Dictionary of Protozoa

593.103

Study and teachings of Protozoan Zoology

593.107

Take another example: Chemical Kinetics of Alkaloids

The basic number for Alkaloids is

547.72

Here, we are asked to add, as per the footnote, as instructed under 547 (on page 697). Since Chemical Kinetics is a topic of Physical Chemistry, so the third instruction Le. 045 Physical Chemistry is relevant to us. Here, we are asked to add to 045 the number following 541.3 in 541.34-541.39.

It means 045 is a compounded facet indicator. The number for Chemical Kinetics is

541.394

The digits following 541.3 are "94" in this case. Thus the complete class number for the title in question is

547.72 +045+ 94 547.720 459 4

In this manner, we can extend any class number in 546 and 547. For Example

Optical properties of Alkaloid solutions

547.72 +045+ 414 547.720 454 14

Thermodynamics of Chemistry of Alkaloids

547.72 +045+ 69 547.720 456 9 Facet indicator for adding from the subdivisions of 541.2 is 044 as per the same instruction.

Stereochemistry of Alkaloids,

547. 72 +044 + 23 (from 541.223)

=547.720 442 3

Quantum Chemistry of Alkaloids

547.72+ 044+8= 547.720 448

Similarly, in 294.4 Jainism, General Principles of Jainism have been placed in 234.41-48. These General Principles can be further individualised as in 291: for this, we are asked to add to the base 294.4 the number following 291 in 291.1. 291.8. Let us take an example.

Sacred books of Jains Our base number is 294.4 and the number for sacred books In 291 is 291.82. Thus to the base 294.4, we will add "82" Hence the class number for "the sacred books of Jains" is 294.4-82-294.482

Similarly, Jain Eschatology

294.4+23 (from 291.23) =294.423

Sacred places for Jains

294.4+35-294.435

Jain Saints

294.4+61 294.461

Some of the most important examples of such a synthesis occur, however. In 350 Public Administration where 351 is Central Governments (theoretical principles). All the Central Governments of various countries except the US Government, have been put at 354.3-9. For the Central Government of a country, we are asked to add to the base number 354 the area notation for that country from Table 2. For example:

Union (Central) Government of India

354+ 54 (12) = 354.54

Central Government of Italy

354+45=354.45

For specific organs or aspects of the executive of the Central Government, we are required to add to the resulting class number, zero and further add the digits following 351.00 In 351.001-351.004.

For example:

Powers of the US President

353.03+22 (from 351.00322) = 353.032 2

Powers of the President of the Republic of India

354+54 (Area Table)+0+313 (Prom 350.00313)

= 354.540 313

This is the class number for the President of India, as further extension is not possible. Term of Office of the Prime Minister of India (the Chief Executive)

354+54+0+34 (from 351.0034) 354.540 34 Ministry of Finance, Government of Punjab

354+545 52 (Area Table)+06+2 (From 351.02)

= 354.545 520 62

Problems in Acquisition of Government Publications

025.28+34 (from 025.173 4) = 025.2834

Book Selection in National Libraries

025.218+75 (from 027.5)=025.218 75 (Area can also be added to 027.5)

Book Selection in the Library of Congress

025.218+75+ 73 (Table 2) = 025.218 757 3

Reference Service in Children's Libraries

025.527+7625 (from 027.625)=025.527 7625

Cataloguing and indexing of Microforms

025.34+94 (From 025.1794) = 025.349 4

Subdivisions beginning with zero should be avoided if there is a choice between 0 and 1-9 at the same point in the hierarchy of the notation. This is called the rule of zero.

- **"Add to...." from the same Section**

Sometimes some special facets, applicable to all the subdivisions of a section are enumerated at the beginning of the same Section. These special facets are of general applicability within the same section. Instructions are provided against each subsection and their further divisions to add the desired facet. Take, for example, the title:

Heart Diseases Physicians Heart Specialists or Cardiologists

For heart diseases, we will have to go to the section dealing with all the diseases in medicine 610. The number for diseases is 616; and the specific number for heart diseases

6 16.12 (Diseases) * of heart

Here an asterisk leads us to the footnote which instructs us to add as instructed under 616.1-616.9. Going to this bulk of on (pp. 868-869). we find the number for Physician is 0232 and it is directly attachable to the base number:

616.12 0232-616.120 232

Similarly,

Prevention of Heart Diseases

616.12+05 616.120 5

Case studies in Heart Diseases

616.12+09-616.120 9

In such cases, since the subject divisions have usurped the original place of the standard subdivisions, therefore, the standard subdivisions are advanced to the place beginning with a double zero:

Research in Heart Diseases

616.12+0072-616.120 072

Similar Instructions are also found under the subdivisions of 618

618.1 Gynaecology

618.11 Diseases of Ovary

As per similar instructions, one can add to this number any required facet enumerated under the heading 618.1-618.8

Preventive measures for ovary diseases

618.11+052-618.110 52

Surgical treatment of ovary diseases

618.11+07-618.1107

Take another example:

746 Textile arts and handicrafts.

To many of the subdivisions of 716 may be added a special subdivision given under 746: and whenever these special facets are admissible such places have been marked with an asterisk*

Crochet Patterns

Under 746 the specific class number for crochet is 746.434 and as per instruction, we add to it the number for "Pattern" given on page 1283.

Thus the complete class number is: 746.434+041 746.434 041 Pattern in Woven Carpets

746.72+041= 746.720 41

Similarly, under 787-789, "other" instruments and their music, many special facets have been enumerated which can be added, as explained before, to the subdivisions in 787-789

Guitar programmes

781.61 +0739-781.610 739

One can add area notation from Table 2 to 0739, 1

required:

Guitar Programmes in U. S. A

781.610739 + 73 (T2)

= 781.610 739 73

Guitar Scores

781.61+5-781.615

Take another example in 546 Inorganic chemistry. Here almost all the individual elements are extendable by some special facet enumerated once and for all at the beginning under the general heading 546 Inorganic chemistry. The instruction here is: Add to each subdivision identified by* as follows:

1 The Element

2 Compounds

22 Acids and bases

24 Salts'

25 Complex compound

5 Physical chemistry

6 Analytical chemistry

For example, if the subject is: Potassium salt Class number for Potassium is

546.383

and "Salt" is a Special facet having the number "24"

The complete class number for Potassium salts therefore is:

546.383+24

= 546.383 24

Similarly, the Special facet for "Physical Chemistry of individual elements is "5". As per instruction. it is further divisible as the subdivisions of 541.3 as in 541.34-541.39.

We are to add to 5 the digits following 541.3 in 541.34-541.39.

For example,

Physical Chemistry of Potassium

546.383+5= 546.383 5

Chemical Kinetics of Potassium

(It is a topic of Physical Chemistry)

The base number is 546.383

Since it is a Physical Chemistry aspect, so we add 5

546.383 +5

= 546.383 5

The digit "5" is further extendable by the subdivisions

of 541.3

The class number for Chemical Kinetics is

541.394

The digits that follow 541.3 are "94". Hence the complete class number for "Chemical Kinetics of Potassium" is

546.383+5+ 94 546.383 594

Similarly,

Isotopes of Potassium

546.383+5+88 546.383 588

Photochemistry of Potassium

546.383+5+5=546.383 55

Quantitative Analysis of Sodium

546.382 + 65 546.382 65

Some of the facets applicable to some of the subdivisions of 721-729 Specific aspects of the architecture have been enumerated there on page 1238

722 Ancient and Oriental Architecture

722.11 Chinese

It, as per instruction, admits a facet enumerated under 721-729.

Maintenance and repair of the Chinese Architecture

722.11 +0289=722.110289

Preservation Theatre Buildings

725+82 + 0288 725.820 288

The architecture of Buildings for physically handicapped

725.54

(Here there is no need of adding "42" from the facets given under 721-729)

Preservation of Knitted laces

746.22+0488 =746.220448

Repair of Woven rugs

746.72 +0489 = 746.720 489

Scores of Children's Songs

784.624+06 -784.62406

Collection of Duet Songs sung by Children

784.82 +1 (from 784.306 11) = 784.821.

1.4 SUMMARY

The present unit deals with the work of practical classification and consists of two distinct phases first phase deals with intellectual work in sorting out the specific subject of a document under classification and the second deals with the assignment of appropriate notations.

After reading this unit you will be able to :

i. analyse the subject;
ii. locating class number;
iii. practical number building.

1.5 GLOSSARY

Add Note: An instruction appended to an entry to extend the class number by a part of the number taken either from the schedules(Volume 2) or from any of the Tables 2 to 7 (Volume 1).

Centred Entry/Centred Heading: A heading denoted by a span of numbers, as there is no specific number for that heading. Under every centred entry, a number for comprehensive works is always given.

'Class elsewhere' Note: An instruction given under a heading directing to a distinct number for a related subject, or for a part of that subject.

`Class here' Note: Instruction under a heading giving explicit instructions to class a topic under that class number where apparently it does not seem a part of that heading, Usually the subject to be classed there is broader than the heading under which this note appears.

Classifier: A person who assigns class numbers from a classification system to books and other reading material in a library.

Subject Analysis: The specific subject of a document may be determined by examining the document under classification through its title, sub-title, preface table of contents and the text.

1.6 SELF ASSESSMENT QUESTIONS

1. What is the rule of application in DDC?
2. What is the first-of-two rule in DDC?
3. What do you understand by "add to" instructions?
4. What is rule-of-three? Explain with an example.
5. What do you understand by rule-of-zero?
6. Define the sections of personality?
7. Where we can add the special facets?
8. What is the use of an asterisk (*)?

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Dr. Smita

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150

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रामकथा के विविध आयाम

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अनुक्रमणिका

28

The Concept of Ramrajya in Tulsi's Ram Charit Manas: A Politico Philosophical Analysis

*Pankaj Lakhera**

An ideal state, a good social order, and a moral way of life have always been the quest of every society at all times. Religion, moral values, law, politics, and administration have all been set up to overcome the weaknesses of imperfect human nature. Every civilization is always in search of such leaders and heroes who could remove social evils and establish an ideal social order.

The historians question the historicity of Ram. They doubt the very existence of the person itself. According to prof. R. K. Tripathi, "History requires concrete evidence in the form of coins, inscriptions, etc to prove the existence of a character. Even if we take into account places mentioned in the Ramayana like Chitrakoot, Ajodhya, which still exist, the fact is that Ramayana is not a historical text. So, from that perspective, there is no historical evidence available of Ram." Having said that, we still cannot negate Rama's presence easily, since he has been a part of our collective consciousness for a long time. "In fact, it is because of this, that we cannot look at Ram objectively, since he has made the transition from being simply a character in an epic to a religious figure," he symbolizes the ethical conduct which is to be followed by each individual.

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says S. Settar, former chairman of the Indian Council of Historical Research. (Atul Sethi, 2007)

The question of the hour is whether historicity is more important than symbolism? The popular narrative of the story of Ram is that he is a legendary figure. The story of Ramayana is imaginary. But, we have to create a new narrative of Ramayana. For us, the story of Rama may not be true historically, but, it symbolizes a moral socio-political order which should be established for the well-being of mankind.

Great western political thinkers like Plato gave the theory of an ideal state and a philosopher-king. The theory was totally imaginary. But, it was developed in the light of the then prevailing degenerated polity of the city-state of Athens which Socrates criticized vehemently. (Adam, J. (ed.), 1902,)

Similarly, The famous thinkers of enlightenment and renaissance such as Thomas Hobbs, John Locke and Rousseau propounded the theory of social contract. For them, state was not the product of divine will but an outcome of a social contract which was reached upon among the members of human society at a certain point in time. The theory came in the context of a fuel despotic socio-political order which enslaved the entire population of Europe. It is said that their theories are not historically proven. But, that does not lessen their importance because these theories are not real stories but they symbolize the need for a democratic polity which was the need of the time.

During the period of renaissance, Sir Thomas More wrote the book "Utopia" in 1516. He was the first person to use the term "utopia," describing an ideal, imaginary world in his most famous work of fiction. His book describes a complex community on an island, in which people share a common culture and way of life ("16th Century Dreams. At its heart, the book poses the question of whether there could ever be such a thing as a "perfect" world and served as a platform to highlight the chaos of European politics at the time. The book, written in 1516, is Moore's attempt to suggest ways to improve European society, using "Utopia" as an example. (Cristina Akuna and Reagan Bleasdell)

The famous Russian writer and philosopher Leo Tolstoy wrote in his famous book "Kingdom of God is within you" in the 19th century in which he called for the establishment of a moral social order at the world level. The book was written in the context of the 19th-century world when Europe was divided into two military camps that were engaged in an arms race and a bitter imperialistic rivalry with each other. Through his work, Tolstoy wanted to show an alternative idealistic way of life to the so-called civilized nations of Europe who were engaged in exploiting the entire world.. (Tolstoy, 1894)

The same is true about the story of Tulsi's ram. It may not be historically true, but it symbolizes a moral polity that was the call for a perfect moral society during the difficult times of the medieval India. The concept of "Ram Raj" described in Ram Charit Manas was an effort to rejuvenate a society that was suppressed by an alien rule. It may also be called an attempt to bring a renaissance into Indian society.

The Indian society of the medieval period was marked by several social evils. Sati and Johar were widely practiced. Many women of that time were forced to become sati. Child marriage and polygamy were also prevalent in society. Another evil of that time was the rigid caste system. It was marked by the ego and pride of upper caste people against the lower caste groups. The caste consciousness was accompanied with the superstitious idea of purity and pollution.

Ramcharit Manas established equality between man and woman. It says Ram and Sita are the same but of two different genders. Sita's swayamvar and rewrite of Maya Sita which was not present in Valmiki Ramayana show dignity of women. Ramcharit Manas also argued that men should hear the advice of women and gave an example of King Bali of Kish kindha who did not hear the advice of his wife Tara which resulted in the loss of his life in the hand of his brother Sugriv. 21st century saw the rise of several feminists movement, me too movement, which says that no one can touch the women without her consent. Ramcharit Manas highlighted that abducting someone else wife without her consent is not acceptable while women may choose to stay with a person who captured their kingdom after the defeat of her husband in the war. Thus, It underlines women's rights. (Kumar, 2020)

It is believed that the Hindu society of the ancient period was marked by a flexible Verna scheme which was a simple system of division of labor. This was later changed to a rigid caste system resulting in all types of discrimination including untouchability. Tulsidas in his Ramcharit Manas discarded the malpractice of caste discrimination and untouchability. He clearly says that bhakti and devotion are the only means to reach god. If you do well, you are of good caste and if you do bad deeds, you are a bad caste person and there is no in-between.

Ram Charit Manas mentioned the characters like Sabari and Kewat who were said to be belonging to a low caste, but as they were devoted to Lord Ram and had no negative thoughts or greed, they were considered of the same caste as of Lord himself. (Kumar, 2020)

Apart from the caste system and women's rights violations, Indian society of that time was oppressed and suppressed by a foreign rule which created a lot of distortion and disturbance in the social order. There was a lack of unity among the Hindu masses. That was the period of Mughal rule, idolatry was strongly criticized and a lot of low caste people were converted to Islam. Tulsidas made a genuine effort to bring two sects of Hindu society together, Shaivism and Vaishnavism. He interpolated many instances in his Ramcharitmanas which were not there in the original Ramayana written by Valmiki. For instance, Ram worshipped Lord Shiva in Rameswaram before he went to Lanka to fight with Ravana. The main aim was to bring the two sects together and bring Hindu unity in an already chaotic condition. (Kumar, 2020)

The above said ideas of Tulsidas have been summarized in the description of Ram Rajya. A vision of Ram Rajya is an ancient vision, first articulated by Valmiki in his Sanskrit literature on Ramayana. During medieval times, Tulsidas in Ram Charit Manas presents this vision and brings it to the popular level. During modern times, Mahatma Gandhi articulated it as a global vision for human society. It may be compared with Plato's vision of an ideal state of Republic or Thomas Moor's "Utopia" of the period of renaissance. Even the great Russian philosopher Leo Tolstoy gave the same vision in his famous book "The Kingdom of God is within You".

In Ramayana, Ram Rajya is established font Sri Ram returns to Ayodhya after killing Ravana in Lanka. As the king of Ayodhya, he creates a kingdom where everyone is happy. The description of this Ram Rajya may look Utopian to us today. Given the fact that this legend and phrase has survived for so long, this must have been a reality at some point in time, even if that period did not last forever. (Goyal, 2019)

Description of Ram Rajya comes in Uttara Kand of the 7th Canto of Ram charit manas after Sri Ram has sent back all his friends who came with him from Lanka, Kishkindha and Prayag. Dohas and Chaupais, describe the different aspects of a Ram Rajya. (Goyal, 2019)

In this Doha, Tulsidas gives the abstract of what Ram Rajya is:

बरनाश्रम निज धरम निरत बेद पथ लोग
चलहिं सदा पावहिं सुखहि नहि भय सोक न रोग

"When everyone lives according to the Dharma of their Varan and Ashram or when everyone does what they are supposed to do in their work and as per their stage in life as defined in the Vedas. When there is no fear, no sorrow, and no disease – it is the essence of Ram Rajya.".(Goyal, 2019)

He says in Ram Rajya, no one suffers physically, spiritually, and bodily. Everyone lives in harmony with affection towards each other while performing their duties as described in the scriptures. For our times, we can take it as per the law and ethically perfect society. (Goyal, 2019)

She further elaborates, in "Ram Rajya, no one dies young. Everyone has a beautiful body free of diseases. No one is poor, sad or pitiable. No one is a fool or without Shubh Lakshana or auspicious signs.No one is vain. Everyone is pious and busy doing their Dharma. All men and women are smart and talented. All are knowledgeable and respect those who know. Everyone is thankful and no one engaged in the deceit of any kind." (Goyal, 2019)

"In Ram Rajya, Dand (a staff) can only be seen in the hands of Yogis, who use it to rest their hand on it while doing their Tapasya. Jati Bhed (difference in different Jatis or castes) can only be seen in the dictionary of dancers who use it to define the difference between different rhythms & notes. Jeet (winning) only refers to the winning of hearts as there is no enemy left to be won." (Goyal, 2019)

"All the forests are full of flowers and fruits. Lion and elephants live together. All the birds and animals live harmoniously without the known animosity between them, with mutual affection. Birds chirp & different animals live happily without fear. Mild, cool, fragrant wind blows, and bees buzz as they collect honey from the flowers." (Goyal, 2019)

"Mountains and hills are mines of precious stones or Manis. All rivers are full of cool, clean, and sweet water that is the source of happiness. Oceans stay within their limits, and they leave their treasures on the shore for humans. All ponds are full of lotus blooms spreading joy in all 10 directions." (Goyal, 2019)

"Markets are full of things at no price. Cloth merchants, jewelers, traders sit in the market like Kuber – the god of wealth." (Goyal, 2019)

It is worth noting here that such a heavenly state of affairs may not be true in reality. But, it is a vision of an ideal state or a "utopia" that was presented by Valmiki first and then by Tulsidas. It represents a moral social order and a perfect model of good governance. It also symbolizes the state of a clean environment with balanced ecology.

CONCLUSION

In this way, we find that the story of Rama, the hero of great epic Ramayana is in search of a good moral social and political order. It resembles the models which were put by western thinkers during the period of renaissance. Although, one knows that this ideal is like a remote star that could not be achieved in near future, it represents and symbolizes the ideal society which would become a role model for future generations.

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CONTENT

9

आत्मनिर्भर भारत के लिए मजबूत सामाजिक न्याय के चिंतन की अवधारणा

मनीष कुमार[1]

सारांश

भारत में न्याय की संकल्पना और इसके अवधारणाओं को प्राचीनकाल से ही परिभाषित किया जाता रहा है। 19वीं शताब्दी के भारतीय चिंतकों ने जाति आधारित भेदभाव को उजागर करते हुए न्याय के संकल्पना में सामाजिक न्याय के महत्व को गंभीरता से प्रदर्शित किया। उनके प्रयासों के फलस्वरूप भारतीय संविधान में कानूनों के द्वारा जाति आधारित भेदभाव पर कुछ हद तक लगाम तो लगा, परन्तु आज भी प्रत्यक्ष और अप्रत्यक्ष रूपेण भेदभाव पूरी तरह से खत्म नहीं हुई है। आज भारत जब आजादी का 75 वें अमृत महोत्सव मना रहा है और वर्तमान की सरकार सामाजिक समरसता और सामाजिक न्याय के प्रति अपनी प्रतिबद्धता लगातार बनाई हुई है, जिसका स्पष्ट प्रमाण वर्ष 2014 के बाद प्रधानमंत्री श्री नरेंद्र मोदी जी के करिश्माई नेतृत्व में वर्ष 2017 भारतीय लोकतांत्रिक गणराज्य के 14वें राष्ट्रपति के रूप में अनुसूचित जाति समुदाय के कर्मशील श्री रामनाथ कोविंद का राष्ट्रपति के पद पर सुशोभित होना और उसके बाद वर्तमान कार्यकाल के लिए अनुसूचित जनजाति समुदाय की संघर्षशील आदर्श नेतृत्व महामहिम श्रीमती द्रौपदी मुर्मू जी का इस पद पर सुशोभित होना। एक भारत और श्रेष्ठ भारत के तरफ बढ़ता हुआ सकारात्मक कदम परिलक्षित होता है। साथ में सरकार ने आत्मनिर्भर भारत के लिए "अंत्योदय योजना, बेटी बचाओ, बेटी पढ़ाओ, उज्जवला योजना, स्किल इंडिया, स्टार्टअप इंडिया, जैसी सफल परिणाम आधारित योजनाओं को धरातल पर उतारने का प्रयास कर रही है। मुस्लिम महिला विरोधी तीन तलाक को समाप्त कर इनको मुख्यधारा में जोड़ने का सफल प्रयास एवं अनुसूचित जाति/जनजाति उत्पीड़न अधिनियम को और मजबूती से सशक्त बना करके के सामाजिक न्याय के लिए एक मज़बूत रास्ता को प्रशस्त कर रही है। लेकिन इन प्रयासों के बावजूद हमारे भारतीय संदर्भ में विडंबना यह है की जिन सामाजिक न्याय के प्रमुख अग्रदूतो के वैचारिक विमर्श को नए भारत के निर्माण का आधार बनाया और इन्होंने अपने संघर्ष के परिपक्वता से भारतीय समाज में विद्यमान चुनौतियों को जिन मौलिक चिंतन और वैधानिक उपायों को अपना कर के स्थाई समाधान करने का सफल प्रयास किया। वह आजादी के बाद के कांग्रेस के नेतृत्ववाली सरकारों ने इनके दर्शन और सोच को वास्तविकता के धरातल पर नहीं उतारा। इस लेख के माध्यम से हमारे वर्तमान नीति निर्माताओं को फिर से मूल्यांकन करके यह समीक्षा करना होगा की अंबेडकर और गांधी जैसे महान समाज सुधारको के मौलिक चिंतन को अब तक हम पूरी तरह से समस्याओं के समाधान के लिए लागू नहीं कर पाए हैं और जिसका नतीजा है कि सामाजिक न्याय के लिए जो अपेक्षित परिणाम आना चाहिए वह अब तक सुनिश्चित नहीं हो पाया है। अतः प्रस्तुत लेख सामाजिक न्याय की अवधारणा, इसका इतिहास एवं इसके परिभाषाओं की आधारशिला रखने वाले भारतीय आधुनिक चिंतकों के विचारों पर विस्तृत रूप से चर्चा का एक प्रयास है ताकि आत्म निर्भर और विकसित भारत के लिए इनके दर्शन को नए सिरे से आत्मसाध्य कर नए भारत के निर्माण में कोई कमी न रह जाए।

Keywords: *आत्मनिर्भर भारत, न्याय, सामाजिक न्याय, समरसता, अंबेडकर, गांधी*

प्रस्तावना

न्याय शब्द आज के सन्दर्भ में बहुत ही महत्तवपूर्ण है। न्याय की अवधारणा को विभिन्न समय-काल और परिस्थिति में समाज शास्त्र के कई विचास्कों ने अलग-अलग प्रकार से परिभाषित किया है। कुछ चिंतकों ने इस धर्म, अधर्म, नैतिकता, आदर्श और राज्य के महत्तवपूर्ण अंग की तरह देखा है। यह भी देखा गया है कि न्याय का सन्दर्भ इसलिए भी व्यापक है क्योंकि यह मनुष्य के अस्मिता एवं उनके जीवन यापन पर प्रत्यक्ष रूप से प्रभाव डालता है। भारत एक लोकतान्त्रिक देश है। जिसका संविधान विश्व का सबसे बड़ा लिखित संविधान है। भारत ने अपने सभी नागरिकों के लिए संविधान के माध्यम से समानता एवं न्याय की स्थापना उनके मौलिक अधिकार में सुनिश्चित किया है। इसकी नींव संविधान के प्रस्तावना में ही रख दी गयी थी। अंतोगत्वा इसका ये संवैधानिक रूप से प्राप्त न्याय राजनितिक न्याय से सम्बंधित हो जाता है। न्याय का यह रूप जब समाज से जुड़ जाता है तब उस समाज में जहां व्यक्तियों के लिए चाहे वो गरीब हो या अमीर, वंचित हो या उत्पीड़ित सबके लिए एक न्यायिक सोपान का निर्माण किया जाता है। जिसको हम सामाजिक न्याय के रूप में देखते अथवा समझते है। हर व्यवस्थित समाज में जुड़ाव और सौहार्द स्थापित करने के लिए व्यक्तियों के बीच अधिकार की समानता, स्वतंत्रता, बंधुता, सहयोग तथा कानून के प्रति निष्ठा के भाव का होना आवश्यक है। एक आदर्श समाज में सभी व्यक्तियों के ज्ञान, बल, गुण, क्षमता तथा अधिकार जैसे विषयों का आदर करना स्वाभाविक है, समाज के हर व्यक्ति को उनके जरूरतों की चीजों की पूर्ति करनी पड़ती है और इन सभी स्थितियों में यह ध्यान रखना अनिवार्य है कि मनुष्य के स्वभाव में यह उत्पन्न न हो की समाज में या सरकार द्वारा उनके साथ समाज के अन्य व्यक्तियों के तुलनात्मक अध्ययन

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से यह दोष उत्पन्न हो कि उनके साथ पक्षपात हुआ है। इसी भावनात्मक दोष रहित स्थिति को हम आम चाल की भाषा में न्याय कहते है। राजनितिक शास्त्र के माध्यम से जब इसे समझने का प्रयास करते है तो अमूमन यह देखा गया की न्याय का सिद्धांत मानवीय हित से अधिक जुड़े होते है। मानवीय तर्क से कम। अपनी इसी गुण की वजह से न्याय अधिक स्पष्ट हो जाता है तथा इसके साथ ही साथ इसकी श्रेष्टता अत्याधिक बढ़ जाती है। न्याय की अपनी एक ऐतिहासिक पृष्ठभूमि है जिसका विवेचना विभिन्न विद्वानों ने अपने अपने ग्रंथों और लेखों के माध्यम से किया है। राजनीति शास्त्र के ग्रीक दार्शनिक प्लेटो ने अपने न्याय की अवधारणा में जो की उनके द्वारा रचित कालजयी पुस्तक "द रिपब्लिक" में वर्णित है उसमें उन्होंने कहा कि न्याय सामाजिक जीवन के वास्तविक सिद्धान्त है। प्लेटों की न्याय की अवधारणा को कुछ राजनीतिक चिंतक अपने विचारों से बताने का प्रयास भीं किया है जिसमें राजनीति विषय के दार्शनिक अर्नेस्ट बार्कर का नाम मुख्य रुप से लिया जाता है उनके अनुसार प्लेटो का न्याय उनके विचारों की एक दो दरवाजों को जोड़ने वाली यंत्र और उनके प्रवचन का पाठ था। (Barker 1952)

राजनीतिक शास्त्र के विख्यात यूनानी दार्शनिक अरस्तू ने अपने न्याय की विवेचना में उसे वितरणात्मक न्याय के रूप में देखने के लिए प्रस्तावित किया जिसमे उन्होंने माना है की वितरणात्मक न्याय का स्पष्ट अर्थ है की समाज के सभी नागरिकों के बीच राज्य के सभी संस्था के साथ साथ उसके सभी संसाधनों पर जैसे की, राज्य द्वारा प्रदान सेवाओं पर, वस्तुओं पर एवं राज्य द्वारा मिलने वाले सम्मानों का समाज में समान रूप से वितरण होना चाहिए। यह असमानता को समानता की ओर तथा उनके योग्य और अयोग्यता पर आधारित होनी चहिए। न्याय शब्द के अर्थ के तर्कसंगत स्थिति को देखते हुए कानून निर्माण करना सर्वोपरि है जिसके अंदर मुख्य रूप यह तत्व मौजूद होना चाहिए की वो बिना किसी वर्ग, लिंग, जाति या जातिय भेदभाव के बिना समान अधिकार और न्याय का कानून को परस्पर आगे बढ़ाए, जिसका तात्पर्य यह है की राज्य की सरकारें राज्य के नागरिकों से सही बर्ताव और व्यवहार करें तथा उनके अधिकारों का सम्मान नैतिक रूप से जो सही प्रतित हो या उचित हो उसके अनुरूप होना होना चाहिए। राज्य को कानून भी लागू करना चाहिए और उसे समाज के भले के लिए उनकी सुरक्षा के लिए अधिनियमित भी करना चाहिए। (Katariya, 2015)

इस तरह से न्याय की विभिन्न परिभाषा को देखने के बाद जब न्याय की आधुनिक रूपरेखा जो की अभी के समाज में विद्यमान है उसे न्याय के आधुनिक राज्य के परिदृश्य में समझने का प्रयास करते हैं तो मुख्य रुप से अमेरिकी विचारक जॉन रॉल्स का नाम सर्वप्रथम दिया जाता है। रॉल्स ने अपनी पुस्तक "न्याय का सिद्धांत - 1971 "में न्याय की अवधारणा के सिद्धांत को विकसित किया जो समाज के मूल ढांचे को समझने में अत्यंत लाभदायक सिद्ध हुआ, रॉल्स की न्याय संबंधी अवधारणा यह कहता है कि सामाजिक आर्थिक असमानताएं जीवन की अपेक्षाओं को नियंत्रित करती है। इसलिए सामाजिक न्याय का सिद्धांत इन असमानताओं पर ही लागू होना चाहिए। रॉल्स का विचार हमें यह सोचने पर अग्रसर करता है कि हम सोचे कि सामाजिक संरचना के मूल सिद्धान्त के बारे में शुरुआती विचार क्या रहे होंगे या समाज में क्या सहमति बनी रही होगी और इसी आधार पर वह अपनी न्याय की कल्पना को अग्रसर करते हुए काल्पनिक दृश्य के तहत विकसित करता है जिसे अंग्रेजी में हम लोग "*Veil of Ignorance*" कहते हैं। (Rawls, 1971)

न्याय की अवधरणा का विचार प्रस्तुत करते हुए रॉल्स ने जो सिद्धांत पेश किये थे उनमें हारवर्ड यूनिवर्सिटी के प्रोफेसर रोबर्ट नोज़िक ने कुछ त्रुटियाँ का जिक्र किया है उन्होंने रॉल्स के सिद्धांत में कमियों को उजागर करते हुए अपने पुस्तक "अनार्की, स्टेट एंड यूटोपिया" में न्याय की अधिकारिता का सिद्धांत का प्रतिपादन करते हुए लॉक की तरह प्राकृतिक अधिकारों का समर्थन किया तथा लॉक की तरह संपति के अधिकार को माना है तथा ये भी कहा है की हर व्यक्ति अपने हिसाब से सभी चीजों का अधिकारी तो नहीं हो सकता पर जो जिस चीज का अधिकारी है उसे वो अवश्य मिलना चाहिए या प्रदान करना चाहिए। (Nozik,1974)

न्याय के इस अवधारणा के बाद प्रख्यात विद्वान अमर्त्य सेन ने भी अपने लेख में न्याय के विभिन्न प्रकारों का उल्लेख किया है। जिसमे उन्होंने अपने पुस्तक "*Idea of Justice*" में यह स्पष्ट करने का प्रयास किया है की न्याय का वितरण हम कैसे अथवा किस आधार पर करें। (Sen, 2009) इस लेख के माध्यम से सामाजिक न्याय के विभिन्न पहलुओं पर ध्यान आकर्षित करने का प्रयास किया गया है तथा इसकी अवधारण, समस्या और निराकरण के लिए किए गए उपबुधों या निराकरण के प्रकारों पर प्रकाश डालने का हर संभव कोशिश की गई है।

सामाजिक न्याय की अवधारण

जहां तक सामाजिक न्याय की बात आती है तो सामाजिक न्याय की अवधारण, न्याय के मुकाबले कहीं अधिक है, जैसे की इसके नाम में ही सामाजिक शब्द जुड़ा हुआ है जो समाज की स्तिथि को दर्शाती जो की इस भावना के साथ जुड़ा है की सामाजिक न्याय

समाज से ही जुड़ा हो सकता है।इस अवधारण का विस्तृत और व्यापक क्षेत्र है यह अपने अंदर सामाजिक घटना उसके मुद्दे, सामजिक समस्याएं और इसके निराकरण जैसे तत्व समेटे हुआ है और यही वजह है की इसमें परिवर्तनों का सामाजिक और आर्थिक क्षेत्र जुड़ा हुआ है। इस परिवर्तन के लिए किए गए प्रयासों में समाज के वो सभी लोग जो कहीं न कहीं शोषित है, दमित है या वंचित है उन सभी के जीवन को उत्कृष्ट बनाने या समाज में उनके उन्नति के लिए क्रियाशील है। इसका मुख्य उद्देश्य आर्थिक, सामाजिक, और राजनीतिक लोकतंत्र का संरचना तैयार करना तथा समाज में फैले जाति और वर्गों के बीच द्वेष या भेदभाव को समाप्त करना है।

समाजिक न्याय की अवधारण का विकास 19वीं शत्तब्दी के प्रारंभ में औद्योगिक क्रांति और उसके बाद यूरोप में उत्पन्न हुए नागरिक क्रांति के द्वारा ही इसकी शुरूआत हुई। जिसका मुख्य उद्देश्य मानव शर्म को पूंजीवादी व्यवस्था से हो रहे शोषण से दूर कर समतावादी समाज के निर्माण का था ।इस काल में अमीर और गरीब के बीच गहरी लंबी खाई उत्पन्न हो चुकी थी जिसके कारण विभिन्न विद्वानों एवम् बुद्धिजीवियों का ध्यान पूंजी, संपति और धन के वितरण के तरफ खींचा चला गया और वे सभी इन सभी क्षेत्रों में एक समतावादी समाज की कल्पना करने और उसको फलीभूत करने के लिए संघर्ष करने लगे। 20 वीं शताब्दी के मध्य तक आते आते यह सामाजिक न्याय जो अभी तक अपने आर्थिक असमानताओं पर ध्यान केंद्रित की हुई थी अब यह यहां से बढ़कर नस्ल, लिंग और समाज में व्याप्त विभिन्न असमानताओं पर अपने ध्यान केंद्रित करने के साथ साथ अभिव्यक्ति को भी अपने दायरे में ले लिया या यूं कहे की यह सामाजिक न्याय इन सभी मुद्दों और असमानताओं को अपने अंदर समाहित करके अपने रूप को विस्तारित करने लगा। समाजिक न्याय की अवधारण एक संगठित अवधारणा है जो व्यक्ति के जीवन को अर्थ और महत्व प्रदान करती है और समाज में विद्यमान संविधान द्वारा तय किए गए कानून के शासन को गतिमान करती है। सामाजिक न्याय कुछ जगहों में धार्मिक परंपराओं में सिखाया जाता है तो कहीं यह समाजवादी आर्थिक ढांचे का आधार भी होता है।

सामान्य रूप से इस तरह से सामाजिक न्याय राज्य के नागरिकों के लिए कई प्रकार की मुद्दों या उनके द्वारा उठाए गए पहलों के माध्यम से उनके बीच समानता लाने के लिए समान आधिकारों की रक्षा या उनको समर्थित करने वाली एक विस्तृत अवधारणा के संरचना में निर्धारित हुई प्रतीत होती है । सामाजिक न्याय एक प्रकार से कालांतर में समाज के लोगों के बीच जो अतीत से चले आ रहे संघर्ष को कम करने या उन नागरिकों से हुई गलतियों को दूर करने से या उसे जड़ से मिटा देने से संबंधित माना जाता है। सामाजिक न्याय का दायरा बहुत बड़ा होने के कारण यह बहुत बड़ी जनसंख्या को प्रभावित करता है उन तक अपनी पहुंच सुनिश्चित करता है। इसमें नस्ल, जातियता, लिंग एवं यौन अभिमुखता, व्यक्ति की उम्र, धार्मिक परंपरा एवं विकलांगता जैसे विषयों पर फैले असमानताओं को बदलने के लिए इसको अपने लक्ष्य में शामिल किया हुआ है। समाज में कई प्रकार के जैसे धन, स्वास्थ, लोक कल्याण आदि के क्षेत्र में समानता को बढ़ाने के लिए उनके हैसियत और उनके अधिकार या शक्ति को बढ़ाने के लिए सामाजिक न्याय एक मुख्य पहल माना जाता है। अर्थिक तौर पर इसे समझते है तो यह सामाजिक न्याय,अक्सर हम देखते है की समाज के कुछ वंचित वर्ग समाज के अन्य विशेषाधिकार वर्ग के तुलना में आय,संपति या आर्थिक मदद या अवसर से उनके वनस्पत वंचित रह जाते है,उनके पूर्णवितरण के लिए किए गए कोशिश को कह सकते है । राज्यस्तरीय सरकार द्वारा कई प्रकार के कार्यक्रमों से या नीति नियमों के माध्यमों से सामाजिक न्याय के लिए उचित कार्यक्रमों को आगे बढ़ाने के लिए सरकार मुख्य रूप से आगे कदम बढ़ा सकती है या सामाजिक न्याय के पहल को आगे बढ़ाया जा सकता है। सामाजिक न्याय का परिदृश्य की विवेचना तथा इसके प्रकार को हम निम्नलिखित तरीकों से समझ सकते है। इसके पहले खंड में हम इसे स्थायी आजीविका जिसका मतलब होता है रहने के लिए समुचित व्यवस्था या उसके साधनों तक लोगो की पहुंच जैसे की रोटी, कपड़ा, मकान के लिए उपयुक्त साधनों तक पहुंच तथा विकास के साधन के रूप में रोजगार, शिक्षा एवं स्वास्थ के लिए जरूरी या न्यूनतम साधनों तक पहुंच। दूसरा है सामाजिक तथा राजनीतिक भागीदारी, समजिक और राजनीतिक भागीदारी से नागरिकों को मौलिक अधिकार की सुनिश्चता के साथ सरकार में भागीदारी तथा उनके सशक्तिकरण के लिए एवं न्याय के लिए सभी आवश्यक सुविधाएं एवं संसाधनों पर उनकी पहुंच सुनिश्चित करती है। सामाजिक न्याय के प्रारंभ की बात करें तो यह सिद्धान्त कई कारणों से अतिमहत्वपूर्ण है। गरीबी तथा पारिवारिक शिथिलता कई प्रकार के असफलताओं के लिए हानिकारक कारक के रूप में काम करती है, मनुष्य के किशोरावस्था में उसके मानसिक भावनात्मक एवम् उसके व्यवहार को असमानताओं के कारण ही कई बीमारी से ग्रसित होना पड़ता और गरीब तथा असहाय लोगों को सफलता प्राप्त होने में देर हो जाती है । (O'connell et al 2009)

इसी तरह से देखे तो यह नकारात्मक प्रभाव बच्चो और किशोरों के जीवन को प्रभावित करती है। इस तरह की समस्या का अध्ययन करने से यह पता चला की अमेरिका के जो वयस्क है उनके तुलना में वहां के बच्चे और युवा दशकों से गरीबी में अपना जीवन यापन कर रहे है। यह दर लगभग डेढ़ गुना अधिक है और यह अभी भी बढ़ रहा है ,अभी के अध्ययन से यह आंकड़ा इक्ट्ठा

हुआ की करीब 12 से 20 वर्ष के आयु के बच्चे जो कम आय वाले परिवार में पल बढ रहें थे वो सन् 2000 में जो 33 प्रतिशत था वो वर्ष 2008 में करीब 36 प्रतिशत तक पहुंच चुका था। (White and Chau, 2009) कुछ जगहों पर कुछ समूह या लोगों ने सामाजिक न्याय की संघर्षों पर ध्यान केंद्रित करते हुए लिंग या नस्लीय समानता को व्यक्तिगत, पेशेवर और आध्यात्मिक - राजनीतिक मूल्यों और विश्वासों के एकीकरण की आवश्यकता समझते हुए इसके पूर्ण रूप से सफल होने का प्रयास करते समय द्वंदात्मक तनाव का सम्मान करते है। (Stenbeark, 2000) सामाजिक न्याय को लागू करने के लिए भौगोलिक, सामाजिक, राजनीतिक और सांस्कृतिक ढांचा जिसके भीतर व्यक्तियों और समूहों के बीच संबंध हो सकते है को समझना अनिवार्य है, जिसका मूल्यांकन किया जा सकता है और न्यायसंगत या अन्यायपूर्ण के रूप में चित्रित किया जा सकता है।

भारत में सामाजिक न्याय

❖ सांझी और समृद्ध विरासत वाला

भारत जो की विविधताओं में एकता वाले देश के रूप में विश्व में ख्याति प्राप्त है, जिसको रजनी कोठारी ने अपने सिद्धान्त सलाद बॉल मॉडल के द्वारा भी दिखाया है, भारत में लोकतंत्र की स्थापना की तथा 26 जनवरी, 1950 के दिन भारतीय संविधान को अंगीकार किया, भारतीय संविधान अपने आप में एक अच्छे नीति और उसके अंदर भारतीय के अस्मिता की आत्मा को समेटे हुए एक अति विशिष्ट लिखित ग्रंथ है, जो इसे विश्व की अनेक देशों के संविधान से अलग बनाता है। जैसा की हम सभी जानते है सामाजिक न्याय का मतलब होता है बिना किसी जाति, लिंग, नस्ल, धर्म के भेदभाव के बिना सभी के साथ एक समान व्यवहार करना जिसे इस लेख के प्रारंभ में ही परिभाषित किया गया है। सामाजिक न्याय भारतीय संविधान का आधारभूत स्तंभ है। भारत में जाति के आधार पर समाज कई भागों में बटा हुआ है, सभी देशों के असमानताओं के साथ सामान्य मुद्दो पर तो भारत सबके साथ खड़ा तो है पर एक एक असमानता जो सबसे भयंकर बीमारी के रूप में फलफूल रहा था ऐतिहासिक काल से जैसे की कई राजनीतिक सामाजिक विचारक मानते है वो है जाति और अस्पृश्यता, हालांकि अस्पृश्यता का अंत मौलिक अधिकार के अनुच्छेद 17 से खत्म तो कर दिया गया पर आजादी के 75 साल बाद भी यह समस्या दूर दराज के गांवों में देखा या सुना जा सकता है। परन्तु जाति में फैली असमानता आज भी यहां मौजूद है जिसका भान बखूबी हमारे संविधान निर्माताओं को था और उन्होंने इसके लिए सामाजिक न्याय के प्राप्ति के लिए कई उपबंधो को संविधान में जोड़ दिए थे। भारत में सामाजिक न्याय के सामने सबसे बड़ी समस्या यहां की गरीबी भी है। भारत में शुरू से ही अर्थात आजादी से पहले और बाद में भी सामाजिक असमानता फैली हुई थी करीब 75 साल के अपने आजादी के इतिहास में क़रीब एक दर्जन से भी ऊपर पंचवर्षीय योजनाओं लागू करने के बाद भी यह देश समाजिक न्याय प्रदान करने में पूरी तरह सफल नहीं हो पाया आज भी कई जगहों पर असमानता पांव पसारे हुए है , छुआछूत जैसी समस्या जब खत्म होने के कगार पर आती है तो फिर कुछ नई असमानताएं जन्म ले लेती है जो पहले से विद्यमान तो होती है पर उसके आंकड़े साफ नहीं रहते जिसका आधार धर्म, जाति, लिंग असमानता होती है। इसलिए भारत में सामाजिक न्याय की उतनी ही आवश्यकता है जितनी की विश्व के अन्य देशों में या चाहे अपने ही देश में आर्थिक न्याय की समस्या है। जैसे आर्थिक न्याय का अर्थ है सभी नागरिकों को अपने स्वयं के व्यक्तिगत विकास के लिए जीवन के सभी सुखों एवं उसके अवसर की समानता प्राप्त करना, उसी तक सामाजिक न्याय का सही मतलब है समाज के हर व्यक्ति के बीच असमानताओं को खत्म कर उनको राज्य द्वारा दिए गए अवसर में बिना किसी भेदभाव के भागीदारी प्रदान करना। सामाजिक न्याय की जब बात आती है तो ऐसे में भारतीय चिंतक गाँधी और बी आर अम्बेडकर का जिक्र होना स्वाभाविक है उनके विचार और उनके द्वारा सुझाये गए पहलुओं को भारतीय संविधान ने अंगीकार कर उसको फलीभूत करने का हर संभव प्रयास किया जिसमे पूर्णतः न सही पर अधिकतम रूप से अवश्य सफल हुआ है।

❖ गाँधी एवं अम्बेडकर

महात्मा गाँधी ने सामाजिक न्याय के लिए अपना संघर्ष दक्षिण अफ्रीका प्रवास के दौरान अपने युवा अवस्था में की जब उनके साथ एक अति निंदनीय घटना घटी। बात 7 जून 1893 की है जब उन्हें रंगभेद का शिकार होना पड़ा और उन्हें अश्वेत होने के कारण अफ्रीका के पीटरमारिट्जबर्ग रेलवे स्टेशन पर धक्का देकर ट्रेन के डब्बे से उतार दिया गया और उसी दिन से कहा जाता है की गाँधी का सामाजिक न्याय के लिए सत्याग्रह का शुभारम्भ हो गया। इसी घटना के बाद उन्होंने अफ्रीका में रंगभेद के खिलाफ मोर्चा खोल दिया और अफ्रीका में बसे भारतीयों के सामाजिक न्याय के हक़ के लिए आवाज उठाने लगें। दक्षिण अफ्रीका से वापस लौटने के बाद उन्होंने भारत में भारतीयों के लिए भी संघर्ष करना प्रारम्भ किया जिसकी शुरूआत बिहार के चम्पारण से हुई। गाँधी ने अपने सामाजिक न्याय की अवधारणा में सर्वोदय को केंद्र में रखा जो सामाजिक न्याय प्राप्त करने में अहम् साबित हो सकती थी

उन्होंने सर्वोदय का संकल्प लेते हुए सभी भारतीयों के विकास की बात की। गाँधी को सर्वोदय का विचार रस्किन की किताब अन्टू दिस लास्ट से प्राप्त हुई, इसके तहत गाँधी ने मुख्यतः तीन बातों पर विशेष ध्यान दिया। पहला, सबके हित में ही व्यक्ति का हित है। दूसरे में उनका मानना था की जो जिस व्यक्ति का काम है या जो वह काम कर रहा है सब एक सामान है अर्थात उनका मानना था की एक बाल काटने का काम करने वाला तथा एक वकील का काम दोनों का एक सामान महत्व है उसमे कोई अंतर इसलिए नहीं है क्योंकि दोनों को अपनी आजीविका के लिए कमाने का सामान अधिकार है। तीसरा ये था की हर व्यक्ति का जीवन सार्थक है चाहे वो मजदूर ही क्यों न हो। गाँधी का न्याय का विचार उपयोगितावादी के न्याय के विचार से पूर्णतः भिन्न था। उनका कहना है की उपयोगितावादी अधिकतम की कामना करते है जबकि संपूर्णतावादी सभी के हित में विश्वास करते है। इसलिए गाँधी को अहिंसा के पथ पर चलकर हक़ प्राप्त करने वाले संपूर्णतावादी कह सकते है। गाँधी जी ने सामाजिक न्याय के लिए सर्वोदय के विचार के साथ साथ समाज की कुरीतियों जैसे की अस्पृश्यता को खत्म करने, रामराज्य स्थापित करने की बात की, रामराज्य का तात्पर्य किसी धर्म आधारित समाज से न होकर एक कल्याणकारी राज्य से है जहां हर प्रकार से समानता मौजूद हो, गाँधी ने समाज में समानता लाने के लिए कुटीर उद्योग, लघु उद्योग के बढ़ावा देने तथा इसके माध्यम से समाज में आर्थिक समानता की बात करते है। भारत में व्याप्त अस्पृश्यता को देखते हुए उन्हें बहुत दुख होता था वे समाज को इस भीषण अभिशाप से निकलना चाहते थे, उनके अंदर उनके आत्मा में उनके प्रति अधिक सहानुभूति तथा प्रेम था, समाज के ऐसे व्यक्ति के लिए अगाढ़ प्रेम उनके द्वारा लिखे गए लेख यंग इंडिया में प्रकशित इस शब्दों से अपने आप प्रदर्शित हो जाता है -"मैं कभी दुबारा जन्म नहीं लेना चाहता यदि किसी अवस्था में अगर दुबारा जन्म लेना पड़े तो मैं ईश्वर से प्राथना करूँगा की मुझे अछूत के रूप में जन्म मिले ताकि मैं उनके दुःखो, उनके पीड़ा और उनके मन की दयनीय स्तिथि को महसूस करू उसमे भागीदार बन सकू इसलिए हे ईश्वर अगर दुबारा जन्म देना हो तो ब्राह्मण, क्षेत्रीय तथा वैश्य वर्ण में जन्म न मिले बल्कि अतिशूद्र में मुझे जन्म मिले। (Gandhi, 1921)

गाँधी ने सामाजिक न्याय के लिए समाज की कुरीतियों एवं शोषण के खिलाफ खुलकर खड़े हुए। उन्होंने सर्वोदय एवं स्वराज के माध्यम से सामजिक न्याय के लिए लड़े तथा उनका एक और महत्वपूर्ण सिद्धांत था वो आर्थिक न्याय के लिए था जिसे उन्होंने ट्रस्टीशिप सिद्धांत के रूप में अवगत कराया। इन सभी बातों से एक बात तो तय हो गयी थी की गाँधी सामाजिक, आर्थिक और राजनितिक रूप से समाज में फैले असमानताओं के विरोध में थे और समाज के सभी चीजों पर सिर्फ और सिर्फ एक ही वर्ग का विशेषाधिकार हो वो उसके भी पक्षधर नहीं थे।

भीमराव अम्बेडकर जिन्हे पूरा भारत बाबा साहेब अम्बेडकर के नाम से पुकारता हो और ऐसा हो भी क्यों न, उन्होंने अपने पुरे जीवन काल में समाज के कुरीतियों और शोषण के विरुद्ध सामाजिक लड़ाई लड़े। अम्बेडकर ने शुरू से सामाजिक अन्याय का सामना किया ,हिन्दू धर्म में जन्म तथा बौद्ध धर्म के अंतर्गत मृत्यु प्राप्त करने से लेकर 'नवीना' नाम के एक अलग सम्प्रदाय बनाने तक के सफर में उन्हें यह ज्ञात हो चूका था की एक व्यक्ति के लिए सामाजिक न्याय एवं समाज में समानता कितना अत्यधिक महत्वपूर्ण है। इसलिए जब उनको संविधान सभा के प्रारूप समिति का अध्यक्ष बनाया गया तो उन्होंने सामाजिक न्याय के लिए हर संभव प्रयास करते हुए संविधान में कई उपबंधों को जोड़ा और उसे अधिकार के रूप में जनता तक पहुंचाया। उन्होंने भारत में धर्म आधारित जो व्यवस्था एवं कुरीतिया के साथ जाति जैसी सामाजिक असमानता मौजूद थी, को भारत के लिए एक अभिशाप के रूप में देखा। इसलिए सामाजिक असमानता और सामाजिक अन्याय को जानने के लिए बाबा साहेब अम्बेडकर के विचारों एवं उनके द्वारा दिए गए सामाजिक अन्याय की विवेचना को समझना बहुत अनिवार्य है। उन्होंने अपने विभिन्न लेखो में सामाजिक अन्याय के खिलाफ लिखा, उन्होंने सामाजिक अन्याय के संदर्भ में कहा की भारत देश में एक ऐसा वर्ग है जो अंग्रेजो के साथ साथ भारतीयों का भी गुलाम सदियों से बनकर रहा तथा असमानता जैसे असमाजिक समस्या के तकलीफ देनी वाली पीड़ा को भी सहा है। (Bharti, 1990)

उन्होंने इसके आगे भी कुछ कड़े शब्दों के साथ हिन्दू धर्म के अंदर के व्यवहार जिसे वो बिलकुल ही गलत कहते थे के बारे में कहा की - हिन्दू धर्म एक ऐसा धर्म है जिसमे पशु, पक्षी पालतू जानवर गाय, कुत्ता, बिल्ली इत्यादि को बड़े अच्छे और प्यार से स्पर्श करते यहाँ तक की चिटियां को चीनी भी खिलाते है वैसे हिन्दू धर्म में अपने ही धर्म के कुछ लोगों को छूने से या स्पर्श मात्र से अपने आपको अपवित्र मान लेते है। (Keer,1962) उन्होंने जन्म आधारित वर्ण व्यवस्था को पूरी तरह नकारते हुए कहा की योग्यता के अनुसार उसका वर्ग तय होना चाहिए, उन्होंने समानता तथा उपयुक्तता आधारित समाज के पुर्ननिर्माण पर बल दिया है। अंबेडकर का कहना था की जाति और अस्पृश्यता एक दूसरे के पूरक है किसी एक को बिना समाप्त किये हम दूसरे को समाप्त नहीं कर सकते। अंबेडकर ने अपने आर्थिक, राजनितिक एवं सामाजिक न्याय में व्यक्ति की स्वतंत्रता तथा समानता को भारत के दलित, शोषित, पिछड़ो तथा आदिवासी के स्थिति को ध्यान में रखकर उनके लिए कल्याणकारी योजनाओं के निर्माण के पक्षधर थे तथा

सामाजिक न्याय के रूप में इन सबकी स्थिति को केंद्र में रखते थे। इनके अनुसार सामाजिक न्याय के तत्वाधना में स्थापित नए सामज में कमजोर वर्ग के हित की हिस्सेदारी या भागीदारी सुनिश्चित करना चाहिए और इनके हितों के रक्षा के लिए शासन का कर्तव्यनिष्ट होना अनिवार्य है या इनकी रक्षा का दायित्व शासक पर होना चाहिए।

भारत में जब सामाजिक न्याय की बात होती हैं तो ऐसे में आधुनिक समय के भारतीय राजनीतिज्ञ एवं राजनीतिक विचारक योगेंद्र यादव का नाम ना हो तो यह सामाजिक न्याय की अवधारणा के साथ भारतीय परिदृष्य में एक छलावा हो सकता है। भारत के सन्दर्भ में योगेंद्र यादव ने सामाजिक न्याय के बारे में अपना मत प्रस्तुत करते हुए कहा है की समकालीन भारत में योगेंद्र यादव ने सामाजिक न्याय की अवधारणा में जाति आधारित राजनीतिक एवं उनके लिए किये गए कार्यों को राजनीतिक पार्टी विशेष को वैचारिक दृष्टिकोण से बताने का प्रयास किया है। यादव ने अपनी पुस्तक इंडिया डेमोक्रेसी में कहा है की "सामाजिक समानता में इसका योगदान मुख्य रूप से जातियों और समुदायों के राजनीतिकरण के माध्यम से है, जो अपने आत्म-सम्मान की रक्षा या समानता के लिए धर्मनिरपेक्ष राज्य क्षेत्र में संघर्ष करते हैं"। (Yadav, 2020)

सामाजिक समस्या एवम् निराकरण

आज़ादी के 75 सालों के अपने विकासशील इतिहास में यहां कई प्रकार के आन्दोलन हुए चाहे वो पेड़ को बचाने का आंदोलन, किसी के हक के लिए आंदोलन, किसी जगह के जीव जंतु की रक्षा के लिए आन्दोलन, अपने पर्यावरण के लिए आंदोलन और फिर लिंग समानता का आंदोलन। जिस देश का इतिहास ऐसे आन्दोलन को अपने आंचल में सजोए हुए हैं वहा आज भी सामाजिक न्याय के लिए लोगो को संघर्ष करते हुए देखा जा सकता है। हमारा देश विविधिता में एकता जैसे उपागम से जाना तो जाता है पर यहां जितनी विविधता है उतने ही असमानताएं है जिसका जिक्र ऊपर किया जा चुका है। अगर सामान्य तौर पर देखे तो देश की आधी से ज्यादा आबादी असमानता का श्राप झेल रहा है। कहीं-कहीं तो रहने का घर और उसके जरूरी सामान न प्राप्त होने की भी असमानता के जाल में घिड़ा हुआ है। यहां तक कि लोगों के घर में चूल्हा, बिजली और शौचालय तक की जरूरी सुविधा नहीं थी। निरक्षरता और बेरोजगारी तो आम समस्या हो गई है। सामाजिक समस्या क्या है और क्यों है या इसकी अवधारणा क्या है इसके बारे में रोनहार्ट कहते है की सामाजिक समस्या घटनाओं का समूह या दशा है, जिसे समाज के कुछ लोग अपने लिए उस दशा को अवांछित समझते। समाज के एक वर्ग तथा समूह के सामने रहने वाली ऐसी स्थिति जिसके अत्यंत ही प्रतिकूल परिणाम होते है एवम् जिसे हम केवल सामूहिक कोशिश से ही दूर किया जा सकता है, ऐसी चीजों को हम सामाजिक समस्या के रूप में देखते है या समझते है। (Roanhart, 1952) जैसा की इसकी परिभाषा से ये प्रतीत हो चुका है की एक आम इंसान या कुछ इंसान ऐसी सामाजिक समस्या की स्थिति के लिए उत्तरदायी नही है और ऐसी सामूहिक समस्या को नियंत्रित करना किसी अकेले व्यक्ति या कुछ व्यक्ति की बस की बात नहीं है इसे दूर करने या खत्म करने की जिम्मेदारी पूरे समाज को लेने की जरूरत है। सामाजिक समस्या के लिए विचारक वाल्स और फरफे ने इस अपने शब्दो में लिखा है की - सामाजिक आदर्श क्या यह विचलन माना गया है, जो सामूहिक प्रयत्नों से ही ठीक हो सकता है। (Wals and Farfe, 1961)

सामाजिक समस्या एक ऐसी समस्या है जिसका आचार संबंधी निरुपन होना अत्याधिक आवश्यक है। यह एक ऐसी भावना होती है जिसकी कीमत समाज के लगभग हर व्यक्ति को चुकानी पड़ती है इसलिए इसकी स्थिति ज्यादा भयावह न हो या हानिकारक न साबित हो इसे समय रहते परिवर्तन करना अति आवश्यक है और यह समस्या सभी जगहों पर मौजूद है चाहे वो मानव अधिकार हो, मौलिक अधिकार हो, बच्चे के श्रम से हो, आदिवासियों के साथ भेदभाव का हो, विकलांगता का हो, नागरिक के स्वतंत्रता में हो, पर्यावरण का हो। ये सभी भारत में सबसे बड़ी समस्या है जिसका निराकरण हर संभव कशौटी पर अति शीघ्र होना चाहिए ।हमारा संविधान भी इस बात के लिए वचनबद्ध है की समाज के हर नागरिक को अवसर की समानता, अधिकार , स्वतंत्रता तथा उनकी अस्मिता की रक्षा देश के सभी नागरिकों को प्राप्त हो ,इसके लिए संविधान के मौलिक अधिकार वाले भाग 3 में विभिन्न उपबंधों 12 से 35 तक में दर्शाया गया है। लेखक ग्रैनविल ऑस्टिन ने अपनी कालजयी पुस्तक "द इंडियन कांस्टीट्यूशन - कॉर्नरस्टोनऑफ ए नेशन" इसका विवरण जमीनी तौर पर खुद को और भारतीय संविधान को रखकर किया है जिसे हम डाउन टू अर्थ भी कहते है में कहा है की - "राज्य नीति के निर्देशक सिद्धांत मानवतावादी को निर्धारित करती हैं और समाजवादी उपदेश जो भारतीय सामाजिक क्रांति भी लक्ष्य थे और है।" (Austin, 1966)

सामाजिक अन्याय से बचने का समाधान इंसान के अंदर ही होता है, हम सबको गरीबी की समस्या, पिछड़ेपन, सामाजिक न्याय की अभिव्यक्तियों से रूबरू होना पड़ेगा या होना चाहिए, जिनका उपयोग हम राज्य की संस्थाओं को इसपर काम करने या एक निराकरण के लिए महत्वपूर्ण कदम उठाने पर मना सकते है या विवश कर सकते है। हालांकि कभी कभी देखा गया है की सरकारी

तंत्र द्वारा किए गए सामाजिक न्याय को मिटाने का प्रयास भी समाज में कुछ अलग प्रकार के तनाव अवश्य फैला दिया है। सरकार ने विभिन्न प्रकार के कोशिशों जैसे की सब्सिडी के माध्यम से गरीबी उन्मुलन के प्रयास से, रोजगार सृजन के माध्यम से तथा लोकतांत्रिक ढांचे के अंदर रहकर आरक्षण मुहैया करा कर तथा इन सब योजनाओं पर काम करके लोगों की बुनियादी जरूरतों का पूरा करने का प्रयास अवश्य किया है और आगे भी होता रहे ऐसी स्थिति बना कर रखी गई है। इस सबका एक मात्र लक्ष्य है समाज के हर नागरिक तक सामाजिक न्याय की पहुंच हो सके ।देश के कार्यपालिका, न्यायपालिका तथा विधायिका सामाजिक न्याय प्राप्त करने के लिए जो महत्तवपूर्ण तत्व है उसमे कभी विफल तो कभी सफल अवश्य रही पर अभी तक पूर्णतः सफल नहीं हो पाई है ।और जहां तक रही बात समाजशास्त्रियों ~~की तो~~ उनका मुख्य कार्य ये होना चाहिए की वे समाज से जुड़े सभी समस्या के प्रति आम इंसान के बीच जागरूकता कार्यक्रम आयोजित करे या पैदा करें, उसके कारणों का पता लगाएं, विश्लेषण करें। सामाजिक समस्या के सिद्धांतो को बढ़ावा दे या विकसित करें और उनके और उनके परिणामों के समाधान के वैकल्पिक उपायों की समीक्षा करें, इस तरह के सामूहिक प्रयास से ही हम सामाजिक न्याय के लिए समाज में फैले सामाजिक अन्याय की सही स्थिति तक पहुंच कर समाधान कर पाएंगे। वैसे भी अब धीरे-धीरे यह स्पष्ट होता जा रहा है कि वर्तमान भारतीय नेतृत्व की कुशलता से हाशिए के समाज के बीच लगातार संवाद, समन्वय और निर्णय निर्माण में सहभागी बनाकर के देश की समृद्ध सामाजिक, आर्थिक, राजनीतिक तथा सांस्कृतिक चेतना और गतिशीलता के सामने अधिक समय तक हमारे यहां विद्यमान चुनौतियां टिक नहीं सकेगी और भारत को विश्व गुरु और आत्मनिर्भर बनने से कोई भी शक्ति नहीं रोक सकती।

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Chapter 11
Biofuels from Algae

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Abstract Microalgae have been a very promising and prominent source for the production of biomass, biofuel and bioenergy in the developing world. They can produce smaller land footprints while producing high yields in total and have the potential to use the land that is otherwise incapable of food production. Since microalgae are perennial and have good tolerance power against pH changes, these components are in high demand currently. In this chapter, we have mainly focused on the production of biohydrogen, biomethane and bioelectricity using microalgae as the main component with the mechanisms and the limitations faced during the process. This chapter also covers how microalgae are involved in the treatment of wastewater and biohydrogen production using dark fermentation.

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Biomethane is also one of the major biogases that are produced using the processes of methanogenesis and fermentation with the help of microalgae.

Keywords Microalgal biomass · Biofuel · Bioethanol · Biodiesel · Photobioreactor · Raceway pond

11.1 Introduction

Today energy is a major concern that determines the technological process and living standards of a society. So far, fossil fuels have played a crucial role in terms of energy utilization, but the production of these fossil fuels continues to deplete. Furthermore, these nonrenewable fuels are not sustainable, and moreover, excessive utilization of these fuels in recent years has caused global warming as a result of the release of greenhouse gases. Therefore, there is a pressing need to develop alternative fuels to tackle the ever-increasing global energy demand and also address the environmental issue.

Biofuels are thus known as the best alternative renewable fuels as they have the potential to replace the pollution-causing and exhausting fossil fuels in terms of energy security and environmental protection (Srivastava et al. 2020). Studies have shown that substituting the depleting fossil fuels with renewable biofuels such as biodiesel and bioethanol leads to a net reduction in greenhouse gases by 54% and 31%, respectively (Koh and Ghazoul 2008).Thus, research is now being focused on utilizing renewable sources such as microorganisms for the production of biofuels and making it a commercially viable process.

Of the microorganisms, algae have been recognized for an efficient production of various biofuels, i.e., bioethanol, biodiesel, biogas, biohydrogen, etc. Biofuels from algal biomass is a gainful option as they produce the primary metabolites (lipids, carbohydrates, proteins) via photosynthesis that are building blocks in algae. The carbohydrate content can be utilized for bioethanol production, while the lipid content can be transesterified to biodiesel (Srivastava et al. 2020). The algal biomass also yields biogas and biohydrogen after using suitable conversion technologies (Koller et al. 2012).

This chapter is thus an attempt to evaluate the different biofuels that can be obtained from algae and their economic and environmental impact on society by large.

11.2 Characteristics of Algae

Algae can be categorized into microalgae and macroalgae based on their structure. They are simple chlorophyll-containing eukaryotic, autotrophic organisms that use light for the process of photosynthesis. Algae can grow either photoautotrophically or photoheterotrophically. Photoautotrophic algae can convert the inorganic carbon dioxide present in the atmosphere into organic nutrients of carbohydrates. On the other hand, heterotrophic algae continue their development by making use of cheap organic carbon sources. Algae are classified according to size and shape, viz., macroalgae and microalgae. Microalgae are photosynthetic microorganisms. They can tolerate the harsh conditions with their unicellular and simple colony structures. *Spirulina*, *Chlorella*, and *Dunaliella* are examples of microalgae utilized for bioethanol production (Maia et al. 2020). Macroalgae/seaweeds are acclimatized to marine life and are habitually found in coastal areas. Macroalgae are classified as red seaweeds, brown seaweeds, and green seaweeds based on their pigment content (Özçimen and İnan 2015). *Laminaria*, *Undaria*, *Porphyra*, and *Gracilaria* are examples of macroalgae used for bioethanol production (Ramachandra and Hebbale 2020).

11.2.1 The Superiority of Algae Over Other Microorganisms for Biofuel Production

These algal-based fuels have numerous advantages over other microorganisms and plants in terms of their minimal growth requirements, viz., CO_2, nutrients, water, and sunlight for growth. The biggest benefit of utilizing these fast-growing algae is that they can sequester ten to fifty times more CO_2 compared to the slow-growing terrestrial plants thereby mitigating the impact of CO_2 on global warming. This trapped CO_2 is then fixed by algae to carbohydrates and lipids that can be used for the production of chemicals, biofuels, or food (Mondal et al. 2017).

Another lucrative factor for the production of biofuels from algae is that it can grow in wastewater and brackish/saline water which further eliminate the need for a freshwater medium (Park et al. 2011). Further, algae have low hemicellulose and no lignin in their structural components unlike terrestrial plants as they grow in water. Thus, it is easy to harvest the starch for bioethanol production. Also, in comparison to conventional feedstocks such as plants, algal production does not occupy agricultural lands, does not depend on seasons, does not require the application of any fertilizers for cultivation, and is, therefore, more sustainable (Sharma et al. 2018).

11.2.2 *Bioethanol*

Bioethanol fuel is obtained by fermentation of sugars by microorganisms such as yeast. Bioethanol-blended gasoline is an important eco-friendly alternative to neat gasoline. It provides higher thermal efficiency and improved brake power in a spark ignition (SI) engine. Bioethanol is oxygenated (35% oxygen) and supports combustion, thereby providing the potential to decrease emissions. Bioethanol is used in its pure form (E100 blend) and vaporizes at low temperatures with difficulty; hence, gasoline is typically mixed with a small amount of bioethanol to facilitate ignition. Thus, the E85 blend is the most commonly used gasoline-ethanol blend in motor vehicles. Besides, bioethanol has a high octane rating that allows high engine compression ratios, which enhances the engine's performance and consequently its efficiency (Verma et al. 2019).

11.2.2.1 Bioethanol Feedstocks

Bioethanol is a liquid biofuel that is usually obtained from the first generations' fuel feedstocks, viz., the edible sugary and starchy feedstocks such as sugarcane, corn, sugar beet, and the nonedible second-generation cellulosic feedstocks such as wheat straw and woodchips (Vohra et al. 2014).

The raw materials utilized for bioethanol production are differentiated based on chemical composition, viz., carbohydrate sources: (i) sugary raw materials (sugarcane, sugar beet, whey, sweet sorghum, molasses), (ii) starchy raw materials (grains such as wheat, corn, and root crops, e.g., cassava), and (iii) lignocellulosic raw materials (agricultural waste, straw, wood, and crop residues) (Bušić et al. 2018). Further, sugars from molasses, sugarcane, sugar beets, and fruits can directly be fermented to ethanol by using yeast. For producing sugar from starchy materials that are fermentable, few processes like milling, liquefaction, and saccharification are required. In the case of lignocellulosic materials, milling, pretreatment, and hydrolysis are vital (Vohra et al. 2014).

The advantages of first-generation feedstocks over the other generation feedstocks are low conversion cost and high yield of sugar (Özçimen and İnan 2015). However, the sugar and starch-based feedstocks contest with the food, thus influencing their supply. Thus, alternative non-feed-based second-generation feedstocks such as lignocellulosic biomass are explored. The challenge of using lignocellulosic biomass is that it requires expensive harvesting and pre-processing steps like pretreatment and hydrolysis to obtain the liquid biofuel (Balan 2014). Thus, it becomes pertinent to explore the algae that are grouped as third-generation feedstock for bioethanol production.

11.2.2.2 Algal Feedstock for Bioethanol Production

Ethanol produced from the algae depends on the fermentable algal polysaccharides that include sugar, starch, and cellulose. Macroalgae are preferred over microalgae for producing bioethanol. The carbohydrate content in macroalgae appears to be 25–50% (green algae), 30–60% (red algae), and 30–50% (brown algae). The cell wall of macroalgae is made up of cellulose and hemicelluloses that comprise 2–10% of dry weight. Further, when compared to microalgae, polymers like carrageenan (red algae), mannitol (brown algae), alginate (brown algae), and laminarin (brown algae) are abundantly occurring as structural components. Few macroalgae species have a high content of polysaccharides such as *Porphyra* (40–76%), *Ascophyllum* (42–70%), and *Palmaria* (38–74%) (Özçimen and İnan 2015). In microalgae, the carbohydrate content is up to 70% of the biomass. Microalgal cell walls are made up of inner and outer cell wall layers. The outer cell wall layer comprises polysaccharides, viz., agar, pectin, and alginate, whereas the inner cell wall layer comprises cellulose, hemicellulose, and starch inside the cell. Thus, bioethanol obtained from algae has substantial potential because of a higher rate of production (due to high photosynthetic efficiency), higher content of fermentable carbohydrates in biomass, and low percentage of lignin (which facilitates extraction of sugar) when compared to other terrestrial feedstocks (Maia et al. 2020).

11.2.2.3 Ethanol Production from Algal Biomass

The procedures for ethanol production from algal biomass involve harvesting where it is necessary to collect algal biomass from photobioreactors or open ponds. The next step includes dehydration for removal of up to 50% water content followed by extraction of by-product using different crushing/pretreatment techniques for the increased sugar concentration resulting in improved ethanol yield. The starch and cellulose are hydrolyzed by utilizing chemicals such as acids or enzymes like cellulases. This is followed by fermentation utilizing yeast such as *Saccharomyces cerevisiae* in fermenters. Distillation is carried out after fermentation to obtain ethanol from the fermentation broth by eliminating water and other components (Shalaby 2013).

11.2.2.4 Enzymes for Hydrolysis of Algal Biomass

The microalgae can be hydrolyzed by physical methods such as grinding, milling, and pyrolysis and chemical methods such as using acid/alkali or biologically by enzymes. Enzymatic hydrolysis by cellulase of cellulose is preferred as this process is highly specific and produces reducing sugars, e.g., glucose. The factors that are responsible for the hydrolysis process are the contents of hemicellulose or lignin, the crystallinity of cellulose, thickness of cell wall, the surface area of the substrate, porosity, mass transfer, etc. Since algae contain negligible hemicellulose and no lignin, so cellulase could be utilized to break the microalgal biomass (Noraini et al. 2014).

11.2.3 Biodiesel

Biodiesel is a liquid biofuel that is obtained by the transesterification of triglycerides of oils and fats. Biodiesel does not have sulfur and its performance is similar to petroleum diesel. Further, biodiesel reduces emissions such as particulate matter, carbon monoxide, hydrocarbons, and sulfur dioxide. However, emissions of oxides of nitrogen may be present in compression ignition engines (Mata et al. 2010).

11.2.3.1 Biodiesel Feedstocks

Depending on the origin of the oil sources (plant and animal), they are classified as (i) edible vegetable oils (soybeans, rapeseed, canola, safflower, coconut, groundnut, etc.), (ii) nonedible vegetable oils (jatropha, jojoba, mahua, karanj, etc.), and (iii) animal fats (lard, tallow, fish oil, poultry fat). Since edible vegetable oils have high production costs and there is a lacuna in the supply and demand of such oils, biodiesel is produced from nonedible vegetable oils and animal fats. However, the production of nonedible vegetable oils relies on the availability of the land for growing the crops, while animal fats have high saturated fatty acids and solidify at room temperature. Thus, biodiesel from other sources such as algae needs to be explored (Singh and Singh 2010).

11.2.3.2 Algal Feedstock for Biodiesel Production

Microalgal species are chosen over macroalgae for biodiesel production. The prokaryotic microalgae include *Cyanobacteria* (*Cyanophyceae*), while eukaryotic microalgae are diatoms (*Bacillariophyta*) and algae (*Chlorophyta*) (Mata et al. 2010). The average triglycerides/lipid content ranges from 1% to 70%; however, under certain stress conditions of deprivation of nutrients or high light intensity, some algal species can attain 90% of dry weight in its lipid content. High triglyceride content is usually found in eukaryotic algae than prokaryotic microalgae. The triglycerides occur in algal cells as storage compounds. Other kinds of lipids occurring in algae include phospholipids (lipids with fatty acids with a phosphate group on glycerol), glycolipids (lipids with fatty acids with a sugar molecule on glycerol), and sulfolipids (sulfate esters of glycolipids) (Mondal et al. 2017).

11.2.3.3 Production of Diesel from Algal Biomass

The procedures for diesel production involve harvesting algal biomass from photobioreactors or open ponds. Next, the biomass is processed by dewatering, thickening, filtering, and drying. Thereafter, the oil is extracted by cell disruption technique, followed by transesterification of the oil that yields biodiesel (Mata et al. 2010).

11.3 Supercritical Fluid Extraction of Oil from Algae

Conventional to extracting oil from algal biomass, solvent extraction is usually utilized as it is a rapid and efficient extraction process. The lipid content is directly separated from the dried/lyophilized biomass. Solvents such as methyl tert-butyl ether (MTBE), hexane, isopropanol, and ethanol are commonly used for the extraction of lipids as it gives the most precise lipidome profile and is less toxic. Supercritical fluid extraction (SFE) is an eco-friendly technology that replaces the conventional organic solvent extraction method. The physical properties of supercritical fluids are intermediate between a gas and a liquid. Due to this property, fast penetration of the fluid through cell matrices occurs, which gives a high yield of lipid in a short extraction time. The extraction ability of a supercritical fluid generally depends on its density that can be adjusted by varying the temperature and extraction pressure. The SFE operates at low temperatures, and during extraction, it protects the quality of algal lipid. Therefore, additional solvent processing can be minimized. Supercritical CO_2 extraction can extract lipid from microalgae at a large scale. This process is nontoxic and rapid and produces solvent-free lipids. However, this technique is expensive and requires high energy and therefore is less popular (Ranjith Kumar et al. 2015).

11.4 Bioreactors for Biofuel Production

The growth requirements of microalgae are supply of CO_2, light, organic salts, water, and suitable temperature conditions.

Temperature affects microalgal growth specifically cellular physiology and morphology. High temperatures accelerate the metabolic rates of microalgae, and microalgal growth is inhibited at lower temperatures. The optimum temperature for the growth varies from 15 to 26 °C (Kumar et al. 2011).

Vast microalgal species grow at neutral pH, whereas only a few marine algae grow at pH 8.0–8.4. With the increase in CO_2, biomass productivity with higher concentration can be obtained, and the pH of the media drops to 5.0 which impacts the physiology of the microalgae adversely (Kumar et al. 2011).

Light illumination is the energy source for the microalgae, and the intensity should be optimal for CO_2 fixation and growth of biomass. Light intensity plays as a limiting factor for the production of biomass if it is below the optimum level. Exposure of the microalgae to long duration and high intensity of light causes photoinhibition. Duration of low light intensity enhances growth, CO_2 assimilation, and also microalgal lipid productivity (Mondal et al. 2017). Microalgae have the efficiency to fix atmospheric CO_2 to soluble carbonates, e.g., $NaHCO_3$ and Na_2CO_3. Microalgae consume the CO_2 up to a certain level, and after a certain concentration, it tends to be detrimental to the growth of the cells. The environmental strain caused by the high CO_2 concentration results in a reduction in algal cells for CO_2 sequestration potential (Kumar et al. 2011). The release of O_2 by the microalgae is due to the splitting of water molecules during the process of photosynthesis. The O_2 trapped in the liquid growth media results in harmful effects of photobleaching that decreases the photosynthetic efficiency. Thus the degassing system is needed for the removal of O_2 (Mondal et al. 2017). The mixing rate is vital which affects the growth of microalgae. Proper mixing provides uniform distribution of nutrients and also proper distribution of light to all the cells. Low mixing rates hinder mass transfer in gases and cause settling of biomass, and anaerobic conditions are created. Also, high mixing rates can damage the microalgal cells due to the generation of shear forces. Apart from CO_2, other inorganic elements such as nitrogen are required. N_2 is a component of nucleic acids and proteins. When the growth medium lacks nitrate, discontinuous feeding of nitrates increases the microalgal growth. Under the condition of nitrate limitation, the metabolism of nitrogen in algae declines, which leads to the enhanced synthesis of non-nitrogen compounds. Further, protein synthesis is hindered as a result of insufficient nitrates, and also biomass production is decreased. But under such conditions, lipid concentration increases (Mondal et al. 2017).

11.5 Algal Cultivation Systems

Microalgae can be cultivated in open culture systems, viz., raceway ponds, and in closed culture systems like photobioreactors. The main differences between open and closed systems are in the mode of operation, viz., cooling and gas exchange; in the susceptibility to outside environment, e.g., rainwater and contamination by unwanted species; and on the expenditures for construction and operation of the systems (Jerney and Spilling 2020).

11.5.1 Open Ponds

Cultivation of microalgae in open ponds is in the form of large tanks which is the conventional method and widely used to grow algae at large scale and is relatively simple to operate, construct, and maintain and utilizes minimum energy for mixing the culture (Narala et al. 2016). This setup is inexpensive as old tanks can be utilized to grow microalgae. The types of open cultivation systems include shallow lagoons, circular central-pivot ponds, simply mixed ponds, natural ponds, thin layer cascade systems, and raceway ponds. The most commonly used ones are the raceway ponds (Borowitzka and Moheimani 2013).

11.5.2 Raceways

The raceways are characteristically made of concrete or can be constructed by digging onto the earth that is lined with a plastic liner to avoid the ground soaking up the liquid. Baffles in the channel optimize the space by guiding the flow around the bends. Mostly this system is operated in continuous mode. The fresh feed that contains nutrients (phosphorus, nitrogen, and inorganic salts) is introduced at the paddlewheel, and the algal broth is harvested behind the paddle wheel after completing the circulation through the loop (Singh and Sharma 2012).

The demerits of an open pond system are that they require large areas for scale-up and are affected by the culture conditions of the open ponds such as culturing temperature, the intensity of sunlight penetrating the pond which in turn depends on the depth of the water level of these ponds. Further, loss of water from evaporation cannot be prevented and the weather conditions could be unpredictable. Hence the production rate of algae is impacted due to the local environmental conditions. Moreover, they are unsuitable for commercial-scale cultivation because of the chances of contamination (Singh and Sharma 2012). Thus, biomass produced is variable and low. So, to overcome the drawbacks of an open pond cultivation system for large-scale microalgae production, closed cultivation systems are preferred.

11.5.3 Closed Ponds

Cultivation of microalgae in closed cultivation systems is also known as closed photobioreactors (PBRs). In these bioreactors, illuminating sources are introduced so that algae can grow to utilize this light. Bioreactors that intake CO_2 can use CO_2-rich gas for mixing and as a feed for algal growth. Agitation can be achieved mechanically/non-mechanically by bubbling CO_2-rich gas into the inlet of the photobioreactor. There is high mass transfer in the bioreactors, especially for CO_2 capture. Thus, CO_2 from the gaseous phase is directly transferred into the algae via the lipid phase, and so resistance to mass transfer is increased (Das 2015).

These bioreactors have high photosynthetic efficiency and higher biomass production as they are operated at controlled conditions and parameters. PBRs have many advantages over the open pond system in terms of controlling the physical environmental parameters. Also, PBRs are designed as well as optimized to suit the cultivation of the microalgal strain of choice. Further, this closed system uses little space and increases the accessibility of light. Here the chances of contamination are reduced, and thus higher and pure microalgal biomass can be obtained. However, PBRs have few disadvantages, for example, during operation, there is the issue of overheating, bio-fouling, and growth of benthic algae. Other problems are cleaning the bioreactor and the buildup of dissolved oxygen that results in the hindered growth of microalgae. Moreover, designing these bioreactors requires time and the costs of these bioreactors are high (Narala et al. 2016). The types of PBRs are tubular, flat panel, tank, and hybrid type PBR. Each has its pros and cons (Egbo et al. 2018).

11.5.4 Tubular PBR

These are cylindrical PBRs with high surface-area-to-volume ratios and have higher photosynthetic efficiency due to high lighting efficiencies.

According to the orientations, PBRs are classified into horizontal tubular and vertical tubular PBR (Egbo et al. 2018).

- **Horizontal tubular PBR:** These are set of loops of tubes connected parallelly and are placed horizontally. The shape of this bioreactor is advantageous as it offers maximum reception of sunlight when used outdoor thus facilitating photosynthetic efficiency. However, in this bioreactor, accumulation of O_2 leads to photobleaching that decreases photosynthetic efficiency as well as consumes more energy.
- **Vertical tubular PBR:** These are comprised of vertical tubes and are provided with external illumination. The mixing is facilitated by passing a mixture of air and CO_2 into the system, and the gas bubbles reach the free surface of the culture. Appropriate mixing can be achieved by sparging that helps in the mass transfer of the nutrients and the cells as well as prevents sedimentation of cells. Furthermore, sparging maintains the dark/light cycle movements in the photobioreactor. It affects the exchange of gases (dissolved oxygen and carbon dioxide) between the bioreactor and the atmosphere and thus prevents the building up of layers of culture.

Depending on the flow pattern inside the photobioreactor, vertical tubular PBR comprises of two types airlift and bubble column PBR (Egbo et al. 2018).

- **Bubble column PBR:** The structure of the bioreactor provides a high surface-area-to-volume ratio as the height of the bioreactor is more than double its diameter. Moreover, no additional structures are required for aeration. Also, there is the efficient release of O_2 and good heat and mass transfer. The mixing of culture and CO_2 is accomplished using spargers. But on the downside, in this bioreactor when the gas flow rate is ≤ 0.01 m s^{-1}, there is no circulation flow pattern due to the absence of back mixing. Further, there is the absence of internal light.

- **Airlift PBR:** The bioreactor is partitioned into two parallel regions: the "riser," which has the sparged region, and the "downcomer," which has the culture. The riser and the downcomer are connected at the top and bottom. The bubbles formed in the riser force the gas/liquid in the riser and downcomer to move in up and down directions and so creating a constant recirculation of fluid in the PBR. This fluid flow is due to the change in the average density between the riser and the downcomer that makes the pressure gradient needed for fluid circulation. Hence, this bioreactor provides high mass transfer, and proper mixing and good aeration are achieved. The algae can also be immobilized, and so the same algae can be utilized to obtain the biomass. But this setup is difficult to scale up due to its complexity.

Flat-Panel PBR
Flat-panel PBRs comprise transparent materials for carrying the culture and are illuminated externally by natural solar radiation or by artificial light sources, e.g., LEDs. It can be illuminated internally artificially. This method of cultivation system provides high illumination due to the large surface-area-to-volume ratio and can also be oriented to have more exposure to external light sources, e.g., solar radiation. The use of internal artificial illumination reduces the effect of self-shading in the process of microalgae multiplication. Mixing in modern flat-panel PBRs is done by aeration by passing gas mixture via a perforated air tubing into the microalgal culture (Singh and Sharma 2012).

Tank PBR
This photobioreactor can be of any shape, e.g., cuboidal, tubular, etc., and have a high volume-to-surface-area ratio. This ratio enhances the light attenuation while using this PBR for the production of microalgae outdoor and when using an external light source. In the case of internal illumination, this photobioreactor is promising as it has higher biomass output per land area (Egbo et al. 2018).

Hybrid PBR
A hybrid photobioreactor is a single photobioreactor that is made from a combination of two or more photobioreactor types. Since different photobioreactors have different challenges, a hybrid photobioreactor exploits the specific advantages of the component photobioreactors (Singh and Sharma 2012). Table 11.1 depicts the different hybrid PBRs.

11.6 Biogas from Algae

Even though liquid biofuels are mainly used for transportation, biogas, gaseous fuel is also applied as fuel in vehicles. Compared to fossil fuels and biomass solid fuels, biogas obtained through anaerobic digestion is an eco-friendly, renewable, and versatile fuel that reduces the greenhouse gas (GHG) emission thus producing less quantity of particulate matter and nitrous oxides. Biogas also has the advantage of

Table 11.1 Hybrid PBRs with advantages

Hybrid-type photobioreactor	Advantages	References
Integration of airlift tubular bioreactors with raceway ponds	Production of high microalgal biomass and elimination of contamination	Adesanya et al. (2014)
Integration of hybrid anaerobic baffled reactor (HABR) and photobioreactor (PBR)	High-rate anaerobic reactor remediates wastewater and requires low maintenance while PBR for high microalgal growth	Khalekuzzaman et al. (2019)
Integration of airlift system and stirred tanks	Improvement of gas mixture and light penetration	de Jesus and Maciel Filho (2017)
Integration of raceway ponds and horizontal tubular photobioreactor	Reinforces flash light effect and enhances microalgal biomass yield	Xu et al. (2020)
Integration of open thin-layer cascades (TLC) system with a semi-closed setup	Generation of high-density microalgal culture	Tan et al. (2020))

reducing de-vegetation and deforestation usually practiced to collect fuel sources. In agricultural operations, the digestate and residual solids derived from the anaerobic digestion act as good fertilizers improving the soil structure. The utilization of digestate also helps significantly in reducing the usage of chemical fertilizers (Wiley et al. 2011).

Organic residues from agriculture, sewage sludge, and industrial by-products are widely used to produce biogas through anaerobic digestion. In recent days along with these organic residues, whole biomass or lipid extracted microalgae and macroalgae are also employed in biogas production. The process of anaerobic digestion generally consists of four steps: hydrolysis, acidogenesis, acetogenesis, and methanogenesis, which leads to the production of biogas which could be used to generate electricity in combined heat and power plants. The first step consists of hydrolyzing complex biomolecules such as lipids, carbohydrates, and proteins to fatty acids and alcohol, sugars, and amino acids, respectively. In the second step, these simple organic molecules undergo acidogenesis to produce methanol, CO_2, H_2, and short-chain organic acids such as formic and acetic acid. Acetate is produced in the third step by the process of acetogenesis. In the final step, methanogens produce methane from acetate under strictly anaerobic conditions. The biogas majorly consists of methane and carbon dioxide along with trace amounts of hydrogen sulfide, ammonia, and water vapor (Uggetti et al. 2017).

Algal biomass employed in the generation of biogas has various benefits such as utilizing less energy, requiring low energy for operation, providing nutrient recycling, lesser sludge production, and the highest utilization of algal biomass. The algal residues obtained after the production of biofuels, viz. biodiesel, bioethanol, and hydrogen generation, could be employed for biomethanation (Saratale et al. 2018). The minerals present in the algae fulfill the nutrient requirements of the anaerobic microorganisms and stimulates methanogenesis. But the composition of biomolecules such as lipids, proteins, and carbohydrates present in algae significantly affects the process of algae digestion, and the composition of these biomolecules varies with algal species and growth conditions (Sialve et al. 2009).

Microalgae are the unicellular organisms with a cell wall that typically consists of hemicellulose and cellulose, and both of these macromolecules are of low biodegradability. Majorly studied microalgae for anaerobic digestion are *Chlorella sorokiniana, Spirulina maxima, Spirulina dunaliella, Scenedesmus obliquus, Dunaliella salina, Chlorella vulgaris, Euglena gracilis, Dunaliella tertiolecta*, and *Nannochloropsis oculata.* Macroalgae are having a similar structure to terrestrial plants with high cellulose and hemicellulose content. *Some of the macroalgal species reported in biogas production are Laminaria digitata, Saccharina altissimo, Laminaria hyperborean, Laminaria saccharina, Ascophyllum nodosum,* and *Macrocystis pyrifera.* They are highly crystalline and have the difficulty to undergo biodegradation during anaerobic digestion. In anaerobic digestion, the major rate-limiting step is the first step, i.e., hydrolysis of macromolecules present in algae, and reduces the methane productivity (Saratale et al. 2018). To address these challenges, pretreatment of algae is important to enhance the bioavailability of organic content for microbial hydrolysis; during anaerobic digestion, this reduces the hydraulic retention time and improves the formation of biogas. There are various pretreatment techniques with varying efficiencies which were reported in the literature, and they are mainly classified as physical, chemical, thermal, and biological methods (Montingelli et al. 2015).

Another important requirement in the biogas production through anaerobic digestion of algae is the reactor or digester, and these reactors are similar to the reactors used for other biomass materials. A model reactor must be protected from chemicals, UV light, and corrosive agents, and also it should avoid water and gas leaks. Proper insulation is necessary to maintain consistent biogas production during unfavorable environmental conditions. Reactors used differ in their size, design, materials of construction, mode of operation, reaction temperature, and total solid load. The fixed-dome reactor, floating-drum reactor, plastic biogas reactor, textile bioreactor, etc. are the generally used reactor configurations (Zabed et al. 2020). Major parameters that influence the biogas production through anaerobic digestion of algae are as follows (Jankowska et al. 2017).

Temperature The efficiency of methane production is significantly influenced by the temperature of the digester. An increase in temperature increases methane production as the temperature has a synergetic effect on the rate of metabolism of microorganisms involved in anaerobic digestion. As most of the algae grow in mesophilic temperature, high temperature also inhibits photosynthesis in microalgae.

Organic Loading Rate (OLR) and Hydraulic Retention Time (HTR) Methane yield enhances with an increase in the organic content of the microalgae, and long hydraulic retention time also favors this process. In general, the HTR varies between 30 and 50 days. The OLR and HTR can be maintained at the optimum levels based on the type of algae and their composition. **C/N ratio:** The carbon-to-nitrogen ratio plays an important role in anaerobic digestion, and generally it is ranged between 20 and 30. When the C/N is less than 20, excess ammonia will be released, and the accumulation of high ammonia content increases the pH which leads to toxicity towards methanogenic organisms. To avoid the inhibition of ammonia generally, the C/N ratio is increased by co-digesting algae with substrates such as sludge, food waste, oil greases, etc. (Saratale et al. 2018). In the case of a C/N ratio higher than 30, insufficient nitrogen content reduces the methane content because of the rapid consumption of nitrogen by methanogens to meet the protein demand for their growth.

pH and Alkalinity pH plays a crucial role in microbial activity during anaerobic digestion, and an optimum pH of 6.6–7.2 is required for the growth of microorganisms involved in methane production. The negative effects of pH beyond this range lead to the increased sulfide and ammonia toxicity in the digester. The high salt concentration generally in marine algae shows significant inhibition by causing dehydration of bacteria involved in anaerobic digestion leading to reduced growth and methane production. Imbalance in the alkalinity also results in the carbonate-bicarbonate equilibrium or the ammonia generation because of hydrolysis of protein.

11.7 Microalgal Fuel Cell

The remediation of wastewater and at the same time generation of bioelectricity has gained a lot of attention. Microalgal fuel cell employs sustainable microalgae for wastewater treatment and also a solution for desalination and carbon sequestration. These microalgae can use the different wastewater, viz., domestic, municipal, industrial, and agricultural wastewater, and absorb the nutrients and other toxic metals and render it useful for other purposes (Jaiswal et al. 2020).

Microbial fuel cells (MFCs) are biological and electrochemical systems that generate electricity by biocatalytic reactions in the presence of electrically active microorganisms. A typical MFC comprises of two compartments, i.e., an anodic chamber and a cathodic chamber separated by an ion exchange membrane. The respiring microbes at the anode oxidize the organic matter in the wastewater and produce mobile electrons that are transferred to the anode extracellularly. The electrons from the microbe can be transferred directly without mediators through the gradient occurring on the surface of microbes or carried with the aid of mediators. The electron flows to the cathodic terminal from the anodic terminal via the external circuit thereby completing the circuit that results in the generation of electricity. At the same time, protons that are also generated move through the ion exchange membrane and reach the cathodic chamber, where water is generated by the reduction of oxygen by the electrons. The oxygen is introduced at the cathode either by pumping (dual-chamber MFCs) or through direct contact of the cathode with air (single-chamber MFCs). The concentration of dissolved oxygen (DO) is important for the proper functioning of MFCs. Thus, microalgal MFCs are the

Table 11.2 Different wastewater treatments by algae and generation of electricity

Type of wastewater	Biocatalyst used	References
Dairy wastewater	*Shewanella* algae (MTCC-10608)	Choudhury et al. (2021)
Municipal wastewater	*Chlorella* biomass	Ma et al. (2017)
Fruit juice industry wastewater	*Chlorella vulgaris*	González et al. (2013)
Swine wastewater	*Chlorella vulgaris*	Li et al. (2021)
Effluent from kitchen waste	*Golenkinia* sp.	Hou et al. (2017)

cleanest form of energy generator where the by-product is only water. Further, these microalgae effectively remove chemical oxygen demand (COD), nitrogen, and also phosphorus (Arun et al. 2020). Table 11.2 depicts the different wastewater remediations by algae and also the production of electricity.

11.8 Economic and Environmental Aspects of Algal Biofuels

Commercial vehicles have combustion engines that function only on liquid fuels. Hence, changing to other substitute transport such as electric vehicles involves technological and monetary costs for the consumers. Hence moving to electric vehicles is not an economical substitute in the case of transportation. Moreover, there are liquid biofuels that are obtained from organic plant biomass that are a better substitute for petrol and diesel and also require minimum modification in the engine to run them. The biofuels of bio petrol/ethanol and biodiesel are derived from carbohydrates (sugars) and lipids (fats), respectively. These biofuels are renewable sources and also reduce net carbon emissions and have other socioeconomic incentives (Escobar et al. 2009). Biofuels account for the net decrease in greenhouse gas (GHG) emissions up to 90% in comparison to fossil fuels. However, excessive deforestation paves way for an increase in GHG emissions. Further, an increase in the global population leads to the limited availability of arable lands, also, to add to the excess water requirement for the production of these biofuels. So, conventional biofuels are unsustainable. Thus, algal biofuels are a lucrative alternative to solve this issue. The energy content of the bioethanol from macroalgae is 64% of the energy content of the biodiesel from microalgae. Hence, biodiesel has greater potential to become an alternative to fossil fuels.

In terms of financial viability, first- and second-generation biofuels rely on subsidies for commercial viability. For the time being, microalgal biodiesel is not competitive with fossil fuels. Due to their compact energy properties, these biofuels could be a good option as aviation fuels, and further researches are being conducted at a pilot level to scale up the production of biofuels for the aviation industry. Further, there is a scope for improvement in the method of cultivation, processing the algal biomass with the focus on dropping the capital costs by lowering cost in machinery particularly those that are designed for microalgae processing. Moreover, a significant decrease in costs can also be realized if CO_2, nutrients, and water are obtained at lower costs, or there is the prospect of recycling these raw materials within the production itself. Additionally, from algae, useful products can be obtained such as animal feed. Since lipid content in microalgae is around 30–50% (Yoo et al. 2015). Similarly, the carbohydrate content in the macroalgae is around 50–60% (Kraan 2013). The rest of the biomass can be utilized as a biofertilizer.

In terms of energy requirement, algae have significant energy requirements from the point of view of machinery and capital when compared to terrestrial plants. This leads to a net low energy return that is unsustainable. Further, comparing the open pond and PBR, the latter is more energy intensive as it incurs higher energy costs for cultivation.

In terms of net carbon benefits, commercial production of microalgae has positive net carbon emissions as this is achieved in a controlled environment when compared to the terrestrial planets. In addition to this, microalgal processing machinery requires electricity derived from fossil fuels. Thus, it counters the GHG capture profits.

In terms of nitrogen removal, cultivating microalgae in wastewaters rich in nitrates is profitable as microalgae require nitrogen for their growth. However, excess nitrogen can hamper the production of lipid in microalgae as lipid yield in microalgae increases in nitrogen starvation conditions.

In terms of socioeconomic paybacks, microalgal fuels provide lots of opportunities such as economic benefits to the urban and rural setup. Since conventional fossil fuels are finite, the microalgal biofuel industry seems to be a boon that can generate employment for people with different skill sets as it is usually required in the case of the conventional fossil fuel-based industry (Doshi et al. 2016).

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Ajay Kumar
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Recent Advances in Food Biotechnology

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He has more than 9 years of research and teaching experience in synthetic biology, metabolic engineering, microbiology, and industrial microbiology. He has published 76 articles, 40 chapters, 11 books and 2 patents. He serves as an associate editor, editorial board member and reviewer of a number of peer-reviewed journals. He is also a member of the Board of Study and Academic Council of Indrashil University and is the Member Secretary of Institutional Biosafety Committee (IBSC) in the same University.

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Recent Advances in Food Biotechnology pp 465–481

Control of Foodborne Pathogens Using Nanotechnology

Pankaj Kumar Tyagi, Shruti Tyagi, Vivek Srivastava, Deepak Gola, Arvind Arya & Nitin Chauhan

Chapter | First Online: 25 June 2022

Abstract

Nanotechnology applications are evident in all the major scientific fields including food processing and antimicrobial potential. Nanoscale compounds are being researched and used in the control of foodborne pathogens and increase the shelf life of food products. At the same time, the nanotechnology has showed the path toward the development of sensors for the monitoring of foodborne pathogens, biodegradable nanofilms and covering protect food products from pathogens. Further, the advancement in the field of food nanotechnology led to the development of novel food packaging applications. Contributions of

nanotechnologist in controlling foodborne pathogens and for both types of nanocomposites in the packaging, viz., biodegradable (polylactides, starch, protein, etc.) and non-biodegradable polymers, are addressed in this chapter.

Keywords

Foodborne pathogens **Toxin**

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3

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Removal Process of a Metal-Dye Mixture Using *Beauveria bassiana*

Deepak Gola, Pankaj Kumar Tyagi, Meenu Singh, Anushree Malik, Nitin Chauhan & Yamini Agarwal

Water Conservation Science and Engineering **7**, 613–621 (2022)

Abstract

Metals and dyes are the general concomitant pollutants of wastewater. In the present study, the cadmium and reactive orange uptake capacity of *Beauveria bassiana* were evaluated. It was observed that at 30 mgL^{-1} of cadmium concentration, up to 63% removal of cadmium was attained. As the concentration of cadmium increases from 30 to 100 mg L^{-1}, the removal percentage of cadmium decreases from 63 to 21%. Further, almost 100% removal was observed for reactive orange at 200 mgL^{-1}. However, a decrease in dye removal from 92 to 82% was noticed at 400 and 500 mgL^{-1} concentration of dye, respectively. When both metal and dye were present simultaneously, the removal efficacy of *B. bassiana* was decreased. At 20 mgL^{-1} (metal to dye—1:1),

maximum removal of reactive orange (100%) and cadmium (98%) was recorded. However, at 100 mgL^{-1}, 62% and 37% removal were obtained for reactive orange and cadmium, respectively. The effect of pH and temperature was studied at 40 mg L^{-1} (metal to dye—1:1) with temperatures ranging from 30 to 40 °C and pH ranging from 4 to 7. Maximum removal was obtained at a temperature of 30 °C and pH-7. Further, TEM-HAADF *B. bassiana* showed a uniform accumulation of cadmium inside the cytoplasm. Under control conditions (without metal), *B. bassiana* cells showed a well-defined cell membrane with intact cells, highlighting a clear demarcation of cytoplasm and cell organelles. The EDX analysis confirms the presence of cadmium inside *B. bassiana* cells.

Sl. No - 177 - Chapter

INDIAN WRITING IN ENGLISH

Insights, Interpretations and Illustrations

Edited by

Dr Sadhana Agrawal

Dr Bijender Singh

INDIAN WRITING IN ENGLISH

Insights, Interpretations and Illustrations

The appellation 'Indian Writing in English' foregrounds the idea of celebration of the Indian spirit in all the parameters of literature originally written in English. Despite the urge to shun conventional ways of tracing historical trajectory based on three formative phases — the 19th century colonial and reformist, the early 20th century nationalist, realist and progressive and the late 20th century modernist, postmodernist — the nuanced question of Independence has remained the abiding concern throughout. Pitted against the imperishable empire, writers of the colonial and nationalist phases endeavoured to uphold the spirit of Independence at the wake of the Orientalist/Anglicist debate by fostering continuity with the golden past while looking towards the liberal education and prestigious language of the West. The present anthology entitled *Indian Writing in English: Insights, Interpretations and Illustrations* is a comprehensive and erudite attempt at amalgamating a plethora of Indian Writings in English within its corpus. Sincere and dedicated efforts have been made to include 51 well-researched papers on 51 Indian writers without repetition within the purview of the book rendering it the status of the Bible of Indian Writing in English. The broad spectrum of the book is anticipated to enlighten the minds of the readers with a thorough vision on Indian Writing in English.

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Raja Rao's *Kanthapura:* A Tale of Gandhian Propaganda

Dr Yogesh Kumar Sharma

Indian Writing in English is not very old. It has a most recent history being only a hundred and fifty years old. For almost a thousand years, India remained a slave nation. The Mughals and the British ruled for almost a thousand years over India. Historically Indian literature can be divided into a few stages such as Indo-Anglian, Indo-English, Indian Writing in English and recent Indian English Writings. Diverse cultures, races, religions, languages, freedom struggles, etc. are reflected in Indian writings. Similarly, Indian authors and writings have many categories and followers.

There are some authors whose mother tongue is one of the languages of India. According to K. R. S. Iyengar, there are three types of Indian writers in India, "First, those who have acquired their entire education in English schools and universities. Second, Indians who have settled abroad, but are constantly in touch with the changing surroundings and traditions of their country of adoption. And finally, Indians who have acquired English as a second language" (qtd. in Hossain n. pag.). This made a large number of Indian creative writers present the true picture of India to western learners and readers through their writing.

Nationalism was the subject of many of Raja Rao's novels. When Raja Rao was writing *Kanthapura*, he saw people of Kanthapura participating in the freedom struggle for India with great enthusiasm and passion. At the time, the freedom struggle was at the peak and all accepted Gandhi as their unquestionable leader. So *Kanthapura* was deeply influenced by the teachings of Mahatma Gandhi. However, Raja Rao was almost trapped by the popular narrative of the struggle and Gandhian ideology. It is a chronicle of a nationwide struggle through the viewing of a Karnataka citizen. Critics believe that Raja Rao's *Kanthapura* is the first major novel in

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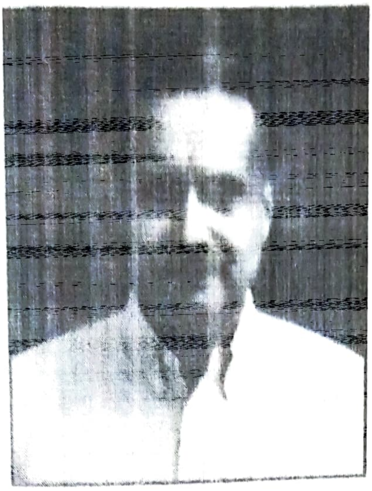

Short Biography-

Prof Yogesh Kumar Sharma is a poet, story writer, essayist, blogger and an author. Prof Yogesh Kunmar Sharma (M.A, MPhil, PhD.) is presently working as Professor in Swami Shraddhanand College, (University of Delhi), Alipur, Delhi-110036. He was also Associate NCC Officer (ANO) in his college.

His early education was held at Khurja and higher education, (M.A., M.Phil., Ph.D.) at Institute of Advanced Studies, Meerut University Meerut, U. P., INDIA. His research work "Influence of The Bhagawad Gita "on Matthew Arnold is considered as outstanding scholarly work in literary circles. Prof Yogesh Kumar Sharma has published several articles on a number of authors and subjects. His articles and poems on different topics have found place in a number of newspapers, magazines and journals. He has written many poems (more than 700), short stories (around 50), articles and essays (200) on different aspects of society concerning day to day life of the people. His poems are very sharp but honest satire on society. As a poet he has authored a book *VOICES. DHAROHAR: THE GLORY OF THE NORTH-EAST* is another book written by him, based on travelogue.

His poems and articles are widely published in journals, newspapers and anthologies in India and abroad. He believes in realism. His poems are far away from the flight of fantasy and imagination. Sometime he is very bitter and sarcastic but this is to give realism to his writing. He is very close to realism of life, society and world in his poems. He believes in universal brotherhood. He loves humanity, social justice, secularism, women's' empowerment and nature.

CELEBRATING POVERTY

With sound high I come, with my agenda and my manifesto,
I celebrate poverty for usual victors only,
I shout poverty-poverty for dead and defeated persons.
A defeated man's thoughts of schools,
A defeated man enjoying freebies and never-ending rest,
Blooms with life itself, cannot have.

Now I know the masses and the leaders;
And these I observe these begging eyes,
Those fables of mystic voyages are all meaningless.
Villas equipped with an immoral wealth
Sailing to the bottomless dark seas
Marching on the soul's cruise.

Lots of aimless boys and girls, herding in schools and colleges
Learning erroneous education, bunking classes.
Missionaries and Maulanas making fast bucks.
And you India creating a fake Utopia ;
Crying the real reckoning for her lot,
The shadows of your future, evil and evil.

Flow, Flow the finest wind of Democracy,
Value thy beauty, 'tis not the freebies only
The Duty and sacrifice are also amassing in thee.
Thou embrace freeloaders alone,
Not of suckers contingent alone,
Nation floats on morals and character.

A nation is built by merit and honesty;
With her Time tours with pride
With all her ancient scriptures, martyrs, heroes.
Fought wars, thou bearest the many crowns
The message of love and compassion;
Seers bless her with divine hands and sparkling eyes.

O countrymen, thou carries priestly nation sails with thee
And great sagely India sails with thee

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Insights, Interpretations and Illustrations

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Contents

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Advaita Kala's *Almost Single*: A Study of Choices and Voices

Dr Saroj Bala

Feminism has been in a state of flux from the beginning. Any one definition cannot define this term. As the society changes in view of socio-cultural transformation, feminist issues also change. The issues that touch the lives of women at a particular time become central to the feminist struggle. Inequality based on gender has been problematised and opposed in many ways by women. These inequalities are reflected in almost all aspects of life of a woman — birth, education, marriage, birth-control, protection, etc. The bases of these lie in the social structures and traditions controlled by patriarchy. Life and work of a woman are defined not by herself but by the male members of her family. Her existence is supposed to revolve around other members of the family, to cater to their needs whereas man, being the primary, is the provider. This extends his control over other members of the family, especially women and children as natural. The struggle of women has been to break these social restrictions and find the avenues of their own growth. Initially, starting with the opposition of social restrictions in education, career choices, their roles within the institution of marriage, the feminist struggle and resistance against oppressive forces has assumed a different and unique direction in the present times. Negotiating her role within and outside family, claiming her share of public spaces, socio-political roles — the feminist idea is exploring once tabooed areas like sexuality, preferences, making unconventional career choices, having her say in matrimonial alliance, breaking the acceptable female body stereotypes. Advaita Kala in *Almost Single* negotiates all these social stereotypes associated with women and provides an alternative way of life for women. A detailed reading of the book implies affirmation of the changed choices whereas apparently there seems to be an opposition to these. Let us try to understand how the women characters chart out a different set of choices to give a viable alternative, while negating the designated role as women under social and cultural constructs. A critical reading of the novel helps us understand the various reasons to feel and do so. It draws a parallel between the traditional socio-cultural norms and the changed stance of women in the present times regarding their views on choices in marriage and otherwise.

Almost Single is set around upper middle class educated people in urban settings where marriage of eligible daughters seems to be the all-important aim of life. Settling down in marriage is considered to be the password for all kinds of security and status — social, financial, physical. While looking for matches, Kala shows how her characters perceive a marital bond and what kind of life they aspire for themselves in that alliance. There is constant debate between the gender based socio-cultural norms and alternative discourse about this. The parents of the three friends, namely Aisha, Anushka and Misha are busy finding suitable grooms for them. They keep reminding their daughters that it is important to settle down in marriage at the appropriate age. Each marriage around her keeps mounting the social pressure on them to follow the tradition. Aisha comments, "Misha's one and only ambition is to net the perfect NRI…It is in this pursuit that she moved from Bhatinda to New Delhi" (5). Also, when her mother breaks the news of Deepak, her neighbour, getting married, Aisha comments, "Every aunty worth her salt and with an eligible daughter in tow has been eyeing him since puberty…." (12). It reminds us of the pursuit of Mrs Bennet to find rich and handsome boys for her daughters in *Pride and Prejudice*. When Aisha asks if he still looks the same as earlier about his looks, her mother answers, "Beta, when it comes to boys like that, who looks at the face…. Money does conquer all" (12). But at the same time a woman has to fit into a physical frame as desired by prospective grooms. A woman has to fit into socially acceptable physical parameters like complexion, height, etc. But Aisha pushes these boundaries. Through her, the writer presents views on the institution of marriage and its purpose. Is it to look for a compatible, mutually respecting relationship beyond measured 'give and take' or just follow the traditional role set for women by the patriarchal hegemony? Is it OKay to accept the subjugation or do we have other options that present us with a more dignified way of life? Women in the novel explore these options. The writer presents insight into the thought process of women regarding the institution of marriage and brings out many perspectives on the same. Let us try to understand the changing dynamics of relationships in marriage and outside it.

It is interesting to note that a reverse reading of the novel — reading against the grain — shows that women in marital bonds actually long for the standing in the sun in all his morning glory. The flash of white was the towel he discarded while staring out into the garden, stark naked ...This is his space and I am the intruder" (28). Later, there is a chance meeting with Karan, who accompanied Anuj to club 'Tao' where Aisha was also present with her friends Ric and Nic. When Karan comes face to face with Aisha, he comments, "Must you insist on stripping me with your eyes?" (52). Aisha denies this vehemently and was thinking of apologising but he again says, "Actually, I love being objectified. And thinking of all the wicked ways in which you want to have your way with me..." (53). Though, there appears to be a female gaze but it is Karan who actually seems to enjoy this. The episode brings up a question, as has been raised by Eva-Maria Jacobsson in her essay "A Female Gaze?" whether we could see a reversed definition of the male gaze? Is there a female gaze? Though, there might be many perspectives, it is noteworthy that the areas associated with men have been discussed overtly rather than in a veiled manner.

Thus, we see that the writer provides an alternative discourse to the traditional socio-cultural traditions to appropriate the status of women in marriage. Not only this, women characters make conscious choices and do not hesitate to assert these. The consciousness about themselves as an individual empowers them to voice their opinions about almost everything that has an impact on them. There is complete rejection of the status of subordination in marriage. It is to be based on mutual liking and respect rather than on one's exterior beauty. Two different views about marriage presented before the readers help them to weigh and find a sustainable and viable option irrespective of all the social pressures. Marriage should not be about just two people living under one roof where one finds accepting everything in absence of any alternative. This alternative is presented by women themselves by way of rejecting their stereotype images. They emerge as thinking beings who take charge of their lives. From accepting their appropriation by others in patriarchal hegemony to questioning the supremacy of men over women; from rejecting the socially and traditionally acceptable role of women to raising registering their views and choices; women have successfully carved a niche for themselves on their own terms.

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Kuhu Sharma Chanana

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To

My Mother,
Late Dr. Susheela Sharma

and

My Uncle,
Shri Hira Lal Sharma

the two Purest Souls
I have ever encountered

Contents

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Kuhu Sharma Chanana

रामकथा के विविध आयाम

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अनुक्रमणिका

6

The Plants of Ramayana

Kiran Bala*

Abstract

The ancient Sanskrit texts are a veritable treasure house of information on the botany of the ancient period. They reveal the deep ties that the ancients had with nature. Ancient Indians felt a deep sense of identity with nature and were aware of the ecological balance found in nature. In this context, Ramayana is the most important source of botanical information. It contains an extensive list of plants and their specific geographical location. The Ramayana discusses the geographical distribution, botanical wealth and forestry. It covers the plants and forests of the region on the other side of the river Ganga. The plants which are mentioned have medicinal value, besides being sacred and with a utilitarian purpose. In this review, attempts have made to list out the plants mentioned in the Ramayana with their, uses in general. With the help of the slokas of the Ramayana, we can identify specific species and the regions to which they belong, which will be a great boon in the writing about medicinal plants

Keywords: Medicinal plants, Herb and Ramayana.

INTRODUCTION

Ramayana, the oldest epic and one of the two great works of Sanskrit literature along with the Mahabharata explores human values and the

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Chapter 4
Microbial Fertilizer as an Alternative to Chemical Fertilizer in Modern Agriculture

Kiran Bala

Abstract The continuous decline of earth's natural resources and increased use of harmful chemical fertilizers pose a great threat to the health of soil. Exploitation of microbes as biofertilizers are considered to some extent an alternative of chemical fertilizers. Many promising species of bacteria, algae, fungi have fertilizer-like activities and are beneficial in agricultural sector. They have extensive potentiality in enhancing crop production, food safety and maintaining long-term soil fertility which is essential for meeting global food demand. Microbes interact with the crop plants and enhance their immunity, development and yield. Many essential nutrients are required for the proper growth of crops, which is present in insoluble form. Microbes by their action convert them in useable form. Different types of biofertilizers and advancement in the field of microfertilizers are discussed in this chapter. Microbial fertilizers are not only cost-effective, nontoxic and eco-friendly but also serve a good substitute for expensive and harmful chemical fertilizers. The aim of this chapter is to discuss microfertilizers' important roles, pros and cons of the techniques and their advancement.

Keywords Biofertilizers · Sustainable agriculture · Chemical fertilizers · Encapsulation · Lyophilization · Nanoencapsulation · Biofilm microbial fertilizers · Nanobiofertilizer

4.1 Introduction

Conventional agriculture has an important role in fulfilling the food demands of a growing human population, which has also led to an increasing dependence on chemical fertilizers and pesticides (Subha Rao 2015). Chemical fertilizers are industrially synthesized with substances composed of known quantities of nitrogen, phosphorus, potassium and their exploitation causes air and groundwater pollution

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डॉ. निशंक के साहित्य में सामाजिक यथार्थ एवं युगबोध

संपादक

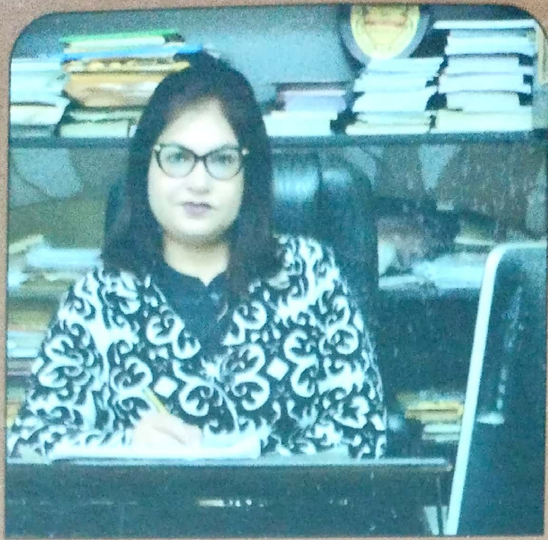
डॉ. किरण खन्ना

निशंक : कथा सृजन में पर्वतीय परिवेश

डॉ. कमलेश सरीन

रमेश पोखरियाल 'निशंक' एक सहज और सरल कहानीकार हैं। इनकी कहानियां पहाड़ी जनजीवन को लेकर रची गई हैं जो ऐसी प्रतीत होती हैं मानो हमारे बीच के लोगों पर घटित हुई हैं। इनकी कहानियां चित्रवत् हैं तथा पहाड़ के विभिन्न रीति-रिवाजों, परंपराओं और संस्कृतियों को अपने में समेटी हुई हैं। इनकी कहानियां संवेदनात्मक भी हैं जो पहाड़ी लोगों के अंतरात्मा को मुखरित करती हैं। इनकी कहानियों में इनके पर्वतीय जीवन की प्रतिच्छाया भी दृष्टिगोचर होती है जो यह बतलाती हैं कि लेखक इन्हीं पर्वतीय परिवेश में रचा बसा है जिसे पर्वतीय प्रदेश की संस्कृतियों ने संवारा है, पर्वतीय संस्कारों ने पाला है और मान्यताओं ने सींचा है।

पहाड़ी जन-जीवन कैसा होता है? वहां किस तरह की समस्याएं होती हैं? लोगों के मनोभाव कैसे होते हैं? उनके विचार कैसे होते हैं? उनकी शिक्षाएं क्या होती हैं? उनका जमीन से जुड़ाव कैसा होता है? वह अपने परिवेश में किस प्रकार से रहना पसंद करते हैं? और उससे बढ़कर जब कोई पहाड़ी परिवेश का व्यक्ति रोजगार की तलाश में महानगरों में भटकता है तो उसे किन परिस्थितियों का सामना करना पड़ता है? इत्यादि जैसे सभी प्रश्नों का सरल उत्तर हमें 'निशंक' जी की कहानियों से प्राप्त हो जाता है। 'निशंक' जी पहाड़ी जनजीवन के तह तक जाते हैं और उनके जीवन की गुत्थियों को सुलझाते हुए कई समाधान भी प्रस्तुत करते हैं। वो एक ऐसे कथाकार हैं जो केवल समस्याओं को उठाते ही नहीं अपितु उसका समाधान भी पूरी स्पष्टता के साथ प्रस्तुत करते हैं।



डॉ. किरण खन्ना

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राष्ट्रीय एवं अंतर्राष्ट्रीय स्तर की प्रतिष्ठित पत्र-पत्रिकाओं में निरन्तर प्रकाशन।

सक्रियता : पत्रकारिता में विशेष रुचि

राज्य/राष्ट्रीय/स्तरीय संस्थानों/अन्तर्राष्ट्रीय आभासी संगोष्ठियों में 'मुख्य वक्ता, मुख्यातिथि और मुख्यनिर्णायक के रूप में सहभागिता।

अंतराष्ट्रीय टीवी चैनल डी. डी. वन से प्रमुख साहित्यिक कार्यक्रम 'बोलते शब्द' में सक्रिय सहभागिता।

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विषय पर सात दिवसीय संकाय संवर्धन कार्यक्रम का राष्ट्रीय/अन्तर्राष्ट्रीय प्रतिष्ठित वक्ताओं के साथ सफलतम आयोजन।

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CONTENT

5

Proto Socio-Religious Outlook: Role in the Past Knowledge for Enlightenment

Ranjan Kumar[1]

Abstract

Source of history carry authentic information of the past. There are primary sources and secondary sources which includes artefacts, archaeological evidences, coins, and literary sources. All these helps us to get close to past as they provide us knowledge of the past. There are regions and traditions where history was documented very late or were kept in oral pattern for very long time. It is always difficult to derive exact history from such source as it has also been criticized for unreliability, imaginative structure, biases, and manipulative construct. But for the knowledge of past of those regions and socio-religious outlooks which were documented late, it is very important to rely on such sources. The biggest strength of Such source is that it is being told from word of mouth and it is carried from generation to generation. It is also considered as a unique insight into the formation of popular consciousness.

Introduction

In the West, oral traditions are gradually withering away. However, in the Indian context, there are many areas where we must rely mainly on oral history. Indian civilization is a unique example of continuity and change where the whole process of historical development with all the colours of all the periods and ages of history are still alive. Thus, the Indian historians have different type of oral sources to complement and supplement or to contrast and juxtapose the written sources. Oral sources, if utilized in a critical manner, may embellish the concept, methodology, and scope of history. It increases the possibility of history of the people and history for the people.

Since, the history was basically written for the ruling or the aristocracy class which gives an understanding of the past from above and it hardly talks about the history of the lower strata. There is a massive need of history writing pertaining to local areas. The knowledge of the local people is acquired through qualitative research. The indigenous knowledge is transferred from one generation to another. The knowledge is gradually being suppressed and eliminated because of west centric knowledge. Because of it, the indigenous knowledge is marginalised which will even vanish after sometime. Similar is the situation of the knowledge of spiritual and religious past. The hagiographical literature of this region is considered as an important source to understand the socio-religious outlook. Beneath these literatures there were several proto socio-religious outlooks that exercised a profound impact on people at lower level. In process to study these proto socio-religious outlook or the covered aspiration, one must depend upon the oral history available in its surroundings. By oral history we mean the reconstruction of the past mainly on the basis of oral sources, which include oral traditions, folklores and interviews. In Bengal and Santhal Pargana, there are many communities which are still unheard, but they carry their history with them. To get the idea and knowledge of their past we must rely mainly on the oral tradition that they have followed.

There is rise of study pertaining to local areas. The knowledge of local people is acquired through qualitative research. The indigenous knowledge is transferred from one generation to other. This knowledge is gradually being suppressed and eliminated because of West centric knowledge.

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शिक्षा, शिक्षक एवं शिक्षार्थी त्रिध्रुर्वी प्रक्रिया का बृहद अवलोकन राष्ट्रीय शिक्षा नीति 2020 के सन्दर्भ में

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7

NEP 2020 – A STEP TOWARDS QUALITY EDUCATORS

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ABSTRACT

The release of National Education Policy in July 2020 after a gap of almost three decades, has brought about a critical review of existing policies. It has exposed significant gaps in implementation of policy provisions and limited trainingopportunities for educators. It calls for a complete structural revamping of education sector in India.

NEP-2020 encompasses radical changes in the education system, its foundational principles, and its operationalization in the country. Teachers being the most important component of a learning environment must possess desired attributes that contributes towards nation-building. Educators must keep themselves abreast with latest developments in the area of education and learning. The NEP 2020 policy documentexhorts, - 'Teachers truly shape the future of our children – and, therefore, the future of our nation". Teachers must play the most important role in nation-building by shaping young minds into skilled and self-righteous citizens who will fulfil their duties towards the nation.

The present conceptual paper enumerates various policy level initiatives for ensuring that talented workforce is motivated into joining the profession of school teaching.

Keywords: *Teacher Education, NEP 2020, Pedagogy*

The National Education Policy recognises and identifies teachers and facilitators at the center of learning process. NEP 2020 seeks toempower teachersand enumerates

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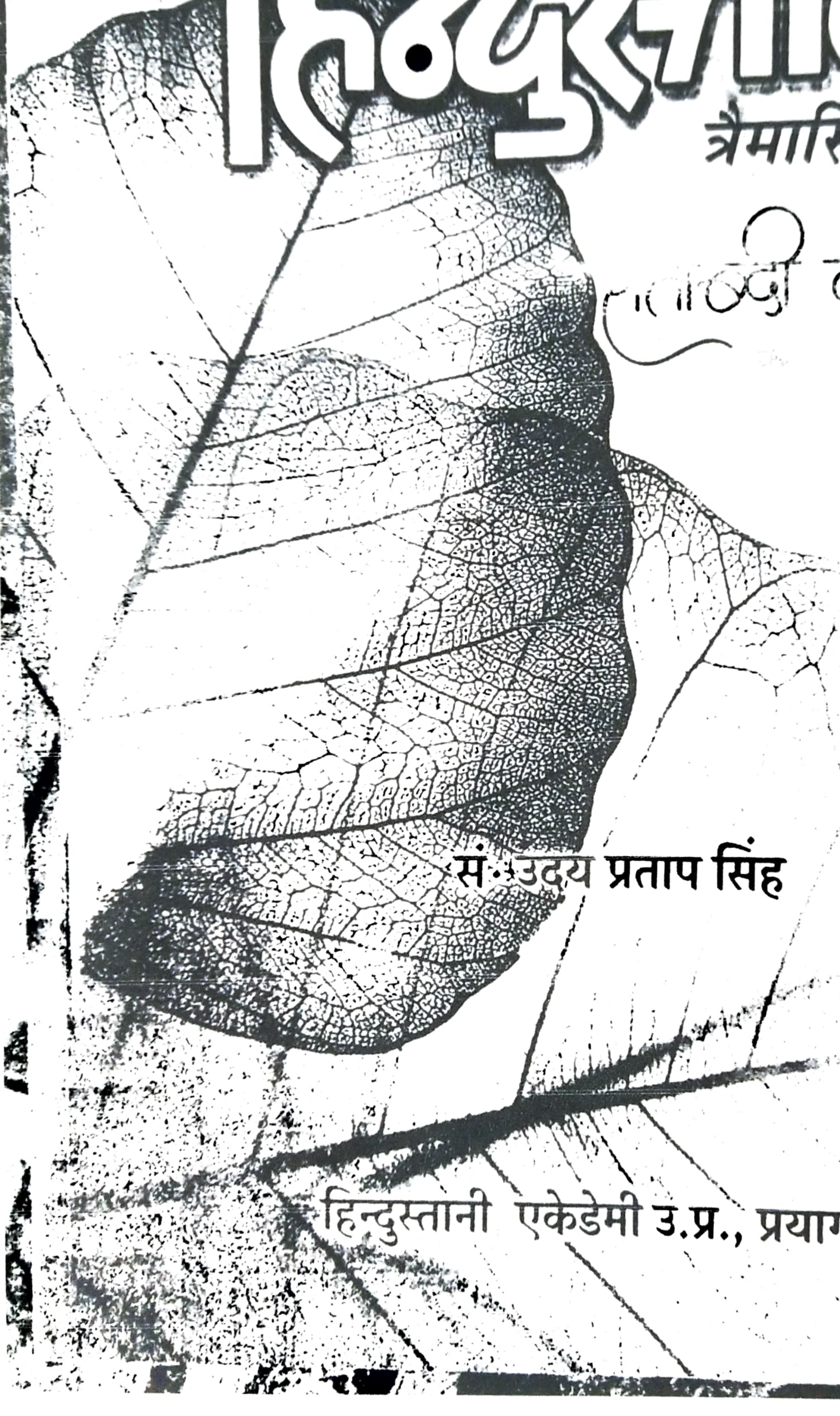

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राम, रामकथा और रामनगर की रामलीला को अभिव्यक्त करती कृति

प्रतिभा राणा

भारतीय संस्कृति के आधार श्रीराम हैं और उन्हीं की कथा 'रामकथा' है; वही कथा जब लोक रंगमंच से मिलती है तो 'रामलीला' बन जाती है। यही रामलीला जब रामनगर की प्राचीन वैशिष्ट्यपूर्ण शैली के साथ प्रस्तुत होती है तो विश्वप्रसिद्ध 'रामनगर की रामलीला' कहलाती है। रामनगर की इसी रामलीला और उसकी विशिष्टता को लेकर हिन्दुस्तानी एकेडेमी प्रयागराज से प्रकाशित डॉ. अवंतिका सिंह की महत्वपूर्ण पुस्तक '**रामनगर की रामलीला और उसका नाट्यालेख**' (प्रथम संस्करण 2019) प्रकाशित हुई है। वैसे तो रामलीला और उसकी प्रदर्शन शैली को लेकर समय-समय पर बहुत कुछ लिखा जा चुका है,रामनगर को केंद्रित करते हुए भी कुछ लेख पारम्परिक लोकमंच की पुस्तकों और पत्रिकाओं में मिल जाते हैं। लेकिन केवल रामनगर की प्राचीन लोकरंगमंच परम्परा को आधार बनाकर लिखी गई सम्भवत: यह पहली पुस्तक है। इसमें रामनगर और अयोध्या की समृद्ध लोकपरम्परा का आलोचनात्मक विश्लेषण पुस्तक और उसकी उपयोगिता को रेखांकित करता है। इस सन्दर्भ में इसकी लेखिका डॉ. अवंतिका सिंह की दृष्टि स्पष्ट है–"विश्वप्रसिद्ध 'रामनगर की रामलीला' की रामलीला पर अनेक देशी-विदेशी विद्वानों ने अपने विचार व्यक्त किये हैं,लेकिन यहाँ मंचित की जाने वाली रामलीला के 'नाट्यालेख' पर बहुत कम चर्चा हुई है।पुस्तक लिखते समय 'रामनगर की रामलीला और उसका नाट्यालेख' को महत्व देते हुए अछूते पहलुओं और समुचित पाठ पर विशेष ध्यान दिया गया है।" (आत्मकथ्य)

चार अध्यायों में विभक्त इस पुस्तक में लोकनाट्य शैली, रामलीला, उसकी संवाद योजना और नाट्यालेख को रामनगर के परिप्रेक्ष्य में समग्रता से विचार किया गया है। इसके प्रथम अध्याय का शीर्षक है *'लोकनाट्य शैलियाँ और रामनगर की रामलीला'* जिसमें रामलीला के साथ-साथ *अन्य परम्परागत लोकनाट्य शैलियों यथा*–रासलीला, नौटंकी (उत्तर प्रदेश), करियाला (हिमाचल प्रदेश), सांग (हरियाणा), ख्याल, गवरी, रास (राजस्थान/गुजरात), माच, पंडवानी, नाचा (छत्तीसगढ़/ मध्यप्रदेश), कीर्तनिया नाट, विदापत नाच, बिदेसिया (बिहार), छिताई-कथा (बुन्देलखंड) पर चर्चा है। जो भारतीय लोकनाट्य शैली विशेषकर उत्तर भारत की समृद्ध लोकनाट्य परंपरा की सूचक है। इन सभी लोकनाट्यों के संक्षिप्त परिचय द्वारा लेखिका ने भारत के सर्वाधिक लोकप्रिय लोकरंगमंच 'रामलीला' के परिपेक्ष्य में 'रामनगर की रामलीला' को केंद्र में रखा है।जैसाकि विदित है यहाँ की रामलीला के दर्शकों/प्रेक्षकों की संख्या बहुत है। रामनगर में एक ही स्थान पर मंच नहीं होता बल्कि पूरा नगर इस रामलीला से सरोबार हो रंगा होता है। पुस्तक के प्रथम अध्याय में इस पर विस्तार से चर्चा है। यहाँ लेखिका अयोध्या और रामनगर की रामलीला का तार्किक तुलनात्मक अध्ययन भी किया है जिसमें रामनगर और अयोध्या की रामलीला में अन्तर, उनकी उत्पति, प्रदर्शन शैली, दोनों क्षेत्रों की रामलीला के कथानक और कथ्य के स्तर पर दोनों क्षेत्रों की रामलीला में अंतर लोकशैली की विविधता को समझने में उपयोगी सिद्ध होगा। इनके साथ रामनगर और अयोध्या की रामलीला को लेखिका डॉ. अवंतिका सिंह ने अन्य कोणों से भी गहराई से जाँचा है। जैसे यहाँ के व्यास और रामायणी दल और मंच का अचल एवं सचल रूप तथा इन दोनों नगरों की शैली पर पारसी प्रभाव। पारसी रंगमंच बेशक पैसा कमाने के मूल उद्देश्य को लेकर आगे बढ़ा लेकिन लोक को, लोकरुचि को यह उपेक्षित नहीं कर पाया। लेखिका भी रामलीलाओं पर पारसी प्रभाव को

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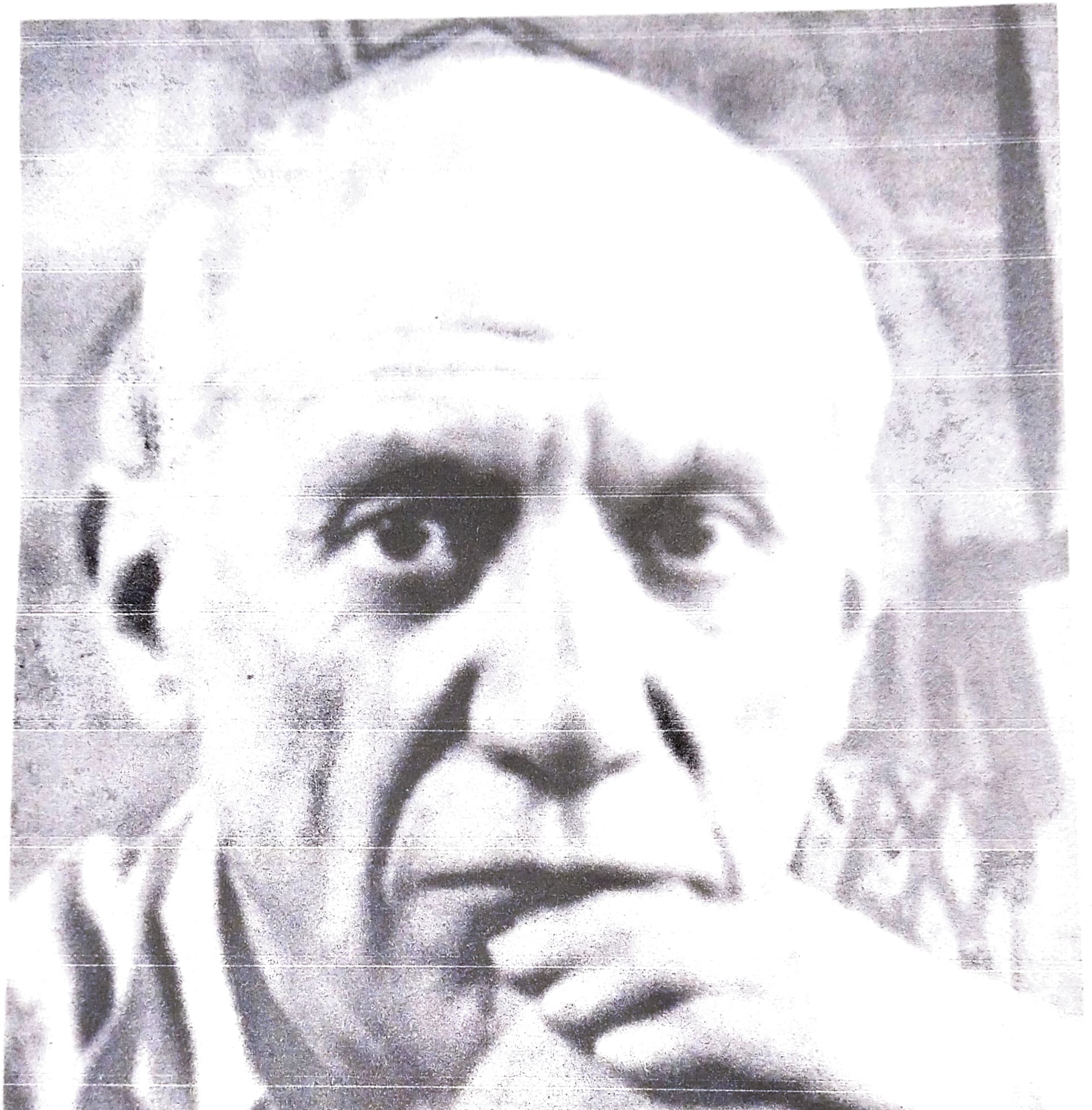

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क्रम

पहली तरफ से 'दूसरी तरफ' की तरफदारी करता नाटक

❑ डॉ. प्रतिभा राणा

वीरेन्द्र : तुम्हें कानून को कबाड़ की तरह खरीदने और बेचने से रोकना है।

बीजी : देश जनता का है, कबाड़ियों का नहीं। (पृ. 73)

अभी हाल में ही डॉ. सुरेश धींगड़ा का नवीनतम नाटक 'दूसरी तरफ' पढ़ने को मिला। इसे तमाम विसंगतियों के बीच संभावनाओं की तलाश का नाटक कहा जा सकता है। ये संभावनाएँ भ्रष्टाचार से ईमानदारी, झूठ के जाल से सच्चाई की लौ, महज जनता से जागरूक जनता और लोकतंत्र के चौथे स्तम्भ मानी जाने वाली पत्रकारिता के सामाजिक दायित्व तक फैली हैं।

डॉ. धींगड़ा एक सक्रिय चिंतक एवं लेखक हैं, जो साहित्य की विविध विधाओं में लगातार कुछ-न-कुछ लिखते रहते हैं। उनकी इस सृजनात्मक सक्रियता का फैलाव राजधानी दिल्ली से लेकर दूर हिमाचल प्रदेश में बसे खूबसूरत शहर पालमपुर तक पसरा है। सम्भवतः नाटककार के रूप में 'दूसरी तरफ' उनका पहला मौलिक नाटक है, लेकिन इसमें चिह्नित चिंतन में परिपक्वता साफ दृष्टिगत होती है। स्वयं लेखक के शब्दों में—"जब समाज में ऐसी स्थितियाँ पैदा होती हैं, जिनसे सामाजिक ढाँचा चरमराने की आशंका होने लगती है, तब दिशा में परिवर्तन अनिवार्य हो जाता है। 'दूसरी तरफ' नाटक ऐसी ही स्थितियों की ओर इशारा करता है। यह राजनीति में नैतिकता के ह्रास, पूँजीपतियों द्वारा राजनीतिक वर्चस्व प्राप्त करने, देश और समाज को अपने स्वार्थों के अनुरूप शासित करने और पत्रकारिता के कर्तव्य और कुछ बच रहे आदर्श की कहानी तो कहता ही है, साथ ही भारतीय समाज में बदल रही सामाजिक मान्यताओं और मूल्यों की ओर भी इशारा करता है।" (कवर पृष्ठ)

नाटक पचहत्तर पृष्ठों में व्यक्ति की अत्यधिक महत्त्वाकांक्षा से वशीभूत होकर हर गलत को सही समझने की कवायद की तरफ भी इशारा करता है। 'मुस्कुराती अर्थव्यवस्था' (पृ. 40) को एक व्यापारी हरीश के माध्यम से रेखांकित किया गया है और उस अर्थव्यवस्था से व्यवस्था, सामाजिक दशा, स्त्री विमर्श, पत्रकारिता, राजनीति और जनता किस तरह सीधे रूप से प्रभावित हो सकती है या होती है इसकी भी पड़ताल दृष्टिगत होती है। 'दूसरी तरफ' नाटक का केंद्र बेशक हरीश है, लेकिन उससे जुड़ी तमाम कारगुजारियाँ व्यक्ति-विमर्श से हटकर समाज-विमर्श का द्वार खोलती हैं। नाटक के कथानक के मूल में हरीश के मामूली

9

Functionalized Magnetic Carbon Nanomaterials for Environmental Remediation

Ambika[1] *and Pradeep Pratap Singh*[2]

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9.1 Introduction

Rapid industrialization and exponential population growth have led to an increased discharge of wastewater containing various pollutants such as heavy metals, dyes, bacteria/viruses, other organic pollutants that pose harmful effects on the environment [1–10]. These harmful and toxic contaminants may lead to various life-threatening diseases [11]. Therefore, there is an urgent need to develop a technology that can effectively control water pollution. Nanotechnology can provide opportunities for environmental remediation [12–44]. In the past few decades, nanocomposites (NCs) have attracted the attention of the scientific community due to their high surface area to volume ratio of the reinforcing nanoparticles compared to conventional composites. The reinforcing material can be prepared using different particles, sheets, or fibers [45]. Carbon nanomaterials (CNMs), such as fullerenes, carbon nanotubes (CNTs), and graphene, have been utilized as ideal reinforcing fillers for the preparation of different carbon nanocomposites (CNCs) for their unique physical and chemical properties, which offer potential advances in various fields [46, 47]. Recently, magnetic carbon nanocomposites (MCNCs) have attracted scientists' attention due to their porous structure, easy recovery and recyclability and benign biocompatibility which may be attributed to their property to respond to an external stimulus such as a magnetic or electrical field. The agglomeration of iron oxide can be reduced by functionalization with carbon nanoparticles. Magnetic separation could replace filtration, reducing the loss of materials. These nanomaterials have been employed for various applications such as catalysis, energy storage, sensors, electronics, biomedical field, and environmental remediation (Scheme 9.1) [48, 49]. This chapter aims to discuss the preparation of functionalized carbon based magnetic nanocomposites (CMNCs) and their application in environmental remediation.

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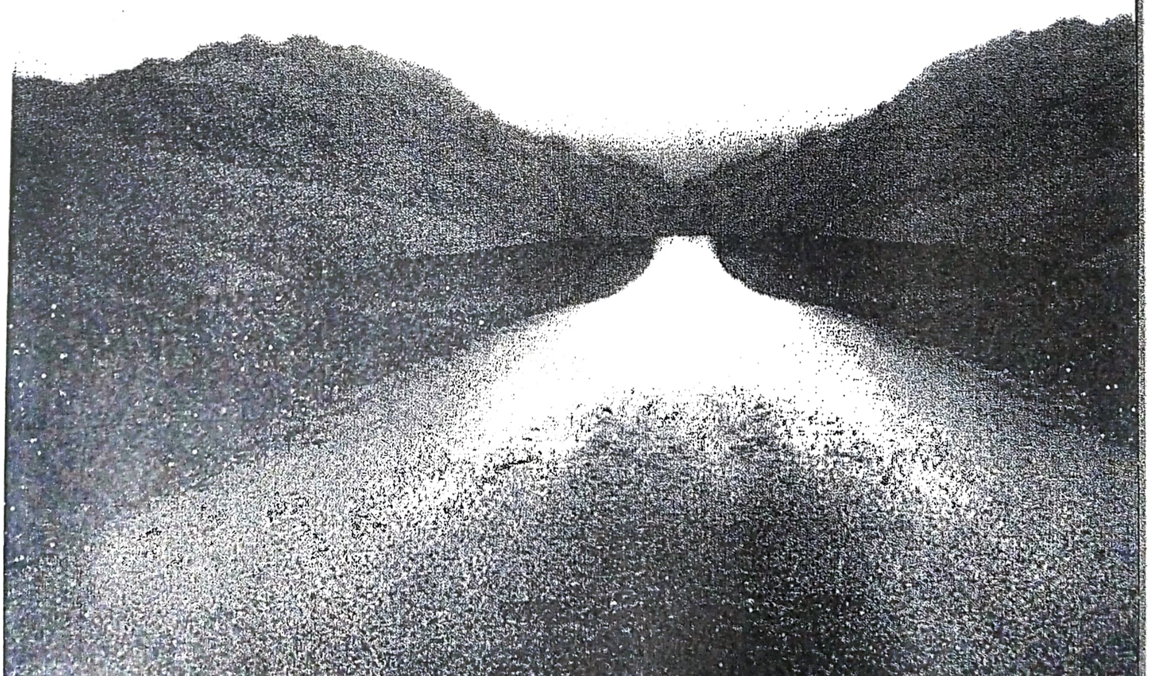

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गगनांचल

साहित्य, कला एवं संस्कृति का संगम

वर्ष 44, 45 नवम्बर 2021-फरवरी 2022 संयुक्तांक

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संपादकीय

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हिंदी-विश्व

साहित्य चिंतन

75 आज़ादी का अमृत महोत्सव

स्वातंत्र्योत्तर राष्ट्रीय रंगमंच की अवधारणा और हिंदी रंगमंच

– डॉ. प्रतिभा राणा

“वैसे उपरोक्त संस्थानों की स्थापना से पहले ही सन् १९३६ में ऑल इंडिया रेडियो की स्थापना हो चुकी थी और कुछ समय बाद लखनऊ रेडियो स्टेशन (१९३९) भी बन गया नतीजतन इससे जुड़े अनेक कर्मी सांस्कृतिक लहर को गति देने में अपना योगदान देने लग गए। शुरुआत में यहाँ उर्दू नाटककारों का प्रभुत्व था परन्तु सन १९४० के बाद से हिंदी नाटककारों की रचनाएँ भी प्रसारित होने लगीं थी। स्वतंत्रता के बाद बनते इस नवीन सांस्कृतिक परिवेश में दिल्ली की भूमिका केंद्रीय रूप में थी। नाटककार जगदीश चंद्र माथुर उस समय के परिदृश्य के सन्दर्भ में जब दिल्ली की पहली सांस्कृतिक संस्था का उल्लेख करते हैं तो अतीत की कई परतें उजागर हो जाती हैं-“नई दिल्ली सांस्कृतिक रूप से अभी सक्रिय ना थी सिर्फ ऑल इंडिया फाइन एंड क्राफ्ट्स सोसायटी ही एक ऐसी संस्था थी जिसे प्रदर्शनकारियों ने संगठन और नृत्य एवं नाट्य प्रदर्शनों के प्रबंध का थोड़ा-बहुत अनुभव था यह संस्था लड़ाई के जमाने से एक कामचलाऊ इमारत में कार्य करती थी और शायद यह पहली ही सांस्कृतिक संस्था थी जिसे अपने भवन निर्माण के लिए जमीन और ऋण दिया गया निर्माण के बाद यह संस्था सांस्कृतिक क्रियाकलाप का मुखरित केंद्र हो गई।

स्वातंत्र्योत्तर राष्ट्रीय रंगमंच एवं रंग आंदोलन को समझने से पहले उन स्थितियों या परिस्थितयों को समझना आवश्यक है जिनसे जूझते और प्रेरणा लेते हुए राष्ट्रीय रंगमंच का स्वरूप बना। उन्नीसवीं शताब्दी में अंग्रेजों ने कलकत्ता, मुंबई और चेन्नई में थिएटर हॉल बनाए। ये महानगर उस समय प्रशासनिक और व्यापारिक रूप से केंद्रीय भूमिका में थे इसलिए यहाँ रह रहे सैनिकों, व्यापारियों और प्रशासन के लोगों के मनोरंजन हेतु थिएटर हॉल विकसित किए गए। यहाँ अधिकतर अंग्रेजी नाटकों का ही मंचन होता था। बेशक हिंदी का नाटक लेखन और प्रदर्शन इन सबसे प्रभावित तो हुआ, लेकिन नकल नहीं बना। भारतेंदु हरिश्चन्द्र और उनके मंडल के रचनाकार, पत्रकार-नाटककार-अभिनेता-निर्देशक आदि अनेक भूमिकाएं एक साथ निभाते थे, उन्हीं के प्रयासों से नाटकों में संस्कृत, लोक रंगमंच तत्वों के साथ पाश्चात्य तत्व भी भारतीय सन्दर्भों में प्रयोग होकर मिलते हैं। दरअसल यही भारतीय रंगमंच की नींव मानी जा सकती है जहाँ वे भारत को भारतीय भाषा और समाज संस्कार के मेल से स्वाधीनता की अनिवार्यता व् आवश्यकता को रेखांकित करते हैं। उस वातावरण में “सुरुचि की रक्षा करना बहुत बड़ी सफलता है। भारतेन्दु के हास्य में अश्लीलता या भौंडापन नहीं आने पाया है, यह प्रसन्नता की बात है।”

इनके बाद माधव शुक्ल ने लखनऊ, कोलकाता और इलाहाबाद में नाट्य मंडलियों की स्थापना की। उन्होंने जिस गंभीरता के साथ नाटकों को प्रदर्शित किया उसमें भारतेंदु के ही आदर्श दृष्टिगोचर होते हैं। भारत में वर्ष १९३० के आस-पास जब सिनेमा का आगमन हुआ तो भारतीय रंगमंच विशेषकर हिंदी रंगमंच की गति पर इसका प्रभाव पड़ा। फलस्वरूप रंगमंच की बजाय सिनेमा आकर्षण के केंद्र में आ गया यहाँ तक कि लोकप्रिय पारसी थियेटर भी प्रभावित हुए बिना न रहा। सोहराब मोदी व पृथ्वीराज कपूर जैसे अनेक कलाकार सिनेमा की

The teaching of management principles continues to be an integral part of management education. These principles help to develop an organized body of knowledge by management practitioners, thinkers and philosophers. Management principles serve as a guideline for doing work with greater efficiency. These principles help managers to take a more realistic view of different managerial problems and direct human behaviour. The conscious manager can become more effective, by using the established management principles to solve problems.

The target segment of this book comprises of UG and PG Management students, across various Universities and B-Schools in India. This book would also cater to the requirements of corporate professionals and policy makers, who are concerned with the study of management theories and principles.

Dr. D. R. Jalwani is an Associate Professor in the Department of Commerce, Swami Shraddhanand College (University of Delhi) Alipur, Delhi, since 2006. He completed his Master and Ph.D from Jai Narain Vyas University, Jodhpur, Rajasthan (Formerly known Jodhpur University). Dr Jalwani also cleared the UGC-NET Examination in December. 1998. He possesses more than 20 years vast experience of Financial Accounting, Marketing Management and Management Accounting to students of undergraduate and post graduate level. He also associated with IGNOU as an Assistant coordinator and Counsellor at 0729. He is life time member of Indian Accounting Association and Indian Commerce Association.

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The simplest way to define life sciences is the study of living organisms and life processes. As science involving cells and their components, products and processes. Biology, medicine and agriculture are the most obvious examples of the Life Science discipline. In this book we have described the different branches of Life Science including biodiversity & it's sustainable use. As life on earth is impossible without Plant as well as animals & it is duty of every individual to make balance and conserve both parts and there sustainable use. Different horizon of Life sciences are described in this book. Reader will enjoy the book with simplestic and holestic approach. Book will be beneficial to both undergraduate and postgraduate students.

Dr. Neerja Shrivastava is working as a Associate Professor (Botany) in Department of Botany, Govt. P.G. College, Kota (Raj). She has more than 23 year experience of teaching as well as research. In her 23 year of experience she supervises more than 10 Ph.D and 07 M.Phil students. She also worked on UGC and Department of Science, & Technology funded project on different field of Microbiology and Plant Science. She has published more than 35 research paper and articles in Journals of International and National repute. She is author of 10 books related to microbiology and Plant Science. She is recognized Councilor of VMOU, Kota & IGNOU New Delhi. She is recipient of "Best Teacher Award" given by Higher Education Department, Govt. of Rajasthan.

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21

Chapter

The Impact of Climate Change on Human Health in India: An Overview

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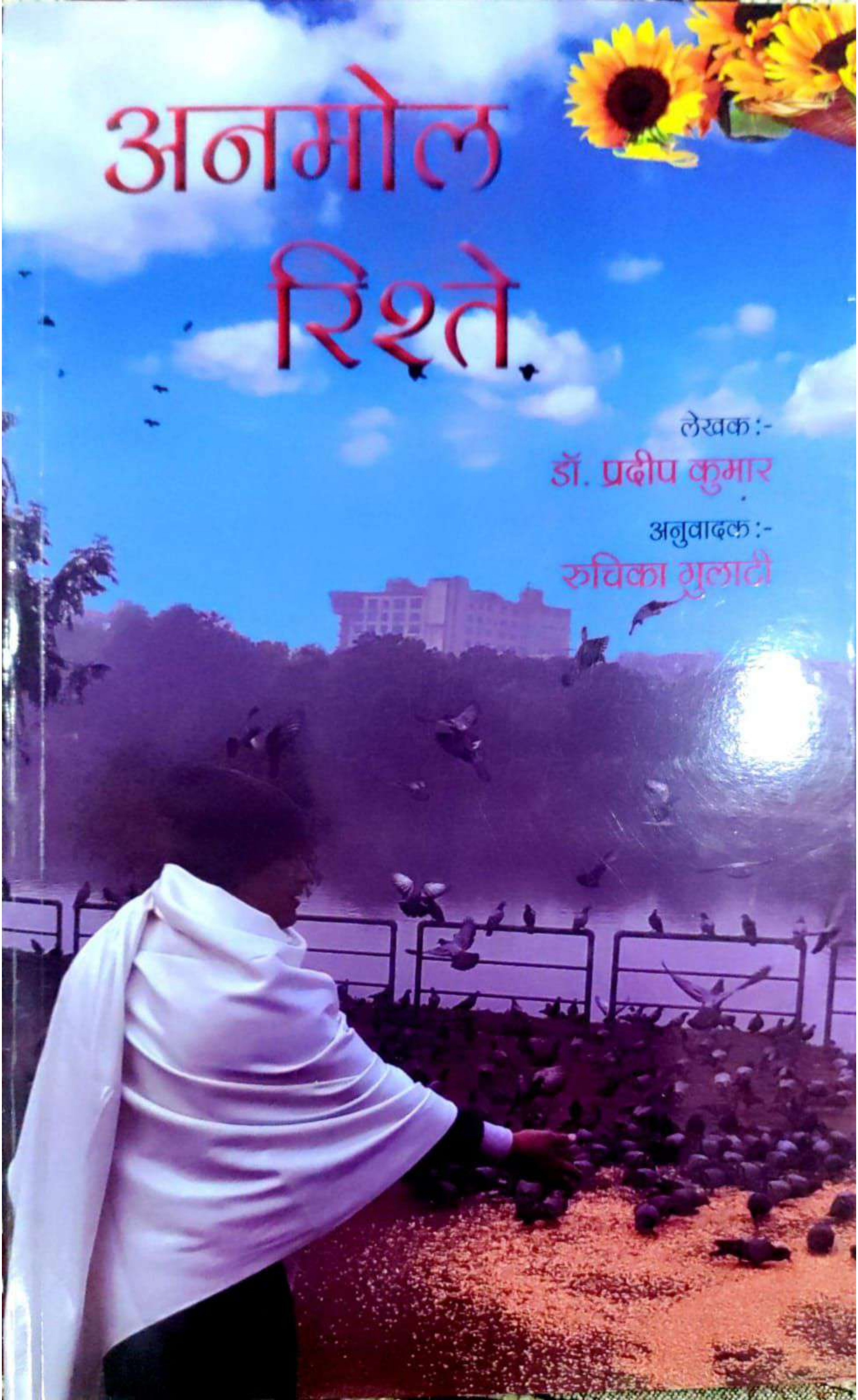
Introduction:

Climate change occurs over decades, and still now-a-day climate change have occurred naturally, because of continental drift, numerous astronomical cycles, variations in solar energy output, and volcanic activity. Over the past few decades, it has become increasingly apparent that human actions changes atmospheric composition causing global climate change [1]. The Ministry of Earth Science (MoES), Government of India have published a report in 2020, under titled "Assessment of Climate Change over the Indian Region" considering that the impact of climate change as one of the most significant and concerning issues of the India that is the second largest country in the world by population and is rapidly catching up to China. The lack of adaptive capacity coupled with limited resources to help bolster health infrastructure have made it extremely challenging for the India to cope with the spread of illness and disease. Due to diverse array of temperature zones, climate change in India is now making things far worse. From the Himalayas in the far north, to coastal megacities, to deserts where the 50° Celsius mark is usually breached, the nation is persistently ranked as one of the most sensitive to climate change [2, 3].

The key question is, how will the climate change affect human health? Climate impacts numerous key determinants of health on which we depends that leads to extremes and violent weather events; resurgence of disease organisms and vectors, food and water, affects the quantity of air and the stability of the ecosystems. Climate changes have both direct and indirect impact on human health. Indirect impacts emanate from changes in temperature patterns that can disturb natural ecosystems, change the ecology of infectious diseases, exacerbate air pollution levels, harm agriculture and fresh water supplies, and cause large-scale reorganization of plant and animal communities [4]. Climate change is a significant and emerging threat to public health. The effects of climate change on human health are influenced by a variety of pathways and there may be long delays between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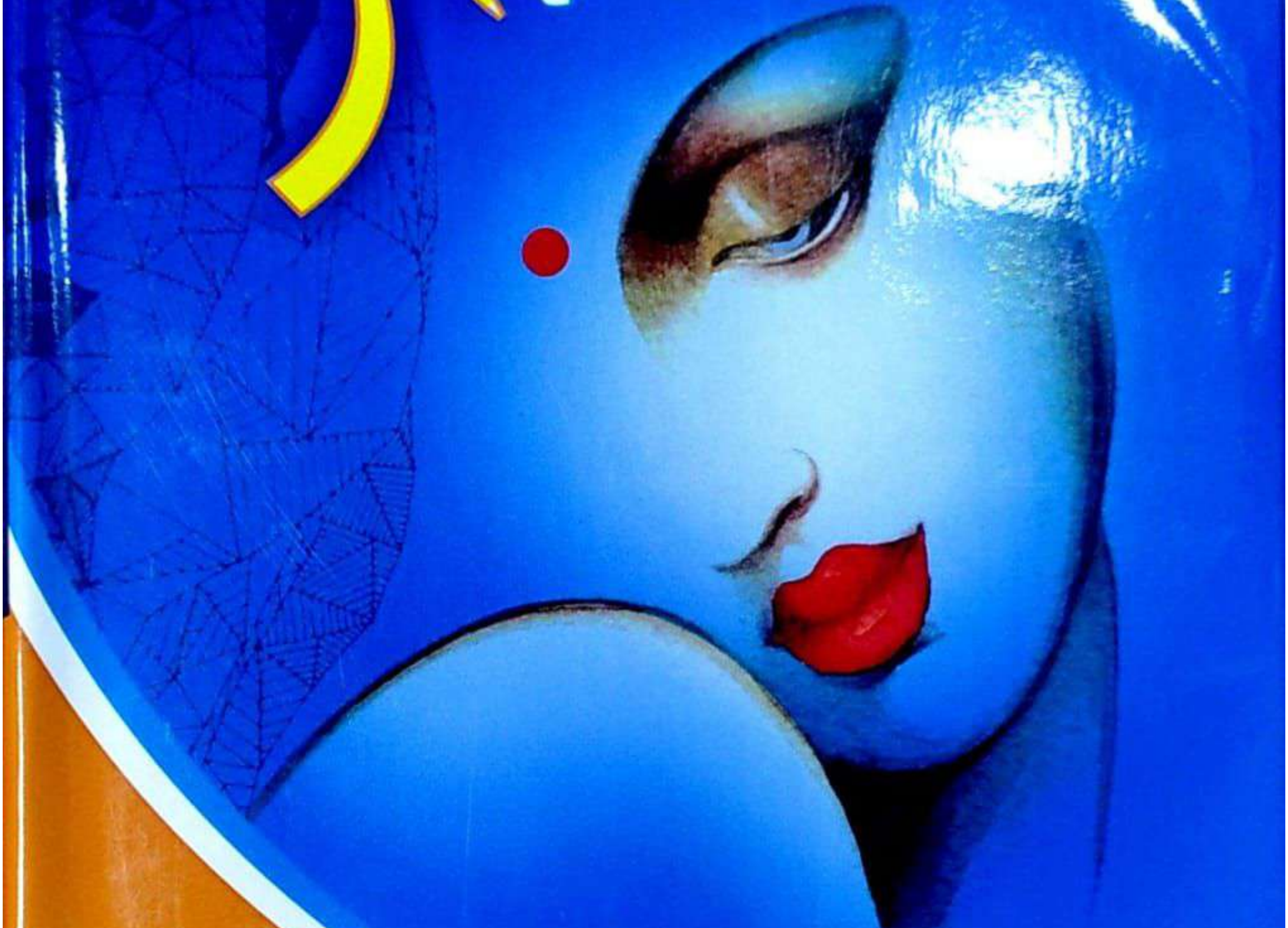

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