FUNGI BIO-PROSPECTS IN SUSTAINABLE AGRICULTURE, ENVIRONMENT AND NANO-TECHNOLOGY

Volume 2: Extremophilic Fungi and Myco-mediated Environmental Management



Edited by

Vijay Kumar Sharma, Maulin P. Shah,
Shobhika Parmar and Ajay Kumar

Fungi Bio-Prospects in Sustainable Agriculture Environment and Nano-Technology

Volume 2: Extremophilic Fungi and Myco-mediated Environmental Management

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Fungi Bio-Prospects in Sustainable Agriculture Environment and Nano-Technology

Volume 2: Extremophilic Fungi and Myco-mediated Environmental Management

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Chapter 1

Extremophilic fungi at the interface of climate change

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Introduction

Kingdom fungi is highly diverse encompassing microscopic forms like yeasts (3−4 μm) to macroscopic forms visible to naked eyes like *Armillaria ostoyo* (can spread in areas up to 10 sq km). They are cosmopolitan in distribution and their presence has been reported from deep hydrothermal vents to Arctic (Amend, 2014). They are unique in containing maximum 1.7×10^{27} Mb of DNA (Landenmark et al., 2015) and 12 Gt of carbon biomass alone on the planet earth as compared to other microbial counterparts (Bar-On et al., 2018). To date, 1,44,000 fungal species are formally named (Willis, 2018). With the advent of next generation sequencing uncultivable forms are also uncovered to a greater depth (Zoll et al., 2016). Such large numbers hold great significance in driving major biogeochemical cycles and relevance in climate change perspectives.

Green house gases (GHGs) are primary cause of climate change and beside anthropogenic activities, microbes play a role in both, being sensitive to, as well as have the potential to worsen the future scenario of climate. It has been predicted that climate change is not homogenous around the globe. There are certain ecosystems that are severely affected such as polar and terrestrial, while there are other ecosystems, fungal inhabitants from such niche, if harnessed properly, would prove good candidates to mitigate climate change, like those from hydrothermal vents, hot springs and extreme pH environments. Extreme ecosystems are a fascinating area of research as they harbor unique microbial diversity (Table 1.1). As evident in a recent report, such ecosystems have been shown as a site of eukaryogenesis with the discovery of *Candidatus* Prometheoarchaeum syntrophicum strain MK-D from

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Rhizosphere Biology

Anita Sharma *Editor*

Microbes and Signaling Biomolecules Against Plant Stress

Strategies of Plant- Microbe Relationships for Better Survival



Springer

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Chapter 7
Plant–Microbe Interactions: An Insight into the Underlying Mechanisms to Mitigate Diverse Environmental Stresses



Asifa Mushtaq and Seema Rawat

Abstract Plants, being sessile, are often exposed to a range of biotic and abiotic stresses, which can negatively impact their growth and development causing humongous losses to the agriculture across the globe. Plants have evolved to sense and mitigate the adverse environmental challenges with an array of protective mechanisms, among which the plant–microbe interactions play a remarkable role in conferring tolerance to multiple stresses. The response of plant to a particular stress is governed by highly complex signaling pathways influenced by the associated microbes. As the abrupt climatic changes are posing a significant threat to the crop productivity, it becomes imperative to elucidate the plant–microbe interactions with respect to protection against environmental hostilities. Essentially, an exhaustive knowledge of the underlying mechanisms of microbe-mediated stress mitigation in plants can be translated into the development of resistant crop varieties, eventually paving the way for sustainable agriculture.

7.1 Introduction

Plants are often exposed to the diverse environmental stresses which affect their vital activities causing a substantial loss in crop quality as well as productivity. Even though a precise estimation of agricultural loss due to various stresses cannot be made, it has been very well documented that such stresses wallop large areas of land and consequently affect crop quality and quantity (Cramer et al. 2011). The varied stresses that a plant can experience have been broadly categorized into two groups, viz, biotic and abiotic. The biotic stresses are a manifestation of the interaction of a plant with pathogenic bacteria, fungi, or viruses as well as insects, and nematodes while the abiotic stresses are posed by drought, temperature extremes (high/low),

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Sustainable Bioeconomy

Pathways to Sustainable Development Goals

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Biotechnological Interventions for Production of Flavour and Fragrance Compounds

7

Tripti Malik and Seema Rawat

Abstract

Flavour and aroma are the important attributes which determine the sensory perception of food, pharmaceutical and cosmetic products. Traditionally, flavour and aroma compounds are extracted from plant and animal sources. In order to meet the huge demand and expenses for various products, the artificial chemicals are now being added. Due to the chemo-phobia and health hazards, artificial flavours and fragrances are not acceptable by the consumers. Biotechnological methods provide better and eco-friendly substitutes for artificial flavour and fragrances. The bio-routes for their synthesis are based on enzymes methods, de novo microbial processes, and bioconversion/biotransformation using microorganisms. Solid-state fermentation carried out by microorganisms can produce a variety of potentially valuable aromatic compounds. Different agro-industrial wastes such as plant residues, bran, straw, flowers, fruit pods can be used as the raw materials which reduces the manufacturing costs of these bio-products and also solves the problem of environmental pollution. Advances in genetic and metabolic engineering are newer approaches of biotechnology which has opened a fenestella in the production of flavour and fragrances.

Keywords

Bioeconomy · Biotransformation · de novo microbial processes · Enzymes · Flavour · Fermentation · Fragrance · Metabolic engineering · Plant tissue culture

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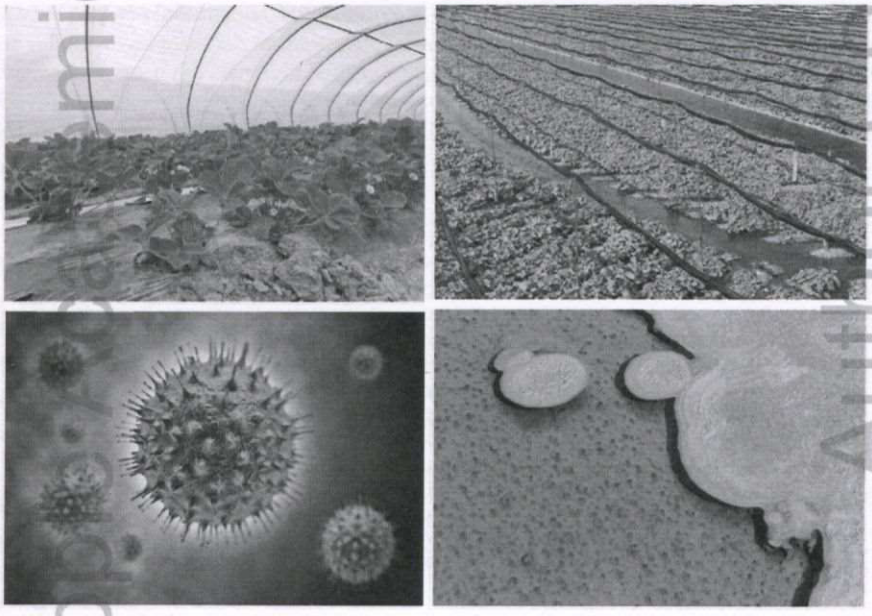

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CHAPTER 10

RADIATION-RESISTANT THERMOPHILES: FROM HIGH TEMPERATURE AND RADIATION TO ENGINEERED BIOREMEDIATION

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10.1 INTRODUCTION

Microorganisms are ubiquitous and competent enough to inhabit hostile niches on Earth-like subsurface, deep oceans, extreme acid, and extreme alkaline conditions, frozen glaciers, seawater, and hydrothermal systems (Rampellotto, 2010). The existence of microbial life in inhospitable environments, viz., geothermal regions, hydrothermal vents, acidic, and hot geysers have unveiled the presence of special category of microorganisms known as thermophiles or hyperthermophiles. The habitat of thermo (or hyperthermophilic) microorganisms is versatile and they have been reported from freshly fallen snow to pasteurized milk to geothermal springs (Ranawat and Rawat, 2017a). The famous abode of thermophiles include hot springs, viz., Yellowstone National Park, USA (Reysenbach et al., 1994, 2000; Slobodkin et al., 1997; Schaffer et al., 2004), in India from Bakreshwar hot spring, West Bengal (Ghosh et al., 2003), Tulasi Shyam hot spring, Gujarat (Gehlani et al., 2015), Unkeshwar hot spring of Maharashtra (Mehetre et al., 2015), Soldhar hot spring of Uttrakhand (Sharma et al., 2015), Deulajhari hot spring, Odhisha (Singh and Subudhi,

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Abstract

Coco pith, an agricultural by-product of coir industry, is a dust left after the extraction of coir fibers from coconut husk. It is accumulated outside the coir industries as huge heaps, which usually becomes an environmental hazard. It is degraded very slowly due to its high lignin and cellulose content. The tannins and phenols are leached out from coir pith heaps by rains which enter the soil and aquatic ecosystems leading to loss of soil fertility and have adverse effect on soil and aquatic biodiversity. Thus, the safe disposal of coir pith is the need of hour which can be achieved by its conversion into value-added products like compost and bioethanol. Due to its rich nutrient content, it has a good prospective as compost. The microbial valorization of coir pith has been proved not only to enrich nutrients in the agricultural soil, but also to increase the pathogen resistance and will surely resolve the environmental pollution problems. The high cellulose and hemicellulose content of coco pith make it a suitable candidate for conversion into bioethanol. This chapter will outline the future prospects in the processing and conversion of coir pith into commercially viable compost and bioethanol.

Keywords

Agricultural waste Coco pith Biofertilizer Bioethanol *Saccharomyces*

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New and Future Developments in Microbial Biotechnology and Bioengineering

Recent Advances in Application of Fungi and Fungal Metabolites: Current Aspects

2021, Pages 69-93

Chapter 5 - Thermophilic fungi: Diversity, physiology, genetics, and applications

Hardi Patel, Seema Rawat

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Abstract

Thermophilic fungi, unlike prokaryotes, are able to grow at temperatures not exceeding 62°C. Their moderate degree of thermophily is probably the reason behind their habitats that are not as exotic as that of thermophilic prokaryotes and also for their not being much explored until now. Their temperature limitation reflects their inability to form thermostable and functional cellular organellar membranes and proteins at elevated temperatures. These organisms thrive in humid, warm, and aerobic habitats such as compost, agricultural residues, stored grains, soil, manure, industrial coal mines, nuclear reactor effluents, etc. The metagenomic tools can aid in unraveling their diversity in different habitats and in understanding their role in their niche. They exhibit a range of physiological adaptations such as a slower metabolism, high proportion of saturated fatty acids in phospholipids, high turnover of enzymes, synthesis of heat shock proteins, difference in lipid storage mechanisms, etc., to survive. Their genome analysis reveals reduced genomic size, high G:C content, shorter introns, fewer transposable elements, and repetitive sequences. They secrete a wide array of enzymes such as amylases, proteases, lipases, phosphatases, xylanases, pectinases, laccases, cellulases, hemicellulases, and glycoside hydrolases, which have more catalytic efficiency than their mesophilic counterparts. They are used in a variety of biotechnological applications such as composting, biofuel production,

FEEDBACK

Maulin P Shah *Editor*

Removal of Emerging Contaminants Through Microbial Processes



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Rhizoremediation of Heavy Metal- and Xenobiotic-Contaminated Soil: An Eco-Friendly Approach

Pramila Verma and Seema Rawat

Abstract

In the last few decades, staggeredly increasing human population, indiscriminate use of pesticides, polycyclic aromatic hydrocarbons, and discharge of effluents containing toxic heavy metals, dyes, etc. have negatively impacted the soil fertility and biodiversity to the extent of converting the agricultural land into barren land. These pollutants can be removed or altered by conventional and physical methods. However, these methods are neither cost-effective nor eco-friendly as they generate large amount of toxic intermediates. The most powerful eco-friendly approach is bioremediation. Microorganisms play a pivotal role in the maintenance and sustainability of any ecosystem. They are versatile and capable to adapt to any challenges posed by the environment. The biotic activities of a diverse group of bacterial populations residing in rhizosphere affect the dynamics of soil which in turn affect the crop productivity. They stimulate plant growth by making soil nutrients available to them, stimulating the production of various plant growth hormones, protecting the plants from pathogens by their antagonistic activity and remediation of the pollutants by sequestering toxic heavy metals, and degrading xenobiotic compounds such as pesticides, PAHs, etc. This chapter highlights the role of PGPR in remediation of heavy metal- and xenobiotic-contaminated soil for sustainable crop production.

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Maulin P Shah *Editor*

Removal of Emerging Contaminants Through Microbial Processes



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Biosorption of Carcinogenic Heavy Metals by Bacteria: Role and Mechanism

Ravi Chauhan, Hardi Patel, and Seema Rawat

Abstract

The various kinds of anthropogenic activities, viz., modern farming, coal burning, mining, and industries, have led to the discharge of heavy metals in the environment which besides causing disaster in the environment may also cause acute and chronic diseases in human beings. The bioaccumulation and biomagnification of heavy metals in soil and water make it a major threat to biodiversity. International Agency for Research on Cancer has classified arsenic, beryllium, cadmium, chromium, and nickel as group 1 carcinogens. The conventional physicochemical technologies used for the removal of heavy metals are cost-ineffective and sometimes generate a huge amount of toxic by-products. Bioremediation is considered as one of the safer, cleaner, cost-effective, and environmentally friendly technology for decontaminating heavy metal-contaminated sites. Microbes possess several mechanisms for metal sequestration, one of which is biosorption. This chapter will focus on the role played by bacteria in metal sequestration and various mechanisms, like binding to EPS, metallothionein, cell surface adsorption, etc., used by them for biosorption of most carcinogenic heavy metals.

Keywords

Carcinogenic · Heavy metals · Bioremediation · Biosorption · Metallothionein

Ravi Chauhan and Hardi Patel have contributed equally to this work.

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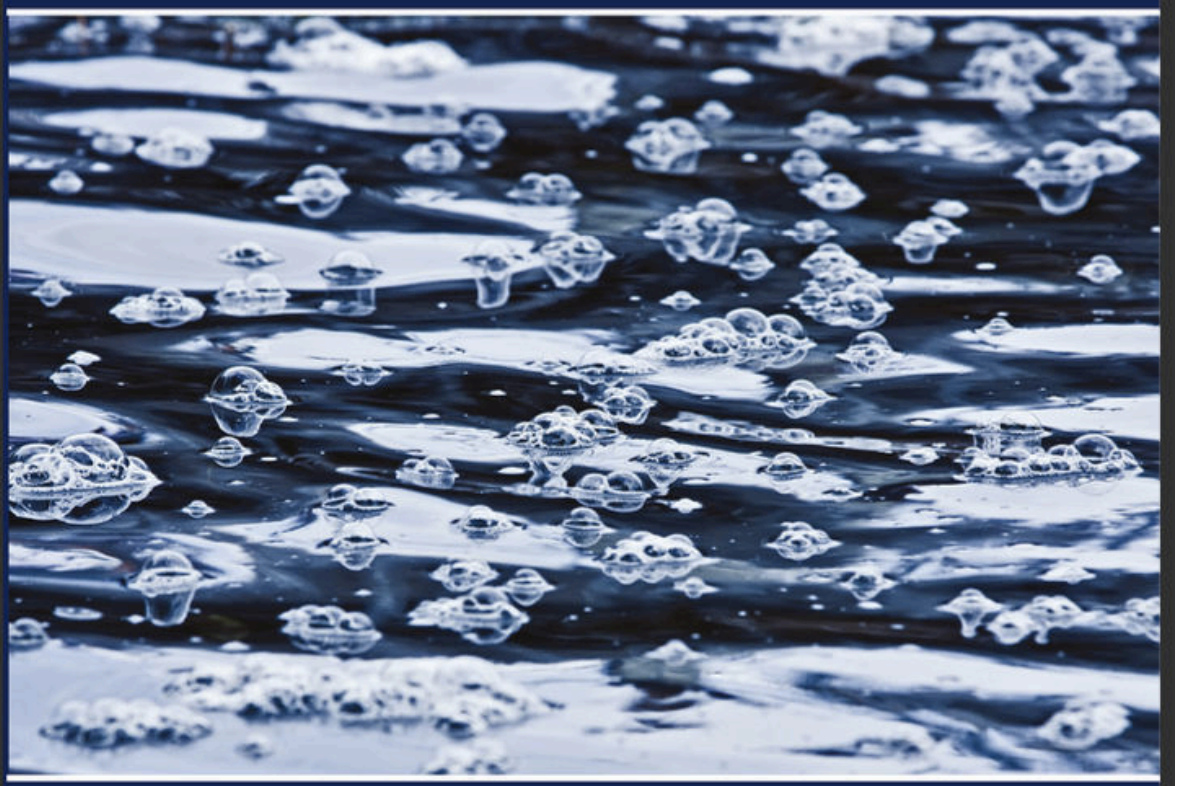
Microbial Ecology of Wastewater Treatment Plants



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CHAPTER 20

Bioremediation of heavy metals from wastewater treatment plants by microorganisms

Neha R. Hirvaniya, Tannu D. Khatnani, Seema Rawat*

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20.1 Introduction

The industrialization, economic and technological developments have severely damaged the environment by polluting ecosystems with various hazardous wastes as they are dumped in soil and water without prior treatments and this waste is a cocktail of degradable as well as nondegradable elements like heavy metals (Kumar, 2018; Kumar et al., 2020a, 2020b). Heavy metals such as Cr, Hg, Cd, Pb, Cu, Ni, and Zn, generated from various natural and anthropogenic activities, contaminate aquatic and terrestrial ecosystems causing serious problems as they affect the biodiversity and also human health. This makes obligatory for Environment Protection Agencies to enforce strict regulation on municipalities and industries for discharge of effluent in water reservoirs (Rathoure and Dhatwalia, 2016; Crini and Lichtfouse, 2019). To meet these directions, different conventional and biological methods have been developed for wastewater treatment plants (WWTPs) to address this environment concern, where biological methods have gained more interest than physicochemical methods because of their ease of applicability, lower cost, and eco-friendly aspects (Kumar et al., 2018, 2021). Microorganisms due to the constant exposure to hazardous chemicals, toxins, and metals have adapted survival and thus can be successfully employed to treat the metal-laden wastewater. However, due to certain limitations of the biological methods, newer approaches and integrative or hybrid approaches are being explored for bioremediation.

20.2 Wastewater

Wastewater is generated due to various anthropogenic activities. Apart from rainwater runoff and agricultural wastewater, wastewater is broadly categorized into two groups: (a) sewage water or municipal waste, generated due to domestic activities, and (2) industrial

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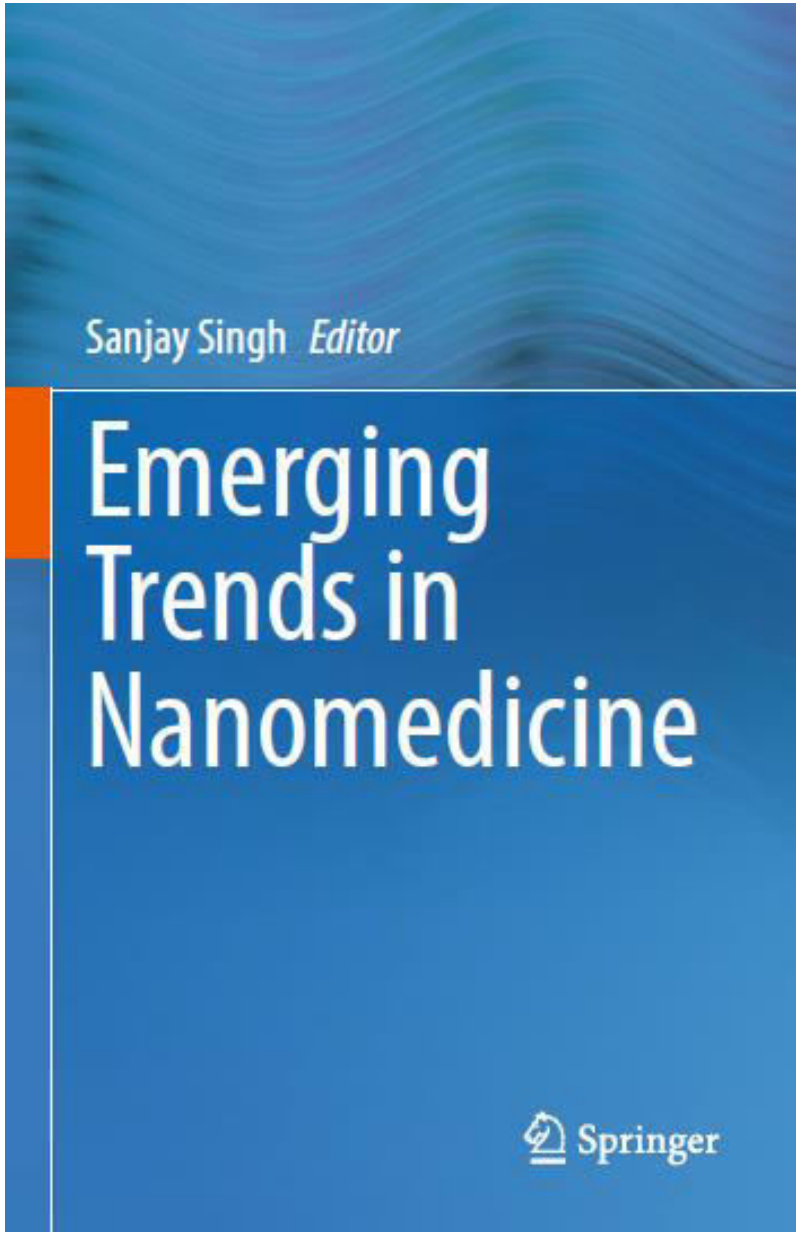

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Abstract

The area regenerative medicine targets to recreate, repair or replace the damaged body part into functional human tissue. Tissue engineering is a part of regenerative medicine that utilizes the principles and methods of engineering for the development of biological substitutes that can restore or improve the function of damaged tissues. It involves scaffolds combined with cells, growth factors or suitable biochemical signals promoting the growth and regeneration of damaged tissues and organs. Scaffolds are three-dimensional structure that mimics the native

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Advances in Bioinformatics



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Protein Analysis: From Sequence to Structure

4

Jaykumar Jani and Anju Pappachan

Abstract

Proteins are primary molecules that control most of the cellular processes. The sequence of a protein is linked to its structure which in turn is linked to its function. Understanding and integrating protein sequence, structure, and function information is necessary to address many challenging areas of Biology including protein engineering, structural biology, and drug discovery. Bioinformatics deals with protein sequences, structures, predictions, and analysis. Accessibility of these data and availability of high-throughput analysis tools will supplement experimental work in order to understand proteins better. Prediction of three-dimensional structures of proteins and studying the structural features are very necessary to understand various diseases and aid in disease diagnosis and drug discovery. In this chapter we discuss about various databases and *in silico* tools and methods related to protein sequence and structure analysis.

Keywords

Sequence · Protein structure prediction · Protein analysis · *In silico* analysis · Protein database · Homology modelling

4.1 Introduction

Proteins are the key players that control almost all activities which sustain living organisms. Even though the genome of an organism consists of information for survival, proteins are the versatile macromolecules that regulate virtually all life

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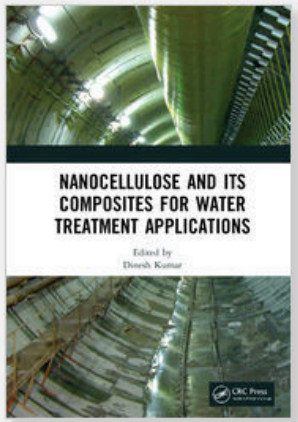

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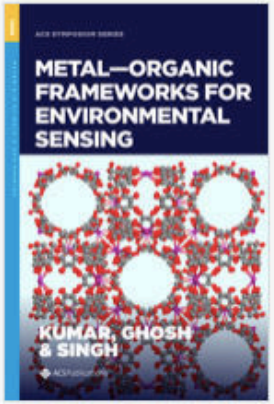

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Abstract

Nanomaterials have gained tremendous attention in the field of research owing to their fantastic and unique properties. Metal-Organic Frameworks (MOFs) are the class of porous nanomaterials constituting organic ligands and inorganic metal ions. MOFs are hybrids of organic-inorganic materials and have attracted researcher's attention due to their large surface area, tunable pore structure, and high porosity. These properties make MOFs applicable in a wide range of applications in various fields, including catalysis, sensing, gas adsorption, and separation etc. Currently, MOFs have been employed for several environmental applications and resulted in outstanding performances. This chapter begins with the introduction of MOFs, then it covers the different applications of MOFs for the environment, including recent advances and challenges.

Metal–Organic Frameworks for Water Decontamination and Reuse: A Dig at Heavy Metal Ions and Organic Toxins

Niharika Singh, Ankita Dhillon*, Meena Nemiwal, and Dinesh Kumar*

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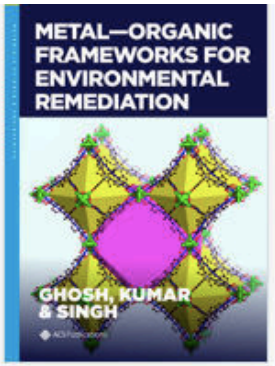

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Abstract

The deterioration of surface and groundwater by several pollutants is a severe global issue. Excess of these impurities inflicts violent health hazards for humans and other conscious beings via bioaccumulation ahead in the food chain. Thus, steps must be pursued accordingly to lessen pollutants' proportion to permissible water limits. This chapter glares at metal-organic frameworks (MOFs), which have been newly cultivated and researched for their potential utility in water decontamination and reuse. We deliver an outline of the present-day potential and fundamental properties of MOFs employed in serving this purpose. A brief follow–on has been carried out regarding the three main strategies for using steps to regulate water contamination. Firstly, MOFs as decontaminating (both heavy metals and organic) agents, secondly as MOFs modified membranes for the infiltration of hazardous materials. Lastly, the research gaps along with the future directions have been proposed for appropriate new experimental design.

Biopolymeric Nanomaterials
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Micro and Nano Technologies
2021, Pages 407-422



19 - Biopolymeric nanomaterials: water purification

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Abstract

The nonavailability of pure drinking water is one of the most prevalent issues troubling people worldwide. Therefore, wastewater treatment is highly essential to make it in a reusable form to meet future needs. Water purification has been the attention and devotion of many researchers and government agencies nowadays. Many wastewater treatment techniques have been employed, and amalgamation of innovative nano-centric methods with traditional approaches has presented

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Chapter 2

Sources of Active Ingredients for Sustainable Corrosion Inhibitors

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Abstract

Metal corrosion is a grave problem, having deleterious effects on human health, the economy, the environment, and many engineering schemes, for example, automobiles, aircraft, naval vessels, and pipelines. For the confirmation of enduring reliability and

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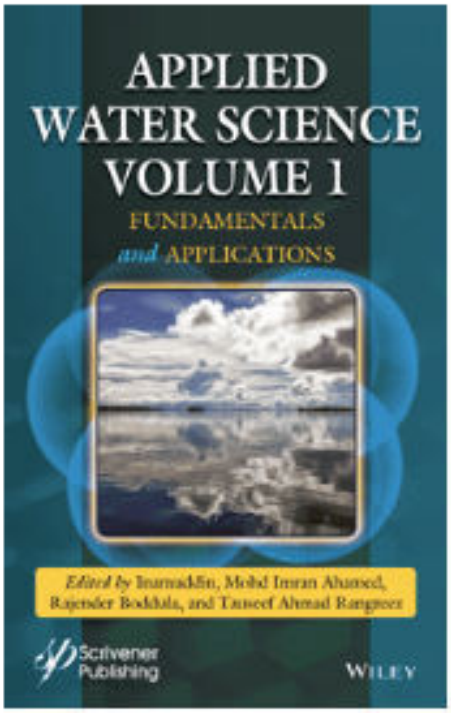

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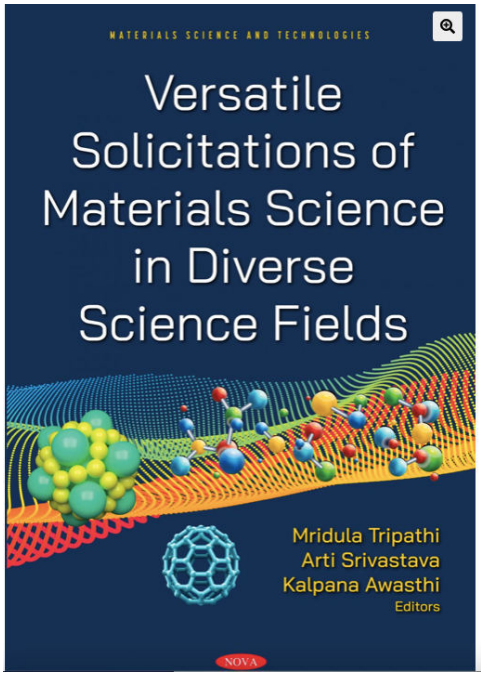

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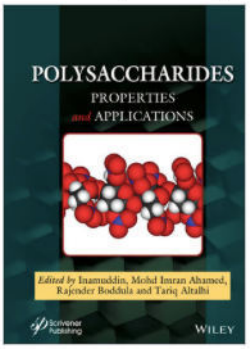

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Chapter 7

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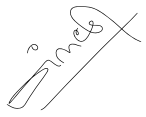
Abstract

Over the years, aerogel materials reduced thermal conductivity, so proved to be the key method for preventing large consumption of thermal energy. In the class of insulating materials, aerogels have been found, these materials reduce the intermorphosis of heat between ambient sol−gel and various drying methods. Due to Aerogel's tremendous qualities, researchers and engineers showed keen interest in its construction. It showed various characteristics such as nano dimensions, minimum density, narrow, structured, small zero and exposed pore structure, forming through sol components in an arbitrary three-dimensional network. Notable, related to aerogel components, involves storage due to the significant capacity of thermal insulation and its minimum power of operation which means that heat can be stored for a longer period. Due to narrow structural entities, it easily captures light in the meso and nanoporous structure. Aerogels have a greater tendency regarding its heat storing efficacy, creating a simple nature, working consistency other than a commercial insulator. Therefore, this chapter focuses on aerogel's new strategy, which is constantly trending to increase the efficiency of aerogels and improving diverse structurally designed openings, especially insulation effectiveness and low thermal conductivity. Herein, we reviewed the formation of porous aerogels by using carbon nanomaterials, and their corresponding materials comprise GO, rGO, and fabrication with polymer, biomaterial which intrinsically embedded in the aerogel structure to achieve outstanding thermal storage characteristics for higher thermal behavior.



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Chapter 8

Aerogels for sensor application

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Abstract

Aerogels with air-filled pores and interconnected 3D solid networks show unique characteristics and, therefore, have tremendous applications in various fields. Integrating specific characteristics of aerogels, large surface area, low density, and high porosity are included which opens up possibilities for new application areas. Aerogels' advanced features provide high selectivity, and sensitivity, fast recovery, and response to sensing materials in sensors such as biosensors, gas, pressure, and strain sensors. In recent years significant work has been done regarding the development of aerogel-based sensors. In this chapter, recent challenges and some approaches to high-performance aerogel-based sensor development are summarized.

Keywords

Aerogel, Sensors, Stress, Electrochemical sensors, Strain

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N_2 Fixation in Bio-Fertilizers

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Abstract

For manufacturing healthy nutrition and yields, plant nutrients are vital for the ever-increasing populace of the world. Nowadays, soil managing methods cause a serious threat to the environment and human health by the use of inorganic chemical-based fertilizers. For growing crop production and soil productiveness, bio-fertilizer has been recognized as a substitute in sustainable agricultural fields. Because of their important part in maintainable crop manufacture and food safety, the exploitation of helpful microorganisms as bio-fertilizers has to turn out to be the key use in the farming segment. Microorganisms that are generally used as bio-fertilizer constituents comprise plant growth-promoting rhizobacteria (PGPRs), phosphorus and potassium solubilizer, nitrogen fixers (N-fixer), cyanobacteria, ecto- and endomycorrhizal fungi, and additional beneficial microbes. The usage of bio-fertilizers corresponds to water uptake and improved nutrients, plant tolerance, and plant growth to biotic and abiotic features. For protecting the atmosphere and sustainability and productivity of soil as cost-effective and eco-friendly contributions for the agriculturalists, these bio-fertilizers will play a vital part. The degradation of the local environment and augmented soil destruction results from synthetic fertilizer use. Microalgae, which are truly associated with their constructive belongings for soil and plants and also their nitrogen fixation capability, are measured as proficient biofertilizers to save the natural atmosphere and cost-effective benefits. By the use of the acetylene decrease analysis, the process of nitrogen fixation can be measured. The root and shoot development of soybean, cowpea, and mung bean suggestively endorsed by the use of biofertilizer under N-supplemented or N-limited conditions. In this chapter, we will comprise the vital additions of biofertilizers in nodulation, plant growth, uptake of nitrogen, potassium, and phosphorus (NKP), nitrogen fixation, and seed yield.

PROOF

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10

Soil Chemistry: Composition and Laws

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Abstract

Gain knowledge about the mysteries of soil chemistry and its function in farming and the atmosphere. Investigate the basic laws of soil chemistry, whether they impact absorption, transfer of cations and anions, and other processes. Explore how the most powerful powers in adsorption, chelation, etc., which involve influences of implementation speed, reaction time, weather effects, pH-to-salt saturation associations, and desorption. Explore whether electrical charges accumulate in soils that generate electrical and chemical potentials causing ions to pass across obstacles like root membranes, nurturing crops, and plants through the plant body. Q2

Q3 ***Keywords:***

PROOF

10.1 Introduction

"No single respects what is at his bases; we all stare at the stars." [Quintus Ennius (239–169 BC)]. "Heaven is beneath our feet and above our heads." [Henry David Thoreau (1817–1862)]. These quotations illustrate how differently humans see the soil that gives them life and feeds them. People's feelings have been whispered for an extended period. Maximum people are quiet at the awareness level of Quintus Ennius, who survived over 2,000 years back. They take for granted the diet that the soil yields, the hygienic water, and air that the soil delivers. Until now, the soil is amazing if one gazes sensibly. The permeable surface of the earth to nearby 1-m deep, the deepness that roots pierce, has much anonymity. The soil is as cryptic and thrilling as any further science and any other portion of the earth. The soil heterogeneously combines inorganic and natural solids,

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8

Heavy Metal Chemistry in Soils

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PROOF

Abstract

Globally, soil contamination by heavy metals has become an environmental issue. Soil is a functional constituent of the biosphere which unprotected from the accumulation of heavy metals in higher concentrations like the arsenic, cadmium, lead, mercury, cobalt, copper, nickel, zinc, selenium, and many more. The accumulation of heavy metals in the soil can be because of natural and anthropogenic activities. The increasing concentration of the heavy metals shows the adverse effect on the living organism and the agriculture fields in the ecosystem. To remove the solemn ecological difficulties and danger to human health attributed by the heavy metals in the soil makes very important its removal by the employment of chemical methods. In the past few decades, cropland ecosystem pollution has been largely increased in various countries. So, various kinds of techniques were utilized for the treatment of heavy metals in the soil as extraction and immobilization. This chapter discusses the various used approaches for the mitigation of the heavy metals from the soil.

Keywords: Redundancy analysis, soil organic matter, hazard quotients, multivariate regression tree, contamination factor

8.1 Introduction

The rapid growth of the population and urbanization increased the amount of heavy metal in the water system. The generation of batteries, thin-film coating, release by-product, and automotive colors worsens the quality

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11

Parameters of Soil Chemistry

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Abstract

In today's world, the main three components of environment, *viz*., soil, atmosphere, and water, be essentially a collection of ordinary wealth to support, develop, and enrich human life. Soil is, perhaps, the primary surface covering of the earth and is appropriate for plant production. Because of its importance for agriculture, the soil is a real concern. Water runs, land usage, and production of plants also have links to the soil. In the present chapter, discussion of a lot of essential soil ideas, and improvement, morphology, components, and belongings (soil air, water, colloids, ion exchange, i.e., cation exchange and anion exchange capacity and pH) will be made. Universal appreciative of earth ideas besides these interlocking associations is important toward creating a sound earth managing option.

Q2 ***Keywords:***

PROOF

11.1 Introduction

Soil is acting a very important character with wholesome existence resting on the earth. Soil like water impacts our lives in many methods and is important for the existence of all living systems. It behaves as a platform for crops that feed millions and millions of people every day that farming and grazing livestock. It is necessary to understand that soil and its characteristics influence existence, and even how soil has been changed and exploited by humankind. Soil awareness also strengthens our environmental understanding. Mismanagement of soil may lead to overall poor development of any place. Environment plays a significant responsibility, directly or indirectly, both in strengthening and spoiling the soil. Soils are crucial for existence, in the sense that they supply the medium for plant development,

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7

Environmental Geochemistry

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Abstract

To investigate the pollution caused in the environment, various geochemical factors are responsible, which comprises a higher concentration of heavy metals, weathering of rocks, mine tailings, and so forth. In geochemistry, investigation finds out the main factor which causes pollution to the environment in particular regions. Many researchers choose the basin, mining area, river, and mountains to check its geochemical behavior regarding the pH, TDS, EC, heavy metals content, minerals, clay, and rocks constituents. With the help of analytical tools, the physicochemical properties of particular geochemical features are characterized. This chapter presented the overview of last decades' research outcomes to know how geochemistry affects the environment stability and causes pollution at various levels.

***Keywords*:** Mining, geochemistry, weathered tailing, pH, total dissolved solids, electrical conductivity

PROOF

7.1 Introduction

Worldwide, the mining and ore extraction generated a huge number of toxic byproducts, which heavily affects the environment and human health. Because of physical, geochemical, and mineralogical features, the tailing mine behavior as the capable source of nearby contamination like airborne transmittance of the tiny particles at the time of dryness is confirmed [1, 2]. The machine-driven transference of tailings through

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CHAPTER

14 Microbial cellulases: An approach toward recent advances in research, their application, and future perspectives

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CHAPTER

15 Optimization and strategies for the production of microbial cellulases and their potential industrial applications

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Microbial cellulases application in production of biofuels

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Chapter 5

Green Corrosion Inhibitors for Technological Applications

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Abstract

Corrosion is an inevitable fact of day-to-day life, and however, because of its technological, economic, and aesthetic significance, it always receives much attention. Most of the corrosion inhibitors are environmentally harmful and toxic synthetic chemicals. In view of the toxicity of the inhibitors, the search for an eco-friendly and non-toxic corrosion inhibitor is of great interest. Green corrosion inhibitors are of concern because of increased awareness and improvements in regulations related to the environment because of their toxicity, restrict regular corrosion inhibitors. The extracts of natural products contain compounds having oxygen, carbon, nitrogen and sulfur. Such elements facilitate compounds to absorb on the surface of metal, forming a protective film to prevent corrosion. The main purpose of this chapter is to provide a comprehensive study of technological applications of green corrosion inhibitors in different industries, such as reinforced concrete, coating, aircraft, oil and gas, acid pickling, and water industry.

Keywords

Corrosion, Green Inhibitors, Eco-Friendly, Non-Toxic, Natural Products, Applications

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Chapter 8

Absorber Materials for Solar Cells

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Abstract

Solar cell production has grown rapidly in the last few decades. Essentially a solar cell (SC), known as a photovoltaic (PV) cell, is nothing more than a p-n junction, composed of a p-type and n-type semiconductor. The electric field is generated at the junction when electrons and holes pass towards the positive and negative terminals respectively. Light consists of photons, and when the light of a sufficient wavelength falls on the cells, the energy from the photon is passed to the valence band electrons, allowing electrons to move to a higher energy state called the conductive band. The entire process is carried out in the absorber layer that lies under the anti-reflective coating of the SC. Since most energy in sunlight and artificial light is within the visible range of electromagnetic radiation (EMR), a SC absorber can absorb radiation effectively at these wavelengths. Because a SC can be made using a variety of materials, its output depends solely on the properties of the material used. This chapter discusses different absorbent materials that are used for solar cells.

Keywords

Solar cell, Photovoltaic Cell, p-n Junction, Absorber Layer

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Chapter 10

Recent Patents on Aerogels

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Abstract

Aerogels possess low density, large surface area, and high porosity, as a result these are considered as the fascinating materials of the 21st century. Aerogel materials have a broad range of extraordinary properties and, therefore, have a remarkable number of applications. Several industrial applications of aerogels are under advance development, like particle detectors, catalysts, and thermal insulators. As the researchers realized their peculiar and extraordinary properties, newer applications of aerogels started emerging. There are technical and scientific applications, besides increasing industrial applications of aerogels. This chapter addresses the recent patents on aerogels.

Keywords

Granted Patents, Cellulose Aerogel, Patents, Industrial Applications

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Chapter 11

State-of-the-Art and Prospective of Aerogels

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Abstract

The term aerogel is used for the cluster of materials, which exhibits definite geometry and certain properties with no set chemical formula. The astonishing physical properties such as non-toxic, high porosity with a large surface area, comparatively lightweight with other solids, inflammable insulation material. The sol-gel process implies the synthesis of aerogel. The composition of aerogel is controlled by some factors such as starting material, catalyst, and conditions of the preparation method. The physical and chemical properties of aerogel make it an interesting material for textiles, aerospace engineering, construction material and especially for energy-efficient retrofitting opportunities of residential buildings. In this chapter preparation methods of aerogel, state-of-the-art properties, and preparation of aerogel and future perspective of aerogels are discussed.

Keywords

Aerogel, Nanoporous, Sol-Gel Process, Thermal Insulation, Surface Modification.

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Chapter 8

Aerogels: Preparations, Properties and Application Tailor-Made Aerogels

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Abstract

This chapter emphasizes modern progress in aerogel researches and its technological implementation. The methods that allow introducing required characteristics in aerogels to meet the necessary requirements in their implementations are given prime attention. The determining factors of aerogels regarding the already present and capable implementation areas are provided in brief. Many customizing techniques like modulating the pore structure, changing the surface, coating of the surface, and post-treatment is described by the outcomes of the last ten years. Regarding the commercial uses of aerogels and its products, an unbroken view of industrial aerogel suppliers is provided and a discussion of plausible substitute sources for raw materials and precursors. Last, the chapter summarizes opinions and potential points regarding the aerogels.

Keywords

Tailor-made Aerogels, Pore Structure, Surface Coating, Post-Treatment, Technical Implementations

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Nanosensors and Nanodevices for Smart Multifunctional Textiles

Micro and Nano Technologies

2021, Pages 7-25

Chapter 2 - Smart nanosensors for textiles: an introduction

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Abstract

Nanosensing is considered as most emerging field of application of nanotechnology. This may be due to its interesting utility in all possible areas of technological advancement. Nanosensors are comparatively newer and innovative devices which are being used multidisciplinary in many applications. Broadly applications of nanosensors can be listed in diverse areas such as pharmacy, biomedicine, agriculture, food, and security. In this chapter we will explore introduction to nanosensors, working, characteristics, applications, and future aspects. Different types of nanosensors, their working principle, fabrication and areas of applications, and recent developments have been incorporated in this chapter. Best attempt have been made to include nanosensors based on different technologies with emphasis on their applications.

9

Dendrimers in gene delivery

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1 Introduction

Gene therapy is a recombinant technique that employs genetic material in advance treatment strategies. This technique may allow treating a disorder by inserting a functional gene into a patient's cells rather than using drugs or surgery [1]. This therapy involves transfer of the identified gene with therapeutic function, specifically and efficiently to the targeted cells, through a carrier termed as vector. Gene vector may be viral or non-viral gene vectors. The viral vectors are used for transfection based on their intrinsic properties such as carrying owns genome from one host cell to the other, navigating a new target cell, entering to the cell nucleus and initiate expression of its genome and replicate [2]. Viruses such as retrovirus, poxvirus, alphavirus, lentivirus, herpes simplex virus, adenovirus, and adeno-associated virus are modified into gene-delivery means by substituting some of the fragment of a viral genome with a functional gene [3].

During initial years of gene therapy development, viral vectors became popular due to their high efficacies in gene delivery both in vitro and in vivo. Later on, certain concerns such as immunotoxicity and genotoxicity, large-scale production problems, and high manufacturing cost were observed [4]. Because of these disadvantages, researchers are coming up with a variety of non-viral alternatives including polymers, liposomes and exosomes, peptides and proteins and nanoparticles [5–9]. Non-viral vectors interact with deoxyribose or ribonucleic acid through electrostatic forces, condense the genetic material into units of a few tens to hundred nanometers thereby protecting the gene fragment and facilitates cellular entry (Fig. 9.1). Such complexes of gene fragment with cationic lipids/polymers are known as lipoplex and polyplex, respectively [10].

Dendrimers are suitable polymer for gene delivery operations attributing to formation of more compact complexes with DNA, oligonucleotides, genes, aptamers, siRNA etc. through a non-viral mechanism [11]. Spherical architecture and polyvalency makes dendrimer a suitable platform for gene delivery. Flexible chemistry of dendrimers offers numerous properties required for efficient gene delivery such as biological compatibility, manufacturing feasibility, stable formulation and controlled delivery of gene. They can efficiently condense nucleic acids into small nanoparticles by ionic interactions and protect them from endosomal or lysosomal degradation [10].

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4

Pharmacokinetic considerations in design of dendrimer-based nanomedicines

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1 Introduction

A class of synthetic polymers with central core, repetitive layers and an ample number of terminal functional groups constitute to form dendrimers which have unique architecture, monodispersity and uniform size. Design of dendrimer can be controlled at every step starting from core to the addition of functional groups or ligands at the periphery. The inbuilt physicochemical properties of the dendrimers like size, surface charge, molecular weight, type of the core, surface functionalities and their association with drugs or proteins decide their pharmacokinetic behavior. For the development of the delivery system, pharmacokinetic profiling is very much required as it indicates the fate of the delivery system in the body and displays about the potential toxic or beneficial events [1].

2 Effect of size, molecular weight, hydrophobicity and charge on pharmacokinetic profile of dendrimers

Pharmacokinetic profile includes parameters like absorption, distribution, metabolism and excretion. In specific, pharmacokinetic properties indicate the behavior of the delivery system inside the body after administration. The properties of dendrimers like size, play a crucial role in elimination through kidneys. With the increase in size or hydrodynamic radius beyond the threshold of kidneys, their plasma residence time gets extended. Increase in generation or molecular weight expands the metabolic stability but at the same time it may also increases toxicity concerns. Surface charges on the dendrimers affect the biodistribution and association with cells or tissues. In general, cationic charged dendrimers like amine dendrimers rapid associates with the endothelial cells and thus are rapid eliminate from plasma.

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Introduction to Nanomedicines: Basic Concept and Applications

1

Ashok Kumar Jangid, Poonam Jain, Deep Pooja, and Hitesh Kulhari

Abstract

The application of nanotechnology in the medical field has grown significantly. Nanomaterials are being used for the diagnosis, prevention and treatment of diseases. This chapter is comprised of three sections. First section elaborates the concept and principle of nanomedicine. It also includes the advantages and disadvantages of nanomedicines. The second section discusses the applications of nanomaterials in bioimaging, drug delivery, nanozyme and biosensing. The last section is focused on the potential risks and challenges in the clinical translation of nanomedicines.

Keywords

Nanomedicine · Applications of nanotechnology · Potential risk and challenges

1.1 Basic Concept of Nanomedicine

Nanomedicine is an interdisciplinary science which involves the application of nanotechnology to health and medicine (Nezhadi et al. 2020). Nanomedicine involves various fields of science including chemistry, physics, engineering, medicine, and material science for diagnosis, control, curing, and treatment of diseases (Li et al. 2020a). In past two decades, nanotechnology has made a significant impact on the pharmaceutical formulation development. The unique physicochemical

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5

Dendrimer-based targeted drug delivery

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1 Introduction

Present research in the field of nanodrug delivery is more focused on surface chemistry which involves conjugating the ligand of interest that can target and take payload to a specific organ, tissue or cell. Among the nanodrug delivery vehicles like lipid and polymer nanoparticles, dendrimers offer new features and compared to other nanoparticles. The basic skeleton of dendrimers which are tree-like molecules comprises of a central core, middle branching units and terminal functional groups [1]. Perfect architecture, monodispersity, ample number of functional groups at terminal portion provides an excellent opportunity to conjugate with variety of ligands, imaging probes and drugs itself. Dendrimers are a kind of architecture and required size, chemistry and functional groups can be synthesized. Dendrimers render flexibility in drug loading, i.e. the drug can be loaded into inner core or can be attached to the surface by simple ionic interactions or through covalent bonding [2,3].

TDD offers advantages like drug delivery to specific site overcomes the side effects which are usually caused by non-specific drug delivery. In addition, the targeting ligand helps in taking the drug to the site of action thus, the dose required to exert the pharmacological effect is less in comparison to conventional dosage forms where a large part of drug wasted through first pass metabolism or unnecessary entry into other cells or tissues. Combination of TDD along with controlled drug release would provide better therapeutic efficacy by decreasing the frequency and dose of medications [4,5].

2 Designing of dendrimers for drug targeting

Drug targeting to the specific site occurs by two phenomena, passive and active targeting. In passive targeting the drug or delivery system reaches and accumulates at particular location or site because of the prevailing in situ abnormal physiological or pathological conditions like for example enhanced permeation and retention effect (EPR) and acidic pH in the vicinity of tumor environment, and thus, these type of conditions helps in

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Dendrimers for diagnostic applications

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1 Introduction

Medical diagnosis is the process of determining the disease or condition by seeing the patient's symptoms and signs. It is usually called diagnosis when the medical context is unexpressed. The information required for diagnosis is typically collected from a history and physical examination of the patient seeking medical hospitality. Several kinds of diagnostic imaging are also done during the process to conclude the result [1,2]. Currently, in-vivo diagnostic imaging comprises an important focus area of medical research. The rapidly evolving field of molecular imaging improves early disease detection and progression of disease and enables image-guided therapy and treatment personalization. Furthermore, it provides essential information on the therapy efficacy. However, molecular imaging requires the use of molecular imaging probes to visualize and characterize biological processes at the cellular and molecular level [3–7]. In this section, a brief overview of frequently used non-invasive imaging modalities with respect to the application of nanoparticles will be provided. Medical imaging comprises the non-invasive assessment of anatomical (or morphological), functional and molecular information, which enables the diagnosis of pathophysiological abnormalities. Current imaging modalities that are routinely used in preclinical research and clinical practice include Magnetic resonance imaging (MRI), computed tomography (CT), positron emission tomography (PET) as well as theranostic modalities such as photothermal therapy (PTT), photodynamic therapy (PDT) and neutron capture therapy (NCT). These modalities are based on different underlying physical principles and, therefore, possess specific disadvantages with respect to sensitivity and specificity to contrast agents, tissue contrast, spatial resolution, quantitative estimation and tissue penetration [8–10].

Recent advances in nanotechnology have led to the development of various nanoparticle formulations for diagnostic and therapeutic applications. Diagnostic nanoparticles aim to visualize pathologies and to improve the understanding of important pathological and physiological principles of various diseases and disease treatments [5,11]. The use of

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Dendrimer-based marketed formulations and miscellaneous applications in cosmetics, veterinary, and agriculture

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1 Current scenario: Translation of dendrimer-based product from research to market

Because of unique and engineerable architecture at nanometer scale, numerous-dendrimer based treatment/therapy/diagnostics have recently made significant strides toward FDA, clinical approval and commercialization [1,2]. For instance, Dendrimer based cardio-diagnostic have been commercially available since 1990s after their approval first from Dade Behring (like the stratus analyzer) [3]. The dendrimer based nanomedicine appeared earlier in patents approx. 28 years ago, some of them have either been expired or licensed to Starpharma (Melbourne, Australia) [2].

Some of the earlier patents have shown wide range of dendrimer based nanomedicine applications including; (a) delivery of pharmaceuticals and brachiotherapeutic metals by encapsulation and conjugation, (b) early diagnosis using dendrimer-based magnetic resonance imaging (MRI), (c) targeted delivery for the treatment of diseases, (d) gene transfection vectors, and (e) for antiviral and antimicrobial applications. Numerous dendrimer-based nanoformulations based on their existing/original patents have been approved successfully and currently available commercially in market are as follow:

1.1 VivaGel™

An active dendrimer-based microbicides have been successfully developed by Starpharma under the trademark VivaGel (i.e., SPL7013). SPL2013 is a specifically designed poly(L-lysine) dendrimer with highly charged polyanionic naphthalene disulfonate surface groups. In 2006, the US FDA granted VivaGel™ Fast Track status recognized its potential ability against HIV infection [4]. Starpharma in collaboration with the US

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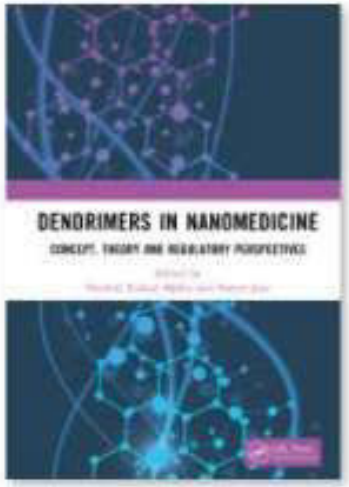

Chapter

Functionalisation of Dendrimers

By Divya Bharti Rai, Deep Pooja, Hitesh Kulhari

Book Dendrimers in Nanomedicine

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ABSTRACT

Dendrimers are effective delivery systems for carrying drugs, gene and other therapeutic molecules. However, plain dendrimers have limited applications and, therefore, are modified or functionalised for various applications. The first part of this book chapter describes various strategies for functionalisation of different dendrimers. The second part of this book chapter discusses the applications of functionalisation of dendrimers for improving cellular penetration, decreasing toxicity, controlling drug release, enhancing biodegradability and designing therapeutic formulations.

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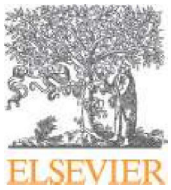

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Strategies to Improve Oral Delivery of Natural Anticancer Molecules

2

Priyanka Shinde, Hina F. Badgujar, and Umesh Kumar

Abstract

Oral route of administration is the most accepted delivery route due to easy painless administration. Oral route is more suitable for chronic therapy and sustained delivery. In recent years oral approach has been used for delivery of various anticancer drugs like Zytiga, Capecitabine, Topotecan. The number of oral administrations of anti-tumour agents has been increased with respect to all other available cancer therapies. Preferable for patients as it reduces the efforts of regular visit to clinic or venepuncture. The most limiting factor for oral delivery is gastrointestinal barrier where epithelial membrane leads to poor permeability of drug and chemicals and enzymes in gastrointestinal tract causes degradation of bioactive compounds. In addition to this pH varies drastically across the GI tract, ranges from 1 to 2 pH in stomach reaching 7 to 8 in colon and rectum. To conquer this limitations nanocarriers are been developed to encapsulate and protect the drugs eventually increasing their pharmacokinetics. The most attractive method includes pH responsive soluble coatings, mucoadhesive nanocarriers, enzyme inhibitor and microbial control system. The present review discusses natural products in cancer treatment, obstacles in their oral delivery and nanotechnology approach to deal with the challenges.

Keywords

Oral delivery · Barriers · pH responsive · Mucoadhesive · Enzyme inhibitor

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Atomic Force Microscopy-Based Force Spectroscopy and Its Various Applications

Jyoti Jaisawal, Amit Kumar Srivastav, Dheeraj K. Singh, and Umesh Kumar

Abstract The complex interaction between various biomolecules and material interfaces at molecular level requires the deeper understanding of different sciences like materials science, nanotechnology, biophysics, biomedicine, and analytical science. Microscopy is very common techniques among these different scientific fields where studies depend upon resolution of Image obtained. None of these microscopy techniques can give both imaging and spectroscopic information with resolution down to nm. Atomic force microscopy is among few scientific tools that can record both imaging and spectroscopic data with high resolution. One such sensitive tool is Atomic force microscopy-based force spectroscopy (AFM-FS), which can be used to probe the intermolecular forces between the biomolecules and interfaces of the various materials ranging from the hard-inorganic surfaces to various soft biological-substrates. The present chapter emphasis the utilization of AFM-FS to understand the biomolecules and materials interfaces interaction at the single-molecule level with emphasis on the basic principles and application of this methodology and some of the practical aspects involved. We believe that the present chapter will be beneficent to the researchers in this field about the fundamental molecular interactions and utilization of AFM-FS to develop the in-depth understanding of the biological functions of various bio-hybrid materials.

Keywords AFM · AFM-FS · Material science · Nanotechnology

1 Introduction

Atomic force microscope (AFM) is a non-conventional microscope which generates images by probing forces operating at the atomic level. These images can be obtained

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Search for anything

Smart materials for medical applications

10

Prithvi C. Asapur, Indrani Banerjee
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1 Introduction

Natural polymer is always the combination of both organic and inorganic components which develops into smart materials with extraordinary functions and properties. Inspiration from the nature to scientists would lead to design the next generation biomedical devices. In last few decades scientists have attracted to the development of composite materials advancement in smart materials [1]. Smart polymer materials are a class of polymers that respond to the external environment and change their physical or chemical properties, therefore called as stimuli responsive polymers. The stimuli could be pH, salt, temperature, electric, magnetic, optical field, etc. that induce macroscopic response in materials depending on the physical state of polymer chains. Such smart biomaterial polymers act as an "on–off" switch for tissue engineering, drug delivery, gene therapy, diagnostics, etc. [2,3].

Typically, while constructing a specific response system, processes such as processing, sensing, and actuating are required to be combined. Combining the properties of different material components enhances the preexisting properties of the individual polymer while broadening the final utility. Hence, nanobiofield has flourished and this leads to increased focus in the development of smart materials primarily for the construction of lab-on-chip and various devices, which find number of applications in biomedical field [4].

Several protein-based constructs are developed, but they do not offer biologically relevant mechanical strength and are less stable. Wide number of synthetic as well as natural polymers are researched for medical applications, of which silk is found to be the ultimate natural polymer for medical applications for its unique properties such as outstanding mechanical strength, biodegradability, and biocompatibility [3]. Silk is the oldest and strongest natural fiber known to man and is a product of both the nature (its evolution) and nurture (its environment) naturally produced by silkworms and spiders. Specifically, silk from silkworm creates new opportunities that offers robust, biocompatibility, implantable material substrate and is widely available [5].

The aim of this chapter is to guide the readers through the amazing world of silk-based smart polymers in order to give current status of research in this area and also provide future directions in this research field and its scope in medical applications. The chapter mentions composition and properties of silk that makes it an excellent material for smart devices. Chapter also mentions the research on different silk-based smart structures that can be used for various medical applications such as drug delivery, tissue engineering, suture, wound dressing, dentistry, and electronic for development of smart systems.

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Plasmonic Solar Cells

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PROOF

Abstract

Photovoltaic (PV) cell is a fundamental solar energy conversion device that converts light energy into electric energy. The light absorption and charge recombination are main limiting factors on the efficiency of PV cell or solar cell. A limited efficiency of PV devices makes them less effective in market for clean energy production. Various tactics and methods are demonstrated to enhance the solar cell performance. Metallic nanoparticles have been utilized to fabricate solar cells because of its novel properties such as large surface to volume ratio and surface plasmon resonance (SPR). Plasmonic nanostructures can influence the absorption of light through scattering of surrounding molecules or particles. The plasmonic nanostructures can scatter or concentrate light at subwavelength scale for increasing absorption in active layer and hence enhancing the efficiency of PV devices. Therefore, the plasmonic nanostructures are promising candidates to develop high efficiency solar cells. We discuss about the fundamental mechanisms, ability to scale up the plasmonic with tailored optical properties, solar cell design, and recent advancements in plasmonic solar cells to generate clean energy and solar fuels.

***Keywords*:** Plasmonic nanostructures, thin film, surface plasmon resonance, light scattering, solar cell

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work and support." —David Schmool, PhD, Director, Groupe d'Etude de la Matière Condensée GEMaC, National Centre for Scientific Research, Université de Versailles/Saint-Quentin, Université Paris-Saclay,Versailles, France

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Contamination of Water
Health Risk Assessment and Treatment Strategies

2021, Pages 31-48

Chapter 3 - Contamination of groundwater by fly ash heavy metals at landfill sites

Krishna Rawat, Bhawana Pathak

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Abstract

Water underneath the Earth surface is considered to be in the purest form of available water, it normally looks clear as ground itself filters water and stores it within the aquifers. Nowadays groundwater contamination by heavy metals is one of the important matters of concern due to the limitations of available water resources and a shortage of a pure form of water. Fly ash that is a thermal waste is one of the major sources of heavy metal release and a reservoir of the same. So it is of the utmost importance to visualize the impact of tons generated and disposed of in nature. From this viewpoint, an attempt was made to understand the importance of groundwater, fly ash disposal practices followed, and its impact on the groundwater quality.

Previous

Next

Keywords

Fly ash; heavy metals; groundwater; aquifers

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7. Terracotta Membrane-based Microbial Fuel Cell with Algal Biocathode: A Low-Cost Alternative to Dairy Wastewater Treatment Coupled Electricity and Biomass Production

Autoren: Smriti Mehrotra, V. Kiran Kumar, K. Man Mohan, S. Gajalakshmi, Bhawana Pathak

Verlag: Springer International Publishing

Erschienen in: Integrated Approaches Towards Solid Waste Management

Abstract

The 21st century is marked by the massive global shortages of water and energy throughout the world. Consumption of food and dairy products at a higher rate is considered a major contributor to it. Among them, the dairy industry is distinctive to this count due to the release of a large quantity of wastewater yielded through its various milk processing entities, cleaning and sanitation units (Kumar et al., 2016). Dairy industry on average discharges 2.5 L of wastewater while processing 1 L of milk (Ramasamy et al., 2004; Elakkiya and Matheswaran, 2013). Its wastewater is marked by high chemical oxygen demand (COD), nitrate and phosphate content due to the fats, high lactose content, various dissolved and suspended solids and the use of nitric acid, caustic soda used in its cleansing operations (Bou Hamad S, 2015). Various traditional physicochemical wastewater treatment techniques are practiced in industries to meet environmental discharge standards. While these techniques are less effective and more costly owing to the energy-intensive processes and the use of chemical coagulants (Sharma, 2014). The efficient management of wastewater resources and their use for energy generation can prove to be a judicious solution to it (Venkata Mohan et al., 2010). Microbial fuel cells (MFCs) are such bioelectrochemical systems, contributing to this attempt in a cost-effective and sustainable manner. This prototype serves the dual purpose of energy generation and wastewater treatment with insignificant negative environmental impacts (Mathuriya et al., 2018). Typical MFCs are composed of an anode and cathode compartment containing electrodes alienated by a cation exchange membrane (CEM). The anodic compartment is fed by the wastewater and sludge, where organic matter oxidises into carbon dioxide in anaerobic conditions through the metabolism of exoelectrogenic bacteria releasing electrons and protons. These electrons pass through the external circuit while the protons cross the CEM to enter the cathodic region, where they combine with an electron acceptor such as oxygen to produce water (González Del Campo et al., 2013). Although these traditional MFCs have proved to be promising in wastewater treatment techniques and energy generation their economic and technical feasibility especially the cost of separators, the kinetics of reduction reaction and cost of aeration in the cathodic chamber have proved to be an obstacle in its practical applications. Therefore, the scientific community is now

solvers to these efforts (Salar-García et al., 2016).

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Abstract and Figures

The chapter is about Carbon sequestration process and its mechanism in microalgae and its use in biofuel production and lipid generation.

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CHAPTER

Carbon Sequestration and Biofuel Production by Microalgae:

An Integrated and Sustainable Approach

9 An Integrated and Sustainable Approach

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INTRODUCTION

The 21st century had witnessed a swift rise in human development due to rapid industrialization, urbanization, and advancement of technology with a consecutive fall in environmental health. As a consequence, issues such as global warming, water scarcity, and energy crisis have become a matter of serious concern throughout the world. Fossil fuels, one of the major sources of energy worldwide, are considered a significant contributor to this devastating problem (Razzak, Hossain, Lucky, *et al.* 2013). Combustion of any fossil fuel releases carbon dioxide, which is one of the major greenhouse gases, contributing about 73% to global warming (Verma, Mehrotra, Shukla, *et al.* 2010; IEA 1998), and it is found to be increasing at the rate of 2.1% per year (International Energy Outlook 2008). According to a report by Mauna Loa Observatory in April 2018, the concentration of CO_2 in atmosphere reached 409 ppm, which is 100 ppm more than the pre-industrial era. If the increment consistency is similar, it is expected to reach up to 535 ppm–983 ppm in 2100 (IPCC 2007; Mondor and Tremblay 2010), far beyond the safe level of CO_2 concentration, which is below 350 ppm (Wennersten, Sun, and Li 2015). Efforts have been made across the world to curb these emissions through various protocols/accord/agreements such as Kyoto Protocol and the Paris Agreement. In order to attain these goals, three main approaches can be realized: (i) carbon diminution/abatement (energy-efficient technology enhancement), (ii) carbon storage and capture (sequestering mechanism–limiting the emission at the source), and (iii) carbon desertion (alternate renewable sources for energy generation). Therefore, researchers throughout the world are focusing on renewable sources for energy generation to mitigate carbon footprints. Therefore, biofuels are a potential option, noteworthy to the present technological world (Pires 2017). First-generation biofuels used vegetable oil from crop plants, which created competition in the food market and hiked the prices of food crops. Many traditional feedstocks for biofuels, such as corn and sugarcane,

Citations (1) References (98)

... They may be autotrophic, utilizing atmospheric CO 2 , or heterotrophic, utilizing organic matter as a source of carbon for the production of oxygen. The most common form of dissolved carbon available are CO 2 , H 2 CO 3 , HCO 3 -, CO 3 -2 and among them, algae utilize HCO 3 and CO 2 forms in their various pathways [39] . Scenedesmus dimorphus used in the present study is a mixotrophic alga deriving nutrition from atmospheric ambient CO 2 and also in dissolved organic form through wastewater penetrated in the cathodic chamber from the anodic chamber. ...

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Strategies and Tools for Pollutant Mitigation

Avenues to a Cleaner Environment

Springer

2021

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Chapter 8
Bioremediation: Efficient Technology to Combat Pesticide Pollutants in Environment

Raman Kumar Ravi and R. Y. Hiranmai

Abstract Pesticides are chemical substances applied to manage the agricultural and domestic pests, but indiscriminate and unsafe use leads to their accumulation in the environment. Bioaccumulation of pesticides is of great public health concern due to their toxicity. Therefore, there is a need to develop assays and methods to easily access and degrade pesticide pollutants in nature. Bioremediation is a key technology that has been proven to be of inestimable value for controlling and managing the pesticides contamination with the help of microorganisms. It includes various strategies that are gaining more scientific and public interest as it is economic and eco-friendly. The microorganisms existing in contaminated environment are explored to degrade the pesticides. Recent advancement in science and technology has provided facts about genetic structure and metabolic activities of microorganisms, which is helpful in the process of bioremediation. In this chapter, we have highlighted the advancements and efficient bioremediation practices to remove pesticide pollutants in the environment.

Keywords Pesticides · Bioremediation · Microorganisms · Environment · Pollution

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1 Introduction

Pesticides are the diverse group of chemicals being used globally and categorized as herbicides, insecticides, fungicides, rodenticides, molluscicides, and nematicides, depending on the target pests. In agricultural sector, these pesticides are applied to prevent or control pest diseases, weeds, and other plant pathogens in order to maintain high agricultural productivity or reduce yield losses (Damalas and Eleftherohorinos 2011). Approximately 45% of food productivity is lost due to pests every year; thus, there is a need to increase the world food production capacity for the rapidly growing population (Schreinemachers and Tipraqsa 2012; Abhilash and Singh 2009). The pesticides are the only toxic chemicals used intentionally into the environment to kill pests. But its uncontrolled utilization has created a lot of health-associated problems. It is estimated that nearly 300,000 deaths account globally every year due to pesticides poisoning (Sabarwal et al. 2018). Therefore, its detection and degradation becomes a necessity and an inevitable area of research. Bioremediation is considered as the removal of unwanted toxic compounds from the contaminated site or environment using biological activities, i.e., elimination of undesirable materials from environment applying biological sources like plants and microbial diversity or the substances obtained from them. Though it is a natural ongoing process, various interventions can be introduced to improve its efficiency as well as make it faster and specific to decontaminate the polluted sites (Hlihor et al. 2017; Shankar et al. 2011; Iwamoto and Nasu 2001; Vidali 2001). Bioremediation can be defined as the application of microbial metabolism to remove or decompose persistent pollutants, such as pesticides from the environment (Huang et al. 2018). Several microbes have been found with efficient metabolic activities that are able to convert pesticides into less toxic metabolites (Hussaini et al. 2013; Gupta et al. 2019). Several microorganisms have been reported having immense potential to deal with xenobiotic compounds (Gupta et al. 2017; Rathour et al. 2018).

Although the biological methods of pesticide removal have encountered, some limitations and challenges, such as screening and identification of potential microorganisms, complex pesticide structures, and delicate environmental conditions (Vikrant et al. 2018; Liu et al. 2019a, b), advancement in technology leads these techniques far above the conventional bioremediation methods. This chapter is mainly focused on the application of microbial metabolisms for bioremediation of pesticides. This also deals with the degradation or removal of pesticides by advanced bioremediation technology. This chapter will provide clues for finding new research approaches in the highly challenging bioremediation field through microbial methods and advanced tools and technologies.

2 Different Sources of Pesticide Contamination

Due to regular anthropogenic activities, the global environmental pollution has increased rapidly. Several persistent toxic compounds, like synthetic pesticides, industrial toxicants, organic solvents, and detergents, are contaminating the environment. Among these pesticides are of great concern (Ollera et al. 2011) due to its toxicity and persistency. The pesticides are released into the environment by several sources, i.e., emissions from agricultural activities, manufacturing and formulation industries, municipal waste, and soil infiltration. Recently, due to the development of agriculture and industry, large amounts of pesticides and other chemicals have been released into the environment (Morillo and Villaverde 2017; Varjani et al. 2018). Agriculture and forestry are the primary source of pesticide contamination in the environment. The increased food demand due to the rapidly growing population has promoted the use of pesticides in different agricultural activities with an increasing rate (Morillo and Villaverde 2017). Agricultural runoff, industrial wastewater, and chemical spills can greatly promote the pollution of pesticides in the environment through biological amplification (Duirk and Collette 2005). Pesticides may pollute the environment through two sources, point sources and nonpoint sources. The point source is a recognizable source of pollution, while a nonpoint source is a source from a wide area. It is impossible to distinguish pollution sources in a large area, such as the transfer of pesticides to surface water from multiple sources that pollute aquatic and terrestrial ecosystems. The common point sources of pesticide pollution in the environment are as follows: agricultural discharge, municipal waste, pesticides application in the agricultural field, wastewater discharge from the agricultural industry, plant residues contaminated by pesticides, improper treatment, and disposal of organic waste near water sources. The most common source of soil penetration, wastewater from spraying containers, and pesticide pollution is cleaning used containers (Neumann et al. 2002; Spanoghe et al. 2004). Opposite to this, nonpoint source pollution of pesticides has no specific discharge point, which is also called diffusion source. Agriculture is the main source of diffuse pollution, and its management is very complex, requiring careful analysis and understanding of many natural and man-made processes (Müller et al. 2002). So far, many treatment technologies have been practiced, but most of them cannot achieve satisfactory degradation effects (Gaya and Abdullah 2008).

3 Bioremediation of Pesticide

Bioremediation is considered as the treatment of polluted environmental medium, such as soil, water, and subsurface material, by altering the environmental condition that supports the microbial growth and development for degrading the target compounds. However, biodegradation is the process in which microbial biomass can effectively break down organic substances into its metabolites. Due to the long life

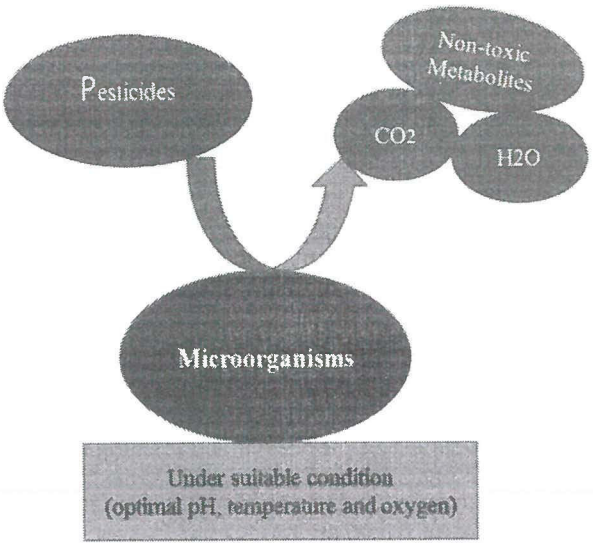

Fig. 8.1 Degradation of pesticides into its metabolites

span, the term biodegradation is often used in ecology, waste management, and environmental remediation. The global annual use of pesticides is about 2 million tons, of which 24% are used in the United States, 45% are used in Europe, and the remaining 25% are used in other parts of the world. According to reports, India consumes 3.8% of the world's total pesticide production. The consumption of agricultural pesticides in India, South Korea, and Japan is 0.5, 6.6, and 12.0 kg ha-1, respectively (Gupta 2004). Earlier, the application of pesticides was relatively helpful in reducing crop yield losses caused by pests, thus opening the way for increasing crop productivity. However, the widespread use of pesticides has caused pollution of the natural environment and has caused some long-term effects on human society (Bhanti and Taneja 2007). Due to the persistence nature, lack of selectivity, biomagnification, and accumulation under different nutrient levels, it is reported that organochlorine is the cause of pest resistance development and harmful effects on nontarget organisms (Carson 1962). The potential threat to all living things caused by the abuse of pesticides has now become one of the most serious environmental or health problems in the world. People mainly complain about the availability of pesticides in drinking water, vegetables, mammalian blood, human food, dairy products, fat samples, and other foods. The pesticide residues are present in different environmental samples through the contaminated food chain, which directly indicates the acute or chronic exposure of human beings to pesticides.

Biodegradation involves the ability of microorganisms to remove contaminants. It is the most promising, relatively effective, and cost-effective technology. This process involves the complete decomposition of the organic compounds into its metabolites (Fig. 8.1). Microbial transformation is an energy-driven process required to detoxify pollutants. Microorganisms have ubiquitous properties. Compared with other living organisms on the earth, they have a large amount of biomass and have a

wider variety and catalytic ability (Paul et al. 2005). It can function even in the absence of oxygen and other extreme conditions. Searching for potential microorganisms that can degrade pollutants, understanding their genetic and biochemical composition, and developing methods for their application in this field have become important tasks for mankind (Megharaj et al. 2011).

3.1 Chemistry Behind Pesticide Degradation

The chemical structure of pesticides strongly influences the susceptibility of pesticides and so their biodegradation. Many studies have shown the relationship between the chemical structure of pesticides and their biodegradability. Some pesticides are easily degraded, but the degradation of some of them are hindered due to the presence of anionic species (Julia et al. 2001). Qualitative analysis of the chemical structure of pesticides can be used to develop bioremediation strategies. Compounds with groups carboxylate (-C(O)OR), amide (-C(O)NR_2), phosphate, hydroxyl (-OH), formyl (-CHO), and carboxyl (-COOH)) are prone to biodegradation due to anoxic conditions. These structural groups are common in nature, and microorganisms may have developed the enzymes needed to deal with them. On the other hand, the presence of certain structural groups reduces the chance of biodegradation. These groups are chlorine and nitro groups, especially those on aromatic rings, quaternary carbon ($CR_1R_2R_3R_4$, no R = H), and tertiary nitrogen ($NR_1R_2R_3$, no R = H), reducing the chance of bioremediation (Schwarzenbach et al. 2003). The enzymes play as a central role in biodegradation (Riya and Jagatpati 2012). Microbial enzymes can convert or degrade pesticides and are an innovative treatment technology used to remove chemicals from polluted environments. The ability of microorganisms to interact chemically and physically makes them an effective degrading agent, leading to structural changes or complete degradation of the target compound. In the microbial community, bacteria, fungi, and actinomycetes are the main pesticide degrading agents (Briceño et al. 2007). Enzyme-catalyzed degradation of pesticides is more effective than the existing chemical methods. Among microorganisms, fungi and bacteria are considered to be excellent microorganisms that produce extracellular enzymes. White rot fungi have been found to be promising bioremediation agents, especially for compounds that are not easily degraded by bacteria. This ability stems from the production of extracellular enzymes and acts on a broad spectrum of organic compounds. Some of these extracellular enzymes are involved in lignin degradation, such as lignin peroxidase, manganese peroxidase, laccase, and oxidase.

4 Microbial Diversity Involved in Degradation of Pesticides

Bioremediation is considered a natural and environmentally friendly technology that can remove various toxic pollutants (Gupta et al. 2016). Microorganisms can metabolize various chemical substances and their derived materials, such as organic complexes, heavy metals, and chlorinated and non-chlorinated pesticides. Microorganisms, such as bacteria, fungi, or algae, can be used to remove organic or inorganic chemicals from the soil environment (Megharaj and Naidu 2017). These potential organisms can degrade toxic chemicals. They may be wild type or genetically modified. Microbes can completely metabolize pollutants or change the chemical structure, thereby promoting their degradation and effectively eliminating pollutants from the environment (Abatenh et al. 2017; Rathour et al. 2018; Gupta et al. 2019). Microorganisms use pesticides as carbon and nutrient sources through their own multiple enzymatic mechanisms (Huang et al. 2018). Several bacteria that degrade pesticides have been isolated, and the list is rapidly expanding (Bass and Field 2011); some of them are listed in the Table. 8.1.

Table 8.1 Microorganisms involved in pesticide degradation

Pesticides	Degrading microorganisms	References
Chlorpyrifos	*Pseudomonas* sp.	Chauhan and Jha (2018)
	Microbial consortium	Singh et al. (2016)
	Bacterial consortium	Ravi et al. (2015)
	Pseudomonas fluorescens	Lakshmi et al. (2008)
	Bacillus subtilis	Lakshmi et al. (2008)
Dichlorvos	*Pseudomonas* sp.	Chauhan and Jha (2018)
Endosulfan	*Bacillus subtilis*	Kumar et al. (2014)
	Pseudomonas sp.	Harikumar et al. (2013)
	Staphylococcus equorum	Bhattacharjee et al. (2014)
	Aspergillus niger	Bhalerao and Puranik (2007)
	Alcaligenes faecalis JBW4	Kong et al. (2013)
Atrazine	*Citricoccus*	Yang et al. (2018)
	Pseudomonas sp.	Lima et al. (2009)
DDT	*Chryseobacterium* sp.	Qu et al. (2015)
	Bacillus sp.	Pant et al. (2013)
Diazinon	*Pseudomonas* sp.	Cycon et al. (2009)
Cypermethrin	*Streptomyces aureus* HP-S-01	Chen et al. (2012)
Methyl parathion	*Pseudomonas* sp. WBC-3	Wang et al. (2014)
	Bacterial consortium	Ravi et al. (2015)
Parathion	*Serratia marcescens*	Cycon et al. (2013)
Glyphosate	*Agrobacterium* strain T10	Ortiz-Hernández et al. (2013)
Lindane	*Pseudomonas paucimobilis*	Rehmat (2012)

4.1 Bacterial Degradation of Pesticides

The biodegradation of pesticides involves the oxidation of parent compounds to CO_2, H_2O, or less toxic compounds (Abatenh et al. 2017; Doolotkeldieva et al. 2018). Bacterial strains belonging to *Burkholderia, Flavobacterium, Arthrobacter, Azotobacter*, and *Pseudomonas* are known to degrade pesticides (Glazer and Nikaido 2007). The pesticide degradation depends not only on the enzyme system of the microorganisms but also on available conditions, such as pH, temperature, and nutrients (Doolotkeldieva et al. 2018). The methods and processes of pesticide degradation vary from compound to compounds and the types of bacteria involved in the process. Both *Pseudomonas* sp. and *Klebsiella pneumoniae* have hydrolases that can degrade organophosphate pesticides and neonicotinoids (Pathak 2018). Sometimes, environmental factors can cause partial degradation of pesticides, leading to accumulation of pesticide residue in the environment. This may cause inhibition of microbial populations. Dichlorodiphenyltrichloroethane (DDT), an organochlorine pesticide, is partially degraded into metabolites of dichlorodiphenyltrichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE), and their toxicity is even higher than the parent compound (Foght et al. 2001). Before introducing microorganisms for pesticide degradation, optimization of the environmental condition becomes necessary and thus inhibits accumulation of metabolites in the soil.

4.2 Fungal Degradation of Pesticides

Although both bacterial and fungal species play a vital role in pesticide degradation, fungi introduce structural changes and then release them into the soil, making them susceptible to further degradation by bacteria and finally turning pesticides into nontoxic substances (Gianfreda and Rao 2004). The degradation of pesticides follows different pathways, depending on its nature, environmental conditions, and microbe type (Ortiz-Hernández et al. 2013). *Phanerochaete chrysosporium* are able to degrade a wide range of pesticides (Singh 2017). The white rot fungi are able to degrade several types of pesticides, such as lindens, atrazine, durone, tert-butazine, metalaxyl, DDT, γ-hexachlorocyclohexane, dieldrin, aldrin, heptachlor, chlordane, and mirex (Pathak 2018). Similarly, fungal species, like *Auricularia auricula, Coriolus versicolor, Agrocybe semiorbicularis, Dichomitus squalens, Stereum hirsutum, Flammulina velutipes, Pleurotus ostreatus, Avatha discolor,* and *Hypholoma fasciculare*, have been shown to degrade different types of pesticides triazines, phenylamide, phenylurea, dicarboximide, chlorinated, and organophosphorus compounds (Bending et al. 2002).

4.3 *Enzymes Involved in Pesticide Degradation*

Enzymes produced by microorganisms in the soil in various metabolic processes are the key to pesticide bioremediation. Enzymes play a major role in the biodegradation of pesticides, at a significant rate, and can help in restoring the polluted environment in the future (Rao et al. 2010). These enzymes also promote the degradation of pesticides in target organisms, through inherent detoxification processes and developed metabolic resistance. The fungal enzymes oxidoreductase, laccase, and peroxidase are mainly used to remove polyaromatic hydrocarbon compounds from fresh water, seawater, or terrestrial water (Balaji et al. 2014). Over the years, organophosphorus-degrading enzymes have been studied in detail, and several bacteria, fungi, and cyanobacteria that use organophosphorus compounds as carbon and nutrient sources have also been isolated (Ghosal et al. 2016; Kandpal 2014).

5 Bioremediation Strategies and Its Application

Depending on the treatment site, there are two basic strategies for removing contaminants, i.e., in situ and ex situ. In situ techniques involve on-site removal of pollutants, while ex situ methods are used for off-site management of pollutants, i.e., in laboratory-scale experiments. The consistency and kinetics of biodegradation of pesticides depends on the microorganism's activities (Jorgensen 2007). The different strategies for both the technique of bioremediation are summarized in Fig. 8.2.

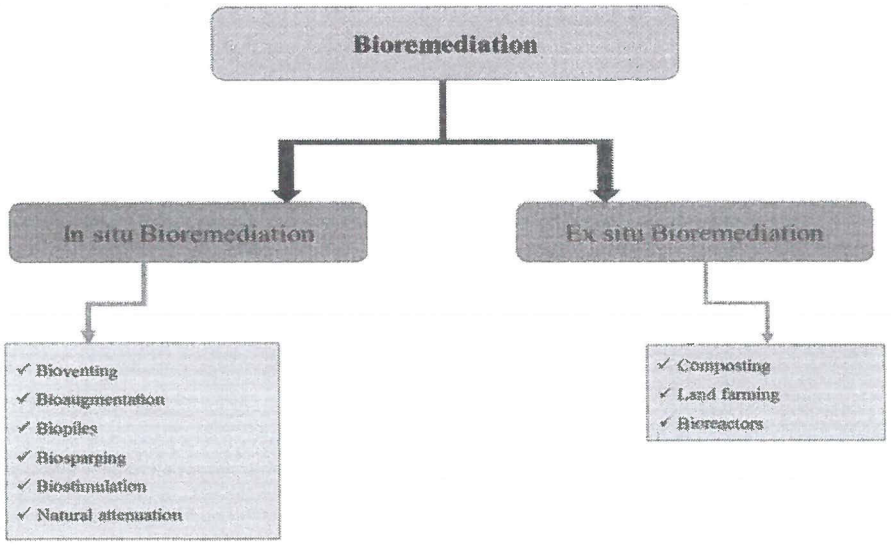

Fig. 8.2 Flow diagram of different bioremediation strategies

5.1 *In Situ Techniques*

In the in situ technology, the pollutants are treated at the contaminated site by simulating the microorganism's metabolism as well as nutrients and optimized environmental conditions (Ahmad et al. 2018). The pollutants are effectively treated on site, thereby avoiding any site excavation or damage to the ecological structure. In this process, the pollutants undergo microbial decomposition under natural conditions and produce carbon dioxide, water, and other less toxic by-products (Doolotkeldieva et al. 2018; Abatenh et al. 2017). The method is conducive to feasible, economical, environmentally friendly, and sustainable to achieve detoxification of contaminated sites. The most common in situ strategies are bioventing, bioaugmentation, biopiles, biosparging, biostimulation, and natural attenuation.

5.1.1 Bioventing

Bioventing involves the supply of nutrients and air through wells to stimulate the native bacteria of the contaminated soil. Bioventing provides low oxygen flow necessary for the biodegradation and accelerates the elimination and degradation of toxic compounds.

5.1.2 Bioaugmentation

Bioaugmentation is used to biodegrade specific soil and groundwater pollutants. It involves adding cultured microbial population into the particular subsurface environment to biodegrade the desired pollutants.

5.1.3 Biopiles

Biopiles provide a favorable environmental conditions for endemic aerobic and anaerobic microbial diversity to remove pollutants by controlling losses of the pollutants by volatilization and leaching.

5.1.4 Biosparging

Biosparging is the process in which air (oxygen) and nutrients are injected to increase groundwater oxygen concentrations and biological activity of naturally occurring microorganisms. This technique accelerates the biodegradation of the toxic organic compounds.

5.1.5 Biostimulation

Biostimulation involves the alteration in the environmental condition to stimulate the native bacterial population capable to perform bioremediation. The process can be done by adding various forms of rate-limiting nutrients and electron acceptors, such as phosphorus, nitrogen, oxygen, or carbon.

5.1.6 Natural Attenuation

Natural attenuation comprises the processes that leads to reduction of the mass, toxicity, mobility, or volume of pollutants without human intervention.

5.2 Ex Situ Techniques

The ex situ techniques involve excavating contaminated samples from selected locations and transporting them to another location for processing (Ahmad et al. 2018). The factors that control off-site techniques include treatment costs, geographic location, type and depth of pollutants, and pollution levels (Azubuike et al. 2016). Due to other parameters, i.e., soil excavation, the processing cost of the ex situ technique may be much higher than the in situ technique.

5.2.1 Composting

Composting is the technique, in which nonhazardous organic materials such as manure are added to contaminated soil. These organic materials support in developing the microbial population growth, thereby improving the temperature for composting. The prepared compost bed has a variety of possibilities for bioremediation of pollutants using organic chelating agents, changing pH, redox potential, and surfactant production.

5.2.2 Land Farming

Land farming technology is used to decontaminate the contaminated site by excavating the contaminate soil and spread on prepared beds, and farming is carried out regularly until the pollutants are degraded. The main purpose of this technology is to motivate the naturally degraded microbial diversity and promote the aerobic degradation of pollutants.

5.2.3 Bioreactors

The reactor is used for bioremediation in which contaminated solid material (soil, sediment, sludge) or water is processed in a designed controlled system. The bioreactors are used for ex situ bioremediation of contaminated soil and water pumped up from a contaminated plume.

6 Approaches for Enhancing the Bioremediation of Pesticides

Bioremediation is a process that is carried out to remove the toxic compounds from the contaminated site using microbial biomass. Although bioremediation may be carried out by several ways, bioaugmentation, biostimulation, and cell immobilization are found very effective for enhanced degradation of pesticides.

6.1 Bioaugmentation

Bioaugmentation is the repair process in which exogenous microbial populations with specific catabolic activities have been applied in biodegradation process at contaminated sites or in the bioreactors. This process is performed either on-site or off-site for the removal of harmful contaminants (Head and Oleszkiewicz 2004; Perelo 2010) and is widely regarded as an effective microbiological method that promotes the degradation of pesticides (Dams et al. 2007; Plangklang and Reungsang 2010). This process is able to eliminate a wide range of contaminants, such as NH_3, H_2S, and petroleum by-products, along with organic and inorganic contaminants (Khan et al. 2005; Park et al. 2008; Xu et al. 2008).

6.2 Biostimulation

In order to improve the microbial efficiency for pesticide degradation, different external stimuli, such as carbon sources, vitamins, oxygen, and other nutrients, have been applied, called biostimulation (Kanissery and Sims 2011). The addition of stimulating nutrients (carbon sources) can promote a quick depletion of available stocks of major nutrients (phosphorus and nitrogen) (Huang et al. 2018; Plangklang and Reungsang 2010). Nutritional supplements are used as inducers to enhance the enzymatic activity and metabolite generation during pesticide biodegradation (Plangklang and Reungsang 2010; Robles-Gonzalez et al. 2008). In order to enhance the microbial degradation caused by stimulation, water-soluble nutrients, such as

NH_3NO_3, $NaNO_3$, KNO_3, K_2HPO_4, and $MgNH_4PO_4$, are applied after mixing with fertilizer (Lima et al. 2009).

6.3 Cell Immobilization

These days, cell immobilization has been used for the biological removal of pesticides, and it is found that it is much efficient than the other types of degradation techniques, because it can maintain catalytic activities for a longer period of time (Richins et al. 2000; Chen and Georgiou 2002; Martin et al. 2000). Compared to conventional biological systems using free cells, whole-cell immobilization has shown significant advantages, such as the possibility of using high cell density, avoiding cell washing even at high dilution rates, being easy to separate from the reaction cell system, repeated use of cells, and better protection of cells from harsh environments. Previous reports indicate that this higher productivity is caused by immobilization-induced cell or genetic modification. There is evidence that immobilized cells have greater tolerance to the perturbation of the reaction environment and lower sensitivity to toxic substances, which makes immobilized cell systems particularly attractive for handling toxic substances such as pesticides (Ha et al. 2008). In addition, the enhancement of the degradability of immobilized cells is mainly due to the protection of cells from the inhibitory substances present in the environment. It was observed that the degradation rate of repeated operations increased in successive batches, indicating that as time passed, the cells became better adapted to the reaction conditions (Ha et al. 2009).

7 Technological Advancement in Bioremediation of Pesticides

With the development of science and technology, different techniques, such as genetic engineering, metagenomics, genomics and proteomics, nanotechnological approaches, etc., are in use for enhanced degradation of pesticides (Fig. 8.3).

7.1 Genetic Engineering for Biodegradation of Pesticides

Microorganisms respond distinctly to different types of stresses and adapt to the contaminated environment condition. This process can be enhanced by using genetic engineering technology. Recombinant DNA and other molecular biology techniques have enabled (a) targeted genes encoding enzymes in metabolic pathways to be amplified, destroyed, and/or modified; (b) pathway bottlenecks to be minimized,

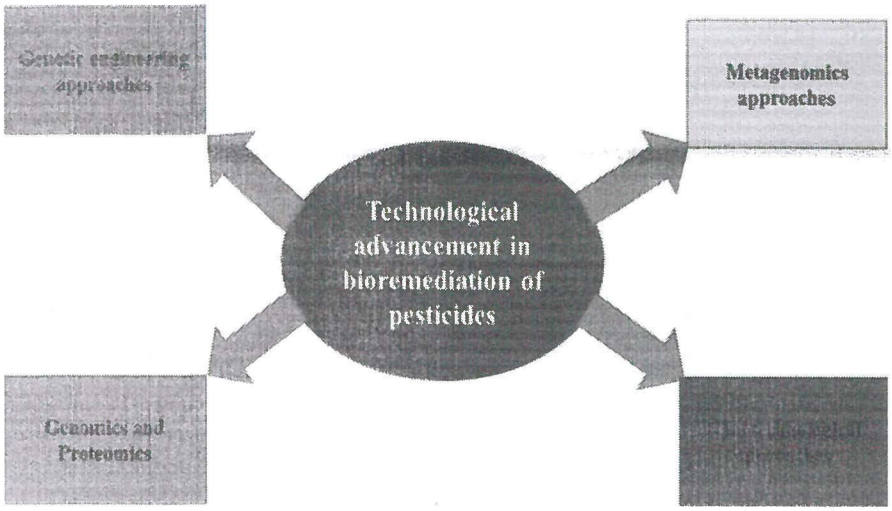

Fig. 8.3 Advanced techniques for bioremediation of pesticides

(c) increase redox and energy generation; and (d) recruiting heterologous genes to give new characteristics (Shimizu 2002; Megharaj et al. 2011). Various genetic approaches have been developed and used to optimize the enzymes, metabolic pathways, and organisms relevant for biodegradation (Pieper and Reineke 2000). New information on metabolic pathways and degradation bottlenecks are still accumulating, and the available molecular toolbox needs to be strengthened. However, even in a single modified organism, the introduced gene or enzyme needs to be integrated into the regulatory and metabolic network to be correctly expressed (Shimizu 2002; Pieper and Reineke 2000; Cases and de Lorenzo 2005). Genetically modified microorganisms have demonstrated the detoxification of organophosphate pesticides for the first time, and they have been cloned and expressed the gene encoding hydrolase in *P. pseudoalcaligenes*, *Yarrowia lipolytica*, *Escherichia coli*, *Streptomyces lividans*, and *Pichia pastoris* (Wu et al. 2004; Fu et al. 2004; Yu et al. 2009; Shen et al. 2010; Wang et al. 2012).

7.2 *Metagenomics Approaches for Biodegradation of Pesticides*

The complexity of microbial diversity depends on various interacting parameters, including pH, moisture, soil structure, climate change, and biological activity (Liu et al. 2019a, b). More than 99% of the microorganisms in the natural environment are difficult to cultivate under laboratory conditions, so they are not friendly to basic research and biotechnological applications (Zhou et al. 2010). In the past two decades, the development of technologies, capable of directly isolating nucleic

acids from environmental sources, has allowed the study of diversity among microorganisms. By performing nucleic acid analysis on environmental samples, scientists can actively study the microbial communities present in the soil without cultivation (Jeffries et al. 2018; Zhou et al. 2010). Every organism in the surrounding environment has a unique set of genomes, and all community members with mixed genomes form a "metagenome." Metagenome technology (metagenomics) has led to the accumulation of DNA sequences, which are now used to develop new biotechnological applications (Kumar et al. 2015). Due to the limitation of being able to cultivate every kind of microorganism present in the environment, genomics search has appeared and will always lead to the dissection of previously unknown genes and proteins, which can be used more effectively to degrade chemical pesticides (Jeffries et al. 2018; Rayu et al. 2012).

7.3 *Genomics and Proteomics Role in Biodegradation of Pesticides*

The traditional molecular biology and genetics approaches are part of functional genomics methods, which can analyze the phenotypic modifications caused by mutagenesis or gene knockout in the organism's genome. Currently, functional genomics has received widespread attention due to the use of important innovative technologies for whole-genome assessment using bioinformatics (Jaiswal et al. 2019).

The new approaches include proteomics for microarrays and metabolic engineering for identifying proteins, characterizing, and expressing them to study their interactions and transcriptome profiles (Zhao and Poh 2008). The implementation of proteomics in environmental bioremediation research provides a global view of the biological composition of microbial cells and provides a promising strategy for the use of molecular methods of bioremediation (Jaiswal et al. 2019). Proteomics study shows the changes in protein patterns, as well as the functions and interactions between proteins (Kellner 2000; Chandrasekhar et al. 2014). It can also show the gene expression and regulation and protein-protein interaction of comprehensive analysis (Baginsky et al. 2010; Aslam et al. 2017). The mixed use of proteomics and genomics allows us to gain insight into the regulatory checkpoints of various metabolic pathways, thereby improving the understanding of gene functions (Manzoni et al. 2016).

Due to exposure to xenobiotic compounds in biological samples, proteomics has allowed extensive evaluation of the overall changes in protein profiles. The identification of key proteins involved in microbial responses in a given physiological state can promote the understanding of which genes are involved in the bioremediation process and how to regulate them (Singh 2017). Recently, proteomics research has been used to identify the degradation pathways of various xenobiotic compounds and their adaptive responses to their toxic effects in different microorganisms (Liu

et al. 2017; Seo et al. 2013; Vandera et al. 2015; Festa et al. 2017; Wei et al. 2017). Several studies regarding microbial biotransformation and their specific effects on biological systems have been carried out, but extensive effects on the global metabolism of microorganisms with the ability to degrade these molecules have not yet been discovered (Bardot et al. 2015). Microbial degradation of pesticides using proteomics methods can determine the relevant enzymes, catalyzing the process, and the main metabolic pathways, utilizing carbon as energy, and the proteins related to damage caused by pesticide exposure. The application of proteomics methods in the field of pesticide biodegradation research has recently become more and more important.

The prime objective of the functional genomics technique is to use basic strategies to expand the scope of biological research, from the analysis of the function of a single gene and protein to the simultaneous and systematic analysis of all genes and proteins in the system (Rayu et al. 2012). The direct method to assess the biological function of genes is to determine the specific conditions under which the gene is disrupted or complementary to other genes. The combined use of transcriptomics and proteomics with traditional genetic methods is helpful to understand the gene function (Rayu et al. 2012; Zhao and Poh 2008). Metabolic engineering evaluates molecular biology approaches to improve cell characteristics, by applying the rational genetic alterations (Santos-Merino et al. 2019). A precise knowledge about microbial physiology and host cells will promote an effective bioremediation process (Rayu et al. 2012). With the development of new genomics tools, problems, such as oxygen stress, availability of nutrients, or high concentrations of pollutants along different geochemical gradients, can be solved (Ruuskanen et al. 2019). Finally, by monitoring the overall microbial community structure and function, strong decision can be made on how to control the field environment conditions to achieve effective bioremediation of pesticides (Maphosa et al. 2012).

7.4 *Nanotechnological Approaches for Biodegradation of Pesticides*

Nanotechnology has emerged as a promising technology with increasing applications in all applied fields, including the field of bioremediation, where it can be applied to remove the soil contamination (Guerra et al. 2018). Due to increase in pollution and its toxic effects, the use of this technologies to remove pesticides has attracted the attention of the scientific community. The size and unique properties of nanomaterials have become the point of interest for remediation of various environmental pollutants, including organic pesticides (Maeda 2011). Nowadays, nanocomposites, bio-nanopolymers, nanoparticles, and bimetallic nanoparticles have been widely used for detection and remediation of pesticide (Garcia and Takashima 2003). The metal oxide nanoparticles are effective photocatalysts that can degrade various toxic pollutants (Panigrahi et al. 2004; Shah et al. 2003).

The advancement in nanotechnological approaches can utilize both the phases, i.e., solid phase and solution phase, to decontaminate the soil under aerobic and anaerobic conditions (Medina-Pérez et al. 2019). For example, iron-based nanoparticles can effectively convert chlorinated organic compounds. The interaction of bacteria and zero-valent iron [Fe(0)] produces biological iron oxide, which can catalyze the dehalogenation of organic pollutants, chlorinated solvents, and pesticides (Quinn et al. 2005). Similarly, silver and gold nanopreparations can efficiently remove chlorpyrifos and malathion pesticides, either in solution phase or coated over alumina (Momic et al. 2016). In the solid phase, the long-term interaction between nanoparticles and pesticides causes them to adsorb on the surface and eventually lead to precipitation. The alumina-loaded nanoparticles are more effective in removing pesticides. Nanoparticles are firmly attached on an inert surface that absorbs pesticides and then are catalytically destroyed. At room temperature, the CCl bonds of hydrocarbons are broken, forming amorphous carbon as a by-product of the reaction (Nair and Pradeep 2007). In addition to single-nanoparticle formulations, stable Fe-Pd bimetallic nanoparticles have been studied, under aerobic and anaerobic conditions, for the degradation of chlorinated pesticides (lindane and atrazine) (Kumar and Pannu 2018). Nanoparticles behave as strong electron donors under anaerobic conditions, leading to the complete reduction of lindane and atrazine in the presence of Fe and Pd as catalysts. In contrast, nanoparticles under aerobic conditions will undergo a Fenton-like reaction. The hydroxyl radicals and active oxygen in the iron nanoparticles promote the oxidation of lindane, by dehalogenation or dehydrohalogenation, whereas dealkylation of alkyl amino side chain is required for atrazine removal (Joo and Zhao 2007).

8 Conclusions and Future Prospects

Due to human activities, huge amounts of pesticides are released into the environment, causing adverse effect on living beings. The microbial assisted pesticide degradation is found as the efficient, ideal, and most sustainable approaches. The microbial communities play an important role in the decomposition of pesticides, nutrient recycling, and biodegradation to repair polluted environments. Pesticides in water and soil can change the diversity and integrity of microbial communities. However, genetic flexibility and metabolic versatility enable microorganisms to resist the presence of pollutants in the environment, including pesticides. These microorganisms have developed strong strategies to degrade pesticides that pollute their environment. This versatile characteristic stands them in the row of potential candidate for pesticide bioremediation. The development of technologies, like genetic engineering, metagenomics, genomics and proteomics, and nanotechnology, has provide the crucial role in biodegradation of pesticides. The advancement in biotechnology and nanotechnology has started a new era of innovations that has the potential to revolutionize the bioremediation sector as biological, efficient, and clean remedial solutions to ensure the sustainability of our planet in the coming future.

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Alteration in microbial population density composition in different land use systems

4

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4.1 Introduction

Land use pattern throughout the continents has gone through drastic changes over the last few decades, as the enormous population growth leading to the stress of food, shelters, and other resources. Developmental activities including industrialization, urbanization, and the modernization are the basic causes of these changes. The land use pattern change has a great impact on the associated ecosystems. Changes in the climatic conditions and patterns of land use systems are subjected to disturb the biogeochemical cycling in the environment which is carried through endogenous microorganisms of the soil in these ecosystems shows in Fig. 4.1. It is now widely accepted that the change in land use can drastically alter the function of an ecosystem. Changes in nutrient cycles, structure, and soil carbon sequestration (C) which occur when natural ecosystems are converted for agricultural use are particularly well documented. Land use change use influences the economic growth, quality of life, environmental resources management, and national food supply. The microorganisms of any soil ecosystems expeditiously respond to soil changes about the chemical or physical properties of soil (Jackson et al., 2007) (Fig. 4.1).

Therefore the understanding of soil microbial community and their responses toward differential land use pattern might be extremely significant for the mitigation of land degradation and desertification processes. Hence the present literature will provide an insight into the changes in the land use pattern and their probable adverse effects on the community of the soil microorganisms.

4.2 Impact of land use on microbial community change in a different land-use system

Land-use change and cover a significant, rapid and comprehensive process. Changes in land use and land cover are human-driven and, in many cases, also

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Molecular characterization of bacterial community succession and analysis of physiochemical properties in a compost of solid organic waste from Gandhinagar, Gujarat, India

5

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5.1 Introduction

The increasing population and urbanization are forcing the world to face the problem of solid waste management which is considered as one of the biggest environmental challenges. A sustainable approach is needed to overcome the pollution caused by the solid waste by converting it into useful products by composting and vermicomposting. The organic solid waste treatment by composting is a natural process that is widely practiced for waste management. Vermicomposting involves earthworms for the process of degradation of biodegradable materials. The resultant product is rich in nutrients, enzymes and plant growth promoting substances (Bajsa et al., 2003).

The approaches by different municipalities for managing this solid waste through monitoring, collection, transport, processing, recycling and disposal highly varies. Among the available technologies of solid waste management, composting and vermicomposting are economic and environmentally friendly and also reduce the waste and help to improve soil quality through supplementing organic rich nutrients. As practiced presently by selected organizations, there is a need to perform composting at home, in the neighborhood, parks, schools, etc. It can be considered as the most important short-term issue in solid waste management in absence of a proper landfill site. A number of compostable materials are collected by municipalities and provide to the farmers, who use it to increase soil fertility (Verma, 2010).

The present-day anthropogenic activities are adding increased waste material to the environment resulting in air, soil, and water pollution and adding to global warming (Peter, 2010). The increased rate of waste production at local and global levels due to increased population and industrialization urges to opt for waste

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Assessment of microbial biomass for production of ecofriendly single-cell protein, bioenergy, and other useful products

12

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12.1 Introduction

Increased population growth has led to a decrease in the quality of life, poverty and hunger. Therefore human beings have been trying to overcome the crisis through technological advancement, which can help them to get more food. In this era of globalized society, it is finally possible to make a reliable estimate of the available resources for human survival through the technological revolution. The global shortage of food and feed has prompted researchers to find ways to increase protein production. Increasing the accessibility of protein in agricultural waste in single-cell protein (SCP) through fermentation is one of the most advantageous methods. SCP is the dried cells of microorganisms and is used as a protein supplement in human foods or animal feeds (Sakine et al., 2009). Microorganisms have been used to produce high-protein foods, such as cheese and fermented soy products for many years. Protein is the main nutrient in both products (Haider et al., 1989).

Microorganisms have the ability to upgrade low-protein organic substances into high-protein foods, which have been used by the food industry. This phenomenon was used in Germany during World War I, when people used the growth of *Saccharomyces cerevisiae* for human consumption. Further, *Candida arborea* and *Candida utilis* were used during World War II and about 60% of the country's pre-war food was replaced (Litchfield, 1983; Arora et al., 1991). The development of microbial systems for use in the food industry has firstly, growth of microorganism is faster than of animals. Secondly, a broader range of materials may be considered as suitable substrates depending on the microorganism chosen. The inexpensive feedstocks and waste products are utilized as sources of carbon and energy. The microbes such as bacteria, fungi, yeast, and algae can be used to grow biomass, protein concentrates, or amino acids (Ivarson and Morita 1982; Aggelopoulos et al., 2014). Since protein contents are the quantitatively important part of microbial cells, these microorganisms, also called SCPs, are a natural protein concentrate

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Soil-plant-microbial interactions for soil fertility management and sustainable agriculture

16

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16.1 Introduction

The soil is regarded as a living system in sustainable agriculture due to the presence and activity of microbes (Janvier et al., 2007). Soil and plant microbial interactions including secretion of plant exudates and complex biological and ecological processes benefit the plant growth and suppress soil borne pathogens (Liu et al., 2016). Microflora and fauna including nitrogen fixing, phosphate solubilizing and plant growth promoting organisms are part of the rhizosphere community. The soil borne pathogens that break the protective mechanism of plants immune system occur there. A complex and diverse population and activity is observed in this microenvironment (Raaijmakers et al., 2009; Philippot et al., 2013) (Fig. 16.1).

The concept of rhizosphere was introduced by Hiltner (1904). He described the narrow zone of soil around roots with microbe populations and activities that are stimulated by root. According to McCully (2005) this concept is now expanded to the physical, chemical, and biological properties influenced by the root exudates and microbial activities. The thin layer of soil immediately surrounding plant roots is an active area with root activity and metabolism and other physiological processes like mineral uptake and nutrient availability. This zone and its activities vary with plant genotype and soil conditions with abundance and diversity (Nielsen et al., 2015).

The soil rhizosphere system is governed by the roots, soil colloid and solution, particles and organic matter. Soil microbial ecology helps to unveil the decomposition of organic matter and how the small amount of organic matter triggers the reaction in nature. The biogeochemistry involves the plant- soil interaction that could be assessed through stochiometric reactions. These reactions describe nutrients reactions, their interactions, and demand by the microbes that decompose the organic litter (Dijkstra et al., 2013; Mooshammer et al., 2014; Rinkes et al., 2013). The stochiometric reactions in nutrient limited conditions help to identify different biogeochemical cycles for nitrogen fixation in ecosystems (Rousk et al., 2013). Isotopic tracer methods also help to systematically estimate the microbial contributions to nutrient transformations and turnover of low molecular weight components (Rinkes et al., 2013). The microbial role in ecosystem level processes is of significance.

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Influence of land use change on native microbial community and their response to the variations in micro environment

15

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15.1 Introduction

A landscape can be considered as a geographical and/or an ecological space where organisms thrive. It can be heterogeneous in terms of resource availability. In order to explore the dynamics of land forms, human activities (i.e., land uses), and organisms, a landscape can be employed as a powerful model. "Landscape dynamics" refers to every single alteration that happens in the physical, biological, and cognitive assets of a landscape. Variation is one distinctive characteristic feature of landscapes. These changes lead to many ecological processes such as species movement and physical flows. Furthermore, anthropogenic activities are significant drivers of change. The prerequisite for the management of natural resources is the observation and understanding of the changes occurring in the ecosystem. Photos, census, and maps are the different analytical tools that bring in various information in order to detect changes in the landscape dynamics (Baudry, 1989).

Landscape dynamics are compelled by external agitations, such as fires, volcanic eruptions, earthquakes, extreme climate events, erosion, and human intrusion—and by internal perturbations, such as physical flows of energy and matter, succession, population fluctuations, and community turnover. Landscape dynamics comprise properties of the landscape, such as stability, persistence, resistance, resilience, and recovery, that operate along a broad range of temporal and spatial scales, such as shifting mosaic steady-state, and equilibrium spatial properties. Landscape dynamics are very significant for land management and conservation. The analysis of landscape dynamics must be conducted with robust conceptualization and explicit modeling taking into consideration the complexity of the processes that occur in the landscape and the different scales at which individuals, populations, and communities respond to environmental constraints. In particular, landscape dynamics can be studied at discontinuities or ecotones, or by evaluating the level of connectivity.

Landscapes changes differ in space and time. No landscape remains static, however the time scales of changes may show a discrepancy from month to millennia.

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Occurrence, fate, and toxicity of emerging contaminants in a diverse ecosystem

Abstract: Activities that were developed for better/modern living conditions of humans are the primary source of contaminants to the natural ecosystem. Some of the compounds involved in urbanization and industrialization are termed emerging contaminants (ECs) or contaminants of emerging concern. ECs are either chemical or derived from natural sources which environmental concerns and public health have been raised in recent years. ECs enter wastewater treatment systems and migrate from here to different ecosystems as direct or by-products. They are persistent and also stay for a long duration due to their less biodegradation and photodegradation nature. Also, ECs accumulated in living cells and transformed through trophic levels. Technological developments and their application/utility in daily life led to the production of various components that are being added to the natural ecosystem. The treated/untreated wastewater enters into fresh/marine water bodies and gets accumulated into fauna, flora, and sediments. These pollutants/contaminants that are getting added on an everyday basis bring about changes in the existing ecosystem balances. ECs have been found in almost every country's natural environment, and as a result, they became a global issue. The present review discusses the route and transport of selected ECs into the terrestrial ecosystem through water and other means and how they influence the natural process in an ecosystem. The ECs such as personal care products, pharmaceuticals, polyaromatic hydrocarbons, endocrine disruptors, nanoparticles, and microplastics are highlighted in this review.

Keywords: anthropogenic activities; emerging contaminants; food web; occurrence; terrestrial ecosystem; toxicity.

1 Introduction

Anthropogenic activities have exerted large stress on the ecosystem. The addition of pollutants throughout environmental matrices changes the ecological condition of a

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given region. Due to the developmental activities, a large number of pollutants in trace amounts are added to the air, water, and soil daily. There is a wide range of undetected contaminants that are being added are of environmental concern. These are also found in biological tissues and quantified by various methods. Emerging pollutants encompass a range of manmade materials added to the environment [1]. Uncontrolled human activities have added a range of pollutants that are in everyday use by modern society and are becoming a part of life. It includes pesticides, personal care, pharma products, and many others included in a part of regular use materials. Emerging pollutants are divided into three categories: Compounds introduced into the environment recently. Compounds have been introduced into the environment for a considerable amount of time but have been detected for a short period. Compounds with well-known adverse effects on ecosystems and human health are identified and measured over time [2]. These emerging pollutants are introduced into the ecosystem through various industries, municipal wastes, and agriculture activities and produces. The sources, occurrence, environmental behavior, and fate of emerging contaminants (ECs) are diverse from conventional contaminants. In advanced research, the pathway of emerging pollutants from source to target is an essential part as their behavior is unpredictable in the environment. The molecular pathway can be detected through genomics to understand the behavior and route of ECs into organisms. Molecular biomarkers can be designed and used to assess the bioavailability of ECs that will also help in environmental biomonitoring and remediation [3].

Agrochemicals, personal care products (PCPs), pharmaceuticals, polyaromatic hydrocarbons (PAH), nanoparticles (NPs), and microplastics (MPs) are the primary emerging pollutants. In addition, many pollutants such as endocrine disruptors, hormones, pesticides, industrial and household chemicals, metals, surfactants, micropollutants, industrial additives, and solvents are also included in the emerging pollutants category. These components are a large group of synthetic or naturally occurring chemicals that have recently appeared in the environment and are not commonly monitored. They enter the environment and cause known or suspected adverse ecological and/or human health effects. Among emerging pollutants, pharmaceuticals are highly stable in chemical structure and possess pronounced biological activity that could be observed through organic chemistry, molecular biology, biotechnology, and pharmacology of the compound. In open ecosystems, they are potentially dangerous, entailing environmental consequences [4].

Reduction of pollutants at source and substitution of toxic compounds can help to reduce/remove them from the environment. In addition, traditional wastewater treatment techniques are not designed to remove or decompose these compounds, so new treatment techniques need to be designed for the reduction of risks and removal opportunities. Examination of wastewater treatment plants (WWTP) and quality of released treated effluent assures the reduction in contaminants in the aquatic system. Water monitoring and the use of new analytical techniques help to detect the contaminants in very small quantity also. The ECs and their associated environmental

problems are received much attention in recent years worldwide. Several studies have reported the impacts of various ECs and remediation techniques. Scopus database analysis for the research output in the keyword of "Emerging contaminants" for the period of 2012–2021 is illustrated in Figure 1. Though the ECs receive worldwide attention, the systematic review is most needed to highlight the current progress in the ECs occurrence and toxicity on the ecosystem. Hence, the present review aimed to discusses the occurrence, fate, and toxicity of selected ECs in a diverse ecosystem. Although there are several chemicals categorized as under ECs, the current review highlights an overview of agrochemicals, pharmaceuticals, PAH, NPs, and MPs as model ECs and their fate, occurrence, and toxicity on the diverse ecosystem are covered in cumulative aspect instead of covering in a detailed manner.

2 Sources and fate of ECs

The environmental fate and potential effects on the environment, their distribution in the environmental compartments (water, soil, and air), and its degradation processes are of concern in the scenario. ECs and their metabolites can enter the environment through a variety of point or diffuse sources, and then enters the water bodies (surface water, groundwater, and marine water), soil, and atmosphere via a variety of routes or mechanisms that are largely determined by ECs properties (persistence, volatility, polarity, and so on) and environmental compartment characteristics [5]. The outflow of WWTP in urban, industrial, and agricultural areas is a major pollution point source for treated municipal and industrial wastewater. Water bodies become a primary contact source of ECs due to the discharge of insufficiently treated effluents from WWTP. ECs can pass through several treatment processes due to their high solubility, low volatility, and – for many of them – low degradability. Because surface waters are the direct receivers of effluents from WWTP and residence durations in surface waters are shorter than in groundwaters, the range and concentrations of ECs observed in surface waters are usually larger than those reported in groundwaters. The ECs enter the soil by the usage of treated effluents for irrigation and the application of chemicals as a fertilizer, herbicides, weedicides, etc. Many ECs, particularly medicines and PCPs, are regarded as key point sources in households (e.g., natural hormones, synthetic steroids). The expired or unused pharmaceuticals are typically disposed of in household solid trash or flushed down the toilet. Excretion in human and animal urine and feces, flushing of unwanted medications, home uses, and bathing are all examples of point sources [6].

The life-cycle distribution of ECs from sources to receptors viewpoint is summarized in Figure 2. The spatial distribution of emerging pollutants in ground and surface water was observed with a wide range of contaminants (emerging and organic) that pose threat to water quality [7]. The presence of contaminants is also influenced by sources, hydrogeography, and inherent properties. The physicochemical properties and release into the environment play a significant role in the occurrence of

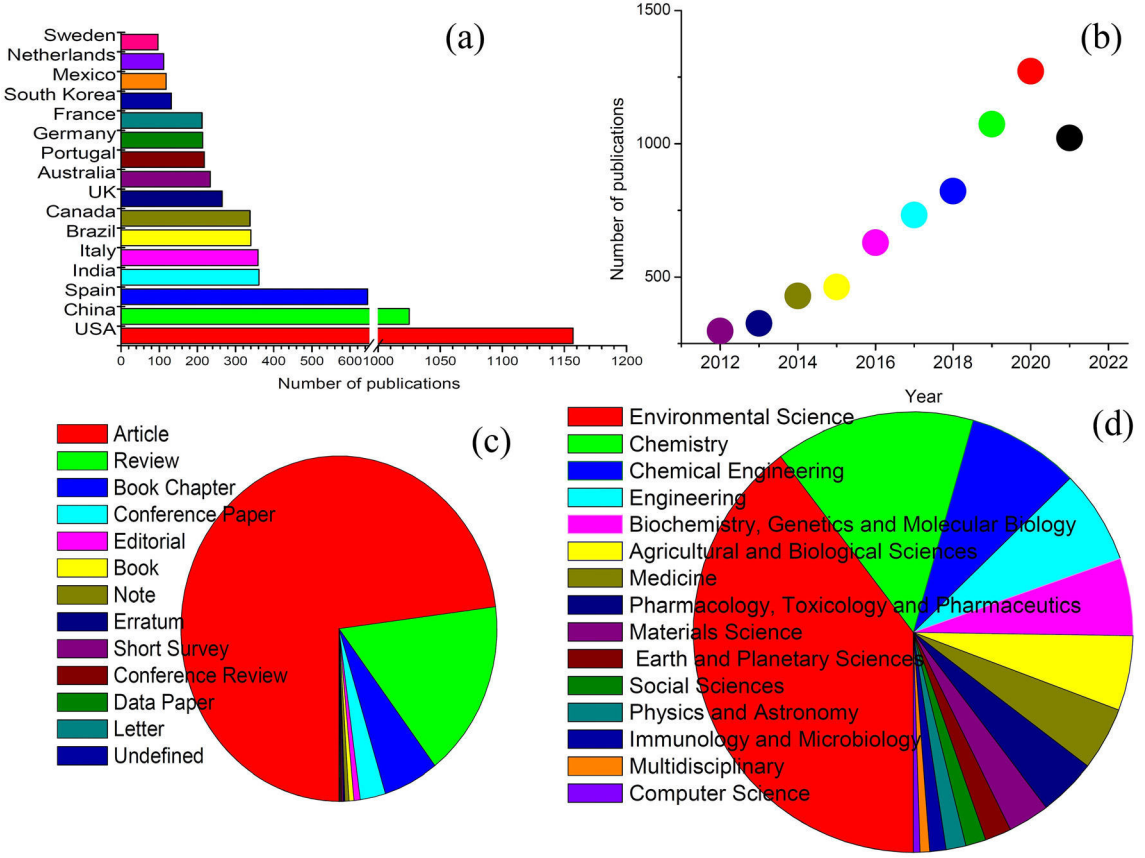

Figure 1: Scopus database analysis for the research output in the keyword of "Emerging contaminants" for the period of 2012–2021 (Scopus database as on 18/06//2021). (a) Documents by Top 15 country/territory, (b) documents for year-wise, (c) documents by type, and (d) documents by Top 15 subject area.

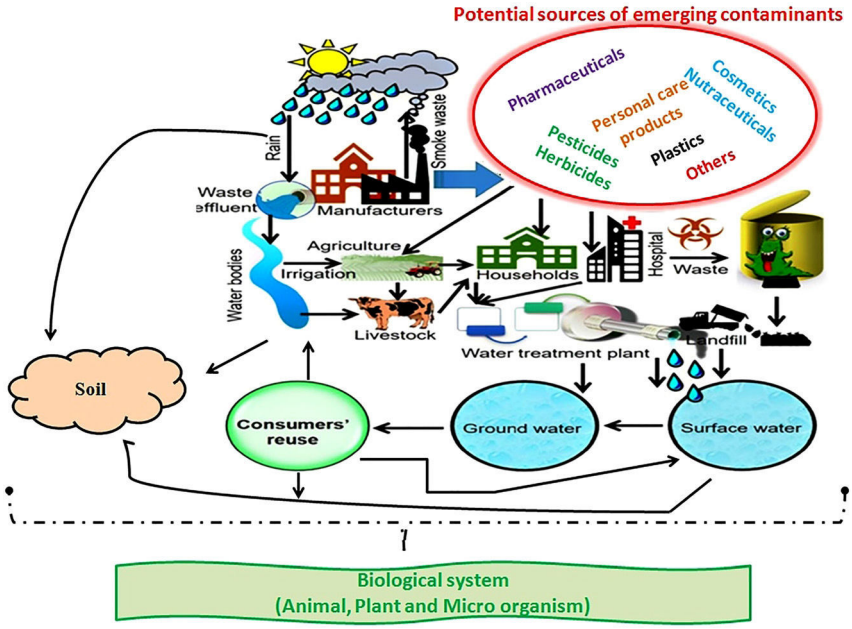

Figure 2: Life-cycle distribution of emerging contaminants from sources to receptors viewpoint. (reproduced after modification with permission from Rasheed et al. [73] Copyright © 2019 Published by Elsevier Ltd.)

contaminants. However, these ECs are hydrophobic and cannot be removed by these traditional treatment techniques. ECs are typically detected in waters downstream of sanitary discharge points at concentrations ranging from 0.15 ng L^{-1} to 2.0 g L^{-1}. However, this concentration can be high in wastewater flowing through the hearts and regions of large cities where many ECs are been utilized [8].

Due to their endurance, they can (bio)accumulate in sediments and river flora and fauna, as biodegradation, chemical degradation, and photodegradation (in the absence of light) can all occur at very low rates. Hence, their disappearance from the environment is almost trifling. Certain microbial populations, however, are able to overcome ECs biocide action and potentially change them, speeding up their disintegration rate. Few kinds of research have looked into the natural biodegradation of ECs like hormones, detergents, and medicines. Typically, these investigations are conducted in the laboratory, but there is no guarantee that the experimental systems accurately reflect the real-world environment, and the application of these findings on a wide scale has yet to be determined [5]. As a result, the development of research for finding the impact of natural microbial systems and sunlight-mediated photodegradation on different type of ECs or their transformed product is a task with great perspective to identify their fate in various environments.

3 Occurrence and Impacts of EC

3.1 Agrochemicals

The consumer products in daily life include biocidal active substances, insecticides, and repellents. Biocides are used in the food industry as disinfectants and food preservatives. Drinking water is treated with biocides to eliminate any harmful micro-organisms. Agrochemicals are used for plant protection and enhancing crop production. The selected examples of ECs of Environmental Protection Agency (EPA) contaminant candidates are listed in Table 1. In agriculture, pesticides are used that are now detected in water sources. Various pesticides are taken up by algae, daphnids, and catfish that accumulate and pass through aquatic food chains. Sanchez-Bayo [9] documented that herbicide application adversely affects plant biomass and biodiversity, arthropod communities ultimately lack food for birds and amphibians that lead to their community reduction. Earth's ecosystems are adversely affected by human activity in agriculture and development. The application of pesticides also affects nontarget organisms in agricultural land and surrounding landscapes.

Meena et al. [10] reported the negative effect of agrochemicals on soil fauna and flora, food safety, and sustainable agriculture and influences nutritional value and health of consumers. Beneficial microbial community gets changed in their population and diseases in plants become common. Agrochemical's potential to cause adverse health effects either acute and persistent damage to the nervous system, reproductive organs, lungs, immune and endocrine system, birth defects, and cancer are reported in laboratory experiments [11]. Bio-magnification and the persistent nature of pesticides pose high risks to living organisms and they also pollute the ecosystem [12]. Bhagat et al. [13] reported from a review study that fungicide azole is used in antifungal products that are used in the plant, animal, and human beings for treatment. They are found in the environment and accumulated in aquatic organisms and cause several detrimental effects on fish. Due to the toxic nature agrochemicals are handled and stored with regulations and used for crop production but adversely affect the environment. The utilization of agrochemicals also leads to groundwater contamination with nitrate and surface runoff of fertilizers to aquatic bodies results in increased algal growth that adversely affects the life cycle of aquatic organisms [14]. Lushchak et al. [15] have stated in their review on pesticides that they possess high persistence and pervasiveness. Their biotransformation permits them to stay long in an environment in a living organism. Fungicides inhibit protein and ergosterol biosynthesis and mitochondrial respiration. Growth of seedling, photosynthesis, amino acid, and lipid biosynthesis is inhibited by herbicides in addition to disrupting the cell membrane. Growth, development, and energy production are affected by insecticides.

Table 1: Example emerging contaminants on the EPA contaminant candidate list (CCL) [75].

Chemical contaminant	CASRN[a]	Use
17-Alpha-estradiol	57-91-0	It is an estrogenic hormone found in some pharmaceuticals.
2-Methoxyethanol	109-86-4	It is used in a number of consumer products, such as synthetic cosmetics, perfumes, fragrances, hair preparations, and skin lotions.
2-Propen-1-ol	107-18-6	It is used in the production of other chemicals.
3-Hydroxycarbofuran	16655-82-6	It is a pesticide degradate, the parent, carbofuran, is used as an insecticide.
4,4′-Methylenedianiline	101-77-9	It is used in the production of polyurethanes foams, glues, rubber, and spandex fiber.
Acephate	30560-19-1	It is an insecticide.
Acetaldehyde	75-07-0	It is a disinfection byproduct from ozonation; it is used in the production of other chemicals.
Acetochlor	34256-82-1	It is an herbicide for weed control on agricultural crops.
Acrolein	107-02-8	It is used as an aquatic herbicide, rodenticide, and industrial chemical.
Bensulide	741-58-2	It is an herbicide.
Benzyl chloride	100-44-7	It is used in the production of other substances, such as plastics, dyes, lubricants, gasoline, and pharmaceuticals.
Butylated hydroxyanisole	25013-16-5	It is used as a food additive (antioxidant).
Captan	133-06-2	It is a fungicide.
Chlorate	14866-68-3	Chlorate compounds are used in agriculture as defoliants or desiccants and may occur in drinking water because of the use of disinfectants such as chlorine dioxide and hypochlorites.
Chloromethane (methyl chloride)	74-87-3	It is used as a foaming agent and in the production of other substances.
Clethodim	110429-62-4	It is an herbicide.
Dimethipin	55290-64-7	It is an herbicide and plant growth regulator.
Equilenin	517-09-9	It is an estrogenic hormone used in hormone replacement therapy.
Equilin	474-86-2	It is an estrogenic hormone and is used in hormone replacement therapy.
Erythromycin	114-07-8	It is used as an antibiotic.
Estradiol (17-beta estradiol)	50-28-2	It is an isomer of estradiol found in some pharmaceuticals.
Estriol	50-27-1	It is a weak estrogenic hormone used in veterinary pharmaceuticals.
Estrone	53-16-7	It is a precursor of estradiol used in veterinary and human pharmaceuticals.
Ethinyl estradiol (17-alpha ethynyl estradiol)	57-63-6	It is an estrogenic hormone and is used in veterinary and human oral contraceptives.
Ethoprop	13194-48-4	It is an insecticide.

Table 1: (continued)

Chemical contaminant	CASRN[a]	Use
Mestranol	72-33-3	It is a precursor to ethinylestradiol used in veterinary and human pharmaceuticals.
Methamidophos	10265-92-6	It is an insecticide.
Methyl bromide (bromomethane)	74-83-9	It has been used as a fumigant and fungicide.
Metolachlor	51218-45-2	It is an herbicide for weed control on agricultural crops.
Nonylphenol[b]	25154-52-3	The main use of nonylphenol is in the manufacture of nonylphenol ethoxylates, which have been used in a wide range of industrial applications and consumer products including laundry detergents, cleaners, degreasers, paints and coatings, and other uses. Several other CASRNs are associated with nonylphenol due to varying chemical structures including 104-40-5, 84852-15-3, 91672-41-2, and 139-84-4.
Norethindrone (19-Norethisterone)	68-22-4	Norethindrone is a synthetic hormone used in oral contraceptives and for hormone replacement therapy.
Permethrin	52645-53-1	It is an insecticide.
Profenofos	41198-08-7	It is an insecticide and an acaricide.
Quinoline	91-22-5	It is a component of coal tars and used in the production of other substances, and as a pharmaceutical (antimalarial).
Vinclozolin	50471-44-8	It is a fungicide.
Ziram	137-30-4	It is a fungicide.

[a]Chemical Abstract Service Registration Number (CASRN#) - Chemical abstracts service registry numbers are used in reference works, databases, and regulatory compliance documents by many organizations around the world to identify substances with a standardized name. [b]Selected from the full list at https://www.epa.gov/ccl/chemical-contaminants-ccl-4

3.2 Personal care products (PCPs)

PCPs used for cleaning, protecting, and keeping body surface in good condition enter the wastewater – sewage plant – receiving water route, - aquatic environment. PCPs are found in different environmental compartments and exert adverse effects on living organisms. They are observed in water, sediments, and biota of any aquatic system. Commonly PCPs occur in human and veterinary medicine and are continuously released into the environment. Environmental fate depends on the physicochemical properties and efficiency of microbes in sewage treatment plants, surface waters, and soils for their biological degradation [16]. PCPs are released through effluents and get bioaccumulated in fish tissues. The use of microbeads in cosmetic and personal care (toothpaste, skin

cleansers, shaving cream, etc.) are reaching public water reservoirs and natural environments as they are used in personal hygiene by communities upstream of rivers, lakes, and seas [17]. They remain in the aquatic system and get into the food web slowly through a transfer at different levels. PCPs enter soil through sludge land application or landfill, use of livestock wastes as fertilizers, and reclaimed water irrigation.

Bioactive compounds used as PCPs (UV filters, synthetic musk fragrances, disinfectants, food additives, biocides, preservatives, and cosmetics) to improve life quality are of concern due to their accumulation in the environment. They are continuously released into the environment through wastes and affect terrestrial and aquatic organisms. Some PCPs, such as polycyclic musks, organic UV filters, and plasticizers, are chiral compounds [18]. PCPs that are used topically are discharged through water and enter into the ecosystem based on their application methods. In wastewater treatment, they are not removed completely and get discharged into water bodies. The PCPs sorbed onto biosolids of treatment plants gets ultimately into agricultural fields during irrigation and get amended to soil and from there to crops and ultimately to animals and humans [19]. Urban runoff and atmospheric deposition are also routes of entry of PCPS into the environment and there it gets transformed. Volatile PCPs are also released into the atmosphere during spray application. If not frequently changed there are chances of its accumulation in swimming pools [20].

A large number of ECs enter water systems from various sources (sewage, disposal, leeching from landfills, drain water, or from industries) and occur in surface waters, and create pressure on wastewater treatment works for their effective removal [21]. There are three main transport pathways that transportation of the compounds into the cells, which are apoplastic (moving between cell walls), symplastic (moving through cells via plasmodesmata), and transmembrane (moving through cells via cell membranes). The ecological-level effects include effects on biodiversity and community composition, habitat structure, nutrient, and food web dynamics, and disease dynamics. PCPs pollution-induced changes in community composition studied in macroinvertebrates (freshwater fish and macroinvertebrates) exhibited ecosystem-level interactions and bioaccumulation [22].

3.3 Pharmaceuticals

The group of ECs and pharmaceuticals are released into the environment through industrial discharges. Due to the universal use of these active pharmaceutical ingredients and their disposal to the aquatic environment, they modify the characteristics of the water body. They also bring about changes in aquatic organisms. Only limited content is removed in wastewater treatment units. A considerable amount of them reaches the aquatic environment and enters the biodiversity. Transformation of

drugs occurs due to various factors that are drained to water bodies. Surface water bodies of most countries contain varying concentrations of animal and human drugs as treated effluents are released by industries. Exposure of aquatic organisms to such chemicals continuously can lead to bioaccumulation and changes in their natural characteristics. Hence, the production of more pharmaceuticals for saving lives also emerged as a new contaminant to the environment. Many of them exert acute effects or chronic effects on organisms indirectly. The examples of adverse effects of selected ECs on different biological sources are summarized in Table 2. Their presence is recorded in surface, ground, and wastewater, and soils that reach from various sources. Various treatment methodologies are unable to remove them completely in WWTP. The effluent from pharma industries needs specific treatment before their discharge.

Wastewater discharges from the treatment unit carry pharmaceutical residues to water bodies and thereby enter into aquatic animals that are being consumed [23]. The pharmaceuticals in the contaminated environment get into an exposure route through the prey and predator. They also observed that fishes are more prone to human drugs compared to other organisms like algae or zooplankton. The type of pharmaceutical decides the magnitude of contamination and effects on the organism [24]. World 1/3rd population lives in the coastal region and annually the population is increasing that ultimately leads to the release of more compounds like PPCPs and is expected to increase further every year [25]. Variation in climatic patterns changes the precipitation and movement of PPCP into ground and surface waters that further exerts synergistic stress effects on marine organisms and ecosystems. Researches have shown that there is an accumulation of pharmaceuticals in aquatic invertebrates and from them, it gets into predators of these invertebrates and further to the food chain. As increases in the use of pharmaceuticals are inevitable their concentration in the aquatic ecosystem and food web also increases [26].

According to Maldonado-Torres et al. [27], depending on solar radiation and soil characteristics PCPs undergo various transformations. These secondary residues can pose risk to the environment as their toxic effects are different from parent compounds. They made a study with ibuprofen and clofibric acid to identify the degradation and its toxicological effect on selected microbes. It was observed that the transformed products could interact with other PCPs in water sources. Ebele et al. [28] observed that PPCPs are found in surface, ground, and drinking water samples in Lagos state, Nigeria during two different seasons. Most prevalent was amoxicillin recorded as 1614 ng L^{-1} in surface water, 238 ng L^{-1} in groundwater, and 358 ng L^{-1} in drinking water. In addition acetaminophen, nicotine, ibuprofen, and codeine were also found. The concentration of glyburide, caffeine, naproxen, and diclofenac concentrations were significantly ($p < 0.05$) higher during the dry season, while Nicotine and Codeine levels were higher during the rainy season.

Table 2: Adverse effects of selected ECs on different biological sources (reproduced with permission from Gogoi et al. [76] Copyright © 2018 Published by Elsevier Ltd.).

Chemical	Adverse effect
Pharmaceuticals	
Diclofenac (nonsteroidal anti-inflammatory drug)	Renal lesions and gill alterations of rainbow trout (*Oncorhynchus mykiss*)
Carbamazepine (antiepileptic drug)	Oxidation stress of rainbow trout (*Oncorhynchus mykiss*)
Gemfibrozil (blood lipid regulator)	Growth inhibition of algae (*Anabaena* sp.)
Penicillin, sulfonamides, tetracyclines (antibiotics)	Cause resistance among bacterial pathogens, that lead to altered microbial community structure in nature and affect the higher food chain
Roxithromycin, clarithromycin, tylosin (antibiotics)	Growth inhibition of algae (*Pseudokirchneriella subcapitata*)
Caffeine (stimulant drug)	Endocrine disruption of goldfish (*Carassius auratus*)
Propranolol (β-blocker)	Reduction of viable eggs of Japanese medaka (*Oryias latipes*)
HHCB (synthetic musk)	Oxidation stress of goldfish (*Carassius auratus*)
Fragrances (musk)	Carcinogenic to rodents, easily absorbed by human skin and may damage the nervous system
Endocrine-disrupting compound	
Bisphenol A (BPA)	Proven to have estrogenic effects in rats and hormonal effects which increase breast cancer risk in humans Reported to act as anti-androgen that causes feminizing side-effects in men.
Estrone and 17-β estradiol (steroidal estrogens) and 17-α ethynylestradiol (synthetic contraceptive) – contained in contraceptive pills	Feminization in fishes mimics as estrogen hormone to nontargets
Preservatives	
Parabens (alkyl-phdroxybenzoate) – (used for antimicrobiological preservatives in cosmetics, toiletries, and even foods)	Shows weak estrogenic activity
Disinfectants/antiseptics	
Triclosan (used in toothpaste, hand soaps, and acne cream)	Acts as toxic or biocidic agent and cause of microbial resistance

3.4 Polyaromatic hydrocarbons (PAHs)

In nature, PAHs are spread as heavy and light benzene ring aromatic compounds and are considered major environmental carcinogens [29]. Their hydrophobicity and electrochemical stability get increased as the size and angularity of a PAH molecule increase. PAHs are part of many dietary ingredients and are assessed by bioaccessibility. Natural (volcanic eruptions, natural forest fire, and moorland fire caused

by lightning flashes, as well as anthropogenic (industrial, mobile, domestic, and agricultural emission sources) emission, adds pollution by PAHs [30, 31]. PAH pollutants are ubiquitous, found equally in aquatic and terrestrial ecosystems as well as in the atmosphere, and are observed to be highly toxic, mutagenic, carcinogenic, teratogenic, and immune-toxicogenic to various life forms [32, 33]. PAHs have higher hydrophobicity and low aqueous solubility so they are deposited in soil and sediments and adsorb on them easily. They get accumulated in soil and are slowly transported to water and plants [31]. Through plants, they enter the food chain. PAHs are entering living organisms (mammals) through inhalation, ingestion, and dermal contact. They strongly influence humans as well as other organisms and adversely affect health [34].

Soil and atmospheric deposition lead to contamination of edible parts of the plants that further get into the food system. Atmospheric deposition, as well as industrial processes, adds PAHs into the most favored beverages tea and coffee that are detected in instant tea and coffee [35]. The black clayish carbon particles and coal tar are entrapped to reduce the bioavailability and natural plant-soil-microbes interaction could be utilized to reduce contamination risks [33]. The high content of PAHs in the soil is toxic to terrestrial invertebrates and they lead to developmental changes and affect reproduction. PAH uptake by plants through root and translocation to different plant parts highly depend on soil type, availability, and concentration. PAHs were expected to be high in fish and shellfish that can lead to biomagnification.

Uptake, transport, distribution, and accumulation of PAHs in the environment and living organisms are determined by their solubility. Volatility is a factor for their transportation in the atmosphere. Its chemical reactivity influences adsorption to organic material or degradation. These all factors favor their presence in the food chain. The lipid tissue of plants accumulates more PAHs compared to the high water content part and limits their transfer to other plant parts. PAHs get adsorbed onto the surface of waxy vegetables. Through surface water, PAHs are transferred to fresh water and the marine ecosystem. There it gets adsorbed onto surfaces. Organisms in these regions get exposed to the PAH and it gets biotransformed and gets into the aquatic food chain. Mussels and oysters accumulate comparatively large quantities as they filter water and possess low metabolic capacity [36]. Benthic organisms such as lobsters, muscles, and clams are exposed to PAHs in sediments and pore water and they are directly consumed by predators (squid and fish) and further by humans.

3.5 Nanoparticles (NPs)

NPs are generally considered with a diameter of 1–100 nm. Engineered NPs come in a variety of forms, and more are predicted to emerge in the future. Most contemporary nanomaterials in the environment can be classified into four categories for such as (i) metal-based materials, (i) carbon-based materials (iii) composites, and (iv) dendrimers [37]. Nanomaterial manufacturing facilities' wastewater may contain a wide range of

NPs. Long-range atmospheric transport, as well as movement in saturated and unsaturated subsurface regions, may result in nanomaterials being transferred to the water. Nanomaterials are most likely discharged into the atmosphere during manufacturing and are eventually found in the effluent of storm runoff [38]. Metal-based NPs tend to disrupt beneficial interactions more forcefully and trigger toxicity due to their unique physicochemical features, such as surface charge, increased surface area and reactivity, and very small size [39]. Colloidal, gas-phase, vapor deposition, and attrition are the four basic types of NP formation processes, all of which can lead to exposure through inhalation, cutaneous, or gastrointestinal routes [37]. When NPs are inhaled or swallowed into the human body, they are frequently thought to be harmful. They get deep into the lungs, where their sheer numbers overwhelm the body's defense mechanisms. They can then be delivered to essential organs via the bloodstream or lymphatic system. Exposure to NPs in soil includes intentional release by soil and water treatment techniques, potential agricultural use industries such as water and fertilizers mentioned above, and inadvertent discharge to air, water, and sludge as the result of various activities [38].

The emission of metal-NPs initiated from the production of raw material, product manufacturing, use, and waste management. The shape of nano-Ag is considered to be spherical for the sake of comparison throughout the literature [39]. This literature summarizes the concentration of nano-Ag in air emissions ranged from 6×10^{-8} to more than 6.9×10^{-4} mg L^{-1} air. Wide ranges of concentrations are reported as above and below the existing industrial exposure limit of 2×10^{-6} mg L^{-1} air. Similarly, for Ag-NPs enabled product manufacturing, the data in the range of 2×10^{-8}–2.4×10^{-7} mg L^{-1} air, 4.4×10^{-4} mg L^{-1} air, and 7.9×10^{-6}–5.5×10^{-5} mg L^{-1} air concentrations. The emission of Ag-NPs in wastewater effluents was found in the range of 0.1–1.3 mg L^{-1} during waste management practices, and 3.8 ± 0.7 mg L^{-1} concentrations were reported during landfilling activities. The toxicological ramifications of these released levels in the environment are unknown. Furthermore, a lack of understanding of NPs' physicochemical properties prevents the development of systematic methodologies for analyzing NPs in complex environmental media [39].

Canesi and Corsi [40] summarized the impacts of NPs on marine invertebrates, which have been identified as important NP targets. The digestive tract and gills are the primary sites of NP accumulation, and the majority of data is available for polychaetes, bivalves, and echinoderms. Immunomodulation, oxidative stress, and embryo damage are the main physiologic reactions. Biomolecule interactions with NPs (e.g., polysaccharides, proteins, and colloids) can alter their aggregation and bioavailability. When the NPs enter inside the organism they have the ability to interact with plasma protein and form a protein radiance that can alter the uptake and toxicity. Current overview of key properties of silica NP (SiNP) (physical and chemical properties, applications, and emissions), latest scientific output related to SiNP, biometric analysis, key toxic mechanisms, and aquatic organisms (knowledge of the ecological toxicity of SiNPs for marine and freshwater) and the main vulnerabilities of ants. The recognition

of the toxicity of SiNP from an environmental point of view has been reported by [41]. Bjorkland et al. [42] reported low bioaccumulation of carbon nanotubes in plants, invertebrates, and nonmammalian vertebrates. Among various metal NPs, silver (Ag) is still the predominant one due to its widespread application. The trophic availability of AgNPs in the food chain using conventional and biodynamic methodologies, the processes that control AgNP trophic transfer, and the toxicological effects of AgNP trophic transfer are all being investigated by [43]. Direct investigation of the *in vivo* fate of AgNPs in the food chain, including the discrimination of ions and NPs, as well as the localization of NPs at the subcellular level, will greatly enhance a mechanistic understanding of AgNP trophic transfer and its toxicological consequences, according to this study. These investigations are found to be dependent on the quantification and localization of NPs in biological samples.

There is a potential risk of groundwater pollution as the NPs are transported through the soil. Little is known about the behavior, migration, and fate of NPs in soil [38]. NPs in the soil are a major concern because of their toxicities with a subsequent threat to soil, the environment, and the human community. These contaminants may badly influence soil ecology, crop production, or product quality, groundwater purity, and human health. Research initiatives are focused on understanding the impacts of manufactured NPs on the human being, soil and formulate combat mechanisms to mitigate the adverse consequences of nanocontaminants on human health and soil quality. While this attempt signifies an exclusive chance for soil scientists to investigate these highly potential technologies, it also emphasizes on foremost challenges to a field of research that has great scope to predict the consequences of nano contaminants on soil ecology and animal health [44]. Metal NPs' continuous deposition, low biodegradability, and extended persistence in soils have a negative impact on the population of soil beneficial bacteria and fungus. Based on multiple toxicity endpoints, the research implies that NP-fungi and NP-bacteria interactions are harmful [39]. Accumulation of zinc, copper, and cerium ions and NPs in carrots is reported by Ebbs et al. [45]. In the sand where the carrots were grown, the NPs and metal ions were mixed separately. Surprisingly, the NPs were no more hazardous than the metal ions, and they accumulated less in the carrot's edible portion.

Selck et al. [46] published EU–US opinions on the status of the ecotoxicity study, research priorities, and future challenges. It covers key topics for future research include characterization of NPs in the environmental matrix, alternative methods for toxicity, exposure assessment, the impact of exposure scenarios on bioavailability, and toxicity have was developed on realistic bioassays for the environment and absorption, internal distribution, and NPs depletion. In recent years, several studies on the fate, transport, and toxicity of nanomaterial contaminants are reported. Engineered nanomaterials (ENMs) face complex fate and transport in aquatic ecosystems due to multiple dynamic interactions between the physical/chemical properties of ENMs and complex environmental conditions. Man-made nanomaterials combine with other materials in water or become by-products. ENM combines with suspended particles,

colloids, and Dissolved Organic Carbon (DOCs) to deposit suspended particles at the bottom of rivers, lakes, and estuaries. Suspended particles can be deposited and buried in sediments, or deposited in water columns, depending on the hydrodynamics. ENM is biologically available to plants which induces nutrient transfer and plant biochemistry [47]. ENMs may accumulate and/or increase concentrations of the component metal or carbon nanomaterials in the fruits/grains of crops, have detrimental or beneficial effects on the agronomic traits, yield, and productivity of plants, induce modifications in the nutritional value of food crops, and transfer within trophic levels [48].

The molecular properties of the accumulated NP are also not well understood. However, a multi-modality-based approach should reveal not only isolated experimental parameters but also the molecular characteristics of the integrated pathway leading to transfection-induced toxicity. A more complete understanding of the link between exposure to the food chain and toxicity outcomes will allow us to predict how ecosystems will respond to AgNP exposure. Comprehensive AgNP risk assessment results accelerate the development of AgNP-related nanotechnology while reducing risk to wildlife and humans [43]. Considering the structural and functional toxicity of NPs to biodiversity, measures for safe NP disposal in the environment have been advocated, and safe by design approaches to reduce NP contact have to be developed. Agro-nanotechnology solutions should be tailored to specific target applications.

3.6 Microplastics (MPs)

Fragmentation of larger plastic (secondary MPs) leads to the production of debris below 5 mm in size (primary MPs) that represents the MPs and that of size between 1 and 100 nm forms nano plastics. MPs are even commonly reported in seafood, honey, beer, and table salt. They are produced by domestic and industrial sources or human activities that are found all over the world in rivers, oceans, soil, and other environments. Those small produced as microbeads are added to toothpaste and exfoliants. Some are produced as larger plastics are broken down in the environment. As they reach the aquatic system through different means are eaten up by organisms [49]. Plastics are used in packaging and when food is heated in it becomes harmful releasing chemicals like bisphenols and phthalates that are endocrine disruptors. In an experiment with mice, MPs were found to be accumulated in the liver, kidneys, and intestine. The MPs can move from the intestine to other parts of the body carried by the blood and are toxic to the brain. *In vitro* studies have shown that human lungs contain plastics as the small particles are present in the air and they produce inflammatory chemicals. Repeated consumption of food packed in plastic can lead to health hazards.

Due to their threat to soil and aquatic ecosystems, MPs are grouped as ECs. Guo et al. [50] made a literature study to observe the MPs in soil and their trophic transfer in food chains and adverse effects on the functioning of ecosystems, microbes, and animal and human health. Similarly, Zhou et al. [51] reported adverse effects of MPs. MPs

interact with different properties of soil and it determines their rate and migration in soil. Its presence interferes with the normal functioning of plant-microbe-soil interactions. They form biofilms on microbes and get transported. Nanoplastics are produced during the fragmentation of MPs debris and arise from the engineering materials used for various industrial processes e.g. water, and air used for cleaning of machines, processing aids, equipment, and textiles. The literature for the in-depth understanding of nano plastics occurrence and fate is very limited, hence it's required much research attention. Browne et al. [52] observed MPs in the circulatory system of mussels. Organisms in the marine ecosystem that live near the bottom line of the food chain also accumulate MPs. It enters the food web by consuming plastic-contaminated fish [53]. In addition to this feeding of MPs facilitates the transport of invasive microbes [54].

MPs are also found in natural sediments and soils. As particles sink to the bottom sediment becomes a source and gets into organisms living there and on beaches [55]. Transported through various segments, plastic debris remains in the environment for centuries and it gets into the ecosystem through various sources [56]. MPs are distributed through air, water and are found in many places. Water currents carry them through and accumulate in different parts and are taken up by flora and fauna of the ocean [57]. In this way, MPs enter food directly or indirectly by trophic transfer or between prey and predator. In urban regions air is inhaled in the industrial area, especially textiles contain MPs that get into living tissues while speaking or eating in these areas [58]. Sea birds, mammals, fishes, and bivalves are studied for MP in their meat and found in chicken gizzards among terrestrial organism that is commonly consumed [59] and more than 690 marine species (edible and nonedible) are reported to contain micro/nano plastics [60].

Seawater contains MPs in a suspended form that is easily entering marine organisms as plankton-eating fish in North Pacific Gyre ingest due to their size [61]. Estuarine catfish in Brazil also contained MPs in their stomach. Benthic zone organisms including crustaceans and polychaetes take up MPs from sediment surface and subsurface layers. Trophic level transfer between species was reported to have more accumulation in the upper trophic level. Edible marine organisms (fish, bivalves, crustaceans, and turtles) contained MPs in their gastrointestinal tract, and in bony fishes, it was found in the stomach and guts [62].

In 2016, the European Food Safety Authority published an overview on the presence of MPs and nanoplastics in food, with a particular focus on seafood [49]. According to their report common mussel, bivalves, shrimps and fish ingests MP. Browne et al. [52] reported that the gut of *Mytilus edulis* contains polystyrene microspheres and they get translocated to the circulatory system. It is also evident by Li et al. [63] that MP is present in mussels used in UK coasts and supermarkets. As the MPs are small in size fishes are unable to distinguish between them and food particles. It gets easily ingested by fish and leads to their entry into the marine food chain. Pollution due to MPs are high in marine habitat and indicator species are identified to be mussels as they are

distributed across varying marine regions and adapt to various changes in surroundings. MP influences ecological and human risks. The MPs' persistence in the marine ecosystem and aquatic life, their trophic transfer via the food web, and the identifications of seafood species as suitable indicators have become a research priority [64]. Heterogeneous distribution and high concentration of MPs are related to oligotrophic subtropical gyres. The concentration depends on the motility of organisms, their feeding habit, and detection capacity. Setälä et al. [65] observed ingestion, inhalation, entanglement, and trophic transfer of MPs in the marine food web. Organisms like filter feeders have also detected, ingested, processed, and rejected MPs. Lipid metabolism and behavior of fish are affected and weight loss, the triglycerides: cholesterol ratio in blood serum, and the distribution of cholesterol between muscle and liver were also influenced by ingestion of NPs.

3.7 Endocrine disruptor chemicals (EDCs)

EDCs are of concern to many scientists and water quality authorities. EDC is a ubiquitous, toxic, and persistent biologically active chemical that mimics or blocks hormone activity in humans and animals, resulting in reproductive function in both men and women. Alternative increases the incidence of breast cancer causes abnormal growth patterns and alters immune function Neurodevelopmental retardation in children. Wastewater may contain tens of thousands of individual EDC and their degradation products, and the net effect of these mixtures can be synergistic or antagonistic (i.e., context-dependent), making it difficult to understand and predict how organisms will respond to them or how to manage them. Vieira et al. [66] summarized the occurrence of some EDCs found in wastewaters and surface waters in several countries which are detected through various analytical methods.

The EDCs are reported in the concentration level of ng L^{-1} in wastewater as follows Estrone-79 (USA), 20 (Canada), 71.2 (France); 17β-estradiol-147 (USA), 20 (Canada), 20.4 (France); estriol-1661 (USA), 297 (France); 17α-ethinylestradiol.-230 (USA), 421 (Brazil); Bisphenol A-2550 (USA), 84 (Brazil); Triclosan-39.8 (Spain); Atrazine-36 (Spain). Furthermore, secondary product degradation is still widely disregarded in bioremediation research. These, on the other hand, might be distinguished by higher concentrations or toxicity levels, or by increased reactive and nonspecific toxicity compared to the parent chemical [67]. EDCs affect the human gut microflora and lead to the development of metabolic disorders due to the induction of xenobiotic pathways. Different EDCs bind to the same hormone receptors and results in combined effects [68]. EDCs in pesticides cause gonad cancer and dysfunction in many animals. Similarly, humans exposed to these were also reported to be at risk of dysfunction of gonads based on their use [69].

4 Toxicity of ECs

EPs' toxicity has resulted in an increase in environmental and human health hazards. EPs are considered very dangerous because nanogram per liter (ng/L) doses can cause hormonal interference in fish, genotoxicity, carcinogenicity in lab animals, endocrine disruption, and immunological toxicity in humans and aquatic creatures [5]. Exposure to these xenobiotic compounds triggers biochemical alterations and develops diseases. The study related exposure to pesticides and relative risk of cancer and observed gonadal diseases (ovarian and testicular cancer and dysfunction). Globally there is an increased consumption of materials containing ECs and it occurs naturally as phytoestrogens, in plasticizers, or industrial substances. Humans are exposed to them in higher or lower concentrations and they are persistent compounds. They mimic estrogenic hormones and interfere with them triggering pathways that result in diverse responses in the biological system [70]. They can bioaccumulate in organisms and induce hazardous health effects. Global pollutants reported to be a part of the food chain involve drugs, industrial chemicals, PCPs, and antimicrobials. Few of them come under the category of endocrine disruptors that are proved by *in vitro* and *in vivo* tests. The overview of common major consequences and adverse effects of ECs of high concern on human health is illustrated in Figure 3. The toxicity of ECs is critically reviewed by Stefanakis and Becker, [6] and it reported that the daphnid fish and algae were susceptible to pharmaceutical compounds, with antibiotics and sex hormones being the most dangerous substances for human health and aquatic life. Besides, it's been reported that many chemical pollutants can interfere with the normal function of the endocrine system of many aquatic and terrestrial animals, making them more vulnerable to the presence of ECs in water than humans. Reproductive dysfunction, reduced fertility, and population decline are some of the negative effects of this interference on organisms' well-being.

Literature has found pyrethroids and their metabolites to contain estrogenic activity compared to parent compounds [71]. ECs involve a range of consumer products, natural compounds, persistent pollutants, pesticides, etc. The food chain is a major route of exposure to the population as they enter through living components. ECs are found in food packaging and have a toxic effect on consumers. The materials leach to food from the packaging materials and might cause chronic illness. These are unintentionally added products that migrate through food to the environment and need toxicological characterization for their effects on biodiversity. The endocrine system and its normal functioning can be affected by various compounds that in turn influence hormonal function. They ultimately get into the food chain through various means. Pesticides used in the agricultural field and plant-based products like phytoestrogen also show such effects. The application of pesticides, food contact materials, and fertilizers is a cause of their entry into the food chain. Lipid-rich foods containing polychlorinated and polybrominated chemicals are a source of EDCs. Multiple residues

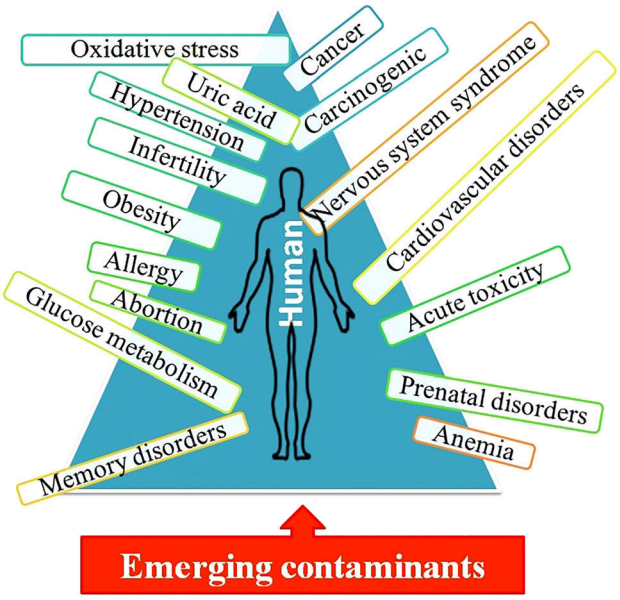

Figure 3: Major consequences and adverse effects of ECs of high concern on human's health [73, 74].

of various compounds in the food materials at different levels need to be assessed to reduce the long-term risks through the food chain [72]. ECs that appear at different concentrations have a negative impact on different organisms including exerting adverse effects on soil and water life and thereby on human beings. Because estimating and evaluating the risk for each of the thousands of chemical compounds and pharmaceuticals that have been identified in the environment is almost difficult, the focus should be on those substances that are known to cause harm. Hence, environment-friendly technologies need to be developed and adopted for the efficient removal of ECs from nature.

5 Conclusion

The great majority of studies available and reported several chemicals as emerging pollutants could be bioaccumulated and hazardous to the various ecosystem. However, our in-depth knowledge about their real environmental occurrence, fate, and toxicity is still limited. The ECs are detected in various concentrations in various ecosystems at present can be overwhelmed in a near future. The toxicological effects of ECs on various life forms are still caution for their negative impacts and most of the findings are just the output of a single contaminant effect. Due to our incapacity to predict the effect (direct and indirect) of mixed contaminants on natural communities

and in a specific ecosystem, extended research in this is high in demand. The best approach to overcome these issues is likely to act on preventions based on the evidence already available and to build cognitive research. The strong policy implementation is highly recommended to promote the derivation of predicted no-effect concentration for emerging pollutants. Intensive ecotoxicological studies based on standard protocols and analyzing very sensitive endpoints to create a relevant data set are highly necessary for protecting the environment. Generation of real impacts of ECs in the various ecosystems and their mode of mechanism, detection, and determination of occurrence, fate, and persistence is highly recommended to overcome the issues associated with the ECs.

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Bioremediation for Environmental Sustainability

Approaches to Tackle Pollution for Cleaner and Greener Society

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CHAPTER

3 Application of constructed wetlands in degradation and detoxification of industrial effluents: challenges and prospects

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1 Introduction

Several small industries or manufacturing units such as wineries, tanneries, textile, and coffee production in remote rural areas support local economic development and this discharge often includes elevated levels of organic matter, nutrients, and metals (Wu, Zheng, Ding, Sun, & Yang, 2015). The effluents from industrial process such as dyes, surfactants, minerals, and certain metals, and pose a life-threatening danger to aquatic fauna and ecosystems (Wu, 2017). The waste or by-products associated with multiple types of pollutants seriously pollute surface water, soil, and groundwater. Water pollution induced by the industrial discharge contains damaging chemicals and substances into water, making it inappropriate for use and other purposes (Ho et al., 2012). Unconventional, wastewater treatment systems are human-friendly, expensive, effective, but complex in its operation and design. The awareness to use of energy capital, non-conventional wastewater treatment is projected to be implemented in the future (Petra, 2015). The constructed wetlands (CWs) required environmental-friendly techniques to be established in small towns or industries for effluents treatment which cannot provide cost-efficient treatment technology (Jing, Lin, Lee, & Wang, 2001; Karim, Manshadi, Karpiscak, & Gerba, 2004). Later, they have been established increasingly to purify agricultural, industrial effluents, and acid mine drainage since it is simple, low maintenance cost, and low minimal energy requirement (Calheiros et al., 2012; Fang, Song, Cang, & Li, 2013). CWs utilize natural energy for pollutants removal that makes this system energetically feasible. The CWs need low development and maintenance costs in comparison to the conventional treatment system (Lin, Jing, Lee, & Wang, 2002; Lloyd, Klessa, Parry, Buck, & Brown, 2004; Ran, Agami., & Oron 2004). Plants are frequently used in

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Chapter 6
Source and Fate of Perchlorate in the Environment: A Grave Concern for World



Paulami Sahu

6.1 Prologue

Perchlorate is an emerging contaminant and considered as a worldwide health issue as it disrupts normal functioning of human thyroid gland by interfering in iodide uptake by it and poses serious threat to overall growth of human, dominantly of foetus and children, by affecting the regulation of metabolism and brain development (Plummer et al. 2006). Perchlorate (ClO_4^-) is a naturally occurring inorganic anion of oxyhalide salts that is frequently detected in the environment (Rajagopalan et al. 2006), and though ClO_4^- of ammonium (NH_4^+), potassium (K^+), magnesium (Mg_2^+) and sodium (Na^+) remain inert at solid state, it can pollute water and soil when dissolved in water (Duncan et al. 2005). Perchloric acid ($HClO_4$) also contaminates soil and water. As chlorine in ClO_4^- has a maximal +7 oxidation state, it shows a very strong oxidizing character, and it is highly soluble too (Kumarathilaka et al. 2016). In terms of kinetics, at ambient condition, ClO_4^- is relatively stable, and this stability is due to the tetrahedral arrangement of oxygen atoms around central chlorine atom, and these oxygen atoms restrict central chlorine to react with reductants (Xu et al. 2015). Due to this stable nature, ClO_4^- may persist for very long period of time, may be decades, in surface and groundwater (Sturchio et al. 2014). This persistent behaviour of the ClO_4^- compelled many environmentalists to determine the fate of ClO_4^- in the environment. At ambient temperature, common ClO_4^- compounds are mainly solid in nature and appeared as white or clear crystals. Their physical properties and uses are given in Table 6.1.

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Chapter 17
Policies and Legal Aspects of Environmental Management

Paulami Sahu

1 Introduction

Environment is one of the key components of sustainable development of human race. Therefore, to protect human civilisation, environment must be conserved. The world today is facing many environmental challenges posed by unregulated human activities. These include air pollution and worsening of air quality, water pollution and depletion of water resources, noise pollution and associated problems, soil pollution and contamination of soil, depletion of water table, climate change, depletion of forests, loss of biodiversity, depletion of ozone layer, problems associated with mounting garbage and wastes including hazardous and toxic wastes. To prevent deterioration of environment, proper environment management plans should be adopted. But to chalk out appropriate management plan, an environmental policy should be framed. The word *policy* is defined as a course of action, which has been proposed or adopted by any government, organisation or an individual. An *environmental policy* is course of action for the protection of environment, wildlife and natural resources. In a developing country like India, an environmental policy is especially required because there is a consistent need for balancing between environment on one side and the needs of human development on the other, considering the public opinion representing the views of both the elite expert and lay public. A good environmental policy is a precursor for ensuring sustainable development. Policy formulation becomes indispensable because policy is an instrument of transformation or a board guideline for planners and administrators to convert a given environment into a preferred environment. It is through a policy that we can precisely identify the problems; fix priority to form alternative approaches and solutions; make a choice among alternatives on the basis of comprehensive analysis of

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Article

Application of Bayesian Statistics to Assess the Aquifer Vulnerability to Groundwater Pollution in and Around Gandhinagar City, Gujarat, India

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A B S T R A C T

Bayesian statistics is a method for defining epistemological ambiguity by the mathematical language of probability. In the 'Bayesian paradigm,' extents of certainty in circumstances of nature are stated which are not negative, the entire belief in all circumstances of nature is set to be one. Bayesian statistical techniques begin with present 'prior' beliefs, update these by the data to provide 'posterior' beliefs, which may be treated as the origin for inferential decisions. In the present study this method is applied to demarcate areas of Gandhinagar vulnerable to groundwater pollution. Due to the over-growing population, industrialization and urbanization, many aquifers are vulnerable to contamination. Remediation of groundwater is very challenging, expensive, time-consuming and sometimes even unfeasible if once it is contaminated. Therefore, the most important aim of the vulnerability maps is to categorize the area into numerous parts, which have different levels of vulnerability to be polluted now or in near future. In the present study, a probability-weighted approach has been utilized to generate the final vulnerability map of the study area. To demarcate different groundwater vulnerable zones, four thematic maps such as (i) hydraulic conductivity of the aquifer, (ii) groundwater velocity within the aquifer, (iii) the thickness of top confining layer and (iv) height of the piezometric surface above the bottom of the top confining layer, were used. The analysis reveals that the entire Gandhinagar Sub-district can be classified into three following aquifer vulnerability zones: (i) Low, (ii) Medium and (iii) High. The spatial distribution indicates maximum parts of the study area is covered with medium aquifer vulnerability to groundwater pollution. Only 4.7 % aquifer, located in the south-western part of the study area, is highly vulnerable to groundwater pollution. Different management plans for different vulnerable zones are suggested. Further groundwater withdrawal is not recommended for highly vulnerable zones.

Keywords: Groundwater Pollution, Hydraulic Conductivity, Isopach, Management Plans

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POTENTIAL IMPACTS OF CLIMATE CHANGE ON GROUNDWATER RESOURCES

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Global climate change involves spatio-temporal climatic variations, alterations in terrestrial and aquatic processes and anthropogenic activities distress the environment critically by affecting the hydrological and biogeochemical cycles. Most important climatic variations are perceived qualitatively and quantitatively disturbing surface and groundwater, groundwater recharge, discharge, storage and saltwater intrusion. Worldwide, approximately one-third of the water consumed derived from groundwater. Overuse of groundwater is hastily expanding with growing in population, industrialization and agriculture. Furthermore, climate change is enforcing pressure on water resources and enhancing incidence of severe drought. Numerous Global Climate Models (GCM) are available for identifying climate and predicting climate change. Outcome of these climatic models like quantification of the groundwater recharge will facilitate in acquiring suitable strategies for climatic adaptation. Improving groundwater storage is a beneficial implication to increase the freshwater accessibility and to boost climatic adaptations. To increase groundwater recharge, Managed Aquifer Recharge (MAR) technology is applied globally, which includes developing infrastructure and improving the landscape to deliberately. MAR can be employed to retrieve groundwater levels, to collect groundwater for future usage and to restrict saltwater intrusion. Efficient, prolonged climatic adaptations and hydrologic irregularity involves actions which safeguard, improve groundwater recharge and control water need.

Keywords: Climate change; Groundwater; Global Climate Models; Climatic adaptations; Managed Aquifer Recharge

Advances in Remote Sensing for Natural Resource Monitoring

Chapter 13 | Token Access

Managing the Blue Carbon Ecosystem: A Remote Sensing and GIS Approach

Parul Maurya, Anup Kumar Das, Rina Kumari

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Summary

Coastal habitats, such as mangrove, seagrass, and salt marsh, are termed “blue carbon” and have recently gained much attention due to their high carbon sequestration capacities. Although the global area of blue carbon ecosystem is much smaller than the terrestrial ecosystem, they sequestrated carbon in a much greater amount in their living biomass, as well as in the sediment. Land Use/Land Cover has affected these productive ecosystems globally. Recent estimates suggest that over one-third of its cover has vanished due to coastal development, deforestation, expanding agriculture, aquaculture, and pollution. Thus, conservation and restoration of these coastal ecosystems is a growing concern. For conservation of these productive ecosystems (such as mangrove, seagrass, and salt marsh), adequate knowledge of their spatial distribution and total cover, standing biomass, change detection, as well as the distinctive mechanisms governing carbon sequestration strategies, are important. This will help in making protection policies and management guidelines. Nowadays, remote sensing and geospatial technologies are emerging widely, which are very effective for mapping and monitoring the coastal ecosystems. These technologies provide real-time large data in a smaller time, which will be helpful for future research by minimizing the information gap. In the present study, detailed description of blue carbon ecosystems, their importance, distribution, carbon sequestration potential, degradation, and loss rate have been discussed. Further, a comprehensive description of various branches of remote sensing (such as optical, hyperspectral, and microwave) and its applications for the management of blue carbon ecosystems has been discussed.

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Advances in Remote Sensing for Natural Resource Monitoring

Chapter 16 | Token Access

Seawater Intrusion and Salinity Mapping in Coastal Aquifers: A Geospatial Approach

Tanushree, Rina Kumari

Book Editor(s):Prem C. Pandey, Laxmi K. Sharma

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Summary

The regional economy of an area depends on sustainable use of land and water resources. Indiscriminate withdrawal of water and insufficient recharge lead to seawater intrusion in most of coastal aquifers worldwide. Prognosis of these challenging pollution risks are extreme in space and time, which affects the agriculture and environment of the area and jeopardizes the regional economy. Due to complexity in behavior, it requires advanced techniques to quantify as well as manage. There are various techniques available to study seawater intrusion, such as geophysical, numerical, geochemical, and isotopic studies. Due to low-cost technology, high accuracy and repetitive coverage, remote sensing and GIS offer a low-cost and effective tool in assessing the groundwater vulnerability as well as salinity mapping. In the present study, the brief discussion has been done on vulnerability assessment through various Geographical Information System based models such as DRASTIC (Depth to Water [D], Recharge [R], Aquifer Media [A], Soil Media [S], Topography [T], Impact of Vadose zone [I], Conductivity [C]), SINTACS, GALDIT (Groundwater occurrence [G], Aquifer hydraulic conductivity [A], Depth to groundwater level above sea [L], Distance from the shore [D], Impact of existing status of seawater intrusion in the area [I], Thickness of the aquifer which is being mapped [T]), EPIK (Epikarst [E], Protective Cover [P], Infiltration condition [I], Karst network development [K]), etc. However geophysical approach coupled with GIS platform plays an effective role in seawater intrusion. Although remote sensing does not play a direct role in the seawater intrusion study, but it is very useful for the salinity mapping, which helps us with better management strategies. A brief discussion on various approaches of remote sensing such as multispectral, hyperspectral, and microwave remote sensing has been done for salinity mapping.

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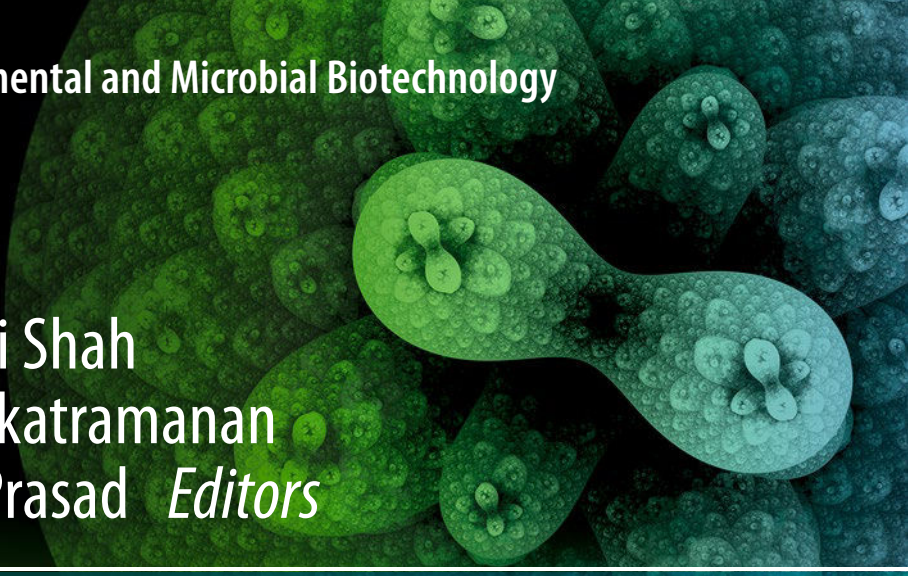

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Bio-valorization of Waste

Trends and Perspectives

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Environmental and Microbial Biotechnology

Series Editor

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Innovative and novel advances in microbial biotechnology are providing great understandings in to the machineries of nature, presenting fascinating prospects to apply principles of biology to different arenas of science. Sustainable elucidations are emerging to address the concerns on improving crop productivity through microbes, depleting natural resources, environmental pollution, microbial degradation of pollutants, nanomaterials, nanotoxicity & safety issues, safety of food & agricultural products etc. Simultaneously, there is an increasing demand for natural bio-products of therapeutic and industrial significance (in the areas of healthcare, environmental remediation, microbial biotechnology). Growing awareness and an increased attention on environmental issues such as climate change, energy use, and loss of non-renewable resources have carried out a superior quality for research that provides potential solutions to these problems. Emerging microbiome approaches potentially can significantly increase agriculture productivity & human healthcare and henceforth can contribute to meet several sustainable development goals.

The main objectives have provided an impetus for research on plants and microorganisms that produce novel bio-products with variable properties and understanding their mechanisms of action at cellular and molecular level. Hence, research activities of the environmental and microbial Biotechnology are comprehensively focused up on major sectors viz., bioresources, biorefining, bioremediation of organic and inorganic pollutants, environmental risk analysis of microorganisms, environmental assessment using microbiological indicators, enzymes for environment, food & industrial applications, nanomaterials & nanotoxicity, sustainable ecobiotechnology, biofertilizer, biocontrol agents for agriculture improvement and natural products for healthcare applications.

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Bio-valorization of Waste

Trends and Perspectives

Springer

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Agricultural Waste Valorization: An Energy Production Perspective

11

Shiv Prasad, Dheeraj Rathore, and Anoop Singh

Abstract

The energy security, utilization of surplus agricultural waste, and environmental concerns lead to explore the opportunities for valorization of surplus agricultural waste. The agricultural waste is rich in lignocellulose, which can be converted into various forms of energy like ethanol, methane, hydrogen, etc. by adopting different technologies. Therefore, the available surplus agricultural residues can be utilized for sustainable energy production. This will not only produce energy from waste but also save the environment from emissions due to its disposal. The sustainable approach for valorization of agricultural waste can be found by employing the various modellings like life cycle assessment (LCA), life cycle costing (LCC), net energy ratio (NER), techno-economic assessment (TEA), etc.

Keywords

Agricultural waste · Lignocellulose · Bioenergy · Valorization · Sustainable bioeconomy · Torrefaction · Pyrolysis · Anaerobic digestion

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11.1 Introduction

Concerns over growing energy demand and energy security, together with the increase of CO_2 emissions due to fossil fuel utilization, contributing towards climate change, are driving the need to find sustainable energy sources (Prasad et al. 2012, 2019a; Behera and Prasad 2020; Venkatramanan et al. 2021a). The agricultural waste valorization for energy production could be one of the most efficient routes to minimize carbon emissions and dependency on fossil fuels (Prasad et al. 2020). Bioenergy or biofuels production from agricultural waste can counteract the accumulation of unrecycled products from various agrarian activities and agro-industrial sectors (Prasad et al. 2019b; Venkatramanan et al. 2021b); thus, addressing two environmental impacts concurrently, viz. disposal site requirement and emissions due to faulty disposal and reducing the dependency on the fossil fuels (Li and Yang 2016). Agricultural waste originates during different activities of crop production and its supply chain. It includes on-farm or off-farm wastes, post-harvest residues such as stalks, straw stalks, husk, bagasse, seed pods, waste fruit, vegetable peels, food processing and packaging wastes, waste from distribution, marketing and consumption sector (Prasad et al. 2007, 2020; Xu et al. 2018).

According to Food and Agriculture Organization (FAO), in 2016, agriculture corresponded to about one-third of total world land area and sugarcane, maize, wheat, rice, potatoes, etc. are among the most cultivated crops (FAO 2018). Deshavath et al. (2019) assessed that around 181.8 MT of agricultural residues (derived from rice, wheat, corn, and sugarcane crops) were burnt in open field in Brazil, China, India, and the United States in the year 2016, and the emissions were equivalent to 15.8 MT of CO_2 (Table 11.1).

FAO estimated that almost 1.3 billion tons of food are wasted every year. It is about one-third of the food produced globally. On the other hand, despite disposal and environmental challenges, agricultural waste can prove to be a sustainable source of energy. Agrarian waste has brought a lot of attention due to its rich organic composition, especially lignocellulose (Venkatramanan et al. 2021b). That can be turned into value-added products such as biochemicals, enzymes, and biofuels (Venkatramanan et al. 2021c). The valorization of agricultural waste into biofuel is in higher demand than its conversion to chemicals (Pham et al. 2015).

Table 11.1 Amount of crops residues burnt in open fields in the year of 2016 and their CO_2 emissions

Countries	Agriculture crop residues burnt (MT/year)				CO_2 emission (MT/year)
	Corn	Rice	Wheat	Sugarcane	
USA	35.11	0.07	7.10	0.24	3.73
India	10.20	23.63	12.09	3.22	4.25
China	38.98	16.75	9.74	1.09	5.75
Brazil	14.96	1.07	0.87	6.65	2.03
Total	*99.25*	*41.52*	*29.8*	*11.2*	*15.76*

Source: Adapted from Deshavath et al. (2019)

However, incorrect disposal of agricultural waste is becoming a severe and vexing problem. The current chapter is focusing on the sustainable use of agricultural wastes for the production of bioenergy.

11.2 Conversion Technologies

The term "Agricultural waste valorization" refers to processing activities aiming to reuse and recycle the wastes into useful products or energy and reduce the waste quantity. "*Waste valorization considers the processing of a large amount of production-related wastes and by-products, which are more homogeneous and abundant in magnitude. The types of wastes used in valorization usually are listed as non-hazardous according to environmental regulations in place*" (Kabongo 2013).

Conventional agricultural waste disposal methods include burning, dumping, landfilling, random piling, etc. Composting and anaerobic digestion are the two traditional waste management methods that keep agricultural waste out of landfills. Composting is popular because it provides biofertilizer for soil improvement. However, it also has shortcomings such as the release of leachate, NH_3, greenhouse gases, and odor (Liu et al. 2014). Currently, many modern conversion technologies are available, which can transform agricultural waste into biofuels for application in the residential, industrial, public transport, and power sectors. Figure 11.1 shows the common pathways for the production of liquid and gaseous fuels from agri-waste.

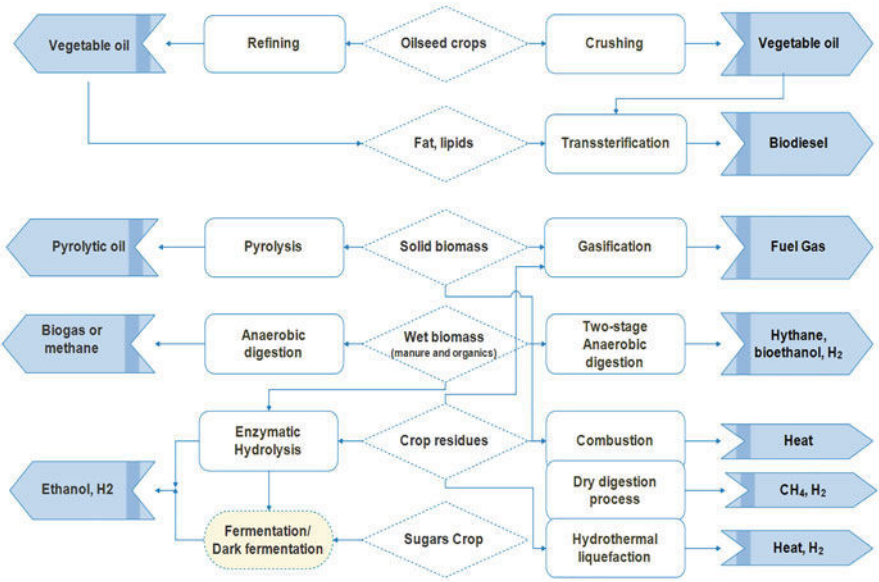

Fig. 11.1 Common pathways for valorization of agricultural waste to biofuels (Source: Prasad et al. 2020)

11.2.1 Thermal Conversion Technologies

The complete combustion of agricultural waste is called thermal conversion, which is to produce heat energy. The thermal combustion is achieved either by "direct combustion" or "incineration." Through the process of direct combustion, the agricultural waste is directly burned to transform into heat and electricity (Clini et al. 2008). The dry farm waste includes leaves, fibers, and stems. The dry farm waste is basically used as heat energy source and they are either directly burned or used as a raw material for the industrial boilers. The direct burning of dry farm waste for the purposes of cooking and lighting is in vogue globally. However, the open combustion of agricultural waste releases toxic emissions, namely dioxins, acid gases, and furans (Scarlat et al. 2015). Hence, direct combustion of agricultural waste is not a preferred option for energy generation. Agricultural waste is burnt in the industrial furnace to generate thermal energy. The thermal energy so generated is used to generate steam in a boiler. The steam turns the turbine that is attached to an electrical generator, which finally produces electricity (Chambers 2003).

Waste incineration is an oxidative combustion process to generate thermal energy under emission control. During the process of incineration, the farm wastes are converted either directly into CO_2 and water vapor or indirectly into CO, H_2, and char. In developed countries like EU, the USA, and Japan, where waste management policies check the land-based waste disposal, incineration is the preferred option (Scarlat et al. 2015). However, waste incineration technology is challenged by the factors like high capital, maintenance cost, and operation cost. These factors limit the energy recovery option (UNEP 2013; UN-HABITAT 2010). Further, the incineration process like the direct combustion process is influenced by the high moisture content of waste. It is also reported that the waste incineration without proper regulatory and control system is vulnerable to create harmful emissions like the dioxins and furans.

11.2.2 Thermochemical Conversion Technology

The thermochemical conversion process involves chemical reactions that occur at varying temperatures. These thermochemical conversion process may take place in the absence or presence of oxygen. While gasification process involves partial oxidation, the pyrolysis process occurs in the absence of oxygen. These processes require specialized reactors and process conditions. In the absence of such conditions, it may turn into an incineration or combustion process. It is important to note that the product of these processes end up either as fuel or as secondary feedstock (char) (Fig. 11.1). Similarly, incineration, pyrolysis, and gasification also release CO_2. The principles underlying the use of each of the thermochemical conversion technologies in harnessing energy from agricultural waste is here subsequently explained in particular.

Pyrolysis is one of the important thermochemical conversion technologies. It is basically a thermal degradation of biological materials in the absence of oxygen and

at a temperature of 400–900 °C (Bosmans et al. 2013). The pyrolysis process results in the production of pyrolysis oil, char, and syngas. The syngas is basically a mixture of carbon dioxide, carbon monoxide, hydrogen, water vapor, methane, and trace gases (Sahoo et al. 2021). Syngas can be used as a fuel. So pyrolysis process can be used for the production of heat, power, and chemicals. Despite the advantages of pyrolysis, agricultural waste with high ash content is not useful feedstocks for the pyrolysis process due to reactor blockage by ash accumulation.

Gasification is another thermochemical conversion process, which occurs in the partial presence of oxygen and at temperature 500–1800 °C to produce syngas. Syngas is used for heat production and electricity generation. In case of gasification process, generally wet agricultural waste is not preferred (Tock et al. 2010). However, supercritical water gasification (SCWG) technology is reported to be a promising technology to utilize wet agricultural waste. As regards the advantage of the supercritical water gasification technology, there is no need to dry the agricultural waste (Gasafi et al. 2008). The supercritical water gasification technology generates high amount of hydrogen and less of carbon monoxide. Further, the supercritical water gasification (SCWG) technology produces less tar and coke. Since the inorganics and salt compounds remained in the aqueous solution, the problem of corrosion can be controlled. However, the supercritical water gasification technology requires capital investment.

Plasma technology is gaining increasing interest for gas conversion applications, such as CO_2 conversion into value-added chemicals or renewable fuels. Plasma technology is based on a physical principle. Matter changes its state, when energy is supplied to it, solids become liquid, and liquids become gas. If even more power is provided to gas, it is ionized and goes into the energy-rich plasma state, the fourth state of matter (Nandkumar 2014). The initial energy essential to create plasma can either be thermal or electric current or electromagnetic radiation. The existence of charged gaseous species makes the plasma extremely reactive and causes it to behave differently from other gases, solids, and liquids. The peculiar benefit of plasma technology is that the energy confined in the plasma allows the usage of low energy biomass waste that would otherwise not be appropriate for energy production using gasification. The high-temperature conditions that are reached in plasma gasification result in the decomposition of organic compounds into their elemental constituents, forming a high-energy synthesis gas, consisting mainly of H_2 and CO_2.

Nevertheless, the application of plasma-based technology for energy generation is challenging. The use of electricity as a primary energy vector is expensive, turning the most potent barrier for plasma-based technology. Moreover, the inorganic fraction of glass, metals, and silicates that is melted and transformed into dense, inert, and non-leaching can be dangerous when released in the environment.

Torrefaction is a thermal process to convert biomass into a more homogeneous product that is densified through pelletization to produce a more energy-dense product called torrefied pellets (TOPs) or briquettes, with comparable properties to coal (Batidzirai et al. 2013). Torrefaction is referred to as mild pyrolysis and conducted in the temperature range at 200–300 °C under an inert air and low heating

rate (Medic et al. 2012). Torrefied biomass (briquettes), which retains up to 96% of its chemical energy, is hydrophobic and resistant to biodegradation. So, it is used as a substitute for coal, heating, co-firing power generation, and gasification (Prins et al. 2006). Briquettes formed from biomass waste is a cheap renewable energy source and eco-friendly. Despite the potential benefits of torrefaction technology, there are still some techno-economic challenges that need to be overcome before the technology is fully commercialized (Nordin 2012).

11.2.3 Biochemical Conversion Technologies

Biochemical conversion technologies of agricultural waste-to-energy are much more eco-friendly as compared to the thermal and thermochemical technologies. Biochemical conversion chiefly involves the action of enzymes to harness the energy from biomass. The technologies under this category are ethanol fermentation and anaerobic digestion for methane production.

11.2.3.1 Ethanol Production

Ethanol as an alternative fuel, is the most common biofuel worldwide. Currently, lignocellulosic biomass is being exploited extensively by many researchers across the globe for developing cleaner and sustainable energy as an alternative to the fossil fuel system (Prasad et al. 2007, 2019b). This ethanol is considered as a carbon-neutral biofuel due to the plant's origin of its carbon and, thus, when it is released during the combustion, it does not contribute to the increase in CO_2 emissions (Hsieh et al. 2002). Ethanol has been promoted as an alternative transportation fuel because of its antiknocking properties, which help to increase octane ratings and improve fuel efficiency (Prasad et al. 2014). The suitable feedstock for ethanol production are grouped into three: (a) directly fermentable sugar-containing materials such as starch; (b) lignocellulosic biomass; (c) urban/industrial organic residues. Reports are also available on direct fermentation of sugarcane, sugar beet, and sweet sorghum to ethanol (Prasad et al. 2009), which require the least costly pre-treatment, where starchy, lignocellulosic resources, and other wastes need expensive pre-treatment, to change into fermentable substrates. However, since maintaining the food security is given higher priority in our agrarian economy faced with rising population pressure, it is not possible to divert a fraction of the sugary or starchy food sources towards biofuel production. *Lignocellulosic material* is potentially the world's largest source of fermentable sugars. They can yield glucose after hydrolysis, which may further be fermented to ethanol. However, the recalcitrant structure of lignocellulose hinders the accessibility of carbohydrates to hydrolytic enzymes and prevents the release of fermentable sugars.

11.2.3.2 Anaerobic Digestion (AD)

Anaerobic digestion (AD) transforms agricultural waste into biogas and digested slurry in controlled anaerobic conditions. The resultant biogas is composed of

60–70% methane along with CO_2 (30–40%) and other traces, while digested sludge can act as a soil conditioner and plant nutrient (Prasad et al. 2017).

The AD process is driven by the concerted action of highly varied microbial populations, consisting of numerous groups of both strict and facultative anaerobes. The process is carried out in a well-designed anaerobic digester/bioreactor. The whole system consists of feedstock, digester, biogas holder, and digestate reservoir is named a biogas plant. The complete anaerobic digestion process can be separated into four main stages, namely hydrolysis, acidogenesis (or fermentation), acetogenesis, and methanogenesis. The anaerobic digestion process is performed in a properly designed bioreactor or anaerobic biodigester. The anaerobic digestion takes place due to the action of anaerobes and facultative anaerobes. The microorganisms involved in the anaerobic digestion process are diverse. The entire anaerobic digestion system is made up of "feedstock," "anaerobic digester," "digestate reservoir," and the "biogas holder." As regards the anaerobic digestion process, the stages are "hydrolysis," "acidogenesis," "acetogenesis," and "methanogenesis." In the hydrolysis process, the complex polysaccharides, biopolymers are converted into simpler substances by the synergistic action of mesophilic and thermophilic microorganisms. The complex polysaccharides include proteins and lipids. The products of hydrolysis are sugars, amino acids, fatty acids, and glycerol. The microorganisms involved in the hydrolysis process belong to the genera *Bacteroides, Butyrivibrio, Clostridium, Fusobacterium, Selenomonas,* and *Streptococcus* (Amani et al. 2010). In the process of acidogenesis, the fermentative organisms, anaerobic oxidizers convert the soluble monomers into organic acids. The microorganisms involved in acid generation are *Clostridium, Eubacterium,* etc. The products of acidogenesis are acetate, lactate, ethanol, CO_2, and H_2 (Insam et al. 2010). The intermediates such as propionate and butyrate are converted into carbon dioxide, hydrogen, and acetate by obligate hydrogen-producing acetogens (OHPA).

Syntrophic acetogenic bacteria such as *Syntrophomonas wolfei, Syntrophomonas sapovorans, Syntrophobacter wolinii*, *Syntrophobacter fumaroxidans, Desulfovibrio vulgaris*, *Thermoanaerobacterium brockii,* and *Pelobacter venetianus* are responsible for converting acetic acid into H_2 and CO_2. Methanogenesis is the last step in which acetate, H_2/CO_2, methanol, and formate are converted into methane (Gujer and Zehnder 1983). The genera *Methanosaeta* and *Methanosarcina* carry out the acetotrophic methanogenesis (Garcia et al. 2000). Other methanogenic groups, i.e., methylotrophic methanogens, utilize methane-containing compounds such as methanol, methylamine, and dimethyl sulfides (Deppenmeir et al. 1996). Although anaerobic digestion is an established waste management method for sewage sludge, wastewater, and animal manure, anaerobic digestion of agricultural waste has caused some operational insufficiencies. Furthermore, low temperature (<20 °C) limits methane yield, which is common during winter seasons.

11.3 Sustainability Assessment of Agricultural Waste Valorization

The technology search for sustainable valorization of agricultural waste for energy production is a great challenge, which can be met by conducting life cycle assessment (LCA) and by calculating the Net Energy Ratio (NER) because LCA is able to provide details of emissions/emission reduction, while NER tells about their energy balance, only positive energy balance processes can be considered for valorization purpose after conducting their LCA. The processes which shows positive energy balance and reduces the emission by replacing the existing/conventional energy source would be sustainable processes for conversion of agricultural waste valorization. The cost-effectiveness of the developed product is also very important to accept the product by the society. Therefore, life cycle costing (LCC) can be adopted for economic analysis of the developed product.

Duque-Acevedo et al. (2020) in a study mentioned that new and better techniques for the recovery of agricultural waste have been developed, based on industrial innovation and high technology, which has contributed to guaranteeing resource efficiency, sustainable production and consumption, and the reduction of negative environmental impact. Serna et al. (2016) in a techno-economic analysis of an specialized energy producing biorefinery to obtain bioethanol, biogas, and electricity taking advantage of agricultural wastes from Colombia concluded that the moisture content of agricultural waste is a challenge for waste valorization as it increases the production cost. They stated that such raw materials can be used under biorefinery scheme for some isolated zones for boosting rural areas or just to produce energy carriers as biogas or ethanol for transport.

Watson et al. (2020) review the impact of hydrothermal liquefaction (HTL) conditions and the feedstock composition on the energy and elemental distribution of process outputs with specific emphasis on the hydrothermal liquefaction aqueous phase (HTL-AP). They compare and contrast the current state of value-added products separation along with biological and thermochemical (gasification and HTL) pathways to valorize HTL-AP. They performed life cycle analysis (LCA) and techno-economic assessments (TEA) to appraise the environmental sustainability and economic implications of these different valorization techniques and presented the perspectives and challenges and the integration approaches of HTL-AP valorization pathways with HTL. Watson et al. (2020) mentioned that HTL-AP is a monetary and environmental burden to HTL biorefineries. Bio-conversion strategies may enable the valorization of HTL-AP, for the production of hydrogen, methane, electricity, and chemicals by employing different pathways, which would make HTL technology more energy productive and cost-effective.

Life cycle assessment (LCA) emerged as a powerful tool to assess the completed process chain and provide a better solution to reduce the emission and increase the net energy ratio. It involves the establishment of number of assumptions regarding the process and data. The results of LCA studies involve a high degree of uncertainty due to the lack of standardized assumptions, which make difficulties in the

assessment of the net energy production and GHG emissions amongst different studies (Quinn and Davis 2015). Techno-economic assessment (TEA) modeling has also emerged as an important tool to understand the commercial viability of biowaste-to-biofuel thermochemical techniques. Engineering related processing models with simulation software packages are generally used to estimate the investment and final selling prices of the final product (Onwudili et al. 2013; Quinn and Davis 2015). The biocrude oil yield, capacity for sustainable production, reducing the burden of the HTL process on the environment, and maximizing long-term profitability are instrumental factor influencing the optimism or pessimism of TEA studies (Juneja and Murthy 2017). Si et al. (2019) compared benchmark commercial applications of two different HTL-AP valorization methodologies, two-stage fermentation and catalytic hydrothermal gasification, to produce biohythane and suggested that two-stage fermentation with conventional reactors resulted in a higher net energy return than that of catalytic hydrothermal gasification.

The employment of various models such as LCA, LCC, NER, and TEA could give a better understanding for choice of processes to achieve a sustainable pathway for valorization of a particular agricultural waste.

11.4 SWOT Analysis of Agricultural Waste Valorization

The SWOT analysis is conducted basically to identify internal strengths and weaknesses, as well as external opportunities and threats of agri-waste valorization for energy production. The analysis is presented in Fig. 11.2. The analysis shows a strong strength for agricultural waste valorization because surplus agricultural waste is available in abundance, resolves the requirement of disposal site and also provides energy and not only reduces the dependency over fossil fuel but also reduces the environmental pollution. In spite of several strengths, it also has some weaknesses such as higher technology cost, absence of waste collection chain, higher capital investment, and lack of governmental support in terms of subsidy, compensations, etc. All this could lead to higher price of unit energy generated and/or negative net energy ratio. There is a number of opportunities available to improve the system and to attract the entrepreneurs and industrialists for valorization of agricultural waste for energy production. Entrepreneurs/industrialists can be attracted by showcasing the technologies at various platforms, by providing regular training and updating the new developments to them and also by developing policies to provide incentives, subsidies, etc. Some threats are also present like lack of specialized equipment manufacturer, entrepreneurs and policies, etc.

11.5 Conclusion

The valorization of agricultural waste for energy production can be considered as a best approach for utilization of agricultural waste as this will not only contribute in energy production but also help in reducing the emission generated due to its

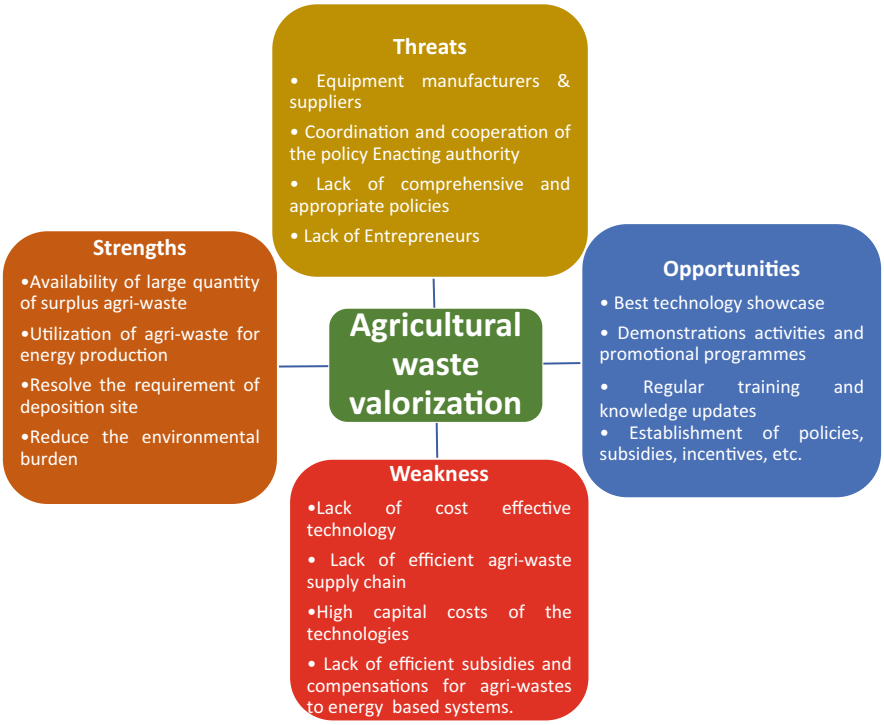

Fig. 11.2 SWOT analysis of agricultural waste valorization

disposal. The sustainable pathway can be achieved by employing various models like LCA, LCC, NER, TEA, etc. The valorization of agricultural waste has a number of opportunities and strengths like surplus agricultural waste, best technologies show-case, etc. but it also have some weaknesses and threats such as cost-effectiveness, efficient supply chain, equipments production, etc. The weaknesses and threats can be reduced by implementation of policies, incentives, subsidies, etc.

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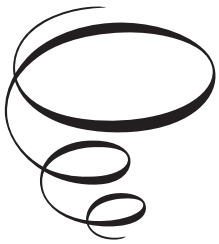

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CHAPTER SEVENTEEN

ACUTE AND CHRONIC EFFECTS OF GROUND LEVEL OZONE ON HUMAN HEALTH

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Abstract

Ozone (O_3) is a highly reactive and oxidative gas that induces adverse effects on human health, including mortality and morbidity. Anthropogenic activities are the primary sources of tropospheric O_3 pollution. Primarily O_3 enters the human body through inhalation and causes acute and chronic health effects. Various studies have shown that O_3 exposure has affected the respiratory system, cardiovascular system, reproductive system, and nervous system and can ultimately cause mortality depending upon age and pre-health conditions. Some studies suggest a direct relationship between the O_3 level and the degradation of human health. This chapter will critically elucidate the severity of the adverse effects on human health under the exposure of variable levels of O_3 concentrations.

Keywords: Human health; Morbidity; Mortality; Respiratory diseases; Tropospheric ozone

17.1 Introduction

Urban air pollution is a mixture of particles and gases which cause acute and chronic effects on plants and human health (Nuvolone et al. 2018; Chaudhary and Rathore 2018,2019; Rathore and Chaudhary 2019; Nassikas et al. 2020; Amiri et al. 2020; Othman et al. 2020). Ozone (O_3), an allotrope of oxygen, is a secondary air pollutant in the troposphere formed from a mixture of harmful gaseous molecules under high sunlight and considered to bea threat to human health (WHO 2003; Lim et al. 2012). Epidemiological studies enumerated the disease burden and calculated it in terms of the number of years lost due to illness, disability caused, and even death. Among these epidemiological studies, a report from the global burden of disease (GBD) is the most reliable and updated research that advocates the deaths, disability-adjusted life years (DALYs), and trends in the exposure of ozone for individuals along with other environmental factors. A report of the GBD published in 2016 by Forouzanfar and GBD Risk Factor Collaborators (2016) suggested that about 4.1 million disability-adjusted life years (DALYs) were due to O_3 exposure in 2015.

Unlike other air contaminants, the concentration of ozone throughout the world is either increasing, remaining stable, or decreasing at a much slower rate (Abeleira and Farmer 2017; Karlsson et al. 2017; Stowell et al. 2017; Wang et al. 2017). The increase in O_3 concentration could be a seasonal or baseline increase or an increase in frequency and the magnitude of high O_3 episodes occur due to variation in the types and concentrations of precursor substances that remarkably influence the kinetics of the pathway of atmospheric chemistry. Fisk (2015) estimated that climate change-related increases in O_3 result from air movement changes, cloud cover, humidity, and emission rates of reactive volatile organic compounds (VOCs and NOx), causing substantial adverse health effects. Fann et al. (2015) analyzed scenarios for the United States and concluded that climate change would support an increase in ambient O_3 levels until 2030. Melkonyan and Wagner (2013) provided a similar projection for Germany. Controlling outdoor O_3 and other air pollutants is a highly challenging task as its formation not only depends upon the precursor's availability but also other co-factors such as region, season, and time of day (Finlayson-Pitts and Pitts Jr. 2000).

To protect human health from O_3, the World Health Organization (WHO) has issued a guideline value of 100 μg m^{-3} as the maximum 8 h

mean O_3 concentration (WHO 2006). Various governmental agencies have also issued recommendations or standards for the maximum concentration for outdoor O_3. Europe's reference value is 120 μg m^{-3} (8 h average), and the alert threshold value of 1 h average is 240 μg m^{-3} (E.C. Ozone Directive 2016). The National Ambient Air Quality Standard (NAAQS) for O_3 in the United States is 0.070 ppm (8 h average) (USEPA 2018) while the national air quality standard for O_3 in Australia is 0.08 ppm (4 h average) (Government of Australia 2018). Canada has an indoor air quality standard of 40 μg m^{-3} 8 h average which is considered to be suitable for health (Health Canada 2010).

Ozone enters the human body through processes of inhalation (USEPA 2018), although, in some instances, exposures through the skin are also reported (Weschler 2016). There is a direct relationship between an increase in the concentration of ambient O_3 and the number of hospital visits, morbidity and mortality rates (Zhang et al. 2006; Smith Xu and Switzer 2009; Sousa et al. 2013). Estimation to O_3-related deaths reveals that about 5–20% of total death share due to air pollution (Anenberg et al. 2009; Lim et al. 2012; Brauer et al. 2012; Silva et al. 2013). The WHO has reported the role of O_3 in mortality and morbidity (2006). Adverse effects of O_3 on human health include problems in breathing, such as inflammation and deterioration to the airways, a decrease of lung functions, emphysema, asthma, bronchitis, etc. (Yari 2016). Furthermore, studies suggested that regular exposure to a high concentration of O_3 may cause damage to DNA (Mortimer et al. 2002; Manikandan et al. 2010; Kleinsorge et al. 2011; Nazaroff 2013).

This chapter is a comprehensive elucidation of O_3 pollution, and its chronic and severe effects on human health, comprising two main sections, followed by subsections. The first section has information about the formation of tropospheric O_3 and its contributory factors. It has a world scenario of ground-level O_3. The next section describes the harmful health effects associated with the variable concentrations of tropospheric O_3 worldwide, with particular reference to the different diseases caused by the alleviated concentrations of O_3.

17.2 Ozone formation in the troposphere

Ozone in the ambient air comprises several sources, such as the intrusion of stratospheric O_3 or their participation in complex photochemical reactions with VOCs (organic vapors or volatile organic compounds), NO*x*, and radiation from the sun. Some organic contributors' activities, including the decay of natural biogenic products and hydrocarbons of olefinic origin

emerging through anthropogenic activities, are also responsible for ozone formation. Along with these contributors, approximately 40 ppb is formed from methane, and this methane comes out due to the intensive agriculture and animal industry (Altshuller 1987; Lippmann 1992). NO*x* levels play critical roles in tropospheric O_3 formation; for example, from 1 ppb of NO_3 is generated 5–7 ppb of O_3 (Altshuller 1987; Lippmann 1992). Figure 17.1 describes the process of O_3 formation and dissociation.

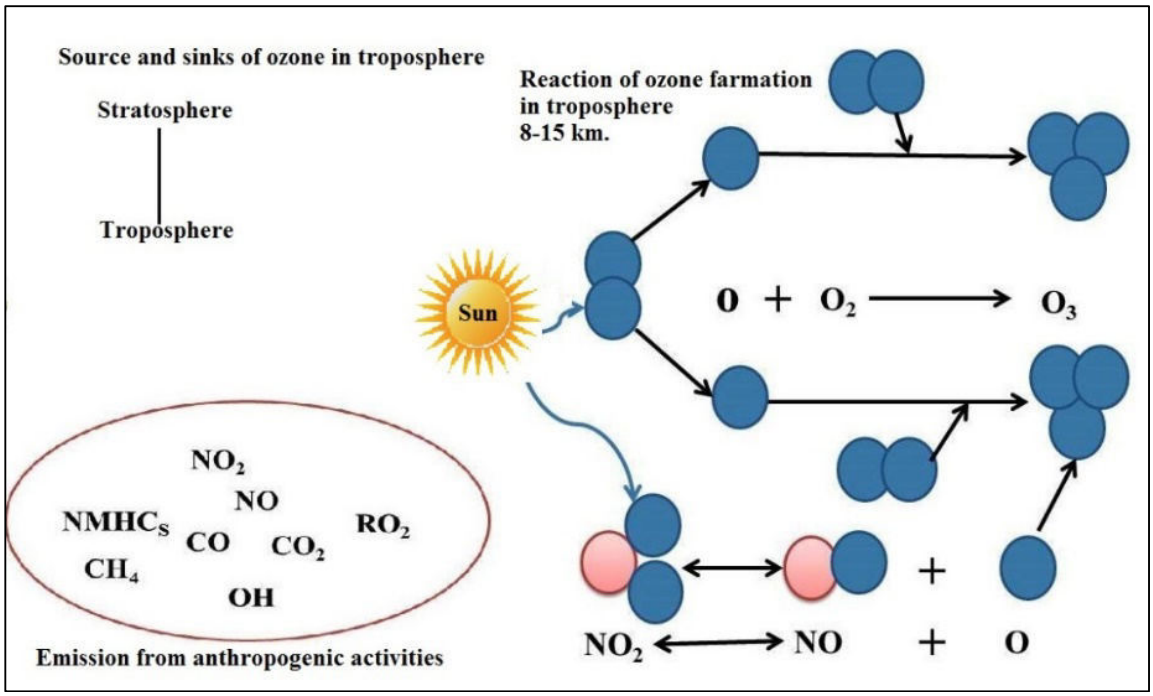

Fig.17.1. A diagrammatic representation of the sources and sinks of O_3 in the troposphere

17.3 Global scenario of ground-level ozone pollution

In recent years, environmental risks caused by exposure to surface ozone from both stationary and mobile sources in East Asia's primary receptors have increased yearly (Nawahda et al. 2012, 2013). Background concentrations of ground-level O_3 have risen from an estimated preindustrial concentration of 10 ppb to average summer concentrations varying from 30 to 50 ppb in the mid-latitudes of the northern hemisphere and O_3 episodes reaching 100 ppb (Morgan et al. 2006).With current air quality legislation implemented worldwide, multimodal simulations for 2030 projected that global surface O_3 would increase by 1.5 ± 1.2 ppb on average, and for the IPCC SRES A_2 scenario, by 4.3 ± 2.2 ppb with the most substantial increases in South Asia, Southeast Asia, and the Middle East (Gauss et al. 2007). According to Dentener et al. (2005), global

photochemical models project that as per the current O_3 precursor emissions legislation, parts of Asia will experience a further significant increase in O_3 concentration up to 2030. Monitoring reports of O_3 in suburban and rural areas of Asia also showed that the mean monthly O_3 concentration now commonly reaches up to 50 ppb (EANET 2006). Rapid industrialization for achieving faster economic growth in China has resulted in higher concentrations of ground-level O_3 since the last decade, which became a severe threat to public health (Zhan et al. 2018). Studies have revealed that the increasing trends in the O_3 concentrations in different megacities of China exceed the air quality standards (Wang et al. 2010; Ran et al. 2009; Wu and Xie 2017). In the summer of 2017, a higher concentration of ground-level O_3 was recorded in many cities of China, with O_3 concentrations exceeding 200 mg/m^3 (Lu et al. 2018). In the north region of China, the O_3 level in the rural areas had an increasing trend of 2.2 mg/m^3/year between 2003 and 2015, whereas, in Southern China, it was 1.7 mg/m^3/year from 2001 to 2007 (Ziemke et al. 2011; Osterman et al. 2008). On the other hand, the increase rate of ground-level O_3 in the urban region of Beijing was recorded at around 5.1 mg/m^3/year, and this increase was around 5% per year compared with that between 2005 and 2011 (Zhang et al. 2014); furthermore, the surface O_3 increase in the city of Guangdong, was at a rate of 1.7 mg/m^3/year from 2006 to 2011 (MEP 2017; Li et al. 2014).

Several studies have used global models to examine the impacts of continued increased emissions of nitrogen oxides on future O_3 concentrations (Ghude et al. 2008). Models predicted that tropospheric ozone could rise 20–25% between 2015 and 2050, and further increase by 40–60% by 2100, with the continued current emission trends (Meehl and Stocker 2007). High concentrations of O_3 are associated with hot sunny weather and are frequently observed in tropical areas where conditions are favorable for O_3 formation (Tiwari et al. 2008). Debaje et al. (2010) observeda monthly average of the daytime maximum of the O_3 mixing ratio ranging from 14 to 57 parts per billion by volume (ppb) with an annual average of about 20 ppb at Ahmednagar, India. Singh et al. (2014) and Sinha et al. (2015) reported 46–67 ppb average O_3 concentration from Varanasi (India) during winter months and 46 ppb from Mohali (India) during summer months, respectively, Chaudhary and Rathore (2020) reported ambient O_3 concentrations ranging between 13.89 and 22.49 ppb day^{-1} from February to June 2017 at Gandhinagar, Gujarat, India. The concentration of O_3 in various cities of India is provided in Table 17.1. The concentrations at different places are much higher than their upper limits.

Table 17.1 Ozone concentration in Indian cities

S. No.	Cities	Study period	Ozone concentration (ppb)	Author's
1.	Delhi	Jan. 2013 to Dec. 2014	37.5 (monthly mean)	Tyagi et al. (2016)
2.	New Delhi	Jan. 2000 to Dec. 2009	15.8 (seasonal mean)	Chelani (2012)
3.	Kanpur	Jun. 2009 to May 2013	27.9 ±17.8(seasonal mean)	Gaur et al. (2014)
4.	Pune	Jun. 2003 to May 2004	30.9 ±14 (seasonal mean)	Beig et al. (2007)
5.	Ahmedabad	Jun. 2003 to May 2004	20.7 ± 5.5 (monthly mean)	Beig et al. (2007)
6.	Nainital	Oct. 2006 to Dec. 2008	43.9±11.5 (seasonal mean)	Kumar et al. (2010)
7.	Mt. Abu	Jan. 1993 to Dec. 2000	39.9±10.8 (seasonal mean)	Naja et al. (2003)
8.	Varanasi	Dec.2011 to Apr. 2012	46.3–67.9 (monthly mean)	Singh et al. (2014)
9.	Mohali	Oct.2011 to Jan. 2014	46.5 (monthly mean)	Sinha et al. (2015)
10.	Chennai	Summer 2005	2–53 (hourly)	Pulikesi et al. (2006)
11.	Maharashtra	2001 to 2005	40–50 (seasonal mean)	Debaje and Kakade (2009)
12	Nagercoil	Mar. 2007 to Feb. 2010	19.8 (annual average)	Elampari et al. (2013)
13.	Tranquebar	May 1997 to Oct. 2000	8.1–25.0 (monthly mean)	Debaje et al. (2003)
14.	Gandhinagar	Feb. 2017 to Jun. 2017	14–23 (daily mean)	Chaudhary and Rathore (2020)

17.4 Toxicity of ozone on humans

Ozone is a highly reactive and oxidative gas with low solubility in water. Because of its chemical properties, exposure to O_3 usually occurs by inhalation. Oral inhalation allows lower O_3 removal rates than nasal inhalation; therefore, vigorous physical activity results in higher penetration into the lungs. Other factors that influence O_3 absorption in humans are age and gender, socioeconomic status, and occupation (Bell et al. 2014). Decades of research on ground-level O_3 reveal significant health effects on the population across the globe. It causes 5,000 premature deaths per year in the United States (Fann et al. 2012; IHME 2016).

The last ISA for O_3 and related photochemical oxidants (EPA 2018) explained that the relationship between O_3 and short-term respiratory effects was supported by sufficient evidence to consider it causal. Similarly, Alhanti et al. (2016) also suggested some relationships of O_3 with long-term respiratory effects, short-term cardiovascular effects, and mortality effects. According to Alhanti et al. (2016), age is the most elementary factor of susceptibility to O_3, with significant health risks related to O_3 exposure observed in older people. Limited or very little suggestive evidence was found to be based upon gender and occupational factors. There are higher risks to females and people in unemployment and a low economy, whereas no significant results in the studies targeted ethnic minorities, i.e., persons with low educational qualifications. The reason for this was the lower solubility of O_3 in water; therefore, it cannot be properly excreted by the upper respiratory tract (Nuvolone et al. 2018). Pre-existing respiratory diseases, such as asthma or emphysema, chronic bronchitis, etc., may result in increased risks for O_3-related health impacts because of the variable quantity of absorbed O_3. Hence, the toxicity of O_3 depends on several conditions, and there is a great variability of responses at the individual level.

There is a considerable amount of literature focusing on the acute effects caused due to O_3 exposure. The WHO has extensively reviewed it (2013a, b). The severity of health effects in humans and the number of people affected through O_3 pollution are represented by a pyramid (Fig.17.2). Less severe health conditions are presented at the bottom of the pyramid. The most affected people are placed in the central part of the pyramid, whereas the most seriously affected, such as by death, or hospital admissions, are placed in the upper vertex and represented by fewer individuals.

On the other side, evidence for the long-term effects of O_3 is less conclusive. Epidemiological studies have to confront some methodological

constraints, mainly for assessing the long-term exposures of O_3; consequently, there is a gap in knowledge that can evaluate the long-term effects of O_3 exposures. Mortality or reduction in the life expectancy period, effects on lung functioning, atherosclerosis, and the onset of asthma are the most common health outcomes taken into consideration for the studies aimed to assess the health effects of long-term exposures to O_3. Many studies conducted in the USA, such as California's The Loma Linda University Adventist Health and Smog (AHSMOG) study by Abbey et al. (1999) and a re-analysis by Lipfert et al. (2006) displayed no statistically significant relationship between long-term O_3 exposure and mortality. But since 2005, various cohort studies conducted in recent years provide a suggestive link between long-term exposure and mortality, and the reports suggest that mostly respiratory and cardiorespiratory mortality is caused in the people affected by predisposing conditions (Lipfert et al. 2006; Krewski et al. 2009; Jerrett et al. 2009; Smith et al. 2009; Zanobetti and Schwartz 2011).

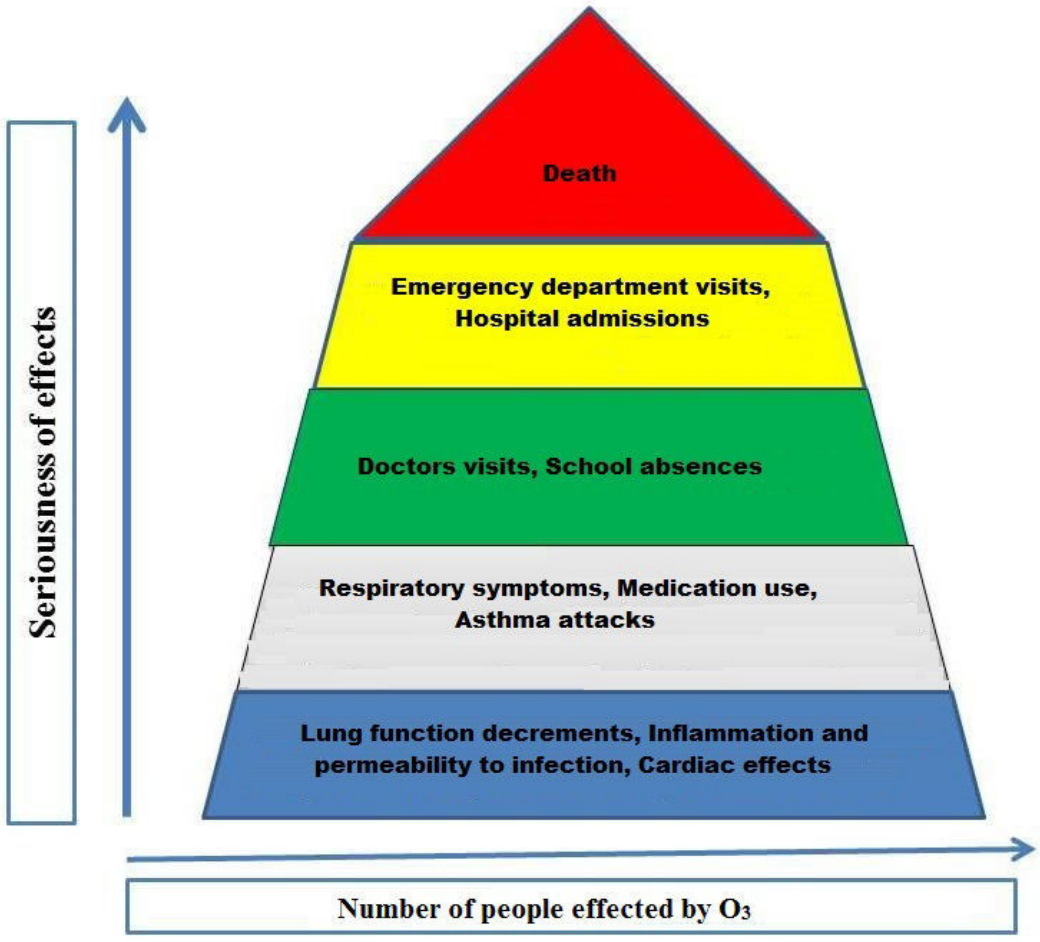

Fig.17.2. Pyramid of health effects caused by ozone

The American Cancer Society Cancer Prevention Study II (CPS II) conducted the most informative and relevant study on this situation. CPS II findings reported a statistically significant relationship between long-term exposure to O_3 and related mortality. Risk estimations by Krewski (2009) suggested there was a stronger association for cardiopulmonary mortality. Similarly, most adjustment methods by Jerrett et al. (2009) showed a significant association between long-term exposure to O_3 and the mortality caused due to respiratory diseases. However, some ambiguity in interpreting these results is due to the interaction between O_3 and $PM_{2.5}$ levels, and it was not so easy to classify the specific effects of the two pollutants.

However, studies conducted on non-human mammal primates allow a better understanding of the results because of the similarities between the primate and the human pulmonary system. Plopper and co-workers conducted a wide range of studies on primates as model organisms. The obtained results have shown a clear association between exposure to O_3 concentrations and alteration in airway morphology and pulmonary function (Plopper et al. 2007). Among different epidemiological studies, the Children's Health Study, conducted in 12 cohorts from communities in southern California, was one of the well-designed studies (Peters et al. 1999). This study found significant associations between lung function and mean annual O_3 concentration among the children spending more time outdoors. However, the lung function growth rates were also found to be significantly associated with a series of other common pollutants such as particulate matter (especially $PM_{2.5}$) and nitrogen dioxide in urban areas. In contrast, exposure to O_3 did not provide conclusive results (Marino et al. 2015). The studies of Künzli et al. (1997) and Tager et al. (2005) reported consistent and significant associations between reduced airway function and long-term O_3 exposure.

For atherosclerosis, carotid intima-media thickness (CIMT) is one of the collective biomarkers used in studies to study pollutants' effects (Künzli et al. 2005). In a cross-sectional study conducted in Los Angeles, CIMT suggested a significant association with residential outdoor $PM_{2.5}$ levels; however, exposure to O_3 provided a weak association (Brook et al. 2002).

17.5 Severe effects of ozone on human health

Ozone pollution creates problems during taking a deep breath and causes coughing and soreness or roughness of the throat, and damages the airways. Most of the people living in ozone risk air areas are affected with

asthma, especially children and older adults who are active workers. Besides this, people with assured genetic characteristics, and people with reduced intake of certain nutrients, such as vitamins C and E, are at greater risk from O_3 exposure (EPA 2017). Chronic disruptive pulmonary (COPD) and other severe diseases are given in Figure 17.3.

17.5.1 Respiratory problem

In their last assessment, the EPA determined that exposure induces decreases in lung function and causes pulmonary inflammation at absorptions as low as 60 ppb. Further, it was also estimated that elevated O_3 days increased the respiratory symptoms and pulmonary inflammation in children with asthma, respiratory-related hospital admissions and ED visits, and respiratory mortality (USEPA 2018). Long-term epidemiological studies supported the likely fundamental effects of O_3, which are adverse respiratory symptoms, new-onset asthma, and respiratory mortality O_3 exposure.

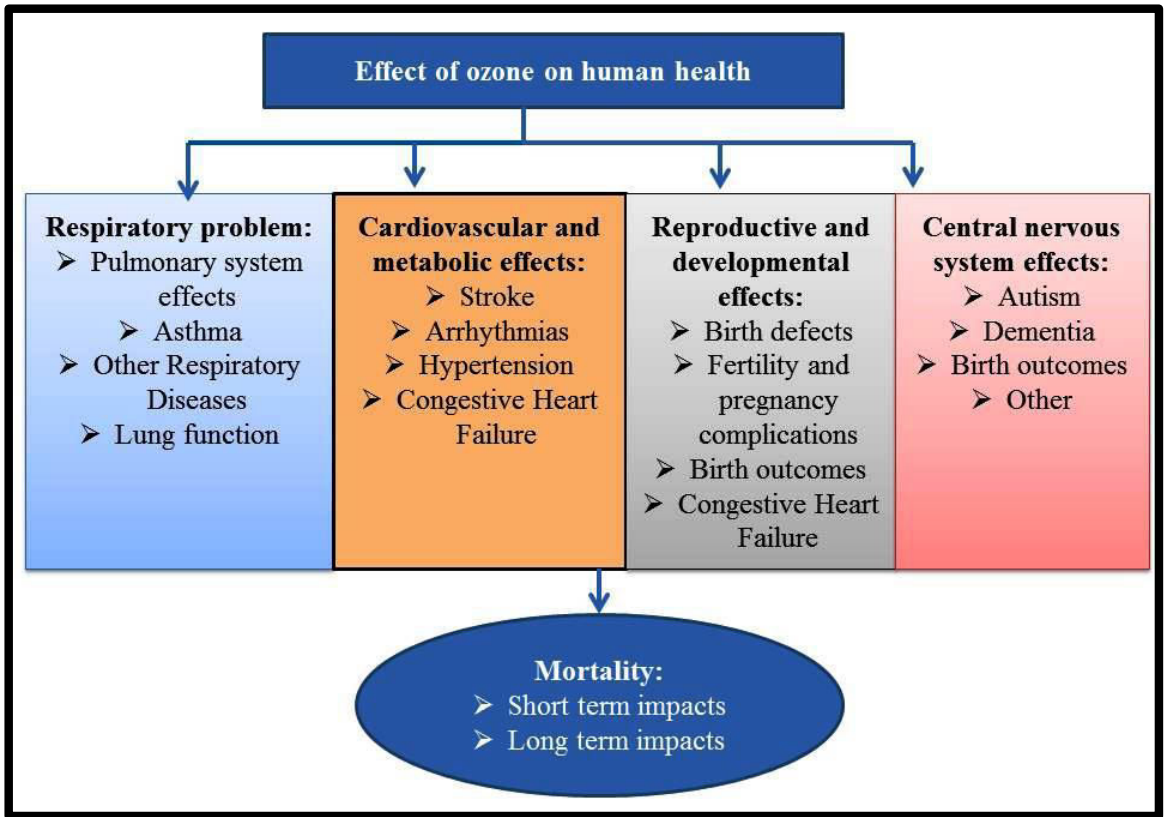

Fig.17.3. Severe ozone effects on human health

17.5.1.1 Pulmonary system problem

Since the WHO update for the air quality guidelines (WHO 2006), a growing scientific interest has been developed to produce predictive models for lung function decrements (FEV1) with the response to inhaled O_3 doses, to evaluate risk and have response thresholds (McDonnell et al. 2012). The induction of a transient decrease in lung function is one of the most studied respiratory acute end-points. Studies were more frequently conducted in healthy young people; usually, non-smokers, exposed to a wide range of O_3 levels (40–600 ppb1) during rest and intensive physical activity (Sousa et al. 2013; McDonnell et al. 2012; EPA 2012). The main results show that subjects exposed to high outdoor O_3 levels (outdoor workers, children in summer camps, exercising adults), but lower than those used in chamber studies, experienced acute lung function decrements (Thaller et al. 2008; Chan and Wu 2005). Results from epidemiological studies reveal robust, positive, and significant relations between the alteration in ambient O_3 levels and increased morbidity. The most frequently studied health end-points or alternatives are hospital admissions to the emergency department, visits for asthma, respiratory tract infections and exacerbation of other respiratory diseases, and school absenteeism in children. The effects were frequently observed in children, older people, asthmatics, and subjects with COPD during warmer months.

As in mortality studies, extensive multicity analyses relate variations of O_3 levels with hospital admissions for respiratory diseases (Burnett et al. 1997; Anderson et al. 1997). Such associations are still significant when introducing the models' time-related variables, such as day of the week, seasonal effects, other air pollutants, and atmospheric factors.

17.5.1.2 Asthma problem

Asthma is a chronic lung disease that inflames and narrows the respiratory airways. Asthma causes recurring periods of wheezing (a whistling sound when you breathe), chest tightness, shortness of breath, and coughing (NHBLI). More than 26 million people are known to have asthma in the United States, of which 6 million are children (NCHS). CDC approximations are that asthma costs the US economy more than $80 billion annually in medical expenses, missed work and school days and even leads to mortality. Eight case-crossover studies have shown increases in the odds of ER visits or clinic visits with odds ratios (ORs) that range from 1.03–1.17 per 10 ppb O_3 (Kim et al. 2015; Yamazaki et al. 2015), or an increase of 3% risk per 10 ppb O_3 (Malig et al. 2016). One study in Japan showed much higher ORs (2.3) precisely for nighttime primary care

visits for asthma (Yamazaki et al. 2014). However, studies in France and Japan found no significant effects of O_3 on asthma emergencies (Yamazaki et al. 2014; Mazenq et al. 2017). Most studies indicated that school-aged children were more susceptible and had higher ED visit rates associated with O_3 exposure. Studies also showed that the effect of O_3 on ED visits for asthma seemed to occur with a shorter lag time in older adults, those in want, disadvantaged and minority communities (Strickland et al. 2014; Kim et al. 2015; Alhanti et al. 2016), and in children who were born premature (Strickland et al. 2014).

Most of the studies show a consistent effect of short-term O_3 concentration on asthma hospital admissions. There are six studies of asthma hospital admissions with a 10-ppb increase in short-term O_3 (up to a 5-day average) showing a 4–11% increase in hospital admissions (Park et al. 2013; Sheffield et al. 2015; Chen et al. 2016; Mohamed et al. 2016; Dai et al. 2018) although the study of McLaren and Williams (2015) showed an inverse effect.

17.5.1.3 Other Respiratory Diseases

Multiple studies have found an increased risk of respiratory infections related to short-term ozone exposure (Table 17.2). The odds of upper respiratory illness (URI) with a 10-ppb increment of O_3 range from 0.99–1.46, while the odds of influenza were 1.28. The odds for pneumonia range from 0.99–1.15 and for bronchitis 0.998–1.05 (Xu et al. 2013; Altuğ et al. 2014; Kousha and Rowe 2014; Xiao et al. 2016; Li et al. 2017). Similarly, studies have reported a 2.8% increase in URIs and a 3% increase in pneumonia and decreased odds (0.31) of bronchitis with decreases in O_3 concentrations (Malig et al. 2016; Berhane et al. 2016). However, studies conducted in Vietnam and Brazil found no connection between O_3 and admissions for respiratory infections (bronchitis or pneumonia) (Negrisoli et al. 2013; Nhung et al. 2018). Notably, a meta-analysis of 12 studies, where exposures ranged from 13–62 ppb, initiates a statistically significant increase in pneumonia (1.7%) per 10 ppb O_3 (Nhung et al. 2017). Some studies of particular respiratory infections such as tuberculosis, pneumocystis carinii pneumonia among HIV patients, infantile respiratory infections, acid-fast bacillus, and O_3 found no or inverse relations (Stern et al. 2013; Jassal et al. 2013; Álvaro-Meca et al. 2015; Smith et al. 2016).

In patients with cystic fibrosis, there are three recent papers relating to pulmonary exacerbations to O_3 exposure. There was a 6–37% increase in exacerbations with a 10-ppb increment in O_3, within two days after exposure. However, long-term O_3 exposure was not associated with the

frequency of pulmonary exacerbations (Farhat et al. 2013; Goeminne et al. 2013; Jassal et al. 2013). In patients with COPD, O_3 seems to have less of an effect than in other respiratory diseases. There was no significant relationship between short-term O_3 exposure and lung function or hospital admissions (Kariisa et al. 2015; Qiu et al. 2018). There was no association between the development of COPD in former asthma patients for long-term exposure. In a large longitudinal cohort in England, there was no association with COPD diagnosis (Atkinson et al. 2015; To et al. 2016).

Overall, data for hospital admissions or other health care visits for respiratory diseases are mixed. Six studies found no significant relationship with O_3 exposure (Jones et al. 2013; Rodopoulou et al. 2014; Rodopoulou et al. 2015; Franck et al. 2015; Pride et al. 2015; Bono et al. 2016). However, a few studies found increases of 2–4% in respiratory admissions from a 10-ppb increase in O_3, or odds ratios of 1.04–1.08 (Lin et al. 2013; de Freitas et al. 2016; Magzamen et al. 2017; O'Lenick et al. 2017). One study noted that their results differed depending on how they summarized the O_3 metrics, and another demonstrated variable relationships in other geographic areas (Pannullo et al. 2017; O' Lenick et al. 2017). These may help to explain the varied results among studies and the fact that respiratory health care visits are a non-homogenous category that may mask effects for different illnesses within this category. In other respiratory effects, critically ill patients were more likely to develop acute respiratory distress syndrome with long-term O_3 exposure (2.5 O Rsper 10-ppb O_3) (Ware et al. 2016). Regarding lung cancer, there are three new studies; two showed no relationship between O_3 and lung cancer incidence (Hystad et al. 2013; Gharibv et al. 2017). However, a study from China covering 368,762 lung cancer cases found an association with O_3 (1.087 ORs per 10-ppb O_3) (Guo et al. 2016).

17.5.1.4 Lung function problem

Several extensive cohort studies have found that long-term or short-term O_3 is associated with decreases in lung function in healthy children (Urman et al. 2014; Hwang et al. 2015; Fernández-Plataet al. 2016; Karakatsani et al. 2017;Tsui et al. 2018). Only three of the studies found no relationship with lung function in children (Fuertes et al. 2015; Barone-Adesi et al. 2015; Neophytou et al. 2016). Some studies found more potent effects of O_3 on girls' lung function and patients carrying genetic polymorphisms (Altuğ et al. 2013; Chen et al. 2016). In children with asthma, cohort studies have found that O_3 was associated with a decrease in peak expiratory flow, but no change in other lung function parameters (Moreno-Macias et al. 2013; Ierodiakonou et al. 2016; Yoda et al. 2017).

Epidemiological, controlled chamber studies and toxicological literature have suggested an association between O_3 and lung inflammation. Recent human studies on short-term O_3 effects on airway inflammation continue to be mixed, with some studies finding an association with lung inflammation markers (Yoda et al. 2014; Modig et al. 2014; Karakatsani et al. 2017; Arjomandi et al. 2017; Cheng et al. 2018).

Table 17.2. Ozone concentration and respiratory diseases

S. No.	Place	Ozone levels (ppb)	Period	Health Outcome	References
1.	Atlanta	43	1993–2009	Asthma EDV	Alhanti et al. (2016)
2.	Dallas	42	2006–2009		
3.	St. Louis	37	2001–2007		
4.	Indianapolis	48	2007–2011	Asthma EDV	Byers et al. (2016)
5.	Atlanta	42	2002–2008	Respiratory EDV	O'Lenick et al. (2017)
6.	Georgia	42	2002–2008	Pediatric asthma EDV, Pneumonia EDV, Bronchitis EDV, URTI EDV	Xiao et al. (2016)
7.	Himeji city, Japan	26	2010–2013	Pediatric asthma PCV	Yamazaki et al. (2014)
8.	California	31–75	2005–2008	Respiratory EDV, Asthma EDV, Pneumonia EDV, ARI EDV, COPD EDV, URTI EDV	Malig et al. (2016)
9.	Adelaide, Australia	28	2003–2013	Asthma HA	Chen et al. (2016)
10.	New York City, NY	30	2005–2011	Pediatric asthma HA, Pediatric EDV	Shmool et al. (2016)

17.5.2 Cardiovascular and metabolic problems

Results from experimental studies on animals have reported some evidence for cardiovascular effects of O_3, such as an increase of heart rate and diastolic pressure, vascular oxidative stress, inflammation, and decreased heart rate variability (Chuang et al. 2009; Perepu et al. 2010; Tankersley et al. 2010), whereas, some other experimental studies made on humans are less conclusive and have provided inconsistent associations with O_3 (Fakhri et al. 2009; Rudez et al. 2009; Thompson et al. 2010; Kusha et al. 2012). Park et al. (2005) conducted a study on 603 men from the Boston area who participated in the Veterans' Administration Normative Ageing Study. Authors observed an 11.5% (95% CI 0.4–21.3) reduction of low-frequency HRV associated with 2.6 $\mu g/m^3$ O_3 increased in 4 h and more substantial effects resulted in men affected with ischemic heart disease and hypertension. Rich et al. (2006) followed patients with implanted defibrillators in the Boston area. They observed an increased risk (OR = 2.1, 95% CI 1.2–3.5) of paroxysmal atrial fibrillation episodes with short-term fluctuations of O_3 concentrations.

Observational studies have found positive associations between exposure to ambient ozone and some cardiovascular alterations, such as oxidative stress, inflammation, alteration of heart rate variability, imbalance of autonomic components, arterial pressure control, coagulation, and myocardial infarction (Chuang et al. 2007; Jia et al. 2011). In Italy, Nuvolone et al. (2013) found a 6.3% (95% CI 1.2–11.7%) increase in out-of-hospital coronary deaths for a 10 $\mu g/m^3$ increase in O_3 and concluded higher risks for females, the elderly, and patients previously hospitalized for cerebrovascular and artery diseases. Zhao et al. (2017) reviewed the literature on the impact of short-term exposure to air pollutants on the onset of out-of-hospital cardiac arrest and confirmed the positive and significant association with O_3 exposure (RR = 1.016, 95% CI 1.008–1.024).

17.5.2.1 Stroke problem

A stroke is a disruption of blood flow to the brain, causing paralysis, slurred speech, and/or altered brain function. Two-thirds of all people who have a stroke have some form of eternal disability. In the United States, a stroke happens every 40 seconds and results in one-fifth of total deaths. CDC estimates that stroke costs the US economy more than $34 billion annually in direct medical costs and lost days of work (cdc.gov 2018).

Short-term O_3 exposure is associated with an increased risk of hospitalizations for stroke, with multiple studies reporting an increase (up

to 3.9%) in admissions for stroke per 10 ppb O_3 (Carlsen et al. 2013; Xu et al. 2013; Guo et al. 2017; Liu et al. 2017). The relationship has been modeled over a range of O_3 values in some studies and found to be roughly linear down to as low as 15 ppb (Huang et al. 2017). A few studies find positive associations in subpopulations like the elderly above 75 years of age, particular types of strokes in specific racial groups, ischemic strokes in non-Hispanic whites, and hemorrhagic stroke in African Americans (Chen et al. 2014; Wing et al. 2015; Montresor-López et al. 2016). An association between exposure to O_3 and regular ischemic strokes has also been reported around a 1.18 ORs value, which depends on the number of days lagged (Suissa et al. 2013). Table 17.3 describes the lower- and upper-case index of stroke risk on human health due to short-term O_3 exposure.

Table 17.3. Short-term ozone exposure and stroke risk

S. No.	Place (Period)	Population (N)	Outcome	Effect, LCI,UCI	References
1.	Dijon, France (1994–2004)	1487	Ischemic stroke	1.54,1.14, 2.09	Herontin et al. (2007)
2.	Allegheny,PA (1994–2000)	26219	All stroke	1.036,1.007,1.065	Xu et al. (2013)
3.	Allegheny, PA (1994–2000)	26219	Ischemic stroke	1.043, 1.011, 1.076	Xu et al. (2013)
4.	South London (2005–2012) 1800	204	Hemorrhagic stroke	1.04,0.88,1.24	Chricton et al. 2016)
5.	Corpus Christi (2000–2012)	3035	Ischemic severity (Disadvantaged)	1.12,1.01,1.24	Wing et al. (2017)
6.	Corpus Christi (2000–2012)	3035	Ischemic severity (Wealthier)	1.23,1.11,1.36	Wing et al. (2017)
7.	Corpus Christi (2000–2012)	317	Recurrent ischemic strokes	0.97,0.87,1.07	Wing et al. (2017)

17.5.2.2 Arrhythmia problem

A small longitudinal cohort found a significant increase in ventricular tachycardia (RR 1.7) and supraventricular tachycardia (OR 1.11) related to 10ppb O_3 in coronary artery disease patients (Bartell et al. 2013). Cakmak et al. (2014) reported increased odds of heart block (ORs 1.1) in a study of cardiac patients with 24-hour Holter monitoring. Studies of Song et al. (2016) and Knezovic et al. (2017) looked at O_3 with all hospitalizations for arrhythmia (irrespective of patient cardiac history), one cohort, and one large meta-analysis; both found no significant relationship. Thus, the seemingly contradictory results may be related to patient addition criteria, with O_3 having a considerable effect on those with prior cardiac disease.

17.5.2.3 Hypertension

Various research groups reported significant effects of short-term ozone exposure admission with complaints of hypertension and lesser increases in diastolic and systolic blood pressure (Weichenthal et al. 2014; Yang et al. 2017; Cole-Hunter et al. 2018; Chen et al. 2018). However, studies that include two meta-analyses do not find any significant association between hypertension and either short- or long-term ozone exposure (Yang et al. 2014; Wing et al. 2017; Yu et al. 2017). Long-term O_3 exposure has also been associated with increased odds of causing hypertension with increases of 0.73 mmHg in systolic blood pressure and 0.37 mmHg in diastolic blood pressure, but a decrease of 1.54 mmHg of systolic blood pressure in patients with sleep-disordered breathing (Dong et al. 2013; Liu et al. 2014). Zhao et al. (2013) suggested that the effects of ozone on hypertension may be more prominent in men and overweight individuals, perhaps explaining some of the variability in the results obtained. In children, long-term O_3 exposure has been associated with increased odds of hypertension, with more substantial effects in overweight/obese children and those who were never breastfed, and short-term exposure was also associated with hypertension (Dong et al. 2014, 2015; Zeng et al. 2017). Thus, the association between hypertension and short-term O_3 exposure remains an open question.

17.5.3 Reproductive and developmental problems

17.5.3.1 Birth defects

Studies have suggested the teratogenic effects of O_3 for a specific gestational period, i.e., 3–12 weeks of fetal exposure to elevated O_3 during

5–8 weeks of pregnancy caused an increased risk of defects in limb formations and resulted in polydactyly, whereas exposure for 3–8 weeks was associated with risk of atrial septal defects (Vinikoor-Imler et al. 2013; Lin et al. 2014). Exposure to ozone over 43 ppb in the third week of gestation is closely associated with a three-fold higher risk of pulmonarystenosis. In contrast, O_3 exposure between 8 and 12 weeks was associated with congenital heart disease, including ventricular septal defect and teratology of Fallot (Zhang et al. 2016). Agay-Shay et al. (2013) found an elevated risk of cardiac malformations, whereas; Vinikoor-Imler et al. (2015) reported an increased risk of craniosynostos is under severe O_3 exposure. However, the effects of O_3 concentrations on early developmental stages are not found to be related to congenital anomalies (Vinikoor-Imler et al. 2013; Farhi et al. 2014; Zhou et al. 2017).

17.5.3.2 Fertility and pregnancy complications

Reduction in sperm count and changes in ovarian response to hormonal stimulation were reported as a result of O_3 exposure on fertility (Carré et al. 2017). Life-threatening problems during pregnancy, such as gestational hypertension and preeclampsia, are critically serious conditions, and the relationship of gestational hypertension to O_3 exposures is somewhat mixed (Lee et al. 2013; Pedersen et al. 2014; Michikawa et al. 2015; Mendola et al. 2016). The study also suggested a slight increase in systolic blood pressure (1.3 mmHg per 10 ppb) with O_3 exposure in the second trimester and a slight decrease (1.9 mmHg) in the third trimester (van Rossem et al. 2015). Ozone can also alter placental function; however, no association has been found for actionson placental volume or vascularization or placenta accreta (Michikawa et al. 2016; Hettfleisch et al. 2017). Closer to delivery, O_3 concentration was not associated with placental abruption but was associated with biomarkers of endothelial function such as ICAM-1, VCAM-1, and endothelin-1 (Poursafa et al. 2015; Michikawa et al. 2017).

17.5.3.3 Birth outcomes

Studies have linked losses in birth weight of the fetus by 13–27 g against a 10-ppb elevation in the average ozone level over the pregnancy, and have proved an improved risk of early gestational age with first-trimester exposure (Laurent et al. 2013; Gray et al. 2014; Michikawa et al. 2017). However, numerous studies on the O_3 effect on birth outcomes have not found deleterious effects of O_3 on the growth of the fetus or birth

weight (Lee et al. 2013; Ritz et al. 2014; Carvalho et al. 2016; Capobussi et al. 2016; Díaz et al. 2016).

17.5.4 Central nervous system effects

17.5.4.1 Autism problem

Exposure to O_3 during pregnancy may cause a risk to develop autism in the child. Epidemiology of a large case-control study reveals a 10% increase in the chances of having autism diagnosed in children with a 10-ppb average increase during prenatal exposure (Becerra et al. 2013) while Jung et al. (2013) reported a 59% increased O_3 risk (Table 17.4).

17.5.4.2 Dementia problem

Case-control studies conducted in Taiwan found a relationship between elevated O_3 concentrations and odds of Alzheimer's disease with vascular dementia diagnosis (Wu et al. 2015; Jung et al. 2015; Cleary et al. 2018). However, a considerable cohort study in Canada shows no significant association with the new onset of dementia [Hazard ratio, 0.97 (95% CI 0.94–0.98)] (Chen et al. 2017). Furthermore, the study of Linares et al. (2017) has shown an 18% increase in hospital admissions with the complaint of dementia-related symptoms with increased O_3.

Table17.4. Effect of ozone on the central nervous system

S. No.	Population	Outcome	References
1.	49,073 children	Autism (full population)	Jung et al. (2013)
2.	158 cases	Autism (full population)	Kim et al. (2017)
3.	346 cases	Autism (low folic acid/high folic acid)	Goodrich et al. (2018)
4.	249 cases	Alzheimer's disease (full population)	Wu et al. (2015)
5.	125 cases	Vascular dementia (full population)	Wu et al. (2015)
6.	2.1 million people	Incident dementia (full population)	Chen et al. (2017)

17.5.5 Mortality caused due to ozone

Two recent multicenter studies made an important contribution in providing evidence on the impact of short-term exposure to elevated O_3 which resulted in mortality: the Air Pollution and Health, A European and North American Approach (APHENA) study (Katsouyanni et al. 2009) and the Public Health and Air Pollution in Asia (PAPA) study (HEI 2010, 2011; Wong and Health Review Committee 2010). The APHENA project is an extensive network with dedicated researchers participating in the multicity European APHEA project, the US National Morbidity, Mortality and Air Pollution Study (NMMAPS) and the multicity Canadian study. The APHENA study pooled data from 12 cities in Canada, 90in the USA, and 32 in Europe to evaluate the coherence of multiple time-series studies and produce a robust estimate of the relation between O_3 increases and mortality. The PAPA study also applied a standardized protocol to collect data and perform statistical analyses, pooling the results from six large Asian cities (Bangkok, Hong Kong Special Administrative Region, Shanghai, Wuhan, Chennai, and Delhi). Other recent European studies have been conducted in England and Wales (Pattenden et al. 2010), France (Lefranc et al. 2009), Italy (Stafoggia et al. 2010), Spain (Ballester et al. 2006), and Greece (Kassomenos et al. 2012). Peng et al. (2013) published the statistical methods used for the re-analyses of APHENA data, using and comparing various methods, such as natural spline (ns), penalized regression spline (ps), and various degrees of freedom (dfs), to remove long-term trends and time-dependent confounders.

Overall, the authors estimated an excess mortality risk of 0.26% (95% CI 0.15–0.37%) related to a 10 $\mu g/m^3$ increase in 1h of daily maximum ozone. Among all models applied, the most substantial effect estimate resulted from the model using natural splines and 8 df per year. Results from European and US studies were similar, whereas those from Canada showed higher risk estimates. Authors hypothesized some explanations of this different pattern, including the influence of other co-varying pollutants and the residual confounding in the Canadian data from unmeasured seasonal or meteorological factors. Authors also discussed the role of the availability of more accurate exposure and outcome data in Canada, as compared with the European countries and the USA, but the authors themselves stated that this explanation seems unlikely, and they do not provide any data to pursue this conjecture. The authors concluded that the re-analyses of APHENA data confirmed the O_3-related acute mortality risk previously reported and that the implementation of an extensive statistical protocol leads to the robustness of results forthe method of data analysis.

17.6 Conclusion

Substantiation from the studies indicates that O_3 pollution increased day by day in the ground-level atmosphere due to anthropogenic activities. Therefore, its high concentration developed uncontrolled problems related to human health. Evidence from observational studies strongly indicates that higher daily O_3 concentrations are associated with increased asthma attacks, hospital admissions, daily mortality, and other morbidity markers. School-aged children and elderly individuals are particularly vulnerable, and the majority of the studies show adverse effects of O_3 at the secritical stages of life. Cardiovascular disease, specifically increased rates of strokes and cardiac arrhythmia in persons with pre-existing heart disease and mortality due to short-term exposure to O_3 are a major health-related risk to the human population. Additionally, the evidence of long-term exposure to O_3 also increases rates of mortality. The epidemiological study of the effects of O_3 on the central nervous system suggests that long-term O_3 exposure could be associated with nervous system dysfunction resulting in an increased risk of autism in children and possibly dementia among the elderly. However, rigorous inquiries are required to better understand the relationship between O_3 and chronic health effects associated with its exposure.

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THE BELT AND THE ROAD INITIATIVE

Implications for India

Editor : Manish

ABOUT BOOK

The Belt and the Road initiative was unveiled by the Chinese president Xi Jinping in 2013. No wonder , this ambitious agenda has sparked a variety of reactions among governments throughout the regions. For Beijing, the BRI constitutes a grand strategy that integrates various factors in pursuit of China returning to great-power status without provoking overt counter reactions from its neighbours and the United States. To this extent, the BRI serves a number of China's core domestic, economic, and geopolitical interests. Undoubtedly, it is an umbrella initiative covering a multitude of investment projects with the aim of promoting the flow of goods, investment and people.

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The Belt and the Road Initiative

Implications for India

EDITED BY

MANISH



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Belt and Road Initiative (BRI) is Chinese President Xi Jinping's signature foreign policy initiative and grand strategy aimed at restoring China's "rightful" great-power status in the world. Dr Manish's does yeoman service for the strategic community by assimilating the wide ranging economic, political and strategic implications of the BRI for India at one place. The book covers considerable ground by examining diverse dimensions of the BRI in terms of their impact on India's core concerns. It is a must read for those interested in knowing and understanding the what, why and how of India vs BRI.

—Lt Gen Syed Ata Hasnain, PVSM, UYSM, AVSM,SM, VSM **(Retd)
Former GOC 15 & 21 Corps, Chancellor, Central University of Kashmir, Member,
National Disaster Management Authority

The book is a comprehensive and timely analysis of China's BRI plan, its global interplay of economics and geopolitical grand strategy, and its implications for India. It is highly recommended for China watchers and strategic cognoscenti.

—Air Marshal Anil Chopra PVSM AVSM VM VSM (Retd)
Director-General Centre for Air Power Studies, Subroto Park, New Delhi

I must commend the efforts led by the editor, Manish, that have gone into this comprehensive volume on India and the Chinese-led Belt and Road Initiative (BRI). Even before India and its concern enters into the picture, there is a need to understand the Chinese State - is it Westphalian? Is it a Civilization masquerading as a State, as Lucian Pye told us? Or is it a Civilizational State that is pushing forward to assume its 'natural' leadership position in the world, after achieving economic growth and social stability? Is the BRI China's version of Grand Strategy with Xi's 'community of shared interests', new terminology for Tianxia? The volume not only addresses but it goes into great detail on India's non-participation affects BRI, what it means for India with BRI projects surrounding it von the land and seas, China's leadership in the emerging technologies etc. All in all, a must read.

—Shakti Sinha, Hony Director, Atal Bihari Vajpayee Institute of Policy
Research and International Studies, MS University, Vadodara,
Distinguished Fellow, India Foundation, New Delhi,
Non-Resident Senior Fellow, Institute of South Asian Studies, Singapore,
Senior Fellow, WRI-India

The 'Belt and the Road Initiative: Implications for India' is a thoughtfully compiled work. China's geo-economic strategic initiative, if it succeeds, has the potential to exponentially spread Chinese influence around the globe. The Editor's introduction and initial two chapters set the tone and segue into the rest of the chapters. The book is truly comprehensive and represents a unique effort to examine various aspects of the BRI. Inclusion of an assessment of the impact of the Covid pandemic makes it current. The carefully arranged chapters explore the success or otherwise, of the BRI in various geographies and countries, and examine the consequent economic and other difficulties, also from the perspective of participant countries. The book is a must not only for those studying China, but also economists and strategists since the world, and India especially, will have to contend with China's Belt and Road Initiative for quite some time.

—Jayadev Ranade, Former Additional Secretary, Cabinet Secretariat, Government of India,
President, Centre for China Analysis and Strategy, New Delhi

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Manish

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INTRODUCTION

Manish and Prashant Kaushik

China's rise to great power status perhaps remains one of the most debated themes of the 21st century. The process unleashed by 40 years of unrelenting reform and opening up has surely catapulted China to the centre-stage of the global arena where China is actively participating in the formation of a global order, best reflected through the Belt and the Road Initiative (BRI). The BRI is by far China's largest cross-regional (or cross-continental) initiative in the world today. It runs through Asia, Europe and Africa connecting the world's most economically active region of East Asia with the most developed parts of Europe, and in between sweeping through the vast hinterland of West Asia, North Africa, Central Asia, South Asia and then stretching all the way to encompass Latin America and South America. Symbolizing its larger acceptability, if nothing much, China has signed BRI cooperation documents with 140 countries and 30 international organizations as of January 2021. The initiative is also a giant of initiatives whereby China has already invested about USD 755 billion in BRI countries between 2013 and June 2020, thereby becoming the second largest investing country in the world.[1] BRI investments span the sectors of energy, transport, real estate, metals, agriculture, chemicals, finance, health, entertainment, logistics and others (Nedopil, Christoph 2020). Domestically, the BRI has been enshrined into the CPC constitution following the 19th CPC National Congress in November 2017 as Xi Jinping's pet project and 'China's top-level cooperation initiative' ('国家级顶层合作倡议'). Undoubtedly, the BRI is the most ambitious of Chinese projects launched till date having far-reaching global ramifications and China has heavily invested in it, both in terms of prestige and money.

The need to understand the BRI cannot be overemphasized and any attempt

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10

South Asia, India and BRI: Chinese Perspectives

Prashant Kaushik

Introduction

India shares a very 'special' relationship with China; it is close yet intricate, perhaps as intricate as it could become, marked by ever-increasing dialogue, cooperation and competition as well as confrontation.[1] They are each other's strategic partners and yet share thousands of miles of unresolved borders. Perhaps no other bilateral relationship could compare with the intricacies decipherable in the India-China relationship. They are seen standing together on many platforms and yet spare no chance to point bickering fingers at each other. In the course of its emergence from nowhere to become the world's second-largest economy and a potential future number one, China's promotion of the Belt and Road Initiative has created no less ripples in the world of ideas and projects than in the power corridors of various countries; India undoubtedly is no exception. While there exists a certain understanding of India's position on the BRI, attempts need to be made to comprehend how China sees India's position on the BRI. This chapter attempts to understand China's perceptions of India's position on the BRI by reading Chinese writings by some of China's renowned international relations scholars and India watchers.

Gleaned from Chinese writings, one, South Asia figures prominently in China's foreign policy deliberations as one of its most important neighbourhoods now

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COVID-19

ANALYSING THE THREAT



Editors

Ajey Lele | Kritika Roy

21

COVID-19 and the Challenge of Global Governance

Manish

the time China reported a novel coronavirus to the World H
nization (WHO) on 31 December 2019, it took barely four months to be
demic, killing hundreds of thousands and growing daily. It is now clea
novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
circulating in Wuhan, China, for some time before it was reported t
O. It is for sure that the Chinese authorities had hidden information. G
talitarian nature of the Chinese regime, it is certainly not surprising. C
tained that SARS-CoV-2 was not readily transmissible between huma
the number of reported COVID-19 infections now touching several mi
across 196 Westphalian entities at the time of writing, this pandem
nely global in every sense of the word.[2]

Doubts have also been raised about the origin of the virus. *The Washing*
oting US diplomatic cables, indicated that the US officials were, car
rried about safety and management weaknesses at the Wuhan Institute
ology (WIV). Since the place of origin of the current pandemic was Wuh
picions were bound to be raised if a lab in Wuhan could have been the source
virus. The US President Donald Trump and Secretary of State Mike Pomp
e both claimed that there is evidence about the pathogen coming from the l
Wuhan. The WHO, however, has made it clear that Washington's claim was
that the coronavirus jumped from anim

Multi–Disciplinary Approach towards Sustainable Development



Editors
Pankaj Srivastava
Jayashree Dubey
Dharmendra Hota

Multi-Disciplinary Approach towards Sustainable Development

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Article

Application of Information Visualization in Academic Libraries: An Overview

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A B S T R A C T

Academic Libraries have numerous sections and they generates huge amount of data and information while providing number of products and services to its users. The generated data or information will be helpful in taking decisions and improveing the existing services. Proper understand and represent the data visualization is essential. The rapid growth of technology has given lot of software tools and techniques for visualizing the information. The visualization is essential for presenting abstract data or information in innovative and creative way. To implement the visualization, its necessary to know what are the possible areas where libraries can easily implement visualizations. This paper presents an overview of the possible areas where libraries can easily and effectively implement visualisation.

Keywords: Information Visualization, Data Visualization, Academic Libraries

Introduction

With the growing amount and accessibility of data and information, visualization is becoming increasingly important. Libraries have been providing lot of services and day today work, library professionals have been handling lot of data and information. The information visualization is the method of consolidating data into one collective, illustrative graphic. Traditionally, data or information visualization has been used for quantitative work, but ways to represent qualitative work have been shown to be equally powerful (Wong, 2013). The main goal of the data visualization is to communicate information clearly and effectively through graphical methods (wikipedia).

Information visualization is a general term that describes any effort to help people understand the significance of data by placing it in a visual context. Patterns, trends and correlations that might go undetected in text-based data can be exposed and recognized easier with data visualization software (Rouse, 2018). The data visualization excels in capturing a viewer's attention and holding it through storytelling. It addresses a complex problem that could be easily looked over, and simplifies it using design. Naturally, a new market for business has emerged (Wong, 2013). The data visualization can help with the analysis of the information and present it in a way that allows viewers to discover patterns that might otherwise be hard to uncover. Large amounts of data are hard to wade through, but data visualization can make that data easily understandable (Visually, 2018).

Background

Information visualization is not a new concept, but the ever increasing amounts of information and advancements in technology are beginning to establish its use also in everyday practices. The possibility to present overviews of large data sets on the one hand and to interactively explore and discover on the other, offer interesting potential also

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Article

Rubric Techniques for Analyzing Usefulness of Open Educational Resources

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A B S T R A C T

Open Educational Resources (OERs) are those open-licensed resources that anybody can reuse in different contexts and are available without any financial burden. COVID-19 pandemic has shown an unpredictable shift of teaching and learning activities in school education in virtual mode. Indian school educators have started taking online classes to engage students in carrying out their routine academic activities. Parallelly, the school librarians have also developed new skills to assist educators by providing the required resources or helping them carry out online classes. The situation has paved the way for OERs to be adapted in numerous academic contexts. Librarians provide various OERs to their users in multiple formats, namely audio, video, PDF files, flipbooks and websites. But a practical exercise that schools should carry out before they provide OERs to their students and educators is to analyse the resources to find out their suitability for use in classrooms and the students' purpose of learning. The paper's objective is to apply the rubric's techniques checklist, rating and analytics scale rubrics to analyse the usefulness of the OERs. School educators, librarians and students are slowly becoming the vital users of OERs in the Indian education environment. Adopting the method of analysing the usefulness of OERs will help identify the context in which the school educators can use them to provide the best OERs to their students.

Keywords: Open Educational Resources, OER Analysis, School Educators, Rubric, Checklist

Introduction

Technology has a reasonable claim on improvisation in the field of education. Significant changes are being experienced in the approach and delivery process of information. The openness of educational resources is due to technology only. The open system to knowledge is possible because scientists, scholars, students and teachers ensure that the access barrier to their scholarly content is removed. Budapest Open Access Initiative (BOAI) in 2002 first used the term open access. With the passage of time and the increased reach of knowledge to everyone through the internet, open resources, open education and open educational resources started emerging. Teaching pedagogy also has been modified due to the moment of open education. The Open Educational Resources (OERs) started appearing as supplementary learning resources and are supporting teaching content in a big way in school education.

Open Educational Resources (OERs) are educational materials in the public domain or published under open

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Editors' Profile



Dr. Shivaram. B. S, presently serving as team leader digital archiving group at ICAST, CSIR-NAL, Govt. of India. Prior joining to CSIR-NAL he served DRDO-MTRDC, a premier R&D laboratory under Ministry of Defense, GOI and NCSI, IISc, Bangalore. Presently, he is serving has Governing Council and Steering Committee member of VTU E-Resource Consortium. Shivaram B. S, is a UGC-NET qualified, holds Ph.D from Kuvempu University, Karnataka and dual Master's degree in Applied Psychology and Library & Information Science from Annamalai University and Bangalore University respectively. He has done Information and Knowledge Management course from NCSI, Indian Institute of Science, Bangalore.



Dr. G. Mahesh is a Senior Principal Scientist and was Head of the Information Resources and Media Division at CSIR-NISCAIR that includes the National Science Library, ISSN National Centre, Scientometrics, etc. He is also a Professor at the Academy of Scientific and Innovative Research (AcSIR) where he teaches S&T [illegible] published research papers in the [illegible] international journals including journals such as [illegible] Electronic Library, etc. He was also the National [illegible] Documentation Centre. He is a Fellow of [illegible] and also served as [illegible] at the [illegible] Fellow. He is currently [illegible] Editor-in-chief of [illegible] Scientific Research and the [illegible] Directorate at CSIR Hq.

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ADAPTING DIGITAL PEDAGOGY IN LIS SCHOOLS TO TEACH INNOVATIVE LIBRARY SERVICES

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"We need technology in every classroom and in every student and teacher's hand, because it is the pen and paper of our time, and it is the lens through which we experience much of our world" - David Warlick

Abstract

Education is an equalizer in today's digital world. There are various avenues for people irrespective of age, gender, region, country to pursue studies of their interest. MOOCs like edX, Coursera, NPTEL and SWAYAM are revolutionizing access to higher education. With the advent of MOOCs, teaching pedagogy has leaned on digital pedagogy. Further, challenging times like the present pandemic situation are compelling higher educational institutions to steadily adopt learning management systems to facilitate virtual learning and the libraries too are providing services in virtual mode.

Teaching and learning process in higher education institutions is different as it is more of walking the students, through the courses. It is a collaborative approach which is becoming popular as open education is creating new options to the faculty and students alike, by adopting digital pedagogy. LIS schools are gradually making the shift to digital platforms by using technological tools for training the future LIS professionals. Helping students understand the role of libraries, management of libraries, organization of knowledge, use of ICT are crucial, but more important is creating awareness and giving exposure as to how the information services are delivered. Library services including information services define the success of every library. As there is a

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Data Visualization Service in Libraries: A Bibliometric Study of Published Literature

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Abstract

Data visualization service (DVS) in libraries is an important and emerging area of service. It offers new opportunities, new avenues and required platform to present library services in an impactful manner. Libraries have been providing research support services in one form or the other, to researchers & faculties to enhance their research activities. Data visualization is emerging as a new service in libraries by adopting best practices for preparing, curating and presenting data in an impactful way thus offering an added advantage. Libraries help their users to integrate various types of data into their research and create charts, dashboards and other visualizations that creates visibility for their research. As a part of data visualization services, various activities such as cleaning data, selecting appropriate data, data structuring, consultation on data analysis methodologies, designing graphics, development of static and interactive web applications, prototyping, development of programming scripts for analytics etc. can be offered by libraries.

Data visualization is a method to explore and explain data in a unique way to make interesting observations. Traditionally, it has been used for quantitative work, but ways to represent qualitative work have been shown to be equally powerful. Therefore researchers and library professionals have initiated many innovative DVS to their users and sharing their best practices in the form of contributions to scholarly journals, as working papers, as research reports, as white papers, etc. Adoption of DVS in libraries is presented in professional conferences, reflectthat libraries are undergoing major change and realigning their services to incorporate data visualization service.

Keeping in view this changing scenario, authors have undertaken a bibliometric study to analyze and understand the trends based on the published literature on 'Data Visualization Service' in libraries. For this purpose, 'Scopus' bibliographical and citation database is used as a source to search the literature. The literature indexed by Scopus database for the entire period from the beginning has been taken. Literature retrieved from this database is analyzed using different bibliometric parameters and the results will be presented in the form of tables, charts, graphs and other forms. The results of this study will give better perspective and insights into the kind of innovative services, under the umbrella of Data visualization thatthe libraries in the developed countries are providing in their respective organizations. This may indeed offer some excellent examples to Indian libraries who are planning in the research-intensive Institutes to initiate new services and be relevant in the present digital context.

Keywords: Data Visualization Service, Bibliometric Study, Scopus, Libraries

1. Introduction

Libraries have been using information communication technologies (ICT) since their advent. Various library services have been hugely influenced by infusion of ICT. The enhancements in the user services are the key differentiators for the libraries. The current scenario, where the users are tech-savvy and library services are moving swiftly into an electronic space, the management of user services calls for an innovative approach.

One of the innovative approaches for managing services in libraries is the use of data visualization tools and technologies that are emerging and maturing. These tools help to analyze the information and present it in such a way that allows the viewers to discover the patterns that might otherwise be hard to uncover. Data visualization as service helps users in presenting the data using visualization tools, preparing and curating data, selecting appropriate data,

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Article

Data Curation Activities in Research Data Repositories: Best Practices

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A B S T R A C T

Although, the massive amount of research data is being generated through modern-day research activities, lack of awareness regarding the documentation, metadata rendering, versioning, file format selection, data cleaning, secure storage options, data deposit templates and making research data easily accessible through research data repositories has resulted in invaluable research data becoming lost or rejected. Proper management and sharing of research data increase the access, impact and efficiency of research activities. Therefore, as a requirement of the government funding agencies' guidelines academic and research institutions have started to establish research data repository platforms. However, to build effective research data repositories with appropriate data curation activities are needed before uploading and publishing data. The current study has been undertaken with the primary objective of presenting the best data curation activities in research data repositories. The study further gives an overview of the software tools and applications available for various data curation activities viz. data cleaning, metadata creation, editing images/ videos, storing data, identifying and validating data files, applications for data curation, and data indexing for searches among other core activities. The author further identifies the roles of interdisciplinary librarians and data generators and data providers to perform the best data curation activities in research data repositories. The methodology of the study was guided by content analysis of literature on data curation activities and the role of interdisciplinary librarians in data repositories. Additionally, data about the software and application tools available for data curation was collected through web surveys. The outcome of this study will greatly benefit the key stakeholders in adopting the best practices for data curation practices in research data repositories for enabling research data sharing and reuse. It will help in the development of required skills and competencies to full-fil the role of interdisciplinary librarians in data curation activities.

Keywords: Data Curation, Data Cleaning, Research Data Repositories, Data Librarian, Data Generator

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Challenges and Opportunities for Libraries in the New Normal



National Institute of Library and Information Sciences
University of Colombo, Sri Lanka
2021

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Conference Program

"Challenges and Opportunities for Libraries in the New Normal"

23rd January 2021
9.00 to 13.15 (SL Time) - Via MS TEAMS

9.00	**Inauguration**
9.05- 9.10	**Welcome Address** Dr. Ruwan Gamage NRS 2020 Symposium Co-Chair Acting Director, National Institute of Library and Information Sciences University of Colombo, Sri Lanka
9.10-9.25	**Address by the Chief Guest** Senior Professor Chandrika. N. Wijeyaratne Vice-Chancellor, University of Colombo, Sri Lanka
9.25-9.30	**Introduction of the Keynote Speaker** Dr. Chiranthi Wijesundara, NRS 2020 Program Committee Member
9.30-9.50	**Keynote Address** Dr. Bhuva Narayan, Assistant Professor, School of Communication, University of Technology Sydney, Australia ***Topic: "Challenges and Opportunities for Libraries in the New Normal"***
10.00-10.50	**Technical Session 1A: Librarianship (LIB)** **Chaired by**: Dr. N.D. Wijayasundara, Librarian, University of Sri Jayewardenepura, Sri Lanka & Mr. Uditha Alahakoon, Assistant Librarian, NILIS, University of Colombo, Sri Lanka **Technical Session 1B: Information Sources and Services (ISS)** **Chaired by**: Dr Syeda Hina Batool, Assistant Professor, Department of Information Management, University of the Punjab, Pakistan & Ms. Ruvini Kodikara, Librarian, University of Moratuwa, Sri Lanka **Technical Session 1C: Covid-19 and Learning (COL)** **Chaired by**: Dr. Md. Anwarul Islam, Associate Professor, Department of Information Science and Library Management, University of Dhaka, Bangladesh & Mr. P.G. Premadasa, Retired Senior Lecturer, NILIS, University of Colombo
10.50-11.00	**Q & A**

11.00-11.50 **Technical Session 2A: Information Literacy (ILT)**

Chaired by: Dr. G.R. Padmasiri, Librarian, University of the Visual & Performing Arts of Sri Lanka & Ms. T.C. Ranawella, Acting Librarian, General Sir John Kotelawala Defence University, Sri Lanka

Technical Session 2B: IT Applications (ITA)

Chaired by: Mr. Prasanna Ranaweera, Senior Lecturer, NILIS, University of Colombo, Sri Lanka, Dr. Chaminda Jayasundara, Librarian, University of Kelaniya, Sri Lanka, & Dr. Muhammad Rafiq, Associate Professor, Dept. of Information Management, University of the Punjab, Pakistan

Technical Session 2C: Effect of Covid-19 Pandemic on Libraries (CPL)

Chaired by: Dr. Naresh Agarwal, Associate Professor, School of Library and Information Science, Simmons University, Boston, USA & Mr. M.M. Rifaudeen, Librarian, South Eastern University of Sri Lanka

11.50-12.00 **Q & A**

12.00-13.00 **Plenary Session**

Plenary Session Chair: Dr. Bhakti Gala, Assistant Professor, School of Library and Information Science, Central University of Gujarat, India (Symposium Co-Chair)

Panelists

Dr. Nadeera Rupesinghe, Director General National Archives, Sri Lanka
Mr. W. Sunil, Director General, National Library and Documentation Services Board of Sri Lanka
Dr. Namali Suraweera, Head, Department of Library & Information Science, University of Kelaniya, Sri Lanka
Dr. Kapila Bandara, Dean, Faculty of Education, University of Colombo, Sri Lanka
Dr. Pradeepa Wijetunge, Librarian, University of Colombo
Dr. Ruwan Gamage, Acting Director, NILIS, University of Colombo

13.00-13.10 **Vote of Thanks**

Ms. Sakeena Alikhan,
NRS 2020 Program Committee Member

13.15 **Closing of the Symposium**

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Message by the Acting Director,
National Institute of Library and Information Sciences (NILIS),
University of Colombo

It is with great pleasure that I bring this message to the NILIS Annual Research Symposium 2020. This year is particularly special as we celebrate the Centenary of the University of Colombo as well as the University Library. Together with the staff and students at the National Institute of Library and Information Science (NILIS) of University of Colombo, I wish to offer my heartfelt greetings to the entire community of the University.

NILIS Annual Research Symposium (NRS), which is a part activity of the main University Symposium enables us to showcase research in Library and Information Sciences across the regions. Due to the pandemic situation, LIS scholars were confined to their homes for several months. This had not prevented them from engaging in scholarly work. In fact, a new variety of research; 'the Covid-19 genre' has sprouted during the calamity. Yet the opportunity to publish was lacking due to the cancellation of many research conferences.

Thus, within a short period of time, NILIS had to organize this symposium, giving only a short notice to researchers. But the response was amazing. Within a timespan of several weeks, we received nearly 80 abstracts. We selected 54, keeping in mind, that we should give opportunity to the maximum number of researchers to present their findings. The studies presented here cover the entire spectrum of information work - from librarianship to infopreneurship.

A special feature this year is that the NRS is organized in partnership with the South Asia Chapter of the Association for Information Science and Technology (ASIS&T). I am thankful to the support given by Professor Bhakti Gala, current Chair of the ASIS&T:SA. I also take this opportunity to express my gratitude to Professor Bhuva Narayan of the School of Communication, University of Technology Sydney, Australia who agreed to deliver the keynote speech.

The Program Committee went to great lengths to plan the memorable event and to ensure the presentations and content meet the required technical standard. The Organizing and Logistics were smoothly handled by the team with professionalism and dedication. We are especially

thankful to Professor K.P. Hewagamage, Director of the University of Colombo School of Computing, who kindly gave us permission to hold the online Webinar at the UCSC premises. Dr. Samantha Mathara Arachchi and his team kindly supported in broadcasting the Webinar, online.

Senior Professor Chandrika N Wijeyaratne, Vice Chancellor of University of Colombo should be specially mentioned for her continued support for NILIS efforts. The Board of Management of NILIS and the Academic Committee helped us to make this event a reality.

Veteran Librarian and Visiting Faculty member of NILIS, Mr. L.A. Jayatissa readily agreed to support in the editing of all abstracts submitted by authors. That was a great relief for the organizing committee. I wholeheartedly extend my gratitude to him who handled a tedious task very professionally, sometimes proposing ideas to standardize the document.

Last but not least, my thanks are due to Mr. Janaka Wipularatne - the Senior Assistant Register, Ms. Sajeewani Jayasekara – the Senior Assistant Bursar, and all the staff of NILIS for their encouragement and support offered to make this event a success.

Dr. Ruwan Gamage

National Institute of Library and Information Sciences (NILIS)
University of Colombo, Sri Lanka

The keynote speaker

Associate Professor Bhuva Narayan
School of Communication, University of Technology Sydney, Australia.

A brief bio

Associate Professor Bhuva Narayan is the Director of the PhD program at the School of Communication at the University of Technology Sydney. Previously, she was the Program Coordinator for the school's Information and Knowledge Management Program for over six years. Dr. Narayan came to Library Science via the book industry in India, and then the editing and publishing industry in the US. She completed the Master of Library and Information Science from the iSchool at the University of Pittsburgh, and a Diploma in Publishing from Harvard University, before moving to Australia where she earned a PhD in Information Science. Dr. Narayan is the Chair of the Research Advisory Committee for the Australian Library and Information Association (ALIA), and an Associate Editor at the Journal of the Australian Library and Information Association (JALIA).

Keynote Address:

CHALLENGES AND OPPORTUNITIES FOR LIBRARIES IN THE NEW NORMAL

B. Narayan

University of Technology Sydney (UTS), Sydney, Australia

Email: Bhuva.Narayan@uts.edu.au

This keynote addresses focuses on the challenges faced by the library sector during recent times and highlight examples of how these challenges have also provided opportunities for several innovations in the sector, including new ways of working. Many libraries such as state and national libraries also have a role as memory institutions, conserving not just primary sources, but also recording contemporary public history through soliciting, collecting, digitizing, and archiving public experience, including web archiving of born-digital information. Simultaneously, libraries and memory institutions also provide access to historical records, documents, and experiences from past pandemics, whose medical, social, cultural, and political responses have informed health and public policy during the current pandemic. Additionally, many intangible cultural heritage entities that thrive on tourism have had to shut down or are curtailed from passing on their knowledges which puts several of them close to extinction. Libraries and museums can play a role by providing space, promotion, and preservation for some of these intangible cultural heritage entities. The keynote will be followed by an interactive activity where audience participation will be key, and where participants can document their own experiences via live technologies.

Keywords: Covid-19; library services; accessibility; public history; documentary heritage

STEREOTYPICAL OR CHANGED: RENEWING THE IMAGE OF LIBRARIANS AND INFORMATION PROFESSIONALS IN ACADEMIA

Amna Farzand Ali,[1] Kanwal Ameen[1]

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Services and functional environments of university libraries in Pakistan are undergoing a tremendous transformation due to developments in digital technologies in various sectors. Perceptions of the user community are fundamental in creating the public image and identity of the profession, which in turn influences the use of libraries and its services. The main objective of the study was to investigate about the image and role of Librarians & Information Professionals (LIPs)) among the community they serve, in terms of perceived educational level, working activities and behavior, suitable professional title, reasons to choose the profession, personality traits and faculty image of LIPs in their institutions. A quantitative research approach which supports the beliefs of post-positivism philosophical worldview, based on descriptive survey method, was employed with the use of questionnaire as the primary data collection tool. Data were collected from six universities in Pakistan. The central libraries were visited to gather the opinions of library users about the perceived image of LIPs. The findings based on 88% response rate revealed that the respondents' perception was not supporting stereotyped image of LIPs. They also acknowledged the working behaviors and nature, and personality traits of the LIPs. Nevertheless, users still hold misperceptions about educational qualifications, professional titles and faculty status of LIPs. In the Pakistani context, the focus of researchers in previous investigations had been on 'library services' and 'library resources'. Although, this is an exploratory study in the perspective of Pakistan, it could be helpful for LIS schools, associations, practitioners and aspirants to enter the profession in creating awareness.

Keywords: *Stereotype Image – Library professionals; Professional identity; Librarians' image.*

MAPPING SUSTAINABILITY ATTITUDES OF PAKISTANI HEALTHCARE PROFESSIONALS: POTENTIAL OF MEDICAL LIBRARIES IN ENVIRONMENTAL CARE

Ayesha Khalid[1], Ghulam Farid[2] , Syeda Hina Batool[3],

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Global warming and subsequent climatic changes are affecting global society severely, and therefore environmental awareness of citizens needs to be developed for the well-being of everybody and improvement of public health. As integral units of any society, hospitals and hospital libraries are required to work towards the raising of environmental awareness among their communities they serve thereby contributing to the improvement of community health. The World Health Organization is frequently highlighting the need for a green environment to protect public health. It is important to investigate how a clean and green environment will mitigate major health problems and disasters such as the current COVID-19 pandemic situation. Therefore, this survey investigated perceived medical libraries' role towards sustainable development. The questionnaire was prepared based on the input of experts in the areas of medicine and sustainable development. Data was collected from a sample consisting of 340 participants which included 122 MBBS, 23 FCPS, 11 MPhil, 17PhD, 133 Nursing and 34 Allied Health professionals. Most participants were aware of personal green practices such as saving water, energy, and recycling while a number of participants claimed that the extent of their green awareness was low. There was significant strong relationship between library role for green environment and future preparations for green environment ($r=.939$, $p<.01$). Furthermore, education & training on green environment was significantly correlated with library role for green environment ($r=.903$, $p<.01$). Majority of healthcare professionals considered libraries as a vanguard for their green education and training programmes. A variety of creative opportunities exist for continued and expanded library environmental services. The findings may be helpful for medical school libraries, the government and policymakers, and health departments.

Keywords*: Environmental health literacy; Public health.*

PRESENT STATUS OF THE HUMAN RESOURCE CAPACITY OF PUBLIC LIBRARIES IN BATTICALOA DISTRICT

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Smooth and efficient functioning of any institution depends on adequate employment of sufficiently qualified staff in its human resource base. The deficiency of human capital will directly affect the smooth functioning of the service. Therefore, this study aims to determine the adequacy of the professional and paraprofessional human resources in public libraries situated in the Batticaloa district and to identify challenges faced in the development of library staff. The survey research strategy was adopted to collect data from the entire population concerned. A self-administrated questionnaire was distributed among all the staff members in all public libraries in the district. The descriptive statistical analytical methods used for analysis of data. The results revealed that the study population consisted of 18 (9.9%) librarians, 135 (74.6%) library assistants, and 28 (15.5%) other categories of staff. 42.5% of the population had 6-10 years of experience on the job. Further, 80.7% of the staff were permanent while the rest of the staff comprised of casual and contract basis employee categories. 56.4% of them possessed professional qualifications in Library and Information Sciences while 61.3% of employees had G.C.E. (A/L) qualifications from the entire population. Moreover, only 18 (20%) libraries were headed by qualified librarians, and other libraries were managed by a person without professional qualifications in the field of librarianship. The major challenges faced by the staff members were the unbearable workload, lack of promotional avenues, not filling the permanent cadre positions, not revising the available circulars to suit the present work environment, and insufficient opportunities for training. It is recommended that the authorities should take immediate action to fill the available cadre posts with qualified persons to enhance the library community services in the district.

Keywords: *Public libraries; Challenges for libraries; Batticaloa district; Human resource capacity.*

ESTABLISHMENT OF NEW LIBRARIES IN BANGLADESH'S REMOTE VILLAGES: PROSPECTS AND CHALLENGES

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This study concentrates on the status of Bangladesh's public libraries and their endeavors towards agricultural development and social mindfulness. Considering the libraries' resources and services and arranging for a factious articulation, the logical base of building up new libraries has been justified. In order to identify the people's requirements from the public libraries in remote villages a questionnaire was designed and distributed among the villagers in the southern and northern areas of Bangladesh. Although a number of villages were selected for the study, they were generally representative of the prevailing situation in the country. The findings reveal that newly established libraries will play out a crucial role in agricultural development and raising public awareness. It is also found that public libraries could be utilized as an educational and cultural hubs in villages. Close to these results, there is a possibility to advance the environmental sustainability of the country. With the section of exploration, some inevitable difficulties are distinguished. Addressing the hindrances appropriately, it has been endeavored to perceive how to handle them with the assistance of local communities, the ambitious young students, the government departments, and the international charity organizations. Conceivable ways to overcome the difficulties, and proposals for setting-up of new rural libraries and information centers in Bangladesh are also being recommended.

Keywords: *Libraries; Agricultural development; Public awareness; Bangladesh – Library services development.*

BEST PRACTICES ON SETTING UP AND RUNNING AN EFFECTIVE SCHOOL LIBRARY BUILDING ENVIRONMENT: AN APPROACH TO SCHOOL LIBRARY DESIGN

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School library is an imperative component of the school education process which cannot be eliminated from the school atmosphere. This is due to the fact that the school library functions as a means of supporting students' learning activities and achieving their learning goals. Setting up of a good library presents a great challenge. Main objective of this case study was to introduce importance of organizing an attractive and inviting learning space in the school library. We got this opportunity through an invitation to serve as consultants in helping re-arranging the Anuradapura, Thammannapura School Library. We organized a training session for the junior school librarian and teachers who were willing to volunteer in developing the library and got the participants to design a creative model making use of existing space to its full potential. In this case study collection arrangement was also pivotal to the design process. Instead of moving bookshelves to imitate final outcomes, the diagrammatic graphic representations of alternative arrangements were put on a wall to select a suitable floor layout. This is found to be effective in comparing different stack arrangements and to ascertain effectiveness in each shelving pattern. It was decided that the new arrangement should reflect the way the subjects were taught at the school, and that the book collections should assist variety of approaches used in schools' reading program's allowing students to independently browse through subject areas of their choice.

Keywords: *School library buildings; Best practices; Library floor layout design; Learning environment improvement.*

RESEARCH ON THE QUALITY OF THE SCHOOL LIBRARY SERVICE: BASED ON THE JUNIOR SCHOOLS IN THE DICKWELLA EDUCATION DIVISION

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Within the school education sector, junior schools assist in initiating the development of knowledge, skills and attitudes of students. Therefore, one of the special aspects identified in the educational reforms carried out in Sri Lanka has been the provision of a quality school library service. However, there is a significant decline in the provision of quality library services in the junior school sector at present, which deserves immediate attention. Although the introduction of a comprehensive school library service is a part in the educational reforms in the country, non availability of a quality school library service for a considerable school community is an important issue to be addressed. This is very much adverse in the context of junior schools. In view of this situation, eight out of fifteen junior schools in the Dickwella Education Division were selected for the study and data collected through interviews and questionnaires using the post positivism methodology. Results reveal that there are major deficiencies in the system such as the lack of trained librarians in the selected junior schools, scarcity of required resources, obsolete formalities and the lack of attraction and interest. Rural junior schools needs more attention on these issues by all stakeholders in realizing the government objective of making 'the nearest school the best school' where the provision of an enhanced school library service is one basic target to achieve.

Keywords*: Educational reforms; Junior schools; Quality library service.*

THE NEED TO IMPROVE THE QUALITY OF SCHOOL LIBRARY SERVICE IN ACHIEVING NATIONAL EDUCATIONAL GOALS

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With the introduction of free education by the Chairman of the Education Committee of the Donoughmore Commission, it became apparent that the country's development would be determined by the successful achievement of the country's educational goals and the time taken to achieve them. As a result, the 1992 National Education Policy Statement and the 1999 National Education Commission's New Education Reforms have been used to enhance the quality of education in Sri Lanka. The island wide school library service can play a role in achieving these goals. Accordingly, our research problem was to investigate the contribution of the school library service in the implementation of the national educational policy in Sri Lanka. Selected 60 primary and high schools and central colleges in Matara Dikwella and Bentara Elpitiya education zones using the convenience sampling method. A self-administered questionnaire was distributed among school library administrators. The questions were targeted for revealing three attributes; employing trained librarians, availability of physical resources, and the attractiveness of the library to the school community. The school libraries were not satisfactorily contributing to achieve the national educational goals because of the lack of trained librarians, the lack of physical resources and by libraries being unattractive to school communities. However, it was concluded that a greater role can be played by school libraries to achieve national educational goals.

Keywords*: National Educational Goals, National Educational Policies, Quality School Library Services*

A STUDY OF HOW DOCUMENT MANAGEMENT CONTRIBUTES TO FORMALIZE THE SCHOOL LIBRARY ADMINISTRATION

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The school library is at the forefront of creating a global citizen of information literacy, an educational objective of the 21st century. This study explores how the school library contributes to the proper management of documents, the achievement of school library objectives, and the streamlining of administration. As a sample, 12 government schools were selected (04 1AB schools and 08 1C schools) in the Gampaha Education Division. A descriptive analysis method was followed. Questionnaires and interviews were the data collection methods. Objectives of the study were to list existing documents in libraries, identify current methods of document management, inquire into the document monitoring process, discuss problems faced by librarians, and introduce methods to streamline document management. In the sample, 33% were appointed librarians, 50% were teachers who teach other subjects, and 17% were library assistants. None of them had been trained in document management. Therefore, all (100%) of them were facing problems in document management. Among those problems are staff needs, building needs, storage requirement, and lack of time to spend due to subject teaching. 91% said that they need updated circulars. Adequate advice had not been received from the administration. This research revealed that although school libraries are subject to external or internal supervision, there is no focus on library document management by the authorities.

Keywords*: school library administration; document management*

DISASTER MANAGEMENT IN LIBRARIES – AN INTEGRATED APPROACH

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In the twenty first century, libraries are becoming increasingly hybrid—that is, their collections contain both digital and physical materials. An Australian PhD research project investigated the various approaches to physical and digital preservation management in Australia's national, state and territory libraries (NSLA)—with a special focus on the field of disaster management. Disasters can result in loss of highly significant collection materials held by libraries; all the preservation strategies that safeguard collections can unravel in a moment in the event of a disaster. Disaster management involves planning, assessing and reducing risks and establishing strategies to respond and recover. The research methodology included surveys and semi-structured interviews with the various digital and physical preservation managers. It identified that typically, twenty first century library disaster plans focus on managing physical materials, while digital disaster planning usually takes place separately within an IT section. The research project investigated whether it was potentially beneficial and feasible to develop an integrated disaster plan as a 'one stop shop', identifying the resulting benefits as well as some of the potential challenges to developing an integrated plan. A 'proof of concept' integrated disaster plan template was successfully developed in conjunction with the State Library of Queensland (SLQ) staff, building on the existing SLQ template that focused on physical collections. Arising from this research project, new disaster management resources were subsequently developed for the Australian Library and Information Association (ALIA). The new resources incorporate an integrated approach to managing disasters for both physical and digital collections <https://www.alia.org.au/information-and-resources/disaster-planning>. The ALIA integrated disaster management resources have been successfully trialed at a number of workshops in Australia and aborad.

Keywords*: Disaster management; Risk management; Digital preservation; Physical preservation; Integration.*

PROMOTING KNOWLEDGE SHARING AMONG UNIVERSITY STUDENTS: DIVERSE ROLE OF INFORMATION PROFESSIONALS

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This study investigates the knowledge sharing behavior of Pakistani engineering students. Another purpose of this study was to identify the information professionals' role regarding students' behavior towards knowledge sharing based on their gender and program's level. Quantitative research approach and survey method were employed in conducting this study. A total of 400 questionnaires were distributed among students of 10 engineering category universities using stratified convenience sampling technique. Results revealed that the majority of students did not share knowledge with the frequency stated as "always". These findings shed light on the need to improve the students' knowledge sharing patterns so that it may become a routine activity for them. Furthermore, knowledge sharing practices of students belonging to different gender and program level differed slightly. This difference based on gender and program's level establishes that students' needs are different in terms of knowledge sharing and, therefore, information professionals need to study different behavior patterns to understand students' core interests. Such understanding might help information professionals target different user groups as per their needs regarding the sharing of knowledge. Results of the study might assist educational institutions and information professionals understand the students' knowledge sharing practices and plan for further improvement of their behavior to meet their educational, research and learning needs. Satisfying students' needs may enable them succeed in their career and earn a good repute for their organization. Findings may also facilitate students to become aware of their requirements and behavior, and to improve their practices to acquire more knowledge.

Keywords*: Knowledge sharing; Knowledge sharing behavior; Age, Education level and knowledge sharing.*

EXTENDING LIBRARY SERVICES TO THE COMMUNITY BY LIBRARY OUTREACH SERVICES: AN INSTITUTIONAL EXPERIENCE OF KOTELAWALA DEFENCE UNIVERSITY

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'Library outreach services' indicates reaching the society beyond boarders of physical libraries, and organized and offered by many libraries. Various initiatives in outreach services are conducted by academic librarians to interact with their surrounding communities. Kotelawala Defence University (KDU) library initiated its outreach services programme with the objectives of promoting and marketing library services particularly among underprivileged user communities, thereby helping them. Current Covid-19 pandemic situation made it necessary for the library to re-assess these outreach services due to some practical issues. This study aims to describe institutional experience in delivering outreach services in the past few years and to make new suggestions. The KDU Library conducted three main outreach projects in three schools located at Ratmalana, Ahangama and Bulathsinhala. These projects were the library development program, book donation program, and the art competition and library renovation program respectively. These were executed in 2015, 2016 and 2017 at different stages. Donors of the projects were KDU staff, students, and suppliers. Additionally, KDU provided labour force by assigning military and civil staff as required. According to the feedback of the end users, renovation project of children's library added immense value to the selected school since it mainly focused on grade five scholarships. It provided an opportunity for related school communities to interact with the university community and the KDU library staff to gain an awareness on issues faced by school librarians. Lack of sufficient assistance from end users and the failure to maintain continuity were the negative issues identified during these projects.

Keywords: *Outreach services; Library development; Library marketing; School libraries.*

THE CHALLENGES OF MARKETING UNIVERSITY LIBRARIES IN SRI LANKA: LIBRARIANS' PERSPECTIVE

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Marketing strategies could be used by librarians to promote library services among the users, to attract new users and to retain the existing ones. It is necessary for university librarians to identify the potential challenges in marketing library services and to develop effective strategies ensuring a streamlined marketing function. The objective of the study was to find out the challenges faced by Sri Lankan university librarians in marketing their services. This study involved all 130 academic staff members in the libraries of the 15 state universities in Sri Lanka coming under the purview of the University Grants Commission. Total population sampling was considered and data collected through self-administrated questionnaires. A 5-point Likert scale was used to measure the responses and the SPSS software package used in analyzing data. 105 valid questionnaires were received giving a response rate of 80.8%. The mean rating of perceived challenges in marketing library services by university librarians in Sri Lanka was considered in interpreting data. Lack of networking librarians was perceived as a major challenge in marketing library services in Sri Lankan university libraries. Further, inadequate funding for marketing, lack of awareness on user needs, lack of marketing skills, and high cost of marketing operations were perceived as challenges by the librarians. This concludes that university librarians in Sri Lanka do face some challenges in marketing their library services. Establishing a consortium of marketing librarians in Sri Lankan university libraries, separate adequate funding for marketing library services and, development of a unique marketing strategy for each library are recommended as further actions.

Keywords*: Marketing library services; University libraries; University librarians; Challenges in marketing library services.*

A STUDY ON THE CHALLENGES AND POSSIBILITIES OF SERVING SENIOR CITIZENS IN PUBLIC LIBRARIES OF THE COLOMBO MUNICIPAL COUNCIL, SRI LANKA

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Ageing of population has become a global phenomenon and it could be observed in Sri Lanka too. This growing segment of the older adults' last phase of life is recognized to afford new challenges- declining health and opportunities - more redundant spare time during retirement. A public library is a suitable place available for them to effectively and efficiently spend spare time; however, they face challenges while accessing these services. Therefore, this study investigates the challenges senior citizens confront while accessing services and how libraries can address the issues faced by them. Three public libraries, namely Colombo, Kotehena, Sri Sucharitha in the Colombo Municipal Council limits, were selected based on the proportion of elderly population density. Two qualitative methods - in-depth interviews and focus group discussions, were used to gather information from administrators and users of these three libraries. Thematic analysis was done of the transcribed interviews by using Nvivo software. The result revealed that most senior citizens are happy to spend time in libraries as it is a vibrant place that reduces their loneliness and mental stresses. Nevertheless, they have encountered issues when they use these libraries - locating information in the lending division, dependency due to physical health conditions, lack of awareness of the library services apart from regular. Further, the study found that public libraries have opportunities to manage those challenges through their resources—user education and assistive technology programs, enhance mobile services, resources and infrastructure facilities liaison with relevant authorities and marketing the services to expand seniors' services.

Keywords*: Public library service; Older adults; Colombo Municipal Council, Sri Lanka.*

A STUDY OF THE INFORMATION SERVICES IN PRADESHIYA SABHA PUBLIC LIBRARIES FROM SRI LANKA

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The Merriam-Webster online dictionary defines the library as "a place in which literary, musical, artistic, or reference materials (such as books, manuscripts, recordings, or films) are kept for use but not for sale" < https://www.merriam-webster.com/dictionary/library >. Libraries and information centers provide a variety of library and information services to their users. Public libraries are the major providers of information services for the public. The aim of this study is to explore the organization of information services in Pradeshiya Sabha libraries, identification of main information services, ascertaining whether there are differences among them, reasons for variations if there are any and make suggestions towards the improvement of such services. Survey research method was used for this study and five Pradeshiya Sabha public libraries situated in the Kandy district were selected. These were Madugalla, Udhadumbara, Hasalaka, Medamahanuwara and Teldeniya public libraries. A sample of 100 users (consisting of 20 users from each library) randomly selected and a structured questionnaire distributed to collect quantitative data while qualitative data collected through interviews. Data analysis done with the use of MS Excel. Results indicate that book borrowing service, user education service and referral service are operational while the use of information technology in library information services remained at a very low level. This Study found number of adverse issues affecting these libraries, major constraints being the lack of funds; librarians having lack of field knowledge and technical skills; and low attendance in training programme conducted for the library staff. Conducting of more awareness programmes, provision of hands-on training and organization of own fund racing programmes are proposed as a possible way out of this situation.

Keywords: *Library information services; Pradeshiya sabha; Public libraries; Kandy district; Sri Lanka.*

CHALLENGES FACED IN DEVELOPING THE PALM LEAF MANUSCRIPT COLLECTION IN THE LIBRARY OF UNIVERSITY OF SRI JAYEWARDENEPURA

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Palm leaf manuscripts are historically valuable documents that include indigenous knowledge of our ancestors. Most of the palm leaf manuscripts are about language, literature, Buddhist culture, medicine, astrology, yantra mantra, fiction, customs, and ceremonies. In Sri Lanka, original palm leaf manuscripts are found mostly in ancient temples and with individuals belonging to aristocratic families. Palm leaf manuscripts are made from palm tree leaves that contain natural organic materials. Therefore, they are naturally susceptible to be damaged. Palm leaf manuscripts at the University of Sri Jayewardenepura (USJ) Library are nearly 300 – 400 years old. Hence, it is a requirement to treat the palm leaf manuscripts without delay to avoid further deterioration. Light, heat, moisture, fungi, insects, and air pollution are some of the known factors for deterioration of palm leaf manuscripts. The objective of this study was to identify the challenges in the process of developing the palm leaf manuscript collection. Nature of the study was descriptive. As the initial step, a unit was established for the preservation and conservation of library materials considering the national requirement. As the other end of the process, digitization of identified palm leaf manuscripts and making them accessible to readers was the objective. In between these two ends, there were many processes to be performed including making aware of the project, collecting manuscripts from various places in the island, appreciation process of the donors, cost determination, cleaning, reading, categorizing, inventorying, cataloguing and digitization of palm leaf manuscripts. Forming of a few committees and formulation of related policy documents were essential tasks. Categorically the challenges were in the form of human capital, infrastructure, funds and technology. It is expected that building awareness about these challenges will be beneficial for librarians those who are interested in developing palm leaf manuscripts collections in their libraries.

Keywords: *Conservation and preservation; Digitization; Palm leaf manuscripts, Sri Lanka; University of Sri Jayewardenepura, Sri Lanka.*

USER SURVEY ON THE CEYLON ROOM COLLECTION, LIBRARY OF THE UNIVERSITY OF SRI JAYEWARDENEPURA

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The Ceylon Room (CR) collection is one of the most useful collections of the library of the University of Sri Jayewardenepura (USJ). It consists of printed materials related to Sri Lanka. The collection comprises of publications of scholars of USJ, government publications, postgraduate theses and collections of historically valuable documents and palm leaf manuscripts. Therefore, it is worthwhile to manage the CR collection more effectively and efficiently. The objective of this study is to identify the user categories that mostly utilize the Ceylon Room Collection. The sample was selected from three faculties out of eight faculties inclusive of both academics and students. The selected faculties were Faculty of Humanities and Social Sciences, Management Studies & Commerce and Applied Sciences. The available library statistics were used as primary data. It was obtained from the usage of CR collection from 2015-2019. The Highest usage of students of CR collection is from the Faculty of Humanities and Social Sciences (78%). Whereas the least usage of the student of CR Collection for the Faculty of Applied Sciences (1%). Within the category of academic staff, the highest usage (65%) reported from the Faculty of Humanities and Social Sciences while the minimum usage (6%) came from the Faculty of Applied Sciences. The result of the study shows that academic staff and students of the Faculty of Humanities and Social Sciences are using this facility extensively. Since there is a low usage among the academics and students of the Faculties of Management Studies & Commerce and Applied Sciences, marketing of the CR collection among the university community become an important task. This could be in the form of conducting awareness programs. The collection needs to be continually re-evaluated to meet user requirements and to support their research activities ensuring a better service.

Keywords: *Academic libraries; Ceylon Room Collection; User surveys; University of Sri Jayewardenepura, Sri Lanka.*

RESEARCH DATA MANAGEMENT SERVICE IN LIBRARIES OF SCIENCE AND TECHNOLOGY INSTITUTES IN INDIA: PERCEPTIONS OF LIBRARIANS

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Research Data Management (RDM) services in Indian libraries is at a nascent stage. Librarians have started exploring the importance of RDM, researcher perceptions and their own roles and responsibilities for the successful implementation of RDM services in their institutes. The primary objective of this research was to study the prevailing practices of RDM services offered in libraries of science and technology (S&T) institutes in India. Data collected through an online survey questionnaire administered to 82 centrally government funded (MHRD, DST, DBT, CSIR, DRDO and DoS) S & T academic and research institutes. The survey questionnaire was active from 12th December 2019 to 31st March 2020. The findings of the study indicate 79.27% libraries are familiar with their researchers' current practices on RDM and 17% of librarians conduct RDM user need assessment. RDM services are offered by 24.39% of librarians on their campuses, while 14.63% of librarians are in the process of planning for initiating RDM services, 39.02% are interested, but still have not initiated the planning process, 21.96 % are not offering any RDM related service. RDM related policies have been designed by 26.86% librarians, and 99.90% of librarians strongly believe that librarians/ library professionals need training of requisite skills to be able to offer RDM services. The study findings reveal that librarians are actively collaborating with other centers from within their parent organizations whereas 36.59% of librarians were collaborating with the IT Centre, research supervisor, research and development department, dean, or project team etc. to provide RDM services in their campuses. The study findings will be beneficial in preparing a conceptual framework for establishing and managing RDM services in libraries of science and technology institutes in India.

Keywords*: RDM services; RDM needs assessment; RDM policy; Librarians skills and knowledge.*

STATUS OF SCIENCE JOURNALS IN DOAJ: AN ANALYTICAL STUDY

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This study is based on metadata extracted from the well-known and authoritative global Directory of Open Access Journals (DOAJ), a database of fully open access peer-reviewed scholarly journals managed by Infrastructure Services for Open Access (IS4OA), United Kingdom. Disciplines chosen for the quantitative study belong to Science as categorized in DOAJ and analyzed using different criteria like language, Creative Commons (CC) license, country of the publisher , etc. Findings of the study reveal that there are 104 Zoology Journals, 218 Chemistry Journals, 111 Botany Journals, 139 Geology Journals, 242 Physics Journals, 85 Microbiology Journals, 38 Astronomy Journals, 52 Physiology Journals, 11 Anatomy Journals and 544 Mathematics Journals indexed in DOAJ. These are published from 82 countries in 32 languages. English emerged as the dominant language of publication with 1355 Journals publishing primarily in this language. On the basis of the total number of science journals published in DOAJ, United Kingdom ranked 1st with 248 Journals followed by Indonesia (164). The study revealed that 21 Indian Science Journals meet the DOAJ inclusion criteria for indexing. 830 Journals used CC-BY licensing. It was also found that 2020 can be marked as the most significant year, as the highest number of (220) Journals have been added to DOAJ collection. Most of the Journals do not charge Article Processing Charge (APC) and most of the Journals do not fulfil the guidelines for DOAJ Seal. The paper also highlights the peer review process adopted by the DOAJ Science journals.

Keywords: *Open Access; Libre OA; DOAJ; Science journals; Creative commons.*

MAIN SOURCES OF INFORMATION DURING COVID-19 LOCKDOWN FOR VISUALLY IMPAIRED STUDENTLS AND ACADEMIC STAFF

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The whole world is suffering from the worst pandemic in the recorded human history due to Covid-19 virus. The World Health Organization (2019), declared the 2019 outbreak a public health emergency of International concern under the International Health Regulations (IHR). Discrimination of visually impaired persons has increased dramatically during the Covid-19 pandemic and visually impaired persons who are often deliberately excluded and ignored by others due to certain 'stereotypes' has been reported. In 'Special Needs Schools' (SNS) and Societies, the communication platform is a vital component. Developing 'core competencies' needed to tackle the "scale and severity" of Covid-19 outbreak therefore became a big challenge. The objective of this study was to find out how the visually impaired persons' information-seeking behavior is influenced by various information channels and sources and also to compare how local government's preparedness and response plan strategies against the pandemic affect it. A random sample of 50 blind or very severely visually impaired children in the age range of 14 to 20 years from both sexes, along with 20 staff members of the School for the Blind, Ratmalana in Colombo District, Western Province, Sri Lanka selected for the study. Online survey and interviews were conducted with the use of email or synchronous "chat" format during the first four weeks after the discovery of Covid-19 disease in the country. The online questionnaire included questions to determine information-seeking behavior of them. Seventy five per cent (75%) of most used information channels were from the mainstream news media. The second most used source of information was WhatsApp. The respondents were depending more on the mainstream news media for Covid-19 information. However, it was revealed that a synchronous use of digital technology media and platforms was also fulfilling the rest of the requirement.

Keywords*: Information seeking behavior; Visually impaired persons; School for the Blind, Ratmalana*

SURVEY ON ONLINE LIBRARY SERVICES PROVIDED DURING THE COVID PANDEMIC SITUATION: WITH SPECIAL REFERENCE TO ACADEMIC LIBRARIES OF SRI LANKA.

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The COVID-19 pandemic can be considered as a turning point of the usual civil life of many people. It has also challenged the conventional teaching and learning methods at all levels of education. The university education system too was affected drastically by the pandemic. This has resulted a move towards the adoption of online teaching and learning methods to continue education programmes in universities. Being a main information service provider, the academic library has a significant role in providing support for online teaching and learning activities of a university. Present study aimed to investigate about the online library services provided by the 15 state university libraries coming under the purview of the University Grants Commission in Sri Lanka, as a response to the "new normal" condition. An online survey was conducted to investigate the online services provided through the websites of the 15 state university libraries under similar conditions and at the same time. Results revealed that almost all libraries provided OPACs, institutional repositories, online databases with off-campus access together with other conventional online services. Further, provision of article indexes, digital document delivery services, government publications, library tours, LMS links, open access books, recommended reading downloads, subject liaison services, voice libraries, and laptop lending services emerged as new services. It could be concluded that the present period of time is the best time period to venture into new services and taking steps to meet the requirements of the changing society.

Keywords*: COVID-19 pandemic; Online library services; Academic libraries; Enhancement of library services.*

SUSTAINABILITY OF LIBRARY AND INFORMATION SERVICES DURING COVID-19 PANDEMIC: A CASE OF SOUTH EASTERN UNIVERSITY OF SRI LANKA (SEUSL) LIBRARIES

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COVID-19 pandemic has created a crisis that drastically impacts academic library services in various aspects. Continuous lockdowns, closure of libraries, social distancing and restricted access to circulation services of print materials has paved ways to rethink new paradigms. The objective of this study is to showcase the initiatives made by SEUSL libraries to provide efficient services to library patrons during the crisis of pandemics. Methodology of this study is based on a review of literature, documentary analysis, and usage statistics of SEUSL libraries. SEUSL libraries sustained to provide virtual library and information services during the first wave of lockdown. Subsequently, during the new normalcy situation these libraries provided both traditional and virtual services by observing the health guidelines and exit strategies formulated by NILIS, University of Colombo as well as IFLA guidelines. In particular, SEUSL libraries offer digital information such as, remote access to scholarly databases, e-books, access to repository, e-theses, online past question papers and subject gateways. User education is conducted through a series of ZOOM webinars, and circulated access guides to e-databases. Virtual teaching of information literacy for undergraduates and postgraduate students is continued through virtual learning environment. Furthermore, SEUSL libraries provide scholarly communication support services to the university researchers through assistance in literature search, delivering articles, coordinating ISBNs, plagiarism checking, finding authentic journals and archiving. However, these libraries were not in a position to home deliver print materials and to offer study spaces. The use of social media was also limited. In conclusion, the SEUSL libraries have successfully strategized its services to a new paradigm of digital transformation that ensures a sustainable library and information services.

Keywords*: Covid-19 pandemic; Corona outbreak; New normalcy; Library & information services; Sustainability of library services.*

THE SOCIOLOGICAL SIGNIFICANCE OF USAGE OF LIBRARIES DURING THE COVID-19 PANDEMIC: EXPERIENCES OF FACULTY OF ARTS, UNIVERSITY OF COLOMBO

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Libraries play a significant role as a social institution in the day to day lives of people. The social significance of the public library is fundamentally its influence on all the individuals of the community and on the interactive relationships among them. The importance of libraries can be judged by the efficiency of their organization and the degree to which they are fulfilling their mission. During the Covid-19 pandemic most of the library facilities available to the students of the Faculty of Arts of the University of Colombo were curtailed. This research aimed at finding the adverse effects of closing physical facilities, and it remains to be seen whether the digitalization of the physical library enables the maintaining of social significance of the use of the library. A sample of 48 students who are enrolled in a four-year special degree programme, with a compulsory research component which requires the use of the library extensively, was used for this study. A semi-structured questionnaire was distributed among them using the Google forms asking them to narrate their experiences. The results revealed that, the social significance of the use of libraries has remained static despite the closing of the physical libraries. However, the narrations provided by the students indicate the need for integrating the faculty-wise library facilities with the main library and the need for a direct connection to main library facilities through the learning management system (LMS), enabling students to carryout their studies even during the pandemic.

Keywords*: Sociology; Library usage; Covid-19 pandemic.*

COVID-19 PANDEMIC, UNIVERSITY EDUCATION AND ROLE OF LIBRARIANS

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COVID-19 pandemic has caused a huge negative impact on university education in Sri Lanka. Students didn't physically attend to lectures due to university closures in the 2020, and they had to use the online education system instead. Online education was a novel experience for university students in Sri Lanka. Moreover, not having access to libraries during the period affected their learning. This study explores the difficulties encountered in using libraries, how it affected University education and the contribution of librarians during this period. The objectives of the study were to examine the relationship between student knowledge and the pattern of library use, to identify the contribution and role of librarians, to identify alternative methods of fulfilling resource needs, and to identify the effect of using alternative modes. The research was based on a qualitative approach. Primary data were collected through in-depth interviews with a purposive sample of 50 students and a convenience sample of 5 librarians belonging to a government university in Sri Lanka. Thematic analysis method was used to analyze data. The findings revealed that the closure of the University has resulted in reducing the use of library facilities and services. Furthermore, that has effected in inabilities in submitting student assignments and presentations. It was also revealed that libraries should identify new strategies to meet the requirements of University students in such a situation.

Keywords*: Online education; Student – Library interaction; Library strategies.*

ACADEMIC LIBRARY SUPPORT FOR E-LEARNING

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Innovations in Information and Communication Technologies (ICT) has a significant effect in educational development. Furthermore, extensive use of ICT in education has created more opportunities for teaching, learning and research. An e-learning environment could be created with the use of ICT, while universities starting revising curricula to integrate with such applications that support and fulfil the learning interest of digital natives. Universities promote student-centered learning processes and also the use of Learning Management Systems (LMS) as a supplementary tool for face-to-face teaching. In this situation, academic libraries have to focus their services on university teaching, learning, and research environment. This study conducted before the emergence of COVID-19 pandemic aimed at identifying academic libraries contribution in e-learning. Applying the case study method, a stratified random sample of 400 undergraduates belonging to the five faculties had been selected through the application of Morgan's table. In addition, academic staff and library academics and administrative staff were also selected for data collection which was with the use of three questionnaires. According to the findings, students expects modern ICT facilities, ICT based information searching facilities, frequent information awareness covering e-resources and electronic-based materials. Academic staff expected e-resources suitable for revised curricula, information awareness programs on e-resources, the library to function as a research consultancy body, and to organize more training programs on e-resources, e-services and e-learning tools. All three categories of participants expected advance use of ICT in providing e-learning services and online access to library services and resources

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Keywords*: Academic libraries; University education; E-learning.*

LACK OF TECHNOLOGICAL DEVICES TO CONNECT WITH LIBRARY SERVICES IN NEW NORMAL

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The novel human coronavirus disease COVID-19 has become the fifth documented pandemic since the 1918 flu pandemic. Higher education can be identified as a major field that is affected by this pandemic. As a remedial measure, online education systems have been introduced in all universities in Sri Lanka. However, it is evident that there is an issue in accessing required online library facilities. Determination of the influence due to the lack of technological devices to get connected to e-library services during the covid-19 pandemic is the research objective. Other objectives were to identify the impact of economic difficulties of undergraduates to spend on technological devices during the pandemic, and to identify the technological facilities in their residential neighborhood such as NenaSala centers, computer labs of provincial and AG offices. 100 undergraduates selected as a sample from the University of Kelaniya under the convenience sampling method. A questionnaire was used to collect data and analyzed with the use of SPSS software. This research reveals that students faced difficulties in accessing online library facilities due to the scarcity of suitable technological devices. We found that 72.6% undergraduate had the problem of lacking technological devices to connect with e-library services and, 83.7% of undergraduates were not allowed to use Nena Sala or other government provided computer lab service due to the pandemic situation. The final result indicated that students were not able to complete their assignments effectively as they could not make effective use of e-library services due to lack of suitable technological devices.

Keywords*: Library services; Online library facilities; Technological devices.*

DEMEANOR, DETERMINATION AND DIFFICULTIES IN BRIDGING THE GAP BETWEEN LIS EDUCATION AND PRACTICE: A VIRTUAL INTERNSHIP DURING COVID-19 PANDEMIC

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Masters degree programme in Library and Information Science (LIS) requires hands-on training to get professional experience. All libraries across India were closed due to Covid-19 pandemic thereby depriving LIS students to undergo hands-on training. The main purpose of this study is to share the experiences of the virtual internship of LIS students as practiced in India during the pandemic. It is important in noting here that India could be regarded as a developing country and most of the aspects would be applicable in the developing world. The study identifies the challenges experienced by all the stakeholders while planning, offering, and undergoing a virtual internship. This qualitative study gives the first-hand account of the three key stakeholders: The Interns undergoing LIS internship; supervisors/ mentors and professionals of the Indian Institute of Technology (IIT) Central Library (where the virtual internship was undertaken), and the faculty of the School of Library and Information Science at the Central University of Gujarat. Data collected through a semi -structured questionnaire with open ended questions and interactions and narratives of the experience of the participating interns. The results shows that all the three stakeholders faced challenges. Five key challenges have been identified viz. technological issues (hardware & software), communication issues (unreliable internet connection, low bandwidth), administrative issues (planning, execution, and implementation of the virtual internship), psychological issues (stress, time constraints, more number of hours in front of screen), and financial issues (expenses related to payments for data packs), The study highlights the measures taken to overcome these challenges. A model is proposed for conducting both virtual and physical internships in a developing country by overcoming all these barriers. The outcomes of the study can be implemented by all LIS Schools in the developing countries where similar situations are experienced. This internship experience has opened the possibility of introducing a virtual internship component along with physical internship in the LIS curriculum.

Keywords*: Library internship; Virtual internship; Virtual learning; LIS education.*

LIS STUDENTS' EXPERIENCES REGARDING ONLINE CLASSES DURING COVID-19 PANDEMIC: A THEMATIC ANALYSIS

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The sudden outbreak of the novel coronavirus disease (COVID-19) has caused irreparable damage to every influential sector in Bangladesh including the education sector. To avoid the loosing of the academic year, almost all the higher education institutions of the country have shifted their traditional classes to online platforms. However, students from different parts of the country faced various problems during their online classes. Thus, the primary objective of this study is to explore the Library and Information Science (LIS) students' positive and negative experiences regarding their ongoing online classes during COVID-19. An online survey was conducted to collect responses from the students of University of Dhaka, University of Rajshahi and Noakhali Science and Technology University. A semi-structured questionnaire was designed using Google Forms including both open and close-ended questions. To reach a wide number of participants, the link to the questionnaire was shared with the students via Facebook, messenger and Gmail. A total of 167 students responded to the survey. Data were analyzed using SPSS software and thematic analysis approach. The results of the study showed that poor internet connection, lack of sufficient devices, high cost of data packs, less attendance in classes, and problematic interaction with teachers were the negative themes, while connection to academic courses, ease in attending classes and having sufficient time to be with the family were observed as positive experiences. Findings indicated that negative experiences are more significant than positive ones. Besides, most of the students shared negative experiences only. From the findings, it is clear that the students are struggling a lot to cope up with online classes. It can easily be assumed that the condition is the same or even worse in the case of other public university students of Bangladesh. It is very much appropriate for the stakeholders and policymakers to come forward to resolve the hurdles faced by students. Otherwise, the ultimate purpose of online classes will fall in vain.

***Keywords**: Online classes; COVID-19 pandemic; Library and information science;*

THE ADAPTATION OF SOCIAL MEDIA IN LIBRARY AND INFORMATION SCIENCE (LIS) EDUCATION TO FIGHT AGAINST COVID-19 PANDEMIC: A PRESENT SCENARIO IN BANGLADESH

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As the pandemic situation is getting worst day by day, peoples' dependence on technology becoming more and more requisite. According to the World Health Organization (WHO) reports, as of January 4, 2021 Bangladesh had 516,019 confirmed cases and out of which 460,598 recovered and 7,626 died. From 26th of March 2020 till now, Bangladeshi educational institutions including their academic libraries has been closed down due to government imposed lockdown. As almost all libraries in Bangladesh operate manually, the actual situation for libraries here is crucial. Above all these constraints some of the university libraries and libraries belonging to national or international organizations are still providing support services to their users through social media. The Department of Information Studies and Library Management (ISLM) of the East-West University (EWU), in Bangladesh was in the front line in adapting social media in their LIS education programmes. They organized several webinars by using Facebook and their digital library platform was used for diversified purposes. The compulsion of COVID- 19 situation and growing users of social media is forcing the LIS professionals to turn to online platforms to keep pace with demands. This study covered 5 Libraries and their activities during COVID- 19 by using Facebook, as it is one of the most popular social media in Bangladesh. The collected data from online social media was analyzed and presented through graphs and charts. The outcome of this study suggests that the conjugation of social media with LIS will not only promote LIS education but also more effective in creating more knowledgeable professionals.

Keywords: *Social media; COVID- 19 pandemic; LIS education; LIS professionals.*

SPEAKING TO LITTLE MINDS: TAKING LITERACY ACTIVITIES TO A CHILDREN'S SOCIETY AT ILLUPPANKADAWALA, ANURADHAPURA

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The knowledge sharing in a community may differ from that of a target group as their social and cultural backgrounds are varied to a great extent. In a community, information will not reach on time and satisfy needs equally. Receiving an invitation from a children's society at an academic library reflects the thirst for information that must be quenched and the need to provide remedies to unsolved problems on knowledge dissemination. Importance of reading was presented before the 35 members of children's society at Illuppankadawala, Anuradhapura in a short speech. At the end of the session a questionnaire was distributed among them to identify demographic information, reading behavior and preference of the reading motivation programme. Findings revealed that the majority of respondents (97%) were willing to read while the percentage of having a library membership were low (34%). Majority of the participants preferred evening time (74%) for reading and they pointed out that they inherit reading from their mothers (28%) and teachers (26%) respectively. The majority like to read books written in Sinhala language . A preferred title was not mentioned by 5.14%. 86% stated that this novel experience captured their minds while 80% stated that the got new knowledge. During the session, several songs sung and 77% liked them and 69% responded that the time duration of the programme sufficient. The essentialness of reading in life (71%) was prominent and it is necessary to conduct a follow-up brainstorming session to determine the participants level of improvement in reading.

Keywords*: Information literacy; Reading camps; Reading motivation.*

EFFECTIVENESS OF APPLYING EMPOWERING EIGHT (E8) MODEL AMONG THE PUBLIC LIBRARY STAFF IN AMPARA DISTRICT

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Ampara district is located in the Eastern part of the country and located about 350 km away from the capital city of Sri Lanka. According to the first-hand experience of the researchers as well as the reviewed literature, information literacy (IL) programs were conducted by public libraries of the district sparsely. To provide a quality service for customers, the staff of public libraries has to be competent in information skills and information retrieval functions. This paper aims to present the effectiveness of applying the E8 model among the public library staff in the Ampara district. The researchers lounged an experimental research design, pre-test, and post-test, and in between 30 hours of training on Information Literacy was conducted. The study also explores their ability to find, evaluate, and apply pedagogical information. In Ampara district, there are 55 public libraries which includes 34 libraries located in Tamil medium dominant areas and 21 libraries located in Sinhala medium dominant areas. The researcher selected the 34 libraries located in Tamil medium dominant areas due to the researcher's limitation in conducting IL skill programs in other languages. Out of a total population of 88 staff members a sample of 22 was drawn using the stratified purposive sampling technique. Their Information literacy skills were evaluated by pre-test, and post-test based on the Empowering 8 Information Literacy Model. The data were analyzed using SPSS version (23) with two levels of descriptive (mean and SD) and inferential statistics (t-test). Pre-test resulted that public library staff are less skilled in using and applying new tools for information searching and the ability to present the data effectively. The results of diagnostic post-tests showed a dramatic increase in public library staff's knowledge and skills. The assessed result of the public library staff indicated significant improvements in the average score from the pre-test to the post-test. In conclusion, training based on E8 model has enhanced the IL skills and knowledge of public library staff.

Keywords: *Ampara district; Empowering Eight (8) Model; Information literacy skills; Information retrieval skills; Public library staff.*

HEALTH INFORMATION SEEKING BEHAVIOUR OF PARENTS OF CHILDREN WITH DISABILITIES

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Parents of children with disabilities (CWD) are frequently seeking information about the diagnosis, prognosis, therapeutic options and available services using different sources. Although several studies have been done in terms of information seeking behaviour of parents of children with specific disabilities, very few studies addressed CWD as a whole. The purpose of the study is to describe the health information-seeking behaviour of parents of CWD by identifying parental health information needs, preferable information sources, barriers for accessing information and by exploring the parental experiences of information seeking process. A mixed-method, cross-sectional study design is employed for this study. 300 parents of CWD will be taken for the study using a convenience sampling method. Quantitative data will be collected using a pre-tested self-administered questionnaire which covers demographic information, types of health information needs, preferences in the use of information sources and barriers encountered in the information sources. A 5-point Likert scale is used in the questionnaire. Qualitative data will be collected using a brief semi-structured interviews which addresses parental concerns of information reliability, experienced difficulties, satisfaction of the available services and the suggestions for the comfortable reach of information. The study aims at identifying the true means of information requirements and available information sources, services and barriers faced by parents of CWD. It is also expected to motivate librarians and other information professionals to assist parents of CWD to fulfill their information requirements enabling early intervention and rehabilitation and thereby enriching the quality of life of CWD families.

Keywords: *Health information; Parental information needs; Information seeking behaviour; Children with disabilities (CWD)*

IDENTIFICATION OF INFORMATION NEEDS FOR THE DEVELOPMENT OF CULTURE-BASED FISHERIES IN SRI LANKA

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Culture-Based Fisheries play an important role in a country, bringing numerous benefits to its society. It is one of the important income-generating industries in the Sri Lankan economy. Due to ever increasing world population, marine fish production has become inadequate to sustain human consumption of fish. Therefore, culture-based fisheries development is identified as a suitable option for filling the gap. This study aims to determine economic information needs in culture based fisheries at a time when CBF production is targeted to increase. The study follows the mixed method of collecting primary and secondary data. Interviews were conducted with relevant experts and the secondary data were collected from sources available at the Department of Fisheries and other related Institutes. Statistical analysis of data shows that there are seasonal variations in the fish production depending on the time period. The results indicated that CBF production has increased significantly over the past period and it also enables the economic development beyond the rural development. Awareness on economic information related to the industry will assist in identifying international trade opportunities while taking steps to ensure sustainability.

Keywords: Culture-based fisheries; Economic information; Food security; Fisheries development.

STUDY ON THE IMPACT OF INFORMATION LITERACY SKILLS FOR STUDENTS LEARNING ACTIVITIES: BASED ON FIRST- YEAR STUDENTS IN HORIZON CAMPUS

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This study investigates the information literacy skills and the level of learning activity skills among first-year undergraduate students at the Horizon Campus. These students had their secondary education at national, provincial and international schools with diverse study facilities. However, at the tertiary education level, they follow similar courses and evaluation procedures. Furthermore, students should be aware and ready to use the changing educational system in the digital world. Information literate persons could recognize information needs and are able to locate, evaluate, and use the required information effectively. Information literacy is a crucial in achieving succss at the higher education level. A cross-sectional survey design was used to identify the information literacy level of first-year students in the four faculties of the Horizon Campus. Data collected through online questionnaires. This study has taken theentire population of 140 students for this purose. Sixty-four percent of the population responded in the survey. Data analyzed and summarized using descriptive statistics. The results reveal that the resources finding skills of the students were eighty-three percent (83%); students prefer the use of electronic information sources in place of print sources. Furthermore, forty-nine percent (49%) searched for information by title and forty-one (41%) by subject. This study recommends that information literacy skills development programs be compulsory for first-year students to efficiently and effectively succeed in educational attainment.

Keywords: *Secondary education; Information literacy; Information skills; Learning skills.*

IMPACTS OF LITERACY LEVEL IN INFORMATION SHARING: A QUALITATIVE STUDY ON FOLK LITERARY TRADITION.

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Literacy level affects the information behavior of people. Sharing of information varies according to the literacy level of people. This study focused on uneducated Muslim women in Ampara district who used to share information or transfer information by means of songs or poems. These poems which are popularly known as '*Kavi'* are not in the published form and the sharing takes place orally. Imaginary feelings such as romance, day- to-day problems experienced such as destituteness, negligence of children, separation from husbands and ignorance forms the content. The study was carried out based on three objectives; to reveal the poems as a medium of sharing information, to show how the poems transfer information about inner feelings effectively and to suggest the ways to conserve and preserve the literature. Qualitative research design was employed. Accidental and Snowball sampling techniques were applied to get the poets since the poets were unknown. Fifteen (15) poets were identified and interviewed. Unstructured questionnaires were designed and in-depth interview was applied to collect data. The unwritten poems are the expressions coming out of the feelings and emotions of experience and not imaginary creations. Qualitative data analysis showed that the poems are illiterate people's convenient mode of sharing information. It was easy for the information receivers to understand and comprehend the content as the form and feelings were the same. It is recommended to take action for the conservation and preservation of the literary heritage appearing in the form of such poems.

Keywords*: Kavi (poems) ; Unpublished poems; Literacy; Life- problems.*

EFFECT OF INFORMATION LITERACY SKILLS OF HEALTH PROFESSIONALS ON THEIR ACADEMIC ACTIVITIES

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Library of the Ministry of Health is one of the key centers for dissemination of health information and knowledge within as well as outside the Ministry. All health professionals use it. It's clearly observed that the users time is wasted much of the time in identifying and exploring information needed for their academic and research activities thereby adversely effecting their academic activities. The aim of this study is to examine the effect of information literacy (IL) skills on the academic activities of the health professionals. Specific objectives were to identify the demographic distribution of health professionals, to determine factors affecting on identifying and exploring information needs of them and to examine the relationship of the IL skills and their academic activities. Quantitative research method was used in this study, where the main tool of data collection was a structured survey questionnaire administered to a selected sample from a study population consisting of health professionals attached to the Ministry and served by the library. The total study population was 60 users of the library out of which 52 was selected as the sample. Response rate was found to be 96% and most of the respondents (54%) were male. Major findings were found to be as follows: 50% of the users access information for three academic activities; 68% used two search techniques to locate information; 38% used two ways of IL skills to identify information needs; 38% used four ways of IL skills to explore information needs; 50% respondents had the problem of wastage of time in searching for information. Therefore, it is proposed to make efforts in organizing more information literacy skills development programmes followed by practical sessions with the collaboration of the librarian.

Keywords*: Information literacy; Health professionals; Academic activities.*

INFORMATION SEEKING BEHAVIOR AND INFORMATION SEARCHING STRATEGIES OF THE STUDENTS: WITH SPECIAL REFERENCE TO 1AB, 1C, TYPE II SCHOOLS IN KOPAY DIVISIONAL EDUCATION OFFICE OF THE JAFFNA ZONAL EDUCATION OFFICE

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The global information revolution has led to an explosion of information. This has led to the need to organize information and the ability to search and use appropriately. This situation created a need to improve the information skills of school children. In this case, the study on "Information Seeking Behaviour and Information Searching Strategies of the Students" is based on a survey conducted using 1 AB, 1C and Type-2 schools in Kopay Division of the Jaffna Education Zone. The samples were selected from the five selected schools according to Krejcie and Morgan sample selection table, and the study was conducted with the aim of identifying the challenges in information seeking behavior of the students and find out the strategies to improve the students' searching behavior. Data was collected from 245 students through a questionnaire and interviews. The results show that 103 (42%) students use the school library for information search, 172 (70%) students use the Internet for searching for information, 93 (38%) students have internet access, and 41 (17%) students use the rural libraries. The study further found that 44 (18 %) students have never used a dictionary as an information resource, while 201 (81%) students had used textbooks to meet their information needs, and 172 (70%) students had sought for assistance from friends for information. Also, when they need information, 196 (80%) discuss with friends, 202 (82.4%) seek teachers, 189 (77%) seek parents and 161 (66%) students seek library access. Moreover, 99 (40%) students use the internet and 87 (35%) use social networking sites. It is recommended to promote the practice of self-learning in students by teachers, to appoint teacher librarians, formulating policy on career development prospects for teacher librarians, library period should be included in the school timetable, and the awareness program to be organized to improve the students' library usage.

Keywords*: Information Seeking Skills, Information Cognition, School Libraries*

AN EXPLORATIVE STUDY ON THE ROLE OF READERS' GROUPS IN FACEBOOK FOR PROMOTING FICTION READING

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Although the development of a country is determined mainly by economic factors, educational and social factors are also taken into account in weighing the development in the modern world. The promotion of reading is extremely beneficial to the educational development of the people of a country. The novel, which belongs to the genre of fiction, expands the horizons of human knowledge and touches on various topics and areas. Fiction published in two Facebook groups over a period of three months were selected as the sample. The research was conducted using a combination of contextual analysis and grammatical study methods. The fiction read by the group were analyzed for origin (autonomous or translation), year of publication and the genre variety. The Facebook reading groups were more interested in their own creations, and the majority of the translated creations included were fiction originally written in English. Considering the scholarly diversity of fiction, works belonging to the sub-genres of social issues and romance were popular the most. Such books have been posted on Facebook many times and the positive response also has been high. The study concludes that Facebook reading groups enhance reader motivation to promote fiction reading. It is also an easy and quick way to address a wider readership at once. Since the libraries could not be accessed during the current pandemic environment, it had been used as a tool to access reading material.

Keywords*: Fiction, Reading promotion, Facebook*

INTEGRATED LIBRARY SYSTEMS – DISCOVERY INTERFACE (ILS-DI): A STANDARD FRAMEWORK FOR REAL TIME CONNECTIVITY WITH INFORMATION DISCOVERY APPLICATIONS

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The primary purpose of a library service is to meet the information needs of library users, facilitation of their research, and making them more educated and empowered. As a discovery tool, a union catalog allows end-users to discover items suitable for a given subject and to find out the availability and location. In a way, it ensures rapid retrieval of source materials. They also provide multiple source search interfaces. To date, most of the national and international union catalogs are only able to perform the functions of a traditional catalog and lacks a number of other useful features such as the indication of real-time availability status, reservations, renewal, request for articles, and the use of ILS authentication credentials,. They are also not provided with expanded search features such as full-text search, faceted navigation, and resource grouping. The purpose of this study is to provide a solution for this problem through the standard protocol- Integrated Library System–Discovery Interface (ILS–DI) by using Koha ILS at the backend and VuFind discovery system at the front end. The developed framework is based on three-layer architecture with Koha ILS as the data provider, Open Archives Metadata Harvesting Protocol (OAI-PMH) as the data collection protocol and VuFind as the discovery layer. A Koha ILS-DI protocol designed particular for multi-backend driver to interlink Online Public Access Catalogue (OPAC) and ILS functionalities with VuFind discovery layer. The study suggests that the framework can act as an information discovery prototype to help entire library community to access the information quickly and comprehensively. Based on the outcome of this study, implementation of ILS-DI based discovery applications in universities and academic libraries could be strongly recommended. It will also increase the realization of the parent organizations' expectations, attract more users and enable libraries to offer better quality services.

Keywords*: Koha; VuFind; ILS-DI; OAI-PMH; Union catalogue; Integrated library systems.*

TRACKING PATRONS USING KOHA IN - OUT MANAGEMENT SYSTEM: A CASE BASED ON LIBRARY SYSTEM, UNIVERSITY OF RUHUNA

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As the COVID-19 world pandemic rages, the governments around the globe had to take measures for contact tracing to identify the individuals who had close contacts with COVID-19 positive individuals. As a result of this, some governments introduced apps that can be used to track the commuting of individuals. However, the majority of shops, organizations and service providers in Sri Lanka used pen and paper method to record their visitors. Due to the nature of COVID-19 spreading through contact, some visitors were reluctant to use pen and paper to provide their information. Moreover, some individuals who write their personal information in such registers faced harassments by revealing their contact numbers and address to unknown people. As a place with a vast diversity of user visits, libraries also faced this problem. Hence, the University of Ruhuna Library decided to implement a patron tracking system using existing resources. The University of Ruhuna library system has been automated with the use of Koha library management system . In 2018 March, Koha system introduced a plugin named "In-Out Management System" to track the patrons who visited the library or sections in the library. The In-Out Management System scans the patron ID at the entry and exit. Using patron ID, patron information are extracted from the library database in Koha. As the library database contains accurate information about each individual in the university, it was the best option to track the library visitors. However, the library had to customize the In-Out Management System to extract information from individuals who have temporary registration number, NIC number and UPF number as the patron ID. This system can use to generate statistical reports regarding library visits, usage of sections/collections, and usage of reading spaces with accurate information. This system can be further developed by using location QR codes to indicate different locations.

Keywords: *Contact tracing; COVID-19; Integrated library management system; Koha; Tracking patrons.*

INFORMATION SERVICES PROVIDED THROUGH THE OPAC: WITH SPECIAL REFERENCE TO UNIVERSITY LIBRARIES OF SRI LANKA.

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Online Public Access Catalogues (OPACs) are one of the main interfaces that link the library with its users. It opens a more intimate gateway for online users. There is a variability of OPAC services due to the software platforms that provide OPACs and activation of built-in service plugins available with the software. Therefore, this study aims at identifying variations in OPAC services among the 15 state universities of Sri Lanka. In this study, the available types of OPAC software (whether free or fee), built-in services provided by those software platforms, and how far each university library adopted those services through the OPAC were investigated. This cross-sectional research conducted as an online survey and took place in a computer lab facility at the University of Ruhuna, with same environmental, and connectivity situations. All the 15 university OPACs were loaded and evaluated simultaneously by 15 dedicated evaluators in dedicated computers. The evaluation conducted under four main characteristics that were visible in OPACs in general, namely the accessibility, interface, promotion of reading, and service diversity. All 15 universities have adopted OPACs and 93% of them are using KOHA (Free) platform while 7% is still using the fee-based platform. Most of the library services are provided through the OPACs of many libraries. However, laptop lending service, article index service, plagiarism check and newspaper articles are specific services offered by some universities. It can be concluded that there is a variability among OPAC services provided by the universities and filling the gaps in services will ensure a better service experience and passive marketing of services to the OPAC users of the library.

Keywords*: OPAC services; Academic libraries; Library services enhancement.*

SOCIAL MEDIA OPPORTUNITIES FOR UNIVERSITY LIBRARIES: NEED OF THE ERA TO SUSTAIN THE POSITIVE IMAGE

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Social media (SM) tools help and enable university libraries (UL's) to deliver library services instantly and effectively. SM tools had been used during the COVID-19 pandemic. The study explores the use of SM tools and their adoption trends in Pakistani UL's. Also, social media opportunities (SMO) for UL's of Pakistan were identified. Analysis of patterns based on sector, geographical division, and SM use was also executed and significant differences were reported. The study was conducted from an organizational perspective and used an online questionnaire to collect data through a census survey. The population for the study covered all (181) Higher Education Commission (HEC) recognized universities and 124 (69%) valid responses were received. The study findings revealed the importance of SM is recognized and that the trend in adopting SM increased during the period of last three years. The study revealed that use of SM is higher in the private sector UL's than public sector UL's. Twenty-five SMO statements were identified and the respondents showed their aggressiveness to the 21 opportunities statements excluding four SMO statements. Moreover, no statistically significant difference was observed in mean scores for all 25 SMO statements based on sector. Also, applying the ANOVA test (one way) found no statistically significant difference in means excluding one statement based on geographical divisions and for two statements based on SM use. The findings are useful for policy makers and the HEC, and perhaps in the library context where libraries strategically integrating SM with their services. Such steps will contribute to sustenance of library services particularly in disaster situations.

Keywords: *Library social media; Social networking sites; University libraries - Social media.*

PRESERVING GLOBAL RESEARCH DATA: ROLE AND STATUS OF RE3DATA IN RDM

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Considering that scientific data is being increasingly recognized as an important raw material for current and future technological advances, many research collaborators have joined together to create mechanisms to secure and preserve it. However, irrespective of the generation of rich analysis results, this study was undertaken to examine the RDM activities on the global Registry of Research Data Repositories platform (Re3data) to increase its level of visualization. The study approached the Re3 website, a global registry of research data repositories to collect the data. The researcher specifically assessed the 9 alternative search strategies that are available in the Re3 database; namely subject, content, keyword, metadata standards, quality management, repository languages, software, repository types and country. It is observed that behaviors related to structured study results are more evident in developed countries as opposed to developing countries, with the United States of America placed first. Results also indicated that research data is more structured in the case of scientific and statistical formats and disciplinary databases, particularly the life sciences. Overall, the software is mainly used for processing data and the English language is strongly supported. Dublin core metadata is often used to increase the quality of data from analysis. This study presented an overall picture of the research data practices throughout the investigation on the Re3data platform. The research proposed best practices focused on RDM operations to improve the amount of Research Data activities.

Keywords: *Research data management; Research data, Scientific data; Re3data, Repositories.*

STUDY OF USAGE IN CLOUD COMPUTING AND DATA MIGRATION IN SELECTED SPECIAL LIBRARIES IN SRI LANKA

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Cloud computing is the delivery of computing services which includes servers, storage, databases, software, analytics, and intelligence over the Internet. Libraries can use it for a variety of functions such as data storage, data migration, and deploying applications & Web content. The purpose of this paper is to explore the situation of cloud computing and data migration used by the special libraries in Sri Lanka. With this objective, 20 special libraries were selected using snowball method, to conduct a survey. A questionnaire and the interview method were used to collect data. Only 45% of the sample have a fair knowledge on cloud computing methods. However, 95% use cloud applications. Majority (95%) uses it for accessing Google cloud applications. Most (95%) of them used cloud for file storage. Cloud had been used for article delivery (90%) and document sharing (80%) too.

Keywords*: Cloud computing; Data migration; Special libraries.*

FROM LIBRARIAN TO 'WEBRARIAN' IN THE NEW NORMAL: CHANGES AND CHALLENGES IN THE LIBRARY, UNIVERSITY OF KELANIYA

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The web-based technology became a timely concern due to the COVID-19 pandemic along with the need to transformation of the role of the librarian towards web-librarian or webrarian. Therefore, this study aimed at identifying the new changes as well as challenges experienced in the new normal. The study highlighted 4 selected dimensions of the library environment to identify the changes: library to website, library services to web services, library users to web users and library collection to web collection. The challenges were identified based on 4 major parameters: institutional concern, users, staff and collection. Data was collected through interviews from randomly selected staff members during 8 months period and through web analytical reports. During the pandemic, the key access to the library was the library main website. The web user percentage rapidly increased in 170.7 and viewers' percentage in 190.5 percent. In addition, a mobile compatible website was developed for the newly implemented online Subject Liaisons Library Service (SLLS). Library online presence in social media was identified as a better platform to reach and interact with users. An online chat platform provided through the library website to perform the work of 'Student Relationship Management' (SRM). An online reservation system for special group discussions were generated to reserve library study areas. Availability of monthly accession list in e-book readable format; scanned recommended readings; online databases, e-books, e-journals and digital-repository facilitated the users to remote access through Shibboleth and VPN login. Such information guide, and instructional tools and even the orientation for freshers were introduced through video presentations. Challenges were experienced in areas such as network coverage, remote login, authentication, adhering to copyright law and web skills of the staff.

Keywords*: Librarianship; University libraries; Webrarian; Web services*

IMPORTANCE OF "RESEARCH COMMONS" AS A "ONE-STOP SHOPPING" MODEL FOR RESEARCHERS

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Introduction of new services catering to the changing needs and requirements of the users is a timely need. This is particularly valuable for the research community. The study aims to explore the importance, relevance and the suitability of introducing the "Research Commons as a One-Stop Shopping Model". Twenty foreign university library websites were selected using the purposive sampling technique. Screenshot analysis and a critical analytical review was carried out. Content analysis was the principal research method. Searching, writing, presenting, publishing, funding, academic discourse and other scholarly services are available under one roof treated as the context of Research Commons. It creates the opportunity for the researcher to conduct research smoothly from "writing research proposal" to "publishing of the outcome". "Research Commons" could be considered as a value-added element in the library. It is a multi-purpose center of excellence enabling the sharing of researcher's knowledge, presenting research outcomes, contribute and seek the assistance from other researchers that lead to synergized effects. Research consultations, systematic reviews, personalized assistance by skilled librarians, statistical software support, statistical consultations, opportunities for grants and funding, writing center, workshops and seminars, conference meeting / chat rooms with collaborative workstations, printing and scanning services, digital lab etc. will be available under one roof. Bringing all research services under one umbrella is an important concept here and will help to save resources of all parties. "Research Commons" facilitates work and encourages new and existing researchers to engage in more research. Commencement of the "Research Commons" in the library will assist the development of a scholarly and research culture in the university environment.

Keywords*: University libraries; Research commons; Research culture; Information services; Research management.*

HOMEGROWN SYSTEM FOR STANDARDIZING THE SRI LANKAN JOURNALS

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Scientific research is an information producing activity for a country. At present, more than 150 scientific journals are published from Sri Lanka. Among the journals available in Sri Lanka, only 07 journals have been indexed by global indexing services. Less coverage of Sri Lankan journals by international indices has been an argument among scientific community of Sri Lanka. It is a fact that International indexing databases have their own criteria as well as limitations in terms of coverage. In order to overcome these barriers, countries like China, India and South Korea have already established their own indigenous models. Sri Lankan Journals Online (SLJOL) database maintained by the National Science Foundation is only the source listing Sri Lankan journals to increase the visibility. It is supported by the Public Knowledge Project (PKP). Yet it has not been recognized as a valid tool in standardizing the performance of journals in terms of world accepted indicators. Main objective of this study was to explore the possibility of proposing a homegrown system for measuring performance of Sri Lankan journals. The study proposes a mechanism for standardizing the Sri Lankan journals. In order to calculate the Impact Factor (IF) and other indicators, 05 oldest journals available in SLJOL were selected. We were able to successfully rank these journals using the impact factor, Number of citations, H-Index, IF etc., using the proposed model.

Keywords*: Journal Impact Factor, Journal Evaluation, Sri Lanka Citation Index, Sri Lanka Journal*s

LIBRARY SERVICES IN SRI LANKA DURING COVID-19

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A nationwide curfew was imposed from in Sri Lanka from the 20th March 2020 with occasional relaxations, except for high-risk zones due to the Covid-19 pandemic. The services of public and private institutions including Libraries, Archives and Museums (LAMs) and Library and Information Science (LIS) teaching institutions were affected across Sri Lanka. After 04 months of closure, the country started getting back to the regular life style, amidst the inhibiting mental conditions such as fear, worry, uncertainty, anxiety, sense of loss, isolation, nervousness due to lack of communication etc. do exist. Safety guidelines were published by the National Library and Documentation Services Board of Sri Lanka (NLDSB), in consultation with NILIS, University of Colombo, and the Sri Lanka Library Association (SLLA). The NILIS published an Exit Strategy from Covid-19 in partnership with the University of Colombo, NLDSB, Sri Lanka National Archives (SLNA), and the Sri Lanka Library Association (SLLA) on 27th April 2020. LIS education institutions brought regular teaching-learning practice onto the online platforms such as Zoom and WhatsApp. However, poor data signals and non availability of smart devices to access learning materials were the problems reported, specially by students residing in remote areas. NLDSB continued to publish advisories and circulars and created a Web site specially designed for Covid-19 related information for libraries. On 9th May 2020 NLDSB published directions on how to reopen the libraries step-by-step. A series of webinars and workshops were conducted by several parties. The Asia Foundation donated Rs.1 million worth protective instruments and disinfectants for public libraries in the Colombo district.

Keywords*: Covid-19, Sri Lanka, Situation report*

LIBRARY SERVICES IN INDIA DURING COVID-19

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Library services across India were severely impacted after the closure of all educational institutions across the country as a precautionary measure to contain the spread of the novel coronavirus from 16th March followed by complete lockdown of the country from 22nd March by the Government of India. Since the last ten months, libraries supporting education and research institutions have migrated to blended ways of working, given the extrinsic challenges posed by a public health emergency like COVID-19. Factors such as lack of ICT infrastructure, internet connectivity, economic disparity, population density have created a vast digital divide across the breadth and width of the country. These factors have become barriers in providing access to educational related services. Libraries from premier educational institutes like IITs, IIMs and NITs have kept their services floating through online mode and are providing remote access to its subscribed contents. The National Library of India reopened after eight months of closure in December 2020 under many guidelines and regulations to ensure safety of readers. The National Digital Library of India has developed a dedicated COVID-19 research repository where research articles, datasets, documents and videos related to this virus and other related content are accessible to all. Significant initiatives have been taken by the university libraries to set up remote access servers, INFED-Shibboleth with the help of INFLIBNET for providing access to study material listed in the syllabi of different courses. Educational activities such as teaching and examinations have been carried out through virtual modes from lockdown 2.0, even universities conducted terminal examinations online for final year students attending from their homes. India with its 28 states and 9 UT's has differing COVID-19 situations in different states. Public libraries have started reopening at 60% capacity in states with lower COVID numbers. As India has started to unlock itself gradually from Unlock 1.0 to Unlock 4.0, libraries are opening for users with limited seating capacity following the standard operating procedure mandated by the Government and the Medical Council of India.

Keywords*: Library services; India, COVID-19.*

THE EMERGENCE OF A NEW LIBRARY CULTURE DURING COVID 19 PANDEMIC: A CASE STUDY OF PUBLIC LIBRARIES OF COLOMBO DISTRICT

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Informed citizens are an essential factor of a democratic society. IFLA/UNESCO guidelines have presented the role of public libraries in this regard. This study aims to examine how public libraries fulfill their duties during the pandemic conditions to develop informed citizenry and adjust to the new normal. As a social institution, the role of the public library is a crucial factor for strengthening the democratic society. According to the philosopher Marshall, Government has a responsibility in confirmation of citizenship. However, during the present covid 19 pandemic situation, public libraries were unable to continue their normal information services to their user communities. The sample of the study consists of public libraries in the Colombo district. The questionnaire was designed for public libraries and interviews were conducted with social scientists and librarians to gather data. Lending sections were closed and reference services were provided services under limitations. Therefore, users were limited. Extension services were temporarily discontinued. Only a few libraries launched online services. But that services were not addressed for common citizens. It was revealed that the majority of public libraries conduct programs such as online tuition classes, Quiz programs and children competitions. Therefore it is recommended that public librarians must focus their attention to initiate innovative and alternative activities related to information provision to strengthen the democracy during the new normal.

Keywords: *Public Libraries; Democratic Society; Citizenship; Online Services; Covid 19 Pandemic*

SOCIAL MEDIA USAGE DURING THE ISOLATION OF COVID-19 INFECTED PATIENTS IN KARACHI, PAKISTAN

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The purpose of this study to determine the use of social media by COVID 19 infected patients during the isolation/quarantine period. This is a survey study and conducted among those individual who infected from the COVID 19. Respondents spend isolation period during the quarantine and after recovery from the COVID-19 disease. Karachi is the place where COVID-19 first patient-reported and also highest number of cases reported. The researchers used the snowball technique to reach the respondent's contact in person or refer respective friends or family and colleagues. A total of 100 online questionnaire sent to respondents and 75 responded. Results are shown that COVID Patient during the Isolation uses social media for mind relaxation during the isolations. Respondents connected with social media during the Isolation period. However, respondents believe that authentic and reliable information for patients and the general public use only Government websites. COVID-19 infected personnel should use limited social media during the quarantine to avoid anxiety and stress.

Keywords: *New Normal; COVID-19 pandemic; Social media; Information anxiety.*

EFFECTIVENESS OF WEBINARS IN DISSEMINATING KNOWLEDGE AND INFORMATION AMONG LIBRARY AND INFORMATION SCIENCE PROFESSIONALS, RESEARCHERS AND KNOWLEDGE SEEKERS DURING THE COVID-19 PANDEMIC IN SRI LANKA.

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Lockdowns and mandatory social distancing during the COVID-19 pandemic in Sri Lanka limited people's access to knowledge and information (KI) sources. Similarly, KI seekers within the field of Library Information Science (LIS) faced limitations in fulfilling their KI needs. This research studies the effectiveness of webinars in disseminating KI during the COVID-19 pandemic by analysing 03 webinars conducted by the Library of Sri Lanka Technological Campus (SLTC) targeting the above audience. The study employed a convergent parallel mixed method. Quantitative data was gathered via a structured questionnaire administered to 96 participants, and analysed using descriptive statistics. Qualitative data was gathered through the analysis of 03 case studies, and analysed under 08 sub themes on the quality of the content and the competency of the resource persons. The majority of the respondents (67%) were found to be highly satisfied with the webinars. Among them, 66% were highly satisfied with the content while only 60% were highly satisfied with the resource persons. The lack of familiarity, technological issues and language barriers were shown as drawbacks, while the use of international resource persons and the minimum cost were revealed to be positive aspects. Despite certain shortcomings, the webinars had effectively catered to both international and local KI seekers. This study concludes that although webinar as a KI disseminating tool is new to the Sri Lankan academia, it can be used as an effective mode of delivery when normalcy in the society is far from the reality.

Keywords: *Knowledge and information dissemination; Library and information science; COVID-19; Webinars; Sri Lanka.*

IMPACT OF ZOOM IN INFORMATION SHARING DURING COVID 19 PANDEMIC: A CASE STUDY

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Information literacy plays a vital role in teaching and learning. Face to face teaching has been common in universities. In the stream of Fine Arts subjects, students take part in practical work and traditional lectures. After the spread of COVID-19 pandemic in the country, the teaching mode was converted into virtual form. The video conferencing app - ZOOM had been identified as an essential tool for teaching in all universities in continuing lectures. This study attempts to find the effectiveness of the virtual lecturing among the Fine Arts students of Eastern University and has three objectives, viz; (a) to reveal the status of lecturing via ZOOM, (b) to reveal whether the technological capacity is sufficient (c) to suggest alternative ways to teach practical oriented subject in the present situation. Quantitative research design was adopted in this research. Total study population consisted of 97 students who follow Fine Arts subjects were taken and Judgmental sampling techniques was employed to gather data. For data entry and analysis Microsoft Excel software platform was used. All respondents expressed that it was not suitable for their studies. It was found that more than 98% of students are using smart phones for lectures and expressed that it is ineffective in learning activity. All students expressed that they did not like this system as they were following a subject with a practical orientation. In view of the above, it could be concluded that action has to be taken to find out an alternative method to deliver lectures which conforms to health guidelines.

Keywords: *ZOOM; Practical learning; Information needs; Information sharing; Fine arts.*

SIGNIFICANCE OF INFOPRENEURSHIP IN COVID-19 PANDEMIC: AN EXPLORATORY STUDY IN SRI LANKAN PERSPECTIVE

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The term 'infopreneurship' derived as a combination of information + entrepreneurship is a profit-oriented; internet and client-based; yet unexplored concept in the Sri Lankan context. Therefore, the key objectives were to gain and spread an understanding on infopreneurship and to emphasize its significance in this pandemic situation. Basically, an analysis of literature and documents carried out to comprehend its origination, nature, key areas, functions and the strategic value. The significance of infopreneurship was validated based on a self-defined framework which consisted of its strategic value in economic, social, educational and business perspectives to address the limitations and barriers faced in this pandemic. The findings shows that the origination of the concept of infopreneurship dates back to 1984; is not a mere process limited to information retrieval and dissemination; being a profit-oriented approach, it contains a long, complex process with number of activities and functions to fulfill the client's needs with a quality outcome; some major similarities in librarianship and infopreneurship were identified; several skills, qualities and practices are essential to become a vendor in this digital world; challenges and changes should have to be experienced. This approach can be initiated to address the rising issue of unemployment in this pandemic situation; simultaneously, as a profit generating strategy via online platforms which assures social distance and 'work from home' concept; skill development opportunity in web-based technology, managerial and business activities, research and publication sector; finally, the entire process leads to an informed society, knowledge society and digital society.

Keywords*: Infopreneurship; Librarianship; COVID-19 pandemic; Information society.*

DISASTER MANAGEMENT IN LIBRARIES DURING 2005-2020: AN OVERVIEW BASED ON THE EMERALD DATABASE

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The International Federation of Library Associations and Institutions (IFLA) describes that library disasters are serious problems faced by the libraries in the world. There are different types of disasters taking place in the world and libraries are no exceptions. The objective of this study is to identify the categories of disasters faced by libraries globally during the period 2005-2020. Data were collected from the publications appeared during the period 2005 to 2020 and available in the Emerald database. Out of a total of 1,717 journal articles published, 47 topic related articles were selected for consideration. Advanced search techniques were used to select the most related journal articles. Keywords were used to select the related journal articles and MS Excel was used to tabulate the search results. After identifying the themes, the identified disasters can be categorized as natural disasters, man-made disasters, and hybrid disasters. The most prevalent type of disaster faced by libraries was natural disasters (72%). It consisted of tsunami 22%, hurricane 22%, flood 14%, and earthquake 14%. Man-made and hybrid disaster types have affected libraries at a similar rate (14%) including a mobile library accident and COVID 19 pandemic. According to the results, tsunami and hurricanes were the main disasters which caused catastrophic loss of life and property in libraries. There were only two articles available related to COVID-19 pandemic as a disaster type in libraries. In order to draw general conclusions about the occurrence based on type of disasters, publications selected from a single database or a single publisher is not adequate and hence, it is recommended to expand this study to cover more sources of literature.

Keywords: *Library Disasters; Disaster management; Natural disasters; Man-made disasters; Hybrid disasters.*



National Institute of Library and Information Sciences (NILIS)
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Jaya Bhimrao Dabarase

Article

Gauging the Social Media Attention of COVID-19 Articles

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A B S T R A C T

Introduction: Altmetrics or alternative metrics has become a novel technique for measuring the impact of the research. It considers social web as a major source of data and measures how a piece of literature has discussed in various social platforms in terms of shares, mentions, bookmarks, tweets, saves, etc. Rather than measuring the scientific impact, it gauges the social impact of the research which can not be done by the conventional way which primarily consisted of counting the citations bagged by an article.

Importance: The deadly pandemic COVID-19 has travelled in social media very fast and subsequently fake information has become a headache. The main impetus for conducting the present study is to know how well articles on COVID-19 have propagated and discussed in social platforms since the disease is unknown to many and social media has become a major carrier of fake information which tempted many to make wrong decisions. We decided to conduct the present study to know how well COVID-19 articles are diffused in social platforms and to find out the hot platform for the discussion. The result of the study can be used for taking proper decisions regarding the management of various social platforms amid this kind of epizootic pandemic.

Objectives: The main objective of the study is to measure the social media attention/ altmetrics of COVID-19 articles.

Methodology: The data for the study would be collected from Dimension database which is a dedicated database for altmetric studies. A search by using the keyword "COVID-19" would be carried out in the database to retrieve articles on the pandemic as on 01 Dec 2020. The articles would be sorted according to the number of social media attention received from highest to lowest. A total of 25 articles with the highest social media attention would be selected and their major metrics from Facebook, Twitter, Mendeley, Blogs, News outlets would be measured and tabled using Excel for the subsequent analysis. The data would be subjected to correlation to know the associations between citations and altmetric attention score in the case of COVID-19 articles.

Keywords: Altmetrics, Tweets, Citations, Social Media, COVID-19, Corona

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Article

Scholars' Perceptions and Practices on Research Data Management in the Universities of Gujarat: A Survey

Madhuri Kumari[1], Minaxi Parmar[2]

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I N F O

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A B S T R A C T

Research Data and its management process is a foundation practice of scholars. The research data included collected raw data from the selected samples for the research as well as the output of research in form of suggestions and analysis. Therefore to manage and preserve the raw data of research, one electronic platform would be needed that takes good care of data as well as enabled to serve it as per the requisites of the scholars during the research. Research Data Management, is a platform to conscious in taking care, authenticity, preservation and services of it. Collected Data is the backbone of any research. So it's much needed to organize, store and preserve the collected data during research in a proper way. Research Data Management (RDM) is that approach which overcomes all the obstacles of data collection and proper application. When data is collected in organized form then it's very easy to apply any statistical tools and techniques. Institutes can easily archive them so it helps the prospective researchers to use them in the future. It increases the usability and longevity of the data. In this digital era, data generation is exponential. To organize this huge amount of data there should be an effective management plane. In this study researcher uses the survey method of data collection through the questionnaire. The questionnaire has been filled by research scholars of the universities of Gujarat. After analyzing the responses received, get a pattern of scholars' perceptions and practices. The core objective of this study is to make scholars aware of the use of RDM and its effect on the ease of doing research. The limitation of this study only conducted on only research scholars of universities of Gujarat. Research scholars of the total of 25 universities of Gujarat i.e. state and central level are taken as a sample. This helps know the actual status of awareness and practices of research data management among research scholars. To find out, the areas that need to improve. By knowing the actual problem institute or RDM planner can plan the solution efficiently. Well structured strategy or resources like software and institutional repositories helps universities to improve Research Data Management (RDM). RDM services influence the research level. Good research always adds gems to the institution.

Keywords: Research Data Management, Research Data, Collected Data, Data Archiving, Data Preservation

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Refugee Management and National Security of India

Nongmaithem Mohandas Singh and Indrajit Sharma

1 Introduction

In the recent past, the world has witnessed the refugee crisis in Europe and South Asia, which is far intense than ever before. According to the United Nation High Commission for Refugee (UNHCR), '65.5 million people were forcibly displaced worldwide which is much more than the total population of some countries'.[1] As on September 2017, the total population of refugees has also grown up to 22.5 million worldwide. At this juncture, 'the blurring of the term *refugee* and *migrant* takes attention away from the specific legal protection of refugees, and also undermines public support for refugees and institution of asylum when they require the same more than ever before'.[2] Simultaneously, after 11th September 2001 terrorist attacks in the USA, immigration issues have emerged as a major concern area of national security of the nations. The recent exodus of the large scale of people from their origin home countries to Europe as well as in South Asia has been questioned as: are they refugees or migrants?

In this context, this chapter explores the security environment of India in the last five years to identify the threats and challenges to its national security. It also analyses the connection between India's refugee management and its national security concern by focusing on the recent South Asian refugee crisis. Historically, India accepted more refugees per year than any other countries in South Asia. In addition to this, India also houses innumerable refugees and migrants who illegally entered in the country regardless of being a non-signatory member of the 1951 UN Refugee Convention and its 1967 Protocol.[3] India's such

1 UNHCR, *Factsheet INDIA 2017*, http://www.unhcr.org.in/images/pdf/UNHCR-India-factsheet-April-2017.pdf, Accessed 10 June 2017.

2 UNHCR. 2016, "UNHCR Viewpoint: 'Refugee' or 'Migrant' – Which is right?", *UNHCR The UN Refugee Agency*, (11 July, 2016), http://www.unhcr.org/new/latest/2016/7/55dfoe555/unhcr, Accessed 8 August 2018

3 UNHCR, *The 1951 Convention Relating to the Status of Refugees and its 1967 Protocol* (Switzerland UNHCR, September 2011), Accessed 8 August, 2017, https://www.unhcr.org/about-us/

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Vijay Sakhuja

Fourteenth Year of Publication



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Indian Nuclear Doctrine: Recent Debates

Arun Vishwanathan

Indian nuclear doctrine has generated a lot of curiosity and debate ever since the draft nuclear doctrine was released in August 1999[1] followed by the official Indian Nuclear Doctrine (IND) that was announced following a meeting of the Indian Cabinet Committee on Security (CCS) on January 4, 2003.[2] The IND generates a great deal of interest for several reasons. First is the fact that India is among the few countries in the world which has publicly released its nuclear doctrine. Countries like United States, Russia among other nuclear weapon possessing states have only released posture reviews to have highlighted their nuclear postures as part of their military doctrine. The United States regularly releases its Nuclear Posture Review (NPR) with the latest iteration being in February 2018.[3] Similarly, the Russian Federation has outlined its broad thinking about nuclear weapons and their employment as part of the Russian military doctrine which was released in 2014.[4]

Another important reason which piques interest in the IND is the fact that India is the only country in the world, other than the People's Republic of China (PRC), which has a declared policy of No First Use (NFU). This aspect of the IND also arouses wide interest, speculation and analysis. The third reason flows out of India's geo-political location given the fact that Southern Asia is home to three nuclear weapon states, all of whom are modernising their nuclear arsenal and delivery platforms. Importantly, these three countries share borders and have fought wars as a result of differences over these boundaries.

Given this background, this Chapter begin by outlining the main aspects of the Indian nuclear programme and importantly, the departures which were made between the 1999 Draft Indian Doctrine and the 2003 official IND. It outline the recent debates which have ensued over the IND given the statements made most recently by the current Indian Defence Minister, Shri Rajnath Singh on India's NFU policy. The recent challenges

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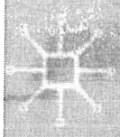
Introduction

Globalization as a phenomenon of intensification of socioeconomic, political, and cultural activities has touched every aspect of human life. There exists a plethora of literature defining and theorizing globalization, and as a multidimensional concept, it is used extensively to describe changes in the contemporary social and political landscape. The rapid pace at which time and space have compressed brings equally sudden shifts in the lives of individuals. Disappearing borders make the states and its populations feel the impact of far distant events. Spread of new diseases, atmospheric pollution, and crashing of markets can be felt like never before, creating a



India, Europe and Asia

Convergence and Divergence

Edited by

Rajendra K. Jain

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CHAPTER 6

India, Europe and Connectivity: From Shared Views on BRI to Mutual Cooperation?

Manasi Singh

Introduction

In an increasingly globalized and networked world, nations are competing to improve geographical connectivity and seek benefits from enhanced political and economic cooperation. China's expanding continental and maritime footprint has caused enough anxiety among the major powers of the world. Its flagship connectivity drive, the Belt and Road Initiative (BRI) has committed heavy investments in infrastructure development projects to deepen economic integration across continents. While India has strongly resisted BRI for violation of sovereignty, the European Union is also critical of the project considering the growing Chinese geopolitical influence in its neighbourhood. Moreover, the US trade protectionism has compelled EU to deepen its engagement in Asia and collaborate with like-minded partners. It is keen to strengthen connectivity between the two continents to tap Asia's economic potential and promote investments in vital sectors like digital, telecom, transport and

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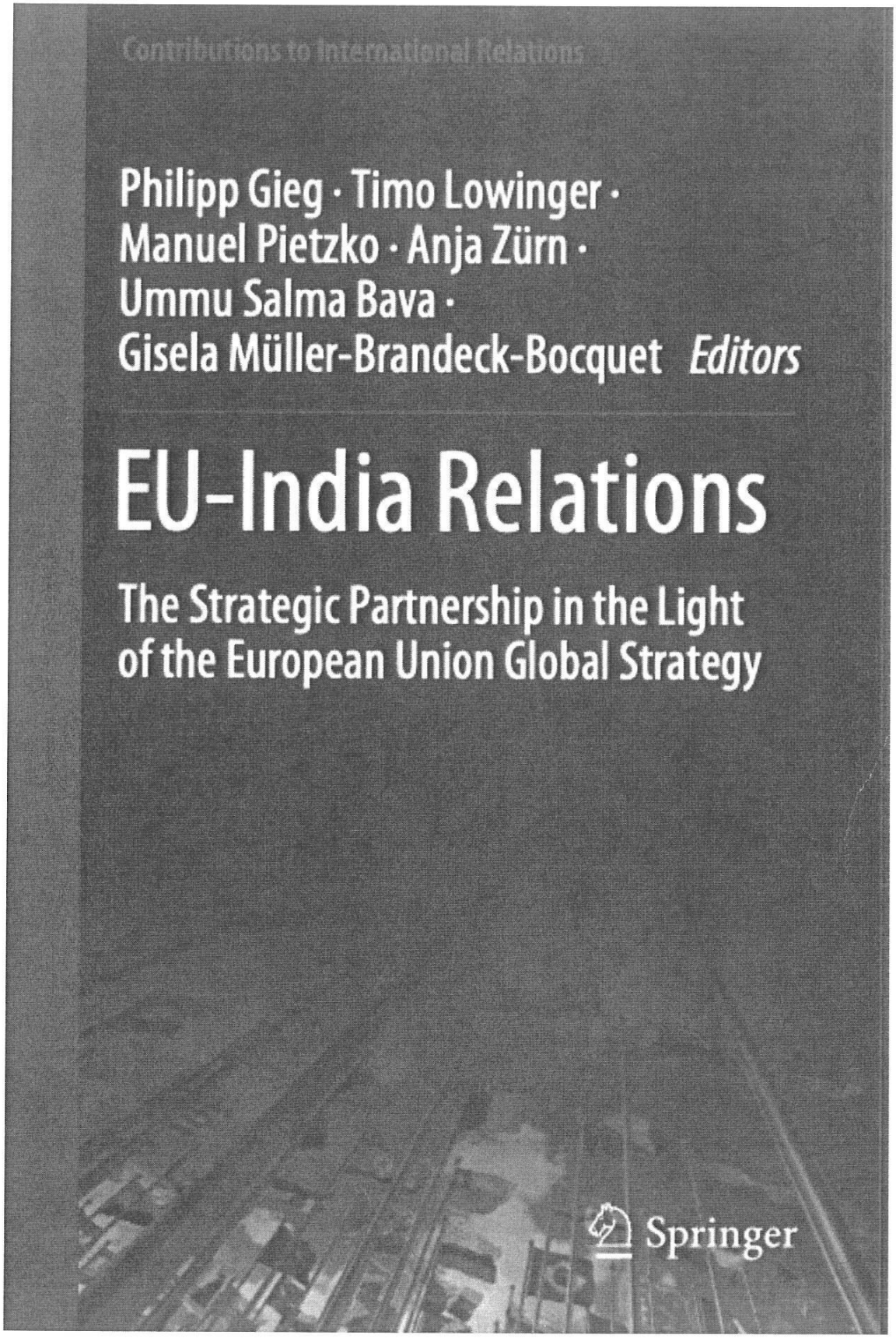
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Multilateralism in a Changing Global Order: Prospects for India–EU Cooperation



Manasi Singh

1 Introduction

Global politics is witnessing profound changes, and as a result, uncertainty looms large over the future of the existing world order. The trade wars, the retreat of the US from the Paris Climate Agreement, from the Trans-Pacific Partnership and from the Human Rights Council, China's assertiveness, and a rising tide of nationalist tendencies across the globe have put multilateralism and traditional forms of cooperation under strain. The post-1945 institutional architecture anchored in security cooperation, economic liberalisation and democratic solidarity is facing a crisis (Creutz et al. 2019). While global challenges rise unabated in number, scope and intensity, there has been a deadlock over developing a collective response to these 'pathologies of globalization' (Rüland 2018: 1). Combating pandemics such as COVID-19 has exacerbated the urgency to manage and address some of the long-neglected but pressing problems that threaten posterity. The crisis has further dented the multilateral architecture with institutions like the World Health Organization (WHO) coming under scrutiny. Rather than putting up a coordinated response, the COVID-19 crisis has intensified US–China rivalry and therefore impeded any collective response through forums like the United Nations (UN) Security Council, G7 or G20.

As an organising principle to regulate state interactions, the conventional form of multilateralism stands outmoded, as new forces cut across state boundaries and reconfigure the global landscape. Rapid proliferation of transnational actors has raised questions related to the legitimacy and accountability of formal institutionalised multilateralism. New forms of governance have emerged in the form of international alliances and multi-stakeholder partnerships, catering to diverse functional needs and requiring domain knowledge. This new form of multilateralism can be

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डा. श्रीष कुमार तिवारी,

प्रस्तावना

मानव शरीर पंचभूतों (अग्नि, वायु, आकाश, जल, क्षितीज) से निर्मित है, तथा जन्म से मृत्यु तक की अपनी यात्रा पूर्ण करके पुनः इन्ही पंचमहाभूतों में विलीन हो जाता है। तथापि अपने जीवन काल में यह देह वह माध्यम होती है जिससे सभी कुछ प्राप्त किया जा सकता है। वस्तुतः मानव जीवन का उद्देश्य ही पुरूषार्थ चतुष्टय–अर्थ, धर्म काम मोक्ष की प्राप्ति है। उपरोक्त उद्देश्य की प्राप्ति हेतु इस देह का स्वस्थ एवं शक्तिमान होना परमआवश्यक है भारत के सम्बन्ध में इसका अध्ययन करने पर पाते हैं कि हमारे मनीषियों, ऋषि–मुनियों ने शरीर के स्वस्थ रखने के साथ–साथ मन को भी स्वस्थ एवं ऊर्जावान रखने पर बल दिया है जिसका वर्णन पौराणिक ग्रंथो, वेदों आदि में प्राप्त होता है, इस सन्दर्भ में प्राचीन गुरूकुल पद्धति का विश्लेषण करें तो दृष्टगम्य होता है कि विद्यार्थियों के साथ अध्ययन के साथ– साथ उनके

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THE BELT AND THE ROAD INITIATIVE

Implications for India

Editor : Manish

ABOUT BOOK

The Belt and the Road initiative was unveiled by the Chinese president Xi Jinping in 2013. No wonder , this ambitious agenda has sparked a variety of reactions among governments throughout the regions. For Beijing, the BRI constitutes a grand strategy that integrates various factors in pursuit of China returning to great-power status without provoking overt counter reactions from its neighbours and the United States. To this extent, the BRI serves a number of China's core domestic, economic, and geopolitical interests. Undoubtedly, it is an umbrella initiative covering a multitude of investment projects with the aim of promoting the flow of goods, investment and people.

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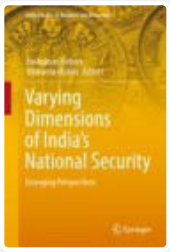

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India's Higher Defence Organisation: Recent Reforms and the Way Ahead

Arun Vishwanathan

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Abstract

Given the regional security environment, India's military and national security preparedness must be ready to face security threats a very short notice. Therefore, a robust higher defence management is critical to ensure that the Indian military is well-equipped, trained, and has clarity on its broader military objectives from the civilian leadership. These go to the issue of civil–military relations, security strategy, and better synergy and jointness among the

three military services. The Narendra Modi government has taken a very important step in strengthening India's higher defence set-up with the appointment of the Chief of Defence Staff (CDS) along with the creation of the Department of Military Affairs in the Ministry of Defence. In addition, it will also study the implications of the CDS on India's higher defence management and on the military's involvement in the national security decision-making process. The essay will also touch upon other important issues which need to be addressed for further shoring up of India’s higher defence set-up, viz., statutory recognition of the office of the National Security Advisor (NSA), need for specialists staffing higher defence organisations, and the need for a national security strategy.

Keywords

Indian defence forces **Chief of Defence Staff**

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GENDER CULTURE AND IDENTITY
in South Asian Diaspora Literature of 21st Century

South Asia, as a subcontinent, is a mosaic of diversity and confluence of different cultures, races, languages, religions, region, sects, caste, class, ethnicities, and, of course, nationalities and sometimes these differences clash with clash each other both 'within' and 'across' the national borders and at the same time tries to maintain the unity, peace and harmony with the bilateral tie and mutual respect to each other. The present book aims to explore how these South Asians divers communities live abroad. How do they retain, perceived and treat their won identities and the collective identity as South Asian starting from traders from ancient time, Indentured labors migrations from 19th century to the late 20th and 21st century trend of trained professionals like doctors, engineers, technocrats, entrepreneurs etc. What are their day to day issues and challenges in the 'host/other land'? One of the significant contributions of this book is the exploring of South Asian diasporas within South Asian countries such as Nepalese, Bangladeshis, Pakistanis, Afghan in India and the vis-à-vis. This redefines the 'South Asian Diaspora' which always defined in relation to the West or out of South Asia, and now being defined though internal perspective. The current book critically engages the scholars from Humanities and Social Sciences to study the issues and challenges of South Asian diaspora communities through multidisciplinary and interdisciplinary perspectives. It emphasizes how literature produced by the diaspora writers of this region manifest their experiences, socio-cultural and psychological conditions, and various other issues such as the issue of home, identity, culture, language, ethnicity, race, religion, gender, caste, nationality etc. It also traces the theme of hybridity, belonging, rootlessness, dislocations, assimilation, acculturation, alienation, and diasporic sensibilities. The scholars of this book contributed to the aspect of (re)presentation or misrepresentation of identities. The book also opened up the critical insight into the contemporary issues of nation/ality/sm, post-nation/alism, transnationalism, de/re/territorializing, cosmopolitanism, refugees, migration, Human rights and multiculturalism etc. The call for paper for this edited volume received good number of scholarly research articles form different researchers across the world. The present book critically engages into discussions on contemporary South Asian diaspora writings and how this literature emerged as distinct category in international academia. It also focuses on major issue of gender, culture and identity which are core theme to literature of diaspora in general and south Asian diaspora in particular.

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The present book explores the complex dynamics of diaspora identity of the South Asians, particularly the Muslim community, in America in the wake of 9/11 as it is depicted in select fictions. The terrorist attack of September 11, 2001, on the World Trade Centre New York, America, commonly known as 9/11 has drastic effecton both the Muslims in general and immigrant Muslims in particular across the world. This was a historic event because for the first time "the guns have been pointed the other way" (Chomsky *Human Nature review* 39). Noam Chomsky provides various reasons behind the attack of 9/11 from the Bill Clinton's attack on Sudanese Al-Shifa Pharmaceutical Plant in Khartoum to taking up power in Afghanistan. But what Although around 3000 American innocents died in 9/11 attack but the response to this attack in the name of "war on terror" killed millions of civilians along with army personals in Iraq, Afghanistan and Pakistan. Apart this 9/11 breaks the social relations between the White Americans and the colored people. Racism re-emerged in the guise of nationalism, the white nationalism, which led to the rise of Islamophobia, hatred against the 'colored' including the Sikhs and Hindus, vandalism, discrimination, attacks on immigrants, etc. Although the stereotyping and negative portrayal in the Western and Oriental discourses have resulted in enough anti-Islamic wave and unexpected phobias in societies about Islam and Muslims. But the tragedy of 9/11 added and magnified the proportion of hatred against Muslims. It pawed ways to America to open modern crusade against the resisting and revolutionary Muslim world. Its traumatic effect affected not just remained with the victims and their families but also the entire Muslim populace of America, Britain, Australia, Europe and Asia. Signs like Muslim names, dress code *Kurta-Payjama, topi, Burka/Hijaab*/Veil and beard were mis/interpreted not only as *signifier* of terrorist's identities but Derridian "transcendental *signified*" *(Derrida 110)* as well. Words like "Islam" and "Muslim" became synonymous with 'terror' and 'terrorist'.

In such circumstances Muslims of world in general and the Muslims in America torn between their loyalty to their motherland and allegiance to the country where they lived at present. They face identity crisis and dilemma. In Pre 9/11 era immigrants in general and Muslim immigrants in particular from South Asia and the Middle Eastern countries to the US and European countries lived under the constant shadow of xenophobia, racism, identity crisis, and other Diasporic hardships but 9/11 multiplied those hardships and transformed them to the *Islamocentric* where Muslims and Islamic identities became the prime target. The fractured psyches of Muslim forced themto face the Post 9/11 dilemmas of nationality, identity, ethnicity, culture etc. Disaporic Muslims started to feel nostalgic about their motherland (which some of them might have left centuries back), past and lost power and glory. They also felt that they belonged everywhere and at the same time nowhere. These conditions of South Asians migrants in general and Muslim in particular is depicted in handful of writing which is produced in post -9/11 ear mostly by Muslim writers of diaspora, what I tried to call it as *Muslim Literature in English after 9/11*. In this book I tried to critically analyze the post 9/11 conditions of the South Asian Diaspora in general and Muslim diaspora in particular in America and Europe by selecting Mohsin Hamid's novel *The reluctant Fundamentalist* (2007) which set in America and Monica Ali's *Brick Lane* (2003) which set in England.

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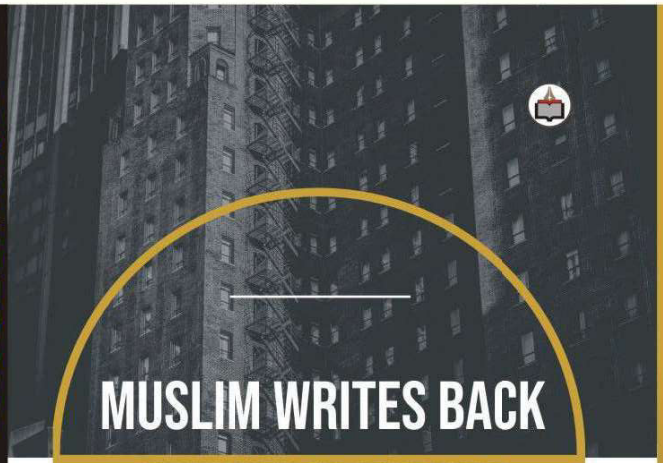
ISLAMOPHOBIA AND RESISTANCE IN SOUTH ASIAN DIASPORA NOVELS AFTER 9/11
Sajaudeen Nijamodeen Chapparban



MUSLIM WRITES BACK

ISLAMOPHOBIA AND RESISTANCE IN SOUTH ASIAN DIASPORA NOVELS AFTER 9/11

WITH SPECIAL REFERENCE TO MOHSIN HAMID'S THE RELUCTANT FUNDAMENTALIST AND MONICA ALI'S BRICK LANE

Sajaudeen Nijamodeen Chapparban

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Changing and dynamic world witnesses global transformation of functions, status, position, mentality, responsibilities and tasks of the educational system. Universities all over the world feel the urgent need to find new formats of activity as the university model is increasingly inconsistent with modern realities. Therefore, the university community thinks deeply about what is happening in educational systems and identifies possible scenarios for further developmentToday's students increasingly realize that their intellectual potential and the knowledge they receive must find practical use in real life. Unemployment, social injustice and the lack of social elevators force them to demand the content and quality of education. Such requirements contribute to the increase of moral and spiritual dimension in educational systems, educate future specialists in the need to serve their communities, and develop in line with universal fundamental values.The book 'Modern Critical Trends in Education' should make a significant contribution to improve the global transformation of the education system, to work out and analyze scenarios of possible events and strengthen the potential of education

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FOREWORD

We are happy that the book 'Modern Critical Trends in Education' has become an international platform for a fruitful exchange of views on extremely important issues, which are discussed by the number of researchers, educators, community leaders from Turkey, Ukraine, Germany, Israel, Albania and India.

Changing and dynamic world witnesses global transformation of functions, status, position, mentality, responsibilities and tasks of the educational system. Universities all over the world feel the urgent need to find new formats of activity as the university model is increasingly inconsistent with modern realities. Therefore, the university community thinks deeply about what is happening in educational systems and identifies possible scenarios for further development.

Today we globally observe the trends in education: rapid massification of higher education, rapid growth in the number of students in higher education; budget cuts in higher education; the technological revolution and the associated rapid development of distance learning technologies. We are not just moving from one university development paradigm to another, we witness a great diversification of university models. These trends are visible in almost all world education systems as universities become business corporations and follow the models of business companies.

Today's students increasingly realize that their intellectual potential and the knowledge they receive must find practical use in real life. Unemployment, social injustice and the lack of social elevators force them to demand the content and quality of education. Such requirements contribute to the increase of moral and spiritual dimension in educational systems, educate future specialists in the need to serve their communities, and develop in line with universal fundamental values.

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Dear colleagues, the book 'Modern Critical Trends in Education' should make a significant contribution to improve the global transformation of the education system, to work out and analyze scenarios of possible events and strengthen the potential of education and research to find out optimal ways to reform.

I would like to thank all the authors, wish them good health, new ideas, acquaintances and friends for further fruitful cooperation!

Prof.Dr. BORYS KHOLOD
President of Alfred Nobel University, Ukraine

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Panchayati Raj in India

Theory and Practice

by
Rajesh Kumar Sinha

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Panchayati Raj in India

Theory and Practice

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5

Working of Panchayati Raj Institutions in Odisha: An Overview

ATANU MOHAPATRA[6] AND RAMAKRUSHNA PRADHAN

INTRODUCTION

Panchayats have been the backbone of Indian villages since the beginning of recorded history. The institution of Panchayati Raj happens to be as old as Indian civilization itself. It was in existence since ancient periods, having an effective control over civil and judicial matters in the village community. Vivid impression and account of Panchayat system in the form of local administration can be found in the *Rigveda, Manusamhita, Dharmashastras, Upanishads, Jatakas* and others (Ghosh and Pramanik, 1999).

The word Panchayat is derived from the word *pancha panchasvanusthitah,* referring to the existence of Grama Sanghas or rural communities. Panchayati Raj Institutions, as the grass root units of local self government have been considered as instruments of socio economic transformation in rural India with involvement of people at the grass root level for bringing about socio-economic development. PRI has been identified as institutional expression of democratic decentralization in India. Decentralization of power to the Panchayats is seen as a means of

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Evolution and Pattern of Indian Outward FDI in ASEAN Region

Jaya Prakash Pradhan, Tareef Husain** and Ravinder****

ABSTRACT

This study focuses on the evolution of Indian outward foreign direct investment (OFDI) flows into the Association of South-East Asian Nations (ASEAN) region since 1980. It describes the changing nature of ASEAN focused Indian OFDI and infers about the causes behind such changes over different periods. It highlights sectoral composition, ownership structure, firm size, and acquisitions that most visibly characterise patterns of investments undertaken by Indian firms in ASEAN region. It also briefly discusses the development impact of Indian FDI in ASEAN. Indian OFDI in ASEAN region has been found to be concentrated in Singapore followed by Malaysia and others. The major sectors in which investment is being done in ASEAN region include services like transport, storage and communication, financial, insurance, real estate and business services while in manufacturing sector most of the investment is in the transport and motor vehicle equipment. The main motivations of Indian firms might be to improve the market strength or to seek assets, business strategies and resources in ASEAN countries.

Keywords: *Outward FDI; Multinational enterprise (MNE); India; ASEAN.*

1.0 Introduction

Rapid growth in the internationalization activities of firms has been a major feature in the context of liberalized and highly growing Indian economy since 2000s (Pradhan & Das, 2016; Sauvant *et al*., 2010). A sharp increase in Indian outward FDI (OFDI) flows during the past two decades targeted at the world market is intrinsically linked to a marked rise in such OFDI flows directed at the ASEAN region.

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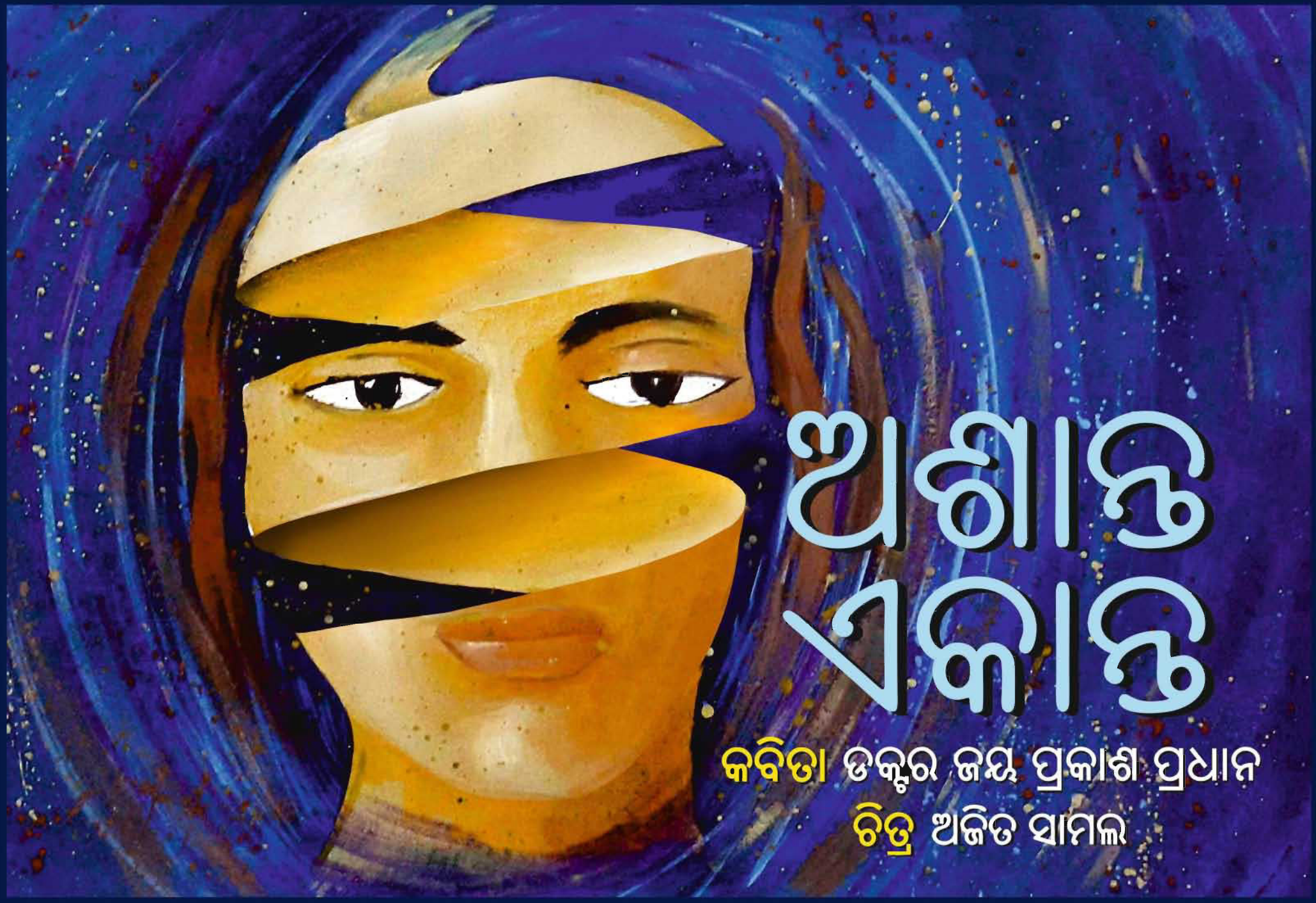
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Paintings by: Shri Ajit Samal
Neither Here Nor Otherwhere!
Poems and watercolours



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Whither? Otherwhere?

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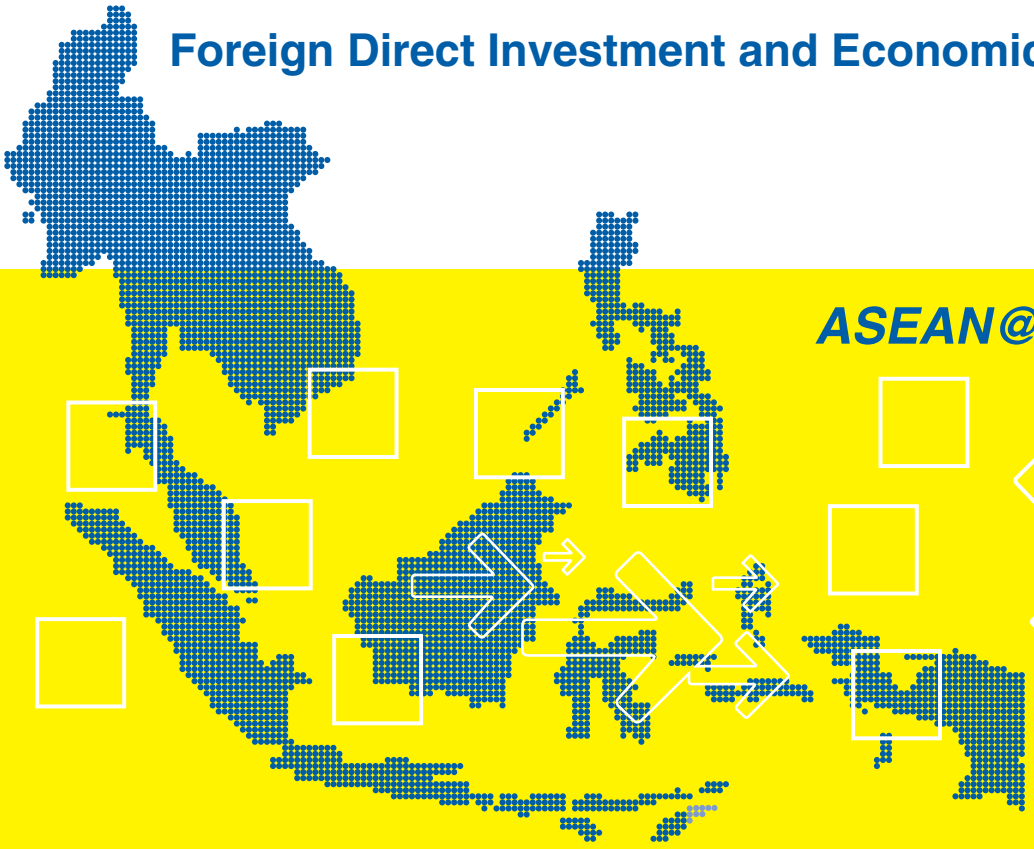
ASEAN Investment Report 2017

Foreign Direct Investment and Economic Zones in ASEAN



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The Association of Southeast Asian Nations (ASEAN) was established on 8 August 1967. The Member States are Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.
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Disclaimer

The ASEAN Investment Report is produced to facilitate a better understanding of FDI developments in ASEAN. The findings, interpretations, and analysis in the Report should be treated with care, as work on harmonising and improving FDI quality across the region is on-going.

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FOREWORD

FDI flows into ASEAN in 2016 remained high despite a decline to USD 97 billion, which reflects the general downfall trend of global FDI flows into the developing economies. FDI flows from most ASEAN Dialogue Partners and intra-ASEAN investment actually increased, with the latter reaching an all-time high and accounting for a 25 per cent share of FDI flows into the region. However, these increases were not enough to help overcome the decline which was due to divestment, acquisition of foreign assets by ASEAN companies in their home countries and repayment of intracompany loans by affiliates within the region.

Many foreign companies have a long historical association with the region, some dating as far back as the 1800s and they continue to invest and expand in the region. This year's Report examines the historical investment development of two Dialogue Partners of ASEAN, namely the European Union (EU) and India. Major multinational enterprises (MNEs) from these countries have been present in ASEAN in a wide range of industries. Many of them operate in multiple locations across the region in different segments of the value chains.

This year's Report also features the development of economic zones in ASEAN. This is a welcome follow-up to the "ASEAN Guidelines for Special Economic Zones Development and Collaboration" adopted by ASEAN Economic Ministers (AEM) in 2016. ASEAN has at least 1,600 economic zones of various types. These zones, ranging from free trade zones, export processing zones, IT parks to mega special economic zones, have played a significant role in the socioeconomic development in the region and in attracting FDI. Given the rapid economic growth and demand, ASEAN Member States continue to develop more economic zones to boost FDI. Policy makers, entrepreneurs, and other stakeholders may find this Report useful in understanding economic zones in ASEAN, as well as the business and investment development in the region in general.



Le Luong Minh
Secretary-General of ASEAN

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Women in Household Economy



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Editor
Archana Sinha

WOMEN IN UNPAID WORK IN INDIA: AN ANALYSIS

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Abstract

The economic value of women's household activity has largely remained underestimated, even neglected, by contemporary economists. The social and economic importance of the household work has been ignored in the literature. Mill and Jevons favoured the traditional sexual division of labour within the household. According to them women's domestic activities form an important aspect of the role of women within society. However, they refuse to recognize the economic value of women's work. Some economists such as Galbraith admit the existence of an economic value of the household activity. Several arguments have been developed in order to include this activity in the Gross Domestic Product. However, all these efforts are still in an embryonic stage and there has been no economic measure of the household activity. These current difficulties stem in part from the fact that women and their economic role have for a long time been ignored by mainstream economists. In addition to these domestic duties, a large proportion of women work as unpaid workers in family farm and family enterprises. However, all this unpaid work goes unrecognised. The National Sample Survey of Indi[illegible]rries out

11 Effects of Public Spending on Quality of Elementary Education in Bihar

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Abstract

This paper is designed to measure the impact of public spending on the quality of elementary education in Bihar. However, it is necessary to stress quality over quantity. Because lack of quality of education leads to wastage of human capital and also restrict for higher-level of education. Though it is required to evaluate the efficiency of public spending on elementary education which is a rudimentary stage of education. Therefore, this study is a way forward to another study because an attempt has been made to measure the quality of elementary education through the lens of public spending. However, public expenditure is one of the crucial variables that affect the educational outcome such as enrolment ratio, drop out ratio, learning skills of students, and so forth. Moreover, public expenditure on elementary education has a positive impact on the drop out ratio and enrolment number. But public expenditure has the least impact on the learning achievements of students in elementary education. . Basically, this study will examine the trends and patterns of public expenditure and their impact on the educational outcome. Although, secondary data has been employed to measure the effects of public expenditure on the quality of elementary education. Apart from that appropriate statistical and econometric tools and techniques are used to measure the quality of elementary education in the state of Bihar.

Keywords: *Public Expenditure, Education, Quality of elementary education.*

"The most distinctive feature of our economic system is the growth in human capital. Without it, there would be only hard manual work and poverty".

T.W. Schultz

Introduction

Public expenditure is an expenditure done by the government to fulfill the collective wants or needs of a country or any nation. Even though the importance of public expenditure has been accepted by various economists such as Wagner and John Maynard Keynes and also advocate the importance of public expenditure on education. As Wagn[illegible]d expenditure on "Culture and

Labour Mobility in Historical Perspective from East U.P, South U.P and North Bihar: Contours of Changes and Continuity



Tulika Tripathi

Abstract Mobility is a fundamental trait of human beings, from the memory immemorial. However, its duration and location and the characteristics of mover keeps on changing. In this paper, we have tried to understand the present nature of mobility over two decades, i.e. 1996–2016 for two regions of Bihar and Uttar Pradesh, which remained to be a poverty concentrated zone in India. In this paper, we have contextualised current pattern of mobility in context to the past patterns of mobility, since mobility is very closely related with the resources and social capital of an individual to which she/he belongs and the source and destination locations. The short run mobility and circular migration has increased among men and new and richer locations to move have been opened during this time period. People from this region have started to migrate to Gulf countries which was earlier only limited to migrating to domestic destinations, that too particularly to Mumbai, Delhi, Gujarat, etc. While long run circular migration has seen new destinations, short run local migration to the same district have increased many folds. Survey observation suggests that the expansion of real estate and service sector have created low skills job catering to flexible job requirements of low skill agriculture workers and small farmers of the same district. However, having stated the change in the pattern of mobility, not everything has changed. The mobility pattern across the socio-economic group remains the same. To be more clear, poor, less educated moving to nearer destinations and better off moving to far off destinations is evident. And returns of those moving to far off places are higher than those moving to nearer destinations. Similarly, those moving to far off place do so for longer durations and those moving to nearer destinations are moving for shorter durations. Further, this paper has looked at the change in road and transportation and banking and financial services as an enabler of frequent mobility and mobility to far off places. Survey results suggest large improvement in terms of road quality and reach of road to the villages. Due to better road networks mostly private transportation like taxi and auto have reached to these villages taking many workers every day/week or month to their respective work locations. These villages now have taxi and auto stand, banking facilities such as ATM, internet and

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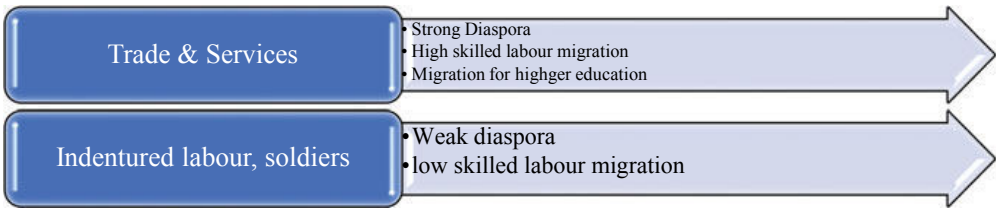
post offices, enabling frequent mobility at one end, and enabling mobility to far off places for longer duration at the other. Since it has eased to reach homes quickly in case of any emergency or to send money as and when needed. So in nutshell, far off destination to move is opened, short run circular migration has increased. However, the characteristics of those migrating to various places for different locations remains the same. Road, transportation, ICT and financial services have played a very important role in changing the nature of mobility from this region of India.

1 Introduction

Mobility has always been an intrinsic part of human civilization. People need a certain minimum of social and economic resources in order to be able to mobile. It is, therefore, no coincidence that wealthy people and societies tend to be generally more mobile than relatively poor people and societies (Haas 2009). A fundamental paradox is that while constraints are likely to motivate people to move, but at the same time they need resources to do so. Thus, mobility is both a cause (among many) and a consequence (among many) of processes of social transformation, which underpin living standard and livelihood expansion. Mobility begets access to resources and better access to resources facilitates mobility. Therefore, historically, people from wealthy regions have been more mobile than poor regions and/or mobility have made those regions richer. People from south and west regions of India, especially from the coastal belt, i.e. Kerala, Gujarat and Tamil Nadu, have been migrating for trade and services and not just as labourers. Therefore, we find a very strong Gujarati and Tamil/Telegu domestic and international diaspora (Tumbe 2018). Further, the migration literature suggest the crucial role played by social networks in helping people at both the places; origin and destination (Mani and Riley 2019; Bertoli and Ruyssen 2018; Bashi 2007). These social networks in form of linguistic and regional diaspora help people from their background to enter the new destination. Helps include information, job offers, accommodation, economic support, social relations, etc. Of all these access to information is so important that it restricts mobility within the same group of people and/or area flowing through these diaspora. Conversely, relatively lower long term spatial mobility and smaller information sets have reduced the chances of acquiring capital among many social groups, including the Dalits and Adivasis, and also stunted the development of their diasporas (Tumbe 2018). The links established by the Punjabis, Gujaratis, Malayalis and Tamilians during the colonial period were critical in extension of their internal and international diasporas. They were followed globally by the Telegus and Kannadigas, while erstwhile dominant UP and Bihari lagged behind in relative terms. Because, migration from UP and Bihar was in form of indentured labourers and recruiters in British Army had no agency to create a strong social network. Therefore, we still find the historical streams and pattern of migration and more mobile regions are wealthiest ones and

vice versa. Here, two things are important; pattern and type of activity of migration/migrants. In light of historical facts, one can observe the following pattern of continuity in the mobility of people.



A case of East and South UP and North Bihar: If we believe in eastward migration hypothesis into Indo-Gangetic valley it received inward migration between 2000 BCE and 300 BCE and even after that (Tumbe 2018). Bihar and Uttar Pradesh are located on the great filed of Ganga Yamuna doab of Indo-Gangetic valley. These two states have most fertile lands, excellent environment for cattle rearing, full of natural resources and traditionally well-fed people. Therefore, it naturally led to a dense settlement of population in this region and less mobility of the people from this area. Measures like passport, taxes on using roads and crossing border during the Mauryan period might have further prevented in/outmigration. Also, this region in the north is blocked by great Himalayan range where the passes are snow blocked, therefore, no going towards East Asia and no trade, social and culture exchange was possible. On the other side, Ganga Yamuna doab had rivers, dividing it from Delhi and northern India. That is why we find limited domestic circular migration from this belt to other parts of country for religion and trade, etc.; Ashoka and Mahavira are two great religious migrants of Bihar. However, in modern times, i.e. pre-independence period, the majority of migration remains limited to indentured labour for plantation and recruitment of soldiers in British Army during World War II from this region. These two groups; one working as slave and other as soldiers would have little agency and capacity to establish a strong network with the people of the place of origin and destination. That is why there is no singular diaspora emerged from this side. Bhojpuri diaspora is identified very late which might loosely cover this area. This diaspora particularly emerged in Africa and East Asia (Trinidad, Fiji, etc.), with no connection whatsoever with the people of Uttar Pradesh and Bihar. Nationally, during Independence movement and after that there was migration from this region to northern India and especially Delhi. Many political leaders like Rajendra Prasad, Pandit Nehru, Shastri, Lohiya and so on so forth migrated from UP and Bihar to Delhi. Thus from this region in near history, we see mostly domestic and circular migration towards northern India particularly Delhi. This migration then was not remained limited to political leaders, and since then the spur of migration ever increasing for services and labour. Uttar Pradesh harbours nearly one-fifth of India's population and it experienced net outflow of 2.7 million people during 1991–2001. Similarly, Bihar also registered the same phenomenon where the net outmigration is around 1.7 million people during the same time period. Rural to urban migration, which from

18 to 38% of intra-state and inter-state migrants, respectively, is predominantly a phenomenon among males (Bhagat and Mohanty 2009).

2 Data

The present study is based on LSMS-I (Living Standard Measurement Survey-I) and its repeat survey (henceforth LSMS-II). LSMS-I was carried out in 1997 by the World Bank and LSMS-II is carried out by us in 2017. The survey was focused on migration and poverty belt of India, which is Eastern and Southern Uttar Pradesh and Northern Bihar. LSMS-2 selected 21 villages out of the original 124 villages of LSMS-1 and revisited same households to construct a panel of households and members. Thus, we have cross section data of around 900 households for two points of time, which is 1997 and 2017. Remarkably, 1990s are the time when road, transportation and communication started expanding in India. Globalisation and capitalist expansion ensured that infrastructure and market expansion took over which have led to increase in labour mobility. The present work uses this household data from two time periods by forming a panel of households to look at labour mobility characterised by the endowment and social characteristics of household. Against this backdrop the present paper is focussed on these two backward states of India, Uttar Pradesh (U.P) and Bihar which have very low level of urbanisation and are considered to be poverty and outmigration belt of India. The migrants from these regions are often more disdainfully referred as 'Bhaiyas'.

The paper is an attempt to understand the mobility and its pattern in this belt. The key to understanding migration in India is by looking at the two Ds, i.e. duration and destination of migration. The paper is organised as following: Sect. 3 examines changes in two decades in duration of mobility using LSMS data of Uttar Pradesh and Bihar. Section 4 analyses the change in destination of migration. This entire analyse is done in the three districts of Uttar Pradesh and four districts of Bihar, which is part of East U.P, South U.P and West Bihar. Section 5 shows the availability of road and transport and its role played in migration. Further, Sect. 6 looks at the availability of banking and communication, and its role played in recent change in migration. Further, Sect. 7 uses the household endowment of vehicle and its impact on pattern of migration.

3 Duration; Short Run and Long Run Mobility

In case of UP and Bihar, the structural transformation led to decline in agriculture profitability but didn't lead to the growth of secondary sector. The growth of tertiary sector and real state have mostly created low level work (ILO 2017, Jha, undated, FICCI 2015). Due to which employment elasticity and agricultural wages fell in both the states (Chavan and Bedamatta 2006, Jha undated). As a result, we see lots

of labour force moving out of agriculture and joining the casual labour force in construction and services.

Continues: There could be various forms of mobility, often distinguished on the basis of duration and destination. It is true that there has been faster mobility of labour in recent times. Its quantum has increased significantly, be it to nearby or far off places. Mobility of labour to adjacent town or city accompanied by better connectivity has changed the earlier form of mobility which was of longer duration. The shortest duration migrations of less than a day or week are called commuting and affect over 10 million people around the major urban centres. Slightly longer duration migrations, in spells of a few months each, with no spell lasting more than six months is known as seasonal migrations/short run migration. Short run migration has increased from 1996–1997 to 2016–2017. A larger part of labour is resorting to short run migration in our survey data as compared to earlier round. By default, short run migration is mostly possible in case of places nearer to residence. It is shown that short run migration is mainly observed in the same district and long term mobility is to far off places. We distinguish these two forms of mobility based on duration. Short run migration are those who report to be at home for nine or more months and long term mobility means who are reported to be at home for less than nine months. Means short run migrants are circular migrants they go for shorter duration often for 2–3 months or lesser, while the long run migrants visit home annually or biannually and therefore remains absent for entire year. Increasing urbanisation, expansion of city boundaries, higher demand for labour in nearby towns, expansion of construction and transport industry, better rail and road connectivity, lowering down of transportation cost and declining family size have promoted short run migration. Construction sector is the most favourable destination for short run migrants as it provides necessary flexibility to match up with seasonality of agriculture. Moreover, labour absorption in agriculture is also going down. Transport sector has also contributed in short run migration. Works like rickshaw pulling, taxi/auto/bus/truck driving provide flexible working period and thus could be combined with farming activities. Therefore, it is most convenient for rural labour to seek job in these sectors and, therefore, we observe an expansion in activity status of individuals as daily wage labours. When we compare short run mobility (Tables 1 and 2) and long term mobility in LSMS-1 and LSMS-2, we find that people moving to far off places have increased. Interstate mobility was quite low in LSMS-1, but it has registered substantial presence in LSMS-2. International mobility is also observed in LSMS-2, particularly to middle east. In the past decade, the locus of emigration to the Gulf shifted from south India to north India, and the Bhojpuri speaking tracts of eastern Uttar Pradesh and western Bihar dominate the unskilled labour flow outside India, much like a century and a half ago. The billions of dollars of remittances from the Gulf that once touched the west coast of India have finally made its way to Ganga.

Further, males are larger in numbers in mobility as compared to women (Table 3), another historically established pattern, remains the same. For instance, between 1838 and 1917 over 2,00,000 Indian labourers migrated to British Guiana and less than a third returned to India. Almost all the migrants traced their roots to the

Table 1 Short run mobility for economic activity: 9 months or more at home

	LSMS-1			LSMS-2			
District	Same district	Other districts-same state	Other districts-different states	Same district	Other districts-same state	Other districts-different states	Total
Jehanabad	67.24	23.84	8.92	88.17	12	0	100
Saharsa	1.45	29.5	69.05	73.5	3.03	23.47	100
Vaishali	37.93	37.93	24.15	90.52	9	0	100
Banda[a]	69.09	22.14	8.77	96.13	4	0	100
Allahabad	73.05	5.25	21.7	95.59	4.41	0	100
Gorakhpur	83.94	8.03	8.03	96.31	2.88	0.82	100
Total	56.74	17.59	25.67	90.45	5.63	3.92	100

[a]Now known as Chitrakoot
Source LSMS-1 and Field Survey

Table 2 Long term mobility: less than 9 months at home

	LSMS-1				LSMS-2				
District	Same district	Other districts-same state	Other districts-different states	Outside India	Same district	Other districts	Other states	Outside India	Total
Jehanabad	76.45	10.08	13.47	0	0	13.68	86.32	0	100
Saharsa	0	12.41	87.59	0	1.03	4.09	94.87	0	100
Vaishali	31.99	36.02	31.99	0	0	8.02	90.69	1.3	100
Banda[a]	47.22	5.56	47.22	0	3.98	6.68	89.34	0	100
Allahabad	0	50	50	0	4.32	11.45	80.19	4.04	100
Gorakhpur	0	24.15	51.7	24.15	0	1.09	76.23	22.68	100
Total	21.94	21.35	52.14	4.56	1.57	5.95	85.3	7.19	100

[a]Now known as Chitrakoot

Source LSMS-1 and Field Survey

Table 3 Economic activity by sex- LSMS-2

	Short run mobility			Long run mobility				
Sex	Same District	Other districts-same state	Other districts-different states	Same District	Other districts-same state	Other districts-different states	Outside India	Total
Male	89.69	5.26	5.05	1.39	5.48	85.82	7.31	100
Female	91.27	6.03	2.7	3.07	4.21	87	5.73	100
Total	90.45	5.63	3.92	1.5	5.4	85.89	7.22	100

Source Field Survey

Bhojpuri-speaking tracts of the Gangetic plains, a core area of the Great Indian Migration wave. Only a sixth were upper castes, rest of all were from low caste or outcaste and middling artisan and agricultural castes and mostly men (Tumbe 2018). Further, if we solely look at the change in duration of migration, pattern almost continues for the long run migration over the two-decade time period. There is almost no change in individuals migrating for 9 or more months in one spell. And the short duration of migration 4–6 months and 7–9 months shows slight increase followed by almost similar decrease in migration for shorter duration, i.e. 1–3 months (Fig. 1).

Our analysis of over two decades time period suggests that not much has changed in the duration of migration besides a small increase in migration for 6–9 and 4–6 months in one spell (Tables 3 and 4).

Changes: Further, our survey from the two rounds over two decades time suggest the change occurred between SES communities in duration of migration. In fact, individuals from the well-off communities, i.e. upper caste, higher MPCE class and land class are migrating for longer duration; they are absent for the entire year. The gendered pattern of migration remains the same; a one of flow for men and fixity

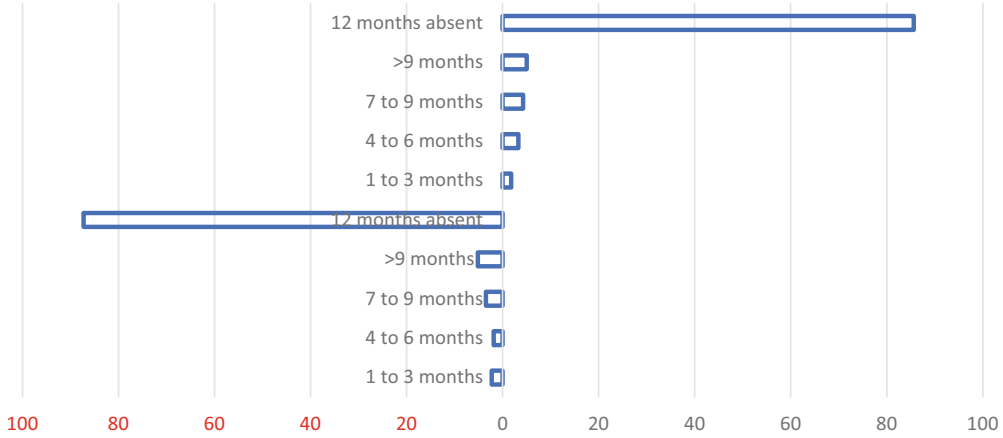


Fig. 1 Change in duration of migration from 1997 to 2016 *Source* LSMS-1 and Field Survey

Table 4 Duration of migration (East UP & West Bihar)

	1997					2016				
	1–3 months	4–6 months	7–9 months	>9 months	12 months absent	1–3 months	4–6 months	7–9 months	>9 months	12 months absent
Male	2.56	2.73	5.8	6.66	82.25	2.85	6.2	7.39	8.84	74.71
Female	1.95	0.88	0.78	3.41	92.98	0.82	0.29	1.35	1.31	96.22
Upper caste	2.92	0.97	2.19	13.63	80.29	0.47	1.17	2.1	8.41	87.85
OBC	1.99	2.19	2.98	2.78	90.06	1.52	3.79	3.46	5.1	86.13
SC/ST	2.22	2.05	2.73	1.54	91.47	2.64	3.44	5.91	2.64	85.37
Muslim	2.58	1.55	10.82	10.31	74.74	0.9	1.49	4.48	12.54	80.6
Poorest	1.76	3.27	5.29	1.51	88.16	4.23	5.71	6.98	5.71	77.35
Poorer	1.94	1.94	3.87	2.66	89.59	0.8	2.59	3.69	5.78	87.14
Poor	1.19	1.9	2.14	2.38	92.38	1.07	1.95	3.31	2.63	91.03
Rich	2.99	2.35	3.84	6.18	84.65	2.03	3.55	3.95	5.17	85.31
Richest	3.21	0.2	2.41	11.45	82.73	0.87	2.73	3.6	6	86.8
0−0.5	2.74	1.92	4.25	5.62	85.46	2.26	3.72	4.17	3.92	85.94
0.5−1	1.31	3.49	4.37	1.75	89.08	0.28	2.92	4.18	5.71	86.91
1–3	1.57	1.39	2.61	6.96	87.48	1.26	2.09	5.13	7.54	83.98
3–5	0.49	2.43	3.4	1.94	91.75	4.6	5.17	4.6	5.75	79.89
5+	3.71	1.31	2.84	5.24	86.9	0	1.99	1.32	5.96	90.73

Source LSMS-1 and Field Survey

for women. Men leave their wife at home to take care of the surviving parents and entire family mostly moves if the parents have passed away (Tumbe 2018). The long duration migration for men has reduced by 10% while it has increased by 8% for the women. If we analyse these numbers with the change in duration of mobility across land class and MPCE quintiles, we find that there is rise in the long run migration for well-off individuals, individuals from large landholding and higher MPCE quintiles. The result also suggests that in cases of long term migration men travel frequently to the native place, to run farming on inherited land, while women doesn't need to do the same. Long term migration has increased for upper caste individuals from 80 to 87% over two decades while other categories of short run migration have declined. Short duration migration increased for OBC and SC/ST and long duration migration declined. Interestingly there is a rise in Muslims migrating for longer duration. It is backed by the historical waves of migration of weavers, especially *Momin* Muslim communities migrated towards the textile towns of Bombay in the nineteenth century. It has contributed to the emergence of a new corridor being established towards Maharashtra (Tumbe 2018) followed by Surat in the twentieth century (Field survey of weavers of Varanasi 2012). Within the MPCE quintile poorer individuals are doing short duration migration. Short duration migration of 1–2 months and seasonal migration of 4–9 months have increased over two decades time period. While the richest individuals are moving for longer duration, the biggest contributor to this group is women relatively to men (Figs. 1 and 2). If we look at the land class category it reinstates the same argument of increasing absentee landlords, where the long run migration have increased while individuals from the smaller landholding groups are either short run or are seasonal migrants. This also shows the reduced profitability and lucrativeness of agriculture as an employment opportunity.

Therefore, while the pattern of migration between male and female and SES category remains the same, i.e. better off moving out first either permanently or for longer duration, poorer communities are short run and seasonal migrants, mostly migrating for shorter duration. But the pattern of duration of migration has changed in two decades time period, frequent commuting and seasonal migration are replaced by long duration migration by better off individuals. It also shows that Lewisian turning point never occurred in this part of India, as individuals still rely on income from agriculture back at home. This result also indicates the lack of well-paid and secure, permanent jobs for individuals in the cities, along with higher cost of living.

Thus today, male migration from East UP and West Bihar extends in all directions within the Indian subcontinent, especially westwards and southwards, with a new line opening to the Gulf countries particularly for semiskilled and unskilled workers. While Gujaratis and Punjabis dominated the earlier waves of migration, the later phase was dominated by South Indians, especially Telegus and Tamilians, current wave of migration is dominated by UP and Bihar. However, the migration from UP and Bihar in comparison to South Indians, Gujarati and Punjabis restricts to domestic migration and of low skilled labours.

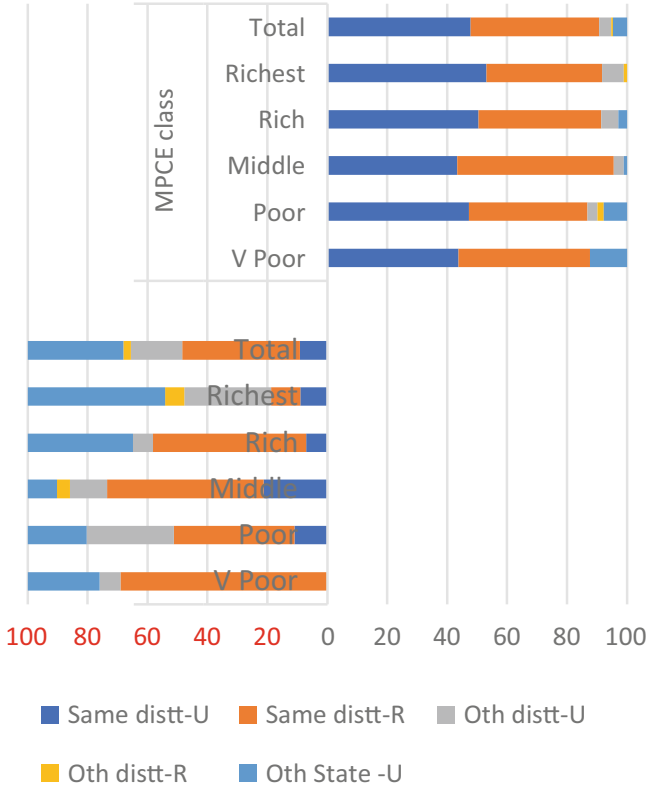


Fig. 2 Change in destination of migration in East UP and West Bihar—Income class *Source* LSMS-1 and Field Survey

4 Destination of Short Run and Long Run Mobility: Changes

Urban centres are always preferred destination, be it now or two decades ago, as Lewis theorise in his dual sector model. The migration destination to same district and other districts in the same state was mostly used by poor MPCE quintiles and land class, however, the rich and upper caste also migrated to urban centres of other states (Table 5 and Figs. 2, 3, 4). Over two decades the class-caste pattern of migration remains the same, the change, however, occurred in terms of tremendous increase in migration within the same district and sharp decline in migration to other states. Further, the decline in migration to other states happened among upper caste, higher MPCE quintile and higher land class. From our field survey, we understand that the rising service and construction sector in the small towns and cities have generated some job opportunities there, which not only made the cities like Allahabad, Gorakhpur, Patna more employable but increased the short run migration and, therefore, frequent commuting by the poorer communities. It has also increased the migration to the nearby urban centres. Thereby also increasing frequent commuting and seasonal migration.

Table 5 In 1997, only about 4% of the population was working outside, which rose to 10% by 2017

There is a bare increase in women working outside the village in comparison to men						
	LSMS-1 1997			LSMS-2 2017		
Sex	Same village	Outside village	Total	Same village	Outside village	Total
Male	94.3	5.7	66.7	79.7	20.3	45.5
Female	99.3	0.7	33.3	98.7	1.3	54.5
Total	96.0	4.0	100.0	90.1	9.9	100.0

Source LSMS-1 and Field Survey



Fig. 3 Change in destination of migration in East UP and West Bihar—Land class. *Source* LSMS-1 and Field Survey

5 Availability of Transport and Communication

Apart from sustained labour demand in an increasingly multi-polar world of multiple migration destinations, mobility seems to have been further spurred by reduction of travel costs and the revolution of communication technology, connecting people over increasingly distant places (cf. Castells 1996). Expansion of transport and communication has also contributed in labour mobility. Therefore, it makes sense to examine

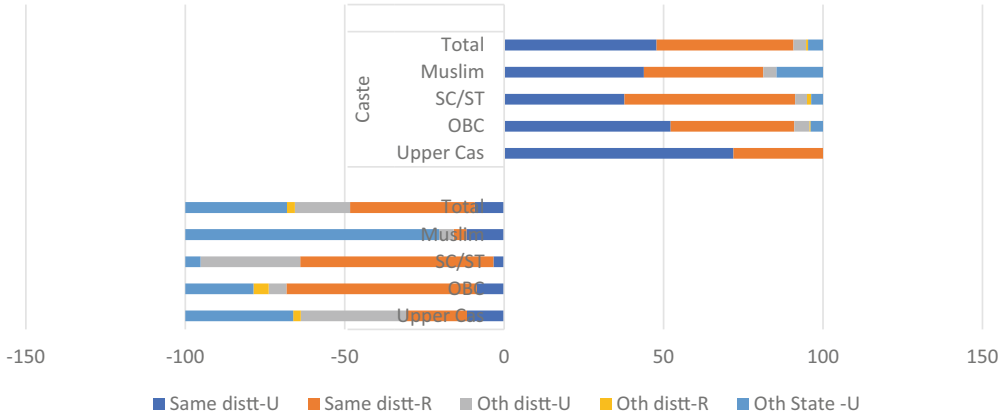


Fig. 4 Change in destination of migration in East UP and West Bihar—Caste. *Source* LSMS-1 and Field Survey

this. In this section, we have analysed village level availability of road, mode of transport and communication. We also include financial facilities as it might have a role in reducing frequent commuting and promoting long term mobility. Our field data shows that almost all villages have road connectivity, mostly metalled road (*pacca* road). Out of 21 villages of our sample, 6 villages have paved roads and only 1 village has trail road. Retail trade has witnessed phenomenal expansion in India and there has been diversification of consumption basket of rural population, away from food to non-food consumption. Consumer goods have entered into consumption basket. A barter-based village economy has been converted into cash transaction. Selling of surplus to market and filling deficit by buying from market is a growing practice in rural India. Thus, market has reached rural India in a big way in post globalisation era. This has been facilitated by better transport, communication and banking system. Thus, private means of transport like taxi/auto have emerged as the main mode of transport to cities from these villages. Public transport like availability of bus stops is still limited. These privately run shared vehicles though cater to the need of the most villagers but their frequency could depend upon the availability of number of passengers and sometimes could be very infrequent. It has surely improved the connectivity of the villages to the cities. Yet it is still a constraint for women, women with children, older and disabled. Particularly the running time of these taxi/auto matches to the mobility requirement of labourers, i.e. early morning and evening and, therefore, limiting the mobility for rest of population. Therefore, our results of migration pattern between male and female shows still relatively migration from this belt is male dominated. The increase in volume of migration is also because of improvement in road and connectivity. However, transport facilities and their stops are generally at the prime location of villages, which also require substantial distance to cover particularly for the labourer class as they often live in the farthest corner of village. This distance has to be covered by foot, further limiting the mobility of most needy with already burdens/sufferings, women and young mothers. This is one of

the reasons for women staying in the villages and demanding work near their homes and limiting the mobility of women for economic activities (Table 6).

6 Availability of Communication and Banking

Apart from road transport, better communication and banking system has also influenced labour mobility. It has also impacted on type of labour mobility. Faster communication has removed the compulsion of staying near to family and, therefore, might have worked as incentive for long term mobility. But, this also means more frequent visit to the village, thereby reducing duration of migration and converting erstwhile long term mobility into short run mobility and frequent commuting. Moreover, changes in banking system have ensured that workers do not need to visit village to hand over earnings. Rather, this is done through banking system or through various apps. Nevertheless, it cannot be said with certainty in what direction this impact has been. But it is sure that labour mobility has been impacted by these changes. Mobile phone has reached every household. In our focus group discussion, villagers reported that in 1996–1997 only 'big people' (*Bdaka ghare*) have telephones, but now every individual in household has mobile as reported in the asset section of our survey. Once upon a time what was done by money order facilities in post offices, with further improving to the money order delivered at doors, making it easier for homebound women to receive money. And easier for males to go far off places (Table 7).

We have further looked at the availability of banking system and internet in the villages. Various researches have suggested that banking system has eased the fund transfer and thereby reduced the limitation to work closer to home (IFAD 2009; Madianou and Miller 2011; Mashayekhi and Branch 2015; Orozco 2016; UNCTAD 2015). Similarly, the internet has played a huge role in terms of sending and receiving information through mobile phones, internet, and many apps (Horst 2006). Our FGD in these villages suggest that people remain connected with their employers through phones and WhatsApp. The young and educated also use it to search and fill online job vacancies. Many researchers have found similar results. None of our study villages have these facilities, though they are available in the nearby towns and it takes on average 15 min to an hour to reach these facilities. Cheaper mobile data have also eased the access to internet through mobile phones. After foot, bicycle and followed by motorcycle is the most frequent used transport to reach to these facilities. We looked at ownership of these vehicles by the distance covered by the villagers. The bicycle is the most common mode of transport and ownership of motorised vehicle remains very low. Therefore, no wonder we see most people covering these distances on foot. This indicates communication has favoured the rich, youth and male and, therefore, higher mobility of this group.

Table 6 Road and transport 2016–2017

District	Village	Road type	Bus stop (no)	Distance to facility (in Km)	Transport to reach to facility	Time taken to reach in mnt.	Taxi/Auto stand (no.)	Distance to facility in Km	Transport to reach to facility	Time taken to reach in mnt
Jahanabad	Ismailupr	Pakka road	2	3	Foot	0.45	2	1	Foot	15.00
	Dahuha	Pakka road	2	2	Foot	0.30	yes	0	Foot	0.05
	Sakrauhrah	Pakka road	2	3	Foot	0.30	2	3	Foot	0.30
Saharsa	Modhara	Pakka road	2	7	Foot/vehicle	0.40	2	2	Foot/vehicle	0.10
	Gamraho	Kutcha road	yes	0.5	Foot	0.05	yes	0.5	Foot	0.05
	Manikpur	Paved road	yes	0.5	Foot	0.05	yes	0.5	Foot	0.05
Vaishali	Jamalpur	Paved road	2	2	Foot	0.20	2	1	Foot	0.15
	Kutubpur	Pakka road	2	0.5	Foot	0.10	yes	0	Foot	0.05
	Mohanpur	Paved road	2	4	Foot/vehicle	0.30	2	4	Foot/vehicle	0.30
Banda	Madain	Pakka road	2	20	Foot/vehicle	0.50	2	3	Foot	0.50
	Karaundh	Pakka road	2	15	Motor vehicle	0.30	yes	0	Foot	0.05
	Pathara	Pakka road	2	6	Motor vehicle	0.20	yes	0	0	0.05
	Audha	Paved road	2	13	Motor vehicle	0.35	yes	0	Foot	0.10
Allahabad	Tarav	Pakka road	yes	0.5	Foot	0.10	yes	0.5	Foot	0.10
	Hathigan	Pakka road	2	6	Motor vehicle	0.20	yes	0.3	Foot	0.05
	Beeker	Pakka road	2	2	Cycle	0.15	2	2	Cycle	0.15

(continued)

Table 6 (continued)

District	Village	Road type	Bus stop (no)	Distance to facility (in Km)	Transport to reach to facility	Time taken to reach in mnt.	Taxi/Auto stand (no.)	Distance to facility in Km	Transport to reach to facility	Time taken to reach in mnt
	Sandwa Khurd	Trail only	2		Foot	0.25	2		Foot	0.25
Gorakhpur	Parsawna	Paved road	2	3	Motorcycle	0.20	yes	0	Foot	0.05
	Ghoradeor	Paved road	2	7	Cycle	0.35	2	7	Cycle	0.35
	Dihwa Bujurg	Pakka road	2	6	Cycle	0.30	2	6	Cycle	0.30
	Kurwa	Pakka road	2	12	Foot/vehicle	0.40	2	2	Foot	0.35

Source Field Survey

Table 7 Financial system and internet 2016–2017

District	Village	Bank	Distance to facility	Transport to reach to facility	Time taken to reach	ATM	Distance to facility	Transport to reach to facility	Time taken to reach	Cyber café	Distance to facility	Transport to Reach to facility	Time taken to reach
Jahanabad	Ismailupr	2	2.5	Cycle	0.20	2	1	1	0.20	2	1	Foot	0.20
	Dahuha	2	2	Cycle	0.20	2	2	3	0.20	2	7	Foot/vehicle	1.30
	Sakrauhrah	2	4	Cycle	0.25	2	4	3	0.25	2	4	Cycle	0.25
Saharsa	Modhara	2	4	Foot/vehicle	0.20	2	7	7	0.20	2	2	Foot/vehicle	0.10
	Gamraho	2	3.5	Motorcycle	0.20	2	3.5	4	0.20	yes	0.5	Foot	0.50
	Manikpur	2	4	Motorcycle	0.15	2	3	4	0.15	2	3	Motorcycle	0.15
Vaishali	Jamalpur	2	2	Foot/vehicle	0.20	2	6	4	0.25	2	6	Motorcycle	0.25
	Kutubpur	2	0.5	Foot	0.10	2	0.5	1	0.10	2	0.5	Foot	0.10
	Mohanpur	2	4	Foot/vehicle	0.30	2	1.5	6	0.15	2	1.5	Foot/vehicle	0.15
Banda	Madain	2	29	Cycle	2.30	2	20	6	0.40	2	20	Foot/vehicle	0.35
	Karaundh	2	2	Motorcycle	0.15	2	15	4	0.30	2	15	Motorcycle	0.30
	Pathara	2	6	Cycle	0.46	2	6	4	0.20	2	6	Cycle	0.40
	Audha	yes	1	Foot	0.70	2	28	4	1.00	2	13	Motorcycle	0.35
Allahabad	Tarav	2	2	Cycle	0.15	2	2	3	0.15	2	2	Cycle	0.15
	Hathigan	2	3	Cycle	0.20	2	3	3	0.20	2	3	Cycle	0.20
	Beeker	2	2.5	Cycle	0.15	2	2	3	0.15	2	2	Cycle	0.15
	Sandwa Khurd	2		Motorcycle	0.35	2		4	0.00	2		Foot/vehicle	1.00
Gorakhpur	Parsawna	2	3	Motorcycle	0.20	2	3	3	0.20	2	3	Cycle	0.20

(continued)

Table 7 (continued)

District	Village	Bank	Distance to facility	Transport to reach to facility	Time taken to reach	ATM	Distance to facility	Transport to reach to facility	Time taken to reach	Cyber café	Distance to facility	Transport to Reach to facility	Time taken to reach
	Ghoradeor	2	3	Cycle	0.15	2	7	3	0.35	2	3	Foot	0.30
	Dihwa Bujurg	2	6	Cycle	0.30	2	6	4	0.00	2	6	Cycle	0.30
	Kurwa	2	3	Cycle	0.30	2	3	3	0.30	2	3	Cycle	0.30

Source: Field Survey

Table 8 Worked outside village and had vehicle

	Cycle	Bike	Car	Total
yes	84.0	15.7	0.4	89.8
Location of work and availability of vehicle				
	cycle	bike	car	Total
Same District	84.3	15.0	0.8	94.1
Other Districts	60.0	40.0	0.0	3.7
Other states	100.0	0.0	0.0	2.2
Total	83.7	15.6	0.7	100.0

Source Field Survey

7 Household Endowments of Transportation and Level of Mobility

What post offices have done to the remittances, that is done by motorised two wheelers vehicles for mobility. From the analysis of household asset ownership, it is clear that there is a sharp rise in ownership of mobiles and motorcycles. While mobile has increased the connectivity, motorcycle has increased the short D-D (duration and destination) migration easy and frequent as suggested in Sects. 3 and 4. Whether working in village or outside, around 89% have any vehicle. Around 15% of the household have motorcycle/scooter. Those who are working in other districts owns more motorcycle/scooter than those working in the same district. The construction of roads under MGNREGA and Pradhan Mantri Gram Vikas Yojana has played a significant role in improving connectivity of village and road quality. It, in turn, increases the ownership of motorcycle, because still most of the village either doesn't have bus/taxi stand or if has the frequency of bus and taxi is low or inconvenient. Therefore, motorcycles in the villages and on the roads of UP and Bihar are the most obviously found and seen vehicle. And a fun fact, it became an important demand in dowry for a graduate with job from poor SES community or without job from higher SES community, shows a social premium in must having a object, i.e. motorcycle for boys (Table 8).

8 Conclusion

Therefore, as discussed in the introduction, while other parts of India benefited from their wealthy and educated diaspora in and outside the country, migration from UP and Bihar mostly remains inter-state or intra-state, of low skilled and less educated labours. Primarily because this area was agriculture belt. As much as 68% of workers was working in agriculture and contributing 39% to state GDP in 1993 in UP and 65% was working in agriculture and contributing 50% to state GDP of Bihar in

1993. As a result when agriculture gradually became unprofitable, its contribution to GSDP in UP & Bihar declined to 20 and 18%, respectively, in 2018–10 (EPWRF, accessed on 12 Feb 2020). Only a very small percentage of population of upper caste who were traditionally educated actually moved out at higher positions and became absentee landlords. But the majority being agricultural labour found job in construction sector as unskilled labour as suggested by our analysis. Further, the coastal belts of India also received immigrants from outside such as Parses, Muslims, Portuguese which not only encouraged trade but also improved the social relations from other continents. But this belt only faced extortion in agriculture through various land and agricultural tax regime, no social or trade exchange which kept this region mostly orthodox, backward and illiterate. So a regional pattern in temporary labour migration is evident in the low income central and north Indian states mostly circular and seasonal migration dominated by young male (Keshri and Bagat 2013), whose remittances are sustaining the loss-making agriculture. Historically, economy of the states based on trade and business flourish, because whenever the regime became difficult for traders and business people, they moved to other countries or regions and thereby creating a strong network between the places of their migration (Sindhis, Baniya). Since UP and Bihar are dependent on agriculture with a fixity of land, this movement is not possible whatever is the regime. As a result, neither they benefited from agriculture activities nor could develop strong network of exchanges through migration.

In our analysis, we have looked at differential in short run and long run labour mobility across household income levels and land endowments. Our result suggests that long term migration to far off places by rich and upper caste and higher land-holding group and short term migration is to the nearer places by poorer communities. The big story about work-related migration in this belt lies between two poles of short and long run migrations which were earlier seasonal and permanent migration. This is the world of semi-permanent migration, where migrants seem to have discovered 'secret of perpetual migration' (Tumbe 2018). However, as hypothesised that household endowment affects one's capability to mobility, we find that the better off workers are migrating to far off places and generally for longer duration. Workers in lowest income quintile are confined to same district with short run migration; only some of them are going to other state and doing long run migration. International migration is reported only in household from the highest income group (LSMS 2016).

Road transportation and banking and connectivity have played a major role in change of duration and volume of migration. Data shows an improvement in reach of roads particularly metaled road. However, there is substantial variation in terms of quality of roads; they are better at the entrance but gets poorer as one enters to the corners of the villages which are generally occupied by the poor and low caste people. Further, taxi and auto have reached to the villages but again the access to them is very selective, and, therefore, one has to travel long to reach them. We don't have data on the frequency of taxi/auto availability, which can be another constraint. Only one village has a bus stop, which also requires travel of 5 Kms. Therefore, household ownership of motorized vehicle seems to have revolutionised frequent commuting. However, still large number of frequent commuters seems to use cycle,

of course, from mostly poorer income groups. Car remains a much luxury. We don't have data on the difficulty faced by this group of people in frequent commuting while mostly doing short run migration, but these are the people who are investors to the village economy; travelling in acute lack of personal/public transport can hint at their struggle and constraint. Further, the migration of young and male and better educated to far off places and better work shows the constraint played by unavailability of transportation in villages particular for women, which is a great constraint for employment opportunity for women. At the end, we can't deny the improvement in basic infrastructure road and transport, banking and information communication and its role played in increasing migration: circular or short run, however, its quantity and quality remains a concern.

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12

Impact of Migration on the Local Labour Markets

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Tulika Tripathi

INTRODUCTION

Migration of labour from one place to another along with its trends, patterns and characteristics is an important indicator of development. Movement of people within the country or outside the borders has a number of political, economic, cultural and social implications for both source and destination places and people. Migrants may have either positive or negative impacts upon the area, which may be qualitative, quantitative or both. The present study has been undertaken to study the high influx of in-migrants in the state of Jammu and Kashmir, especially in the Kashmir Valley. Kashmir Valley comprises 10 districts, but the 2001 Census registered only six districts and the information is provided only for those six districts. The 2001 Census data reported a total of 709,004 in-migrants in the Valley from other states and union territories of India, comprising 42.70 per cent males and 57.30 per cent females. A large proportion of these in-migrants were rural. The study covers in-migrant workers in the valley who come each year from other states and union territories of India, but will exclude local intradistrict and interdistrict migrants within the state. An overall picture of in-migration of labourers in Kashmir Valley is based on an analysis of the 2001 Census data, as data on in-migration of workers in the Valley was not available in earlier censuses and the 2011 Census has not yet published its reports and data on labour migration. However, the 2011 Census has shown a provisional figure at the state level comprising 2,830,930 in-migrants based on the place of last residence. The study is quantitative in nature and is based on secondary data. Relevant published reports, newspaper and journal articles, books and other online sources were also considered during the study.

RESEARCH QUESTIONS

The study looks at the following aspects of migration:

1. What are the socio-economic characteristics of in-migrant workers in Kashmir Valley?
2. What are the causes of in-migration in Kashmir Valley?

Kashmir Valley is a hilly area having a harsh climate in winter and requires people to complete their work, especially of cultivation and construction, in a short period mainly from April to November. The labour demand during this period remains high. This attracts a large number of labourers from other states of India, especially from Bihar, Uttar Pradesh, Punjab and West Bengal (Wani, 2014). There is also a shortage of local labourers in Kashmir Valley. Furthermore, the local labourers are considered lazy, disinterested and costly, having a leisure-seeking mentality and giving less preference to manual work (Singh, 2013). The state also has the highest daily wage rate only after Kerala as reported by the Labour Bureau, Government of India. The Valley is visited by both Muslim and non-Muslim in-migrants. However, Muslim in-migrants find Kashmir a preferable place compared with non-Muslims (Haque, 2014). The results provided by the 2001 Census show a lot of variation in the in-migration flow across the Valley.

SOCIAL PROFILE OF IN-MIGRANTS IN KASHMIR VALLEY

Migration is an important factor responsible for changing the population growth, size and sex ratio and work availability in a region. The census provides a broad information about different socio-economic characteristics of migrants such as marital status, locality, age profile, employment status, gender, education level, languages spoken, religion and nationality. Since the Valley is a conflict zone, it has not been possible for the census surveyors and the authorities to cover all the aspects of migrants. A detailed social profile of in-migrants in the Valley is provided below.

Sex and Locality of In-migrants

Locality, sex and gender identity play an important role in shaping the migration movement. The relationships, movements and expectations in being a rural, urban, male, female and transgender significantly affect the migration dynamics and social networks. Usually people prefer to move and stay in a similar environment and want to follow the same rural/urban character. Individuals of different sexual characteristics experience migration differently, with their own unique set of welfares and complications (International Organization for Migration, 2015). Table 12.1 provides a brief

Table 12.1 In-migrant Workers Classified by Locality, Sex and All Durations of Residence in Place of Enumeration

	Total In-migrants				
Area Name	*Total*	*Rural*	*Urban*	*Male*	*Female*
Kashmir Valley	709,004	493,278	215,726	302,773	406,231
Kupwara	67,275	58,582	8,693	28,569	38,706
Baramulla	97,842	65,764	32,078	48,327	49,515
Srinagar	153,534	29,390	124,144	86,439	67,095
Badgam	83,088	73,847	9,241	31,497	51,591
Pulwama	122,325	109,382	12,943	36,321	86,004
Anantnag	184,940	156,313	28,627	71,620	113,320

Source: Computed by the authors based on Census 2001.

Table 12.2 Percentage Distribution of In-migrant Workers in the Valley Classified by Age and Duration of Residence, 0–9 Years

	Total Migrants (%)						
Age Group	*Kashmir Valley*	*Kupwara*	*Baramulla*	*Srinagar*	*Badgam*	*Pulwama*	*Anantnag*
All ages	96,148	9.63	9.33	26.78	11.99	13.91	28.36
0–9	13,665	14.91	9.89	25.29	16.38	3.61	29.92
10–19	12,432	7.58	12.79	32.87	9.65	7.29	29.82
20–29	39,633	9.74	7.38	20.76	12.82	20.38	28.92
30–39	17,461	8.59	9.00	28.87	10.85	16.68	26.01
40–49	6,758	7.27	11.14	41.02	9.22	7.59	23.76
50–59	3,029	6.31	12.18	37.64	7.43	7.72	28.72
60–69	1,569	6.95	13.32	31.99	8.92	5.93	32.89
70–79	815	5.89	16.93	27.48	7.61	10.80	31.29
80+	361	8.31	13.57	31.02	4.99	8.87	33.24
Age not stated	425	10.59	3.76	44.71	9.88	6.35	24.71

Source: Computed by the authors based on Census 2001.

account of masculinity and locality background of in-migrants in the valley.

A district-level picture of in-migration in the valley shows that there is a lot of variation across districts with regard to residence and gender of in-migrants. The table clearly shows that major in-migration has taken place in Anantnag district, accounting for about 26 per cent, whereas Kupwara district shows the least number of in-migrants (9.49%). Srinagar is the only city in the Valley, but it ranks second in terms of in-migrant workers, followed by Pulwama, Baramulla and Badgam. Majority of the rural in-migrants were found in Pulwama district, comprising mostly female workers (70.30%). Most of the urban in-migrants, especially males, have dominance in Srinagar city due to its urbanized character, whereas in all other districts, rural in-migrants dominate, with a majority of female in-migrants. The difference between Srinagar city and other rural districts can easily be understood. Urban male in-migrants prefer to migrate towards cities or urban areas, whereas rural in-migrants, especially women in-migrant workers, are migrating towards rural areas. It is clearly rural-to-rural and urban-to-urban stream of migration.

Age Structure of In-migrants

Age is one of the important indicators in choosing a particular work. It determines the working capacity of migrants. Generally, migrants in the age group 15–59 years are considered active and capable of doing all sorts of work. Moreover, they can also survive harsh conditions of work and stay. It has also been found that migrants from rural areas are usually younger than those from urban areas (Nair, 2005). A brief age composition of in-migrants in Kashmir Valley along with its districts is provided in Table 12.2.

The age-wise distribution of in-migrants in the valley highlights that the majority of these in-migrants were in the age group of 20–29 years, comprising almost 41 per cent of total in-migrants, whereas the least number of in-migrants were in the age group of 80 and above, almost 0.37 per cent. It means that a major portion of in-migrant workers in Kashmir Valley comprised youth, whereas a very small portion of them comprised elderly people. It also indicates that the number of migrants tends to decline with an increase in age. The second largest

Table 12.3 Percentage Distribution of In-migrant Workers in the Valley Classified by Marital Status and Duration of Residence, 0–9 Years

		Marital Status (%)			
Area Name	*Total In-migrants*	*Never Married*	*Currently Married*	*Widowed*	*Divorced and Separated*
Kashmir Valley	96,148	33.31	65.18	1.34	0.17
Kupwara	9,255	36.38	62.07	1.40	0.15
Baramulla	8,970	37.56	60.48	1.79	0.17
Srinagar	25,750	45.69	53.06	1.13	0.12
Badgam	11,525	34.06	64.80	1.00	0.14
Pulwama	13,376	9.84	88.89	1.11	0.16
Anantnag	27,272	30.39	67.78	1.63	0.20

Source: Computed by the authors based on Census 2001.

category of in-migrants in the valley was in the age group of 30–39 years, which in India mostly includes the married population. It is immediately followed by the in-migration of children in the age group of 0–9 years, who often migrate along with their household/family. There is a lot of variation when we look at the district-wise age structure of in-migrants in the Valley. The overall picture of the Valley reflects that Kashmir Valley, more or less, has been visited by in-migrants of all age groups.

Marital Status of In-migrants

Marital status is an important factor affecting the decisions to migrate. Usually males migrate more than females. But after marriage, married females migrate more often than married males. In some states like West Bengal and Bihar, married migrants have been found migrating alone rather than with their families. On the other hand, in Kerala, migrants have been found migrating with their household. Similarly, migration is more common among migrants who are single than those who are married. It is also important to note that males are more likely singles than females (Singh, 1986). Many a time, it is difficult for in-migrant workers to find residential areas to reside on account of their singleness. Most people do not find it comfortable to keep unmarried males in their houses or in their localities, especially those who are outsiders. Sometimes due to intermarriages between in-migrant workers and local women, a lot of tension arises among the local people. Local people in Kashmir feel discomfort due to such actions of in-migrants (Singh, 2013).

Table 12.3, showing the marital status of in-migrants across the Valley, highlights that more than half of the total in-migrants (65.18%) in the Valley are having a currently married status. It is also true for the different districts of the Valley. Never-married in-migrants in the Valley constitute about 33.3 per cent, which is lower when compared at the district level, except for Anantnag and Pulwama districts. The least number of in-migrants are in the category of divorced and separated for the districts and for the Valley as a whole. The widowed in-migrants were 1–2 per cent in all the districts. The results of marital status for in-migrants in the valley match the results of the total migrants in the country as per the 2001 census. The pressure to earn and support the family may fall on the male partner after marriage, which results in the increasing number of married male migrants.

ECONOMIC PROFILE OF IN-MIGRANTS IN KASHMIR VALLEY

In India, migration of people has been an important phenomenon affecting social and

economic development. It is one of the important livelihood strategies in India (Rajan, 2013). The labour market in the Indian scenario has been identified by the movement of people mainly from the rural and backward areas towards developed areas in search of employment. It is especially for the unskilled people who move from relatively destitute and miserable areas in search of productive employment and higher living (Connell, 1976). Kashmir Valley is a rural area attracting a large number of labourers from both rural and urban areas of other states especially from Bihar, Uttar Pradesh and West Bengal (Wani, 2014). The main attraction pulls for these migrants are higher wages and availability of work. Kashmir is called by many as the 'Second Gulf' for its high wages. The wages per day usually range between ₹300 and ₹400, which are almost double of what one earns in other states of India (Singh, 2013). According to the data compiled by central government's Labour Bureau, Jammu and Kashmir has the second highest agricultural (₹382.14) and non-agricultural (₹401.58) average daily wage rates in the country. Along with wages, in-migrant labourers are also provided tea and food two times per working day. They are also provided with better accommodation facilities than in other places of India and are free from communal tensions or anti-sentiment issues. A study by Haque (2014) showed that in-migration to Kashmir Valley has resulted in positive benefits for in-migrants. There is a positive change in their living standard. They are now living a more satisfactory life than ever before. Their incomes have increased and they are sending relatively more remittances to their families. They have been able to send their children to schools, which was not possible previously. Their daily consumption and savings have increased and they have become capable of building their own houses. Many a time, they work on contracts, charging ₹700 per kanal (5,400 square feet land), but they most often work on a daily wage basis. The main areas where these in-migrants work include sowing and cutting of crops, picking and packing of fruits, petty trade and sales, at construction sites and brick kilns, and as street hawkers, painters, masons, carpenters and coolies, etc.

REASONS FOR IN-MIGRATION IN KASHMIR VALLEY

Movement of people in India is an important process affecting the socio-economic life of people. People migrate for various reasons, of which livelihood generation is foremost. This movement is affected by both pull and push factors. The Census of India (2001) identified seven important reasons of migration. In Kashmir Valley, the important reasons of in-migration are found to be work/employment, business, education, marriage, moved at birth, moved with household and others. The most important role in this migration has been played by education, employment and marriage. Among the males, the main reason for migration has been found to be employment, while among females, it is marriage. In this regard, Agnihotri, Mazumdar and Neetha (2012) mentioned that census is allowing respondents to give only one reason for migration and thus ignoring the other reasons for the same respondent. Since the census data for 2001 provided information on the basis of urban agglomeration (UA) for Jammu and Kashmir Valley, it is not possible here to give a separate picture for different reasons of in-migration at the district level in the valley. For Kashmir Valley, data has been provided for Srinagar UA, which is a combination of three districts, namely Srinagar, Badgam and Pulwama. The reasons for in-migration provided are for these three districts together. It is also important to note here that the results obtained on the basis of these three districts will be applicable to the entire Valley. It is also helpful to understand the in-migrant preference with regard to different reasons in the Kashmir Valley and Jammu region. Table 12.4 provides a comparison of Kashmir Valley with

Table 12.4 In-migrant Workers Classified by All Durations of Residence and Reasons for Migration

		Reason for Migration						
Area Name		*Work/ Employment*	*Business*	*Education*	*Marriage*	*Moved after Birth*	*Moved with Household*	*Others*
Jammu UA	Total	36,402	2,589	3,206	28,383	1,827	58,696	95,953
	Male	31,282	2,032	2,039	718	1,115	23,321	53,726
	Female	5,120	557	1,167	27,665	712	35,375	42,227
Srinagar UA (District 03, 04 and 05)	Total	7,757	288	1,263	4,028	373	7,059	86,167
	Male	7,150	207	910	201	199	2,896	51,310
	Female	607	81	353	3,827	174	4,163	34,857

Source: Computed by the authors based on Census 2001.
Note: 03, Srinagar; 04, Badgam; 05, Pulwama.

the Jammu division in terms of differences in reasons for migration.

The difference in in-migrant inflows in the Jammu region and Kashmir Valley with regard to reasons for migration is mainly on account of the difference in people, culture, religion and development. Since the Jammu region is more developed and relatively peaceful than Kashmir, there would be lot of employment opportunities and high scope for business. De Hann (2011) pointed out that jobless growth of economy in the country is the main cause of male migration. As far as the reason of marriage is concerned, it is very much high for female in-migrants in both Jammu and Kashmir. It is due to the fact that after marriage, females have to go along with their husbands (Chhikara & Kodan, 2012). The sex ratio in the state according to the 2001 Census was 889, which is low, and thus, marriage is one of the significant causes of female in-migrants. The main reason for in-migration in Kashmir Valley is that of shortage of local labour. The in-migrants master all skills and also work late hours. They are easily available in the length and breadth of the valley and do not hesitate in doing any work (Farid, 2015). An analysis of reasons for in-migration in Kashmir Valley shows that males dominate migration in both Jammu and Kashmir in the category of others, which covers majority of the in-migrants. Rest of the reasons are similar to those of the country. The main reason for migration of males was work/employment, and for females, it was marriage after the category of moved with household. Thus, it can be said that economic reasons attract males and non-economic reasons attract female in-migrants in Kashmir Valley. In a discussion with the investigators in the census offices, it also became clear that in-migrants have provided a number of reasons for migration that seem to be totally different from the divided categories such as a good environment, nice local people and beautiful scenery. Even many migrants have given more than one reason for migration and could not focus on any particular reason due to the threatening and conflicting environment of the Valley.

IMPACT OF IN-MIGRATION ON THE LOCAL LABOUR MARKET

Migration of labour is a trans-regional process and cannot be solved by either sending or receiving areas alone. It is a bilateral process and upsets both areas. The impact of this movement varies from nation to nation and from state to state within a nation. These impacts in different regions depend on the

composition, extent and characteristics of immigration flows. The outcomes of this movement can be both beneficial and undesirable, resulting from age, skill level, geographical location, social background and gender of migrants (International Organization for Migration, 2004). The in-migrant labour market in Kashmir Valley is rooted and still growing. This rapid flow has an effective impact on the local labourers and economy of the Valley. A lot of pressure has increased on the basic amenities. These in-migrants are available everywhere in the Valley as local people demand them and feel it economically profitable. The dependence on in-migrants is increasing day by day. There is no proper estimate of these in-migrant workers. Studies have suggested that it may become a threat for the economy in the long run (Hussain, 2012). It will also create problems for the authorities in framing proper developmental policies as there is no registration record of these in-migrants. There is also a loss of finance from the state, which in-migrants are sending to their native states in the form of remittances. A journalist expressed fear that Kashmiris will soon lose hold over their economy, as migrants might be soon found working even on handlooms and shawls (Singh, 2013). There is a conflict between local labourers and in-migrants at many places. The local labourers are also not comfortable with these migrants and often indulge in quarrels. The in-migrants are believed to be responsible for bringing down the wage rate. As such, the local labourers often threaten them and do not permit them to work at many places (Hussain, 2012). The huge number of in-migrants compelled local labourers to move to other parts of the country by rendering them jobless. The local culture of the Valley is also badly affected. Many in-migrants are drug addicts involved in selling and consumption of drugs. In 2007, few in-migrants were caught on rape charges. In-migrant labourers were also found responsible for increasing the number of child labour and beggars in the Valley. They are also responsible for reducing wages and the work space to a large extent (Wani, 2014).

CONCLUSION

Kashmir Valley is receiving seasonal and short-term in-migrants in large numbers from different parts of the country like Uttar Pradesh, Bihar, Haryana and West Bengal despite having worse political and geographical conditions. These in-migrants have not been covered in earlier studies, and state statistics is also silent about these in-migrants. This makes Kashmir Valley a peculiar area to stay. These in-migrant workers are seasonal in character as most of them stay for summers only and leave the valley in the winter season. This process of in-migration in the Valley shows that rural in-migrants prefer to stay in rural areas, whereas urban in-migrants prefer cities. Thus, the in-migration process in the Valley is rural to rural and urban to urban. It is also evident that the entire in-migration in the Valley has been dominated by female in-migrant workers. The main reason for the in-migrant pull in the Valley is shortage of local labour, higher wages and more demand and employment opportunities. The data also reflects that Kashmir Valley, more or less, has been visited by in-migrants of all age groups. As far as the marital status of the in-migrants is concerned, more than half of them have a recently-married status indicating that the Valley is visited mostly by young in-migrants.

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14

The Changing Structure of the Labour Market in Rural India

A Study of the BIMAROU States

DEEPAK KUMAR BEHERA
KSHAMANIDHI ADABAR

Introduction

THE CHANGES IN the structure of the labour market indicate the modernization of a country's labour force and workforce participation. Two types of modernization are needed. The first is the movement of surplus labour from the traditional or agriculture sectors to the modern or industrial sectors, as famously modelled by Arthur Lewis. The second is creating productive human capital that involves improvement in the skill and educational levels of the workforce.[1] Thus, structural transformation in the labour market and creating employment is one of the objectives in the Twelfth Five Year Plan and a major dimension of inclusive development in India. Besides, Santosh Mehrotra, Ankita Gandhi, Bimal Kishore Sahoo and Partha Saha, have emphasized on the rate of transition of labour out of agriculture to industry and services for creating more productive employment in the Indian economy.[2] They have viewed two kinds of transition. First, informal agriculture to informal non-agriculture; second, informal employment in the unorganized sector to formal employment in the organized sector (a decent form of employment) or informal employment in the organized sectors.

The transition and modernization in the structure of India's labour market, however, has been very slow. The trends in employment and

This book is fascinating and innovative. Its welfare implication shall be useful in understanding public policies, especially the policy of public expenditure. The book investigates the degree of public spending on education, the composition of primary education expenditure and the focus on budgetary expenditures and planning of various schemes in the State of Gujarat and given critical understandings of State intervention in the education sector in general and primary education in particular. The book is an in-depth study of an assessment of the effectiveness of public expenditure on primary education. It throws concrete light on the growth, fluctuations, and prospects of public expenditure of primary education in Gujarat and India. Overall, the trends analysis in primary educational expenditure is increasing in the State of Gujarat. The book includes an introduction, statement of the problem, importance and objectives, hypothesis, and study scope. Review of related literature. Methodology -Sources of data, Definitions and terms of the concepts, statistical techniques, analysis of the data. The book focuses on India's educational expenditure, expenditure on primary education expenditure in Gujarat, conclusions, suggestions and prospects, Appendices, etc. The reference book will be of great use to scholars, administrators, planners, policymakers, politicians and students of public economics, education, political science, economics, commerce, management and public administration. It believed that this book would help anyone interested in examining the effectiveness of public expenditure in general and the study of education, particularly in primary education.



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Sarala Dasari
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Public Expenditure and its Impact on Primary Education

Public Expenditure and its Impact on Primary Education

Sarala Dasari
Sonawane Satish Waman

The book is an in-depth study of an assessment of the effectiveness of public expenditure on education in the states of India particularly elementary education. This study throws concrete light on the growth, fluctuations and prospects of expenditure of elementary education in the states of Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal and also in India. The book includes introduction, statement of the problem, importance and objectives, hypothesis, scope of the study. Review of related literature. Methodology -Sources of data, Definitions and terms of the concepts, statistical techniques. Analysis of the Data. The book includes All India situation for educational expenditure, Expenditure on elementary education expenditure in fifteen states, Conclusions, suggestions and prospects, Appendices, etc. This reference book will be of great use to scholars, administrators, planners, policy makers, statesmen and students of public economics, education, political science, economics, commerce, management and public administration. Overall, the disparities in elementary educational expenditure among the states are increasing. It is believed that this book will be helpful for anyone who are interested to examine the effectiveness of public expenditure in general and as well as the study of education.



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IMPACT OF PUBLIC EXPENDITURE ON ELEMENTARY EDUCATION IN INDIA

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(A State Wise Analysis)

B.R. Ambedkar and Social Transformation

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Conclusion: In search of Ambedkar's ideal society: trends, Challenges and recommendations

Jagannatham Begari

Theorising the philosophy of B.R. Ambedkar is an essential as it gives intellectual pursuits to understand his ideas, perspectives and frameworks along with different socio-economic and political aspects. The philosophical quest and resistance of Ambedkar not only need to be read, understood but must relate to the present context, situation and try to resolve socio-economic, cultural and political conflicts. It is to note that not merely use Ambedkar as a symbol but must revisit him to reclaim socio-economic, political and cultural justice. It became a trend for the state and non-state actors to make use of Ambedkar as a symbol, of course, he is the symbol of equality, liberty, fraternity and morality. but not to use this symbol of egalitarianism for the temporary political gains and short term needs, but unfortunately, the state and non-state actors use it for the purpose of their political gains. instead, they must use this symbol and philosophy to upholds human rights, protect and promote egalitarian values: equality, liberty, fraternity and morality and scientific outlook. notwithstanding that uses the philosophy of Ambedkar philosophy and his interventions in the formulation and implementation of policies to help and support the weaker sections, deprived sections of the society and attempt to see that implementation of formal democratic values and procedures into substantial democracy. The philosophy of Ambedkar need more attention and therefore providing space for the people to study and understand Ambedkar is an essential need. thus, it is required to have the policy initiatives to start more research centres, departments and resources centres in the name of Ambedkar, provide required expertise staff, provide infrastructure and give responsibilities to the dedicated scholars and experts to develop these centres and institutions and encourage a generation of scholars to pursue research on Ambedkar and justice. by doing this, the state can develop human resources through which educate and sensitise the people and build the ideal society which Ambedkar has dreamt for. It is not only the constitutional obligation of the state but also the moral responsibility.

Ambedkar's struggle against inequitious society inspires millions of people and gives voice to the marginalised sections. Ambedkar set in motion changes to benefit the lives of millions, fighting for legal protections for

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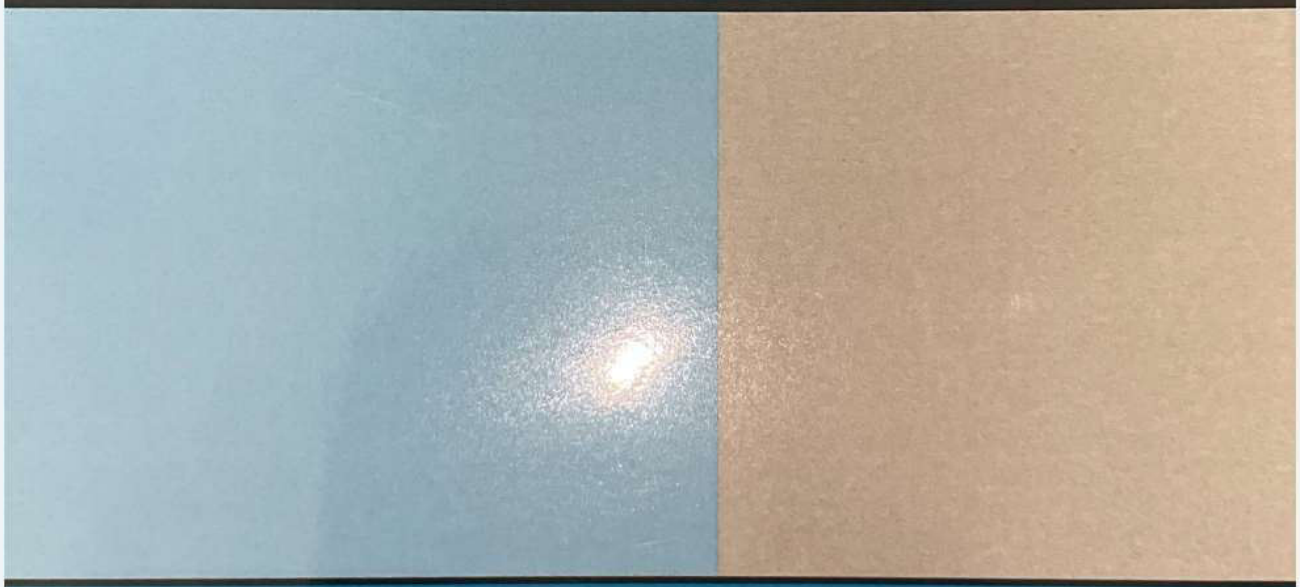

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Geographically, the Gulf is India's extended neighborhood and the only link with the no-less vital Central Asia. With Pakistan denying India its transit rights and Afghanistan having sunk into chaos, Indo-Gulf relations assume special significance. Historically speaking, the strategic relationship between Indian-subcontinent and Gulf goes back to ancient, pre-Islamic days. Britain during its Colonial regime controlled the Gulf tightly because of its overwhelming strategic importance for the defense of India, the brightest jewel in the crown. Remarkably, this control was exercised not from London but from Calcutta (now Kolkata) first, and then, Bombay and New Delhi after 1911. The post 9/11 world scenario appears to have been retelling us the story altogether in a different direction. In the first place, the fading repetition of Iraqi episode among the Iranian society and the subsequent stand taken by Indian diplomatic quarters endangered India's strategic prospects in the West Asian region as a whole. Secondly, India's emerging ties with the United States, thereby, culminating into newly born Nuclear agreement, began to question the historically rooted and culturally deepened Indo-Gulf relations in general and Indo-Iranian relations in particular. Despite significant convergence of interest between India and the US on several issues, India still depends largely on Iran and the Gulf for a variety of facets such as, energy supplies, workers, trade and security. Moreover, the plural, democratic and multi-ethnic nature of India's uniqueness cannot be ignored only for the sake of newly aligned strategic relations with the US (and Israel). India will, therefore, have to balance its relationship between the old and new friends.

Introduction: Even after the end of the British rule in the subcontinent, the Reserve Bank of India acted as the currency issuing authority for the Gulf; this arrangement was terminated in mid-1950s only at the request of Indian Government. The discovery of oil in the early years of twentieth century had boosted Gulf's strategic and economic importance. Almost from the first oil shock of 1973, to say nothing of the Islamic revolution in Iran in 1979 and the first Gulf War in 1991, the Region has swiftly increased and is at a very high pitch today amidst the brisk competition among China, India, Japan and South Korea for securing oil and gas. Two events in 1978 and 1979—the installation of the Islamic regime under Ayatollah Khomeini in Iran and the Soviet invasion of Afghanistan in support of the pro-

3.4.6

ആർ യൂ ഹ്യൂമൻ?

മനുഷ്യേതര മാനവികതയ്ക്ക് ഒരാമുഖം

എഡിറ്റർ
ഡോ. പ്രസാദ് പന്ന്യൻ

ഡി സി ബുക്സ്

MALAYALAM LANGUAGE
Are You Human? Manushyethara Manavikathaykku Oramukham

STUDY/PHILOSOPHY
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പോസ്റ്റ്ഹ്യൂമനിസം മലയാളസിനിമയിൽ: *ആൻഡ്രോയിഡ് കുഞ്ഞപ്പൻ വേർഷൻ 5.25* നെ മുൻനിർത്തി ചില ആലോചനകൾ

ഷിജു സാം വറുഗീസ്

സാംസ്കാരിക പഠനങ്ങളുടെ വിശാല മണ്ഡലത്തിൽ പുതുതായി വികസിച്ചു വരുന്ന ഗവേഷണ മേഖലയാണ് ശാസ്ത്രസാങ്കേതിക വിദ്യകളുടെ സാംസ്കാരിക പഠനങ്ങളുടേത് (Cultural Studies of Science and Technology). പോസ്റ്റ്ഹ്യൂമനിസം സംബന്ധിച്ച അന്വേഷണങ്ങൾ ഈ മേഖലയുടെ പ്രധാന ഊന്നലാണ്. സാംസ്കാരിക പാഠങ്ങൾ അവയുല്പാദിഷ്ക്കപ്പെടുന്ന സമൂഹങ്ങളുടെ തൃഷ്ണകൾ, ഭീതികൾ, ആനന്ദേച്ഛകൾ, ആശങ്കകൾ എന്നിവയുമായാണ് സംവദിക്കുന്നത്. 'സയൻസ് ഫിക്ഷൻ' എന്ന വിഭാഗത്തിൽപെടുത്താവുന്ന കലാവിഷ്ക്കാരങ്ങൾ ഈ മേഖലയിലെ പ്രധാന പഠനവിഷയമാവുന്നത് അതുകൊണ്ടാണ്. ശാസ്ത്രസാങ്കേതിക വിദ്യകൾ സാംസ്കാരികതയെ ആഴത്തിൽ സ്വാധീനിക്കുന്ന ഇക്കാലത്ത്, ശാസ്ത്രസാങ്കേതിക വികാസം മാനവികവാദാനന്തര സാമൂഹികതയെ രൂപപ്പെടുത്തുന്നതെങ്ങിനെയെന്നതിനെക്കുറിച്ചുള്ള ആശങ്കകളും പ്രതീക്ഷകളും സയൻസ് ഫിക്ഷൻ പാഠങ്ങളിൽ കാണാം. ശാസ്ത്രകല്പിതാഖ്യാനങ്ങളുടെ (science fiction) വിശകലനം പോസ്റ്റ്ഹ്യൂമനിസത്തെക്കുറിച്ചുള്ള ചിന്തകൾക്ക് പ്രധാനമാകുന്നത് ഇതുകൊണ്ടാണ്.

ജന്തുക്കൾ, യന്ത്രം എന്നിവയുടെ ഉടൽനിലകളുമായുള്ള വ്യത്യാസത്തിലാണ് മനുഷ്യനെന്ന തന്മയുടെ നിലനില്പ്. അതായത്, മനുഷ്യനെ ചിന്തയുടെ അടിസ്ഥാനമാക്കുന്ന മാനവികതാവാദം (Humanism) ഒപ്പം ജന്തു, യന്ത്രം എന്നീ സംവർഗങ്ങളെക്കൂടി നിർണയിക്കുകയും ഭവശാസ്ത്രപരമായി മനുഷ്യനുമായുള്ള അവയുടെ വ്യത്യാസത്തെ രേഖപ്പെടുത്തുകയും ചെയ്യുന്നു. എന്നാൽ ഭവപരമായ ഈ ഉടലകലം ഉലയുന്ന കാലമാണ് നമ്മുടേത്. മനുഷ്യൻ, ജന്തു, യന്ത്രം എന്നീ സംവർഗങ്ങൾക്കിടയിൽ പുതിയ സംക്രമണ സാധ്യതകൾ വിടരുന്നതിന് സാങ്കേതിക വിദ്യകളുടെ വികാസത്തോടൊപ്പംതന്നെ ജൈവികതയെക്കുറി

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ലേഖനങ്ങൾ



എഡിറ്റർ: ഡോ. മോത്തി വർക്കി



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ശാസ്ത്രം, പരിസ്ഥിതി, അറിവ്

ഡോ. ഷിജു സാം വർഗീസ്

പ്രകൃതിയും മനുഷ്യനും തമ്മിലുള്ള ഇടപെടലിൽ ഒരു വൈരുധ്യം അടിസ്ഥാനപരമായിത്തന്നെ നിലനില്ക്കുന്നുണ്ടോ എന്ന പ്രശ്നം തത്ത്വചിന്തയുടെ ഏറ്റവും പ്രധാനപ്പെട്ട ആലോചനാവിഷയമാണല്ലോ. ജ്ഞാനോദയദർശനത്തിന്റെ ഏറ്റവും വലിയ ചിന്താവിഷയം ഇതുതന്നെയായിരുന്നു. പ്രകൃതിയിൽനിന്നുള്ള മനുഷ്യന്റെ സ്വാതന്ത്ര്യവും പ്രകൃതിയെ യുക്തിഭദ്രമായി മനസ്സിലാക്കാനും ഉപയോഗിക്കാനുമുള്ള അവന്റെ ശേഷിയും ആധുനികതയുടെ ലോകവീക്ഷണത്തിന്റെ അടിത്തറയായി മാറി. പ്രകൃതിയെ അറിയാനുള്ള ആധുനികമനുഷ്യരുടെ ശ്രമങ്ങൾക്ക് തത്ത്വചിന്തയും പത്തൊൻപതാം നൂറ്റാണ്ടിന്റെ ആദ്യപകുതി വരെ 'പ്രകൃതിദർശനം' (Natural Philosophy) എന്നറിയപ്പെട്ടിരുന്ന സയൻസും ഒരേപോലെ ഊർജം പകർന്നിരുന്നതായി കാണാം. എന്നാൽ സമാന്തരമായി, മനുഷ്യനെ പ്രകൃതിയുടെ ഭാഗമായി സങ്കല്പിച്ച കാല്പനികതാവാദികളും, കാർട്ടീഷിയൻ-ന്യൂട്ടോണിയൻ തത്ത്വദർശനത്തെ എതിരിടാൻ ശ്രമിച്ച സ്പിനോസ, ലീബ്നിസ് തുടങ്ങിയവരുടെ ചിന്താപദ്ധതികളും മറ്റും സജീവമായിരുന്നുവെങ്കിലും ജ്ഞാനോദയചിന്തയുടെ കുത്തൊഴുക്കിൽ അവ പിന്തള്ളപ്പെടുകയാണുണ്ടായത്.

പ്രകൃതിയും മനുഷ്യനും തമ്മിലുണ്ട് എന്ന് ആദ്യകാല ആധുനികത മുതൽ ദാർശനികമായി സങ്കല്പിക്കപ്പെട്ട ജ്ഞാനോദയസംഘർഷത്തിന്റെ ചില പ്രധാന മുഖങ്ങൾ അവതരിപ്പിക്കുകയും അത് ആധുനികശാസ്ത്രത്തിന്റെ ജ്ഞാനാർജന രീതികളെത്തന്നെ എങ്ങനെ രൂപപ്പെടുത്തി എന്ന് അന്വേഷിക്കുകയും, ഈ വീക്ഷണം സൃഷ്ടിച്ച വിചാരപ്രതിസന്ധികളെ നേരിടാനുള്ള ചില സമീപകാലശ്രമങ്ങളെ രേഖപ്പെടുത്തുകയുമാണ് ഈ ലേഖനത്തിന്റെ ഉദ്ദേശ്യം.

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എഡിറ്റർ
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ആധുനികശാസ്ത്രവും മലയാളികളുടെ ബുദ്ധിജീവിതവും

ഷിജു സാം വറുഗീസ്

ആധുനികശാസ്ത്രവുമായുള്ള കേരളീയരുടെ ഇടപെടലിനു ദീർഘ കാലത്തെ ചരിത്രമുണ്ട്. വിശദമായ ഈ ചരിത്രത്തെ കുറുക്കി അവ തരിഷിക്കുകയല്ല ഈ ലേഖനത്തിന്റെ താല്പര്യം. മലയാളി ബുദ്ധിജീവി തത്തിന്റെ ഏറ്റവും പ്രധാനപ്പെട്ട ഊന്നലായി ശാസ്ത്രത്തെക്കുറിച്ചുള്ള ചർച്ചകൾ പത്തൊമ്പതാം നൂറ്റാണ്ടിന്റെ അവസാനം തന്നെ മാറുന്നുണ്ട് എന്നതിനാൽ കേരളത്തിലെ പൊതുമണ്ഡലത്തിൽ സയൻസിനെ മുൻ നിർത്തി ഇന്ന് നടക്കുന്ന സംവാദസംഘർഷങ്ങളുടെ ബൗദ്ധികപശ്ചാ ത്തലം അന്വേഷിക്കുന്നതിനു സഹായകരമായ ചരിത്രഘടകങ്ങളെ പരാമർശിക്കാൻ ഈ ലേഖനം ശ്രമിക്കുന്നുണ്ടുതാനും. 1960-കളിൽ യുക്തിവാദപ്രസ്ഥാനവും കേരള ശാസ്ത്രസാഹിത്യപരിഷത്തും രൂപം കൊണ്ടതിനു ശേഷമുള്ള കാലഘട്ടത്തിൽ കേരളീയ പൊതുമണ്ഡലം ശാസ്ത്രവുമായി ഇടപെടുന്ന രീതിയുടെ പൊതുസ്വഭാവം, അതിനു സമീപകാലത്ത് ഉണ്ടായ അവസ്ഥാന്തരങ്ങൾ എന്നിവയാണ് ഇവിടെ മുഖ്യമായും പരിശോധിക്കപ്പെടുന്നത്.

കേരളത്തിലെ ബൗദ്ധികവ്യാപാരങ്ങൾ സവിശേഷമായ ഒരു അക്കാദമിക പ്രവർത്തനം എന്ന നിലയിൽ ഇന്നും തുലോം ദുർബല മാണ്. സാമൂഹികശാസ്ത്ര മേഖലയിൽ ഉള്ള അക്കാദമികഗവേഷകർ പോലും പൊതുമണ്ഡലത്തിലെ ചർച്ചകളിൽ ഇടപെടുന്നതിലാണ് മിക്ക പ്പോഴും ഊന്നുന്നത്. ഏതെങ്കിലും സവിശേഷ ജ്ഞാനമേഖലയിലെ ഗവേഷകരുടെ, പിയർറിവ്യൂചെയ്യപ്പെടുന്ന പ്രബന്ധങ്ങൾ പ്രസിദ്ധീക രിക്കുന്ന ജേർണലുകൾ മലയാളഭാഷയിൽ വിരളമാണ്. സഹഗവേഷ കരുടെ നിഷ്കൃഷ്ടപരിശോധനയ്ക്ക് വിധേയമായി പ്രസിദ്ധീകരിക്കപ്പെ ടുന്ന അക്കാദമികഗ്രന്ഥങ്ങളും മലയാളത്തിലില്ല. ചർച്ചകൾക്കെല്ലാം വേദിയൊരുങ്ങുന്നത് മലയാളത്തിലെ പത്രമാസികകളിലും (ഇപ്പോൾ) നവമാധ്യമങ്ങളിലുമാണ് എന്നതിനാൽ ജ്ഞാനവ്യവഹാരങ്ങൾ ആന്ത രികമായ പടലപിരിയലുകൾക്ക് (differentiation) വിധേയമായിട്ടില്ല. ഇത് പക്ഷേ ശക്തമായ ഒരു പൊതുമണ്ഡലത്തെ നിർമ്മിക്കുന്നതിന് സഹാ യകരമായിട്ടുണ്ടുതാനും.

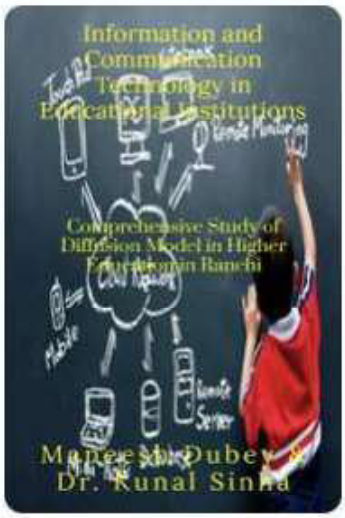
ഈ പശ്ചാത്തലത്തിൽ, സയൻസിനെക്കുറിച്ച് മലയാളത്തിൽ നട ക്കുന്ന സംവാദങ്ങളുടെ പൊതുസ്വഭാവത്തെക്കുറിച്ച് ചില വിലയിരു ത്തലുകൾ നടത്താനാണ് ഈ ലേഖനത്തിൽ എന്റെ ശ്രമം. ആധുനി

കശാസ്ത്രത്തോട് മലയാളികളുടെ സമീപനമെന്താണ്? സയൻസിനെ ക്കുറിച്ചുള്ള അഭിപ്രായങ്ങൾ രൂപീകരിക്കുന്ന ബുദ്ധിജീവിവൃന്ദങ്ങൾ ഏതൊക്കെയാണ്? അവരുടെ സ്വഭാവഗുണങ്ങളെന്താണ്? അറിവു നിർമ്മാണത്തിന്റെ രാഷ്ട്രീയത്തെക്കുറിച്ചും സംസ്കാരികതയെക്കു റിച്ചും പൊതുമണ്ഡലത്തിൽ നടക്കുന്ന ഈ ബൗദ്ധികസംവാദത്തിന്റെ ജ്ഞാനാർജനപരമായ ആധാരമെന്താണ്? കേരളീയ പൊതുമണ്ഡല ത്തിന്റെ തന്നെ ഘടനാപരമായ പ്രത്യേകതകൾ ശാസ്ത്രസംവാദത്തെ എങ്ങിനെ സ്വാധീനിക്കുകയും പരിമിതപ്പെടുത്തുകയും ചെയ്യുന്നു?

ശാസ്ത്രം പൊതുമണ്ഡലത്തിൽ

ആധുനികമെന്നു വിളിക്കാവുന്ന ഒരു ജ്ഞാനപാരമ്പര്യമായി സയൻസ് ഉരുവംകൊണ്ട് തുടങ്ങിയത് പതിനാറു-പതിനേഴ് നൂറ്റാണ്ടുകളിലായി രുന്നല്ലോ. അക്കാലം മുതൽതന്നെ ശാസ്ത്രത്തിന്റെ വികാസത്തിന് കേരളത്തിന്റെ സംഭാവന ഉണ്ടായിട്ടുണ്ട്. കോളനികളിൽ നിന്നുള്ള പഠ നപദാർത്ഥങ്ങൾ (specimens) വ്യാപകമായി കഷൽ കയറി യൂറോപ്യൻ നഗരങ്ങളിലെ പഠനകേന്ദ്രങ്ങളിൽ എത്തുന്നു. പതിനെട്ട്-പത്തൊമ്പത് നൂറ്റാണ്ടുകളിൽ അടിമവ്യാപാരത്തിന്റെ കടൽഷാതകളിലൂടെ യൂറോ പ്പിലെ പഠനമുറികളിൽ എത്തിയ വംശപഠനമാതൃകകളിൽ കേരള ത്തിൽ നിന്നുള്ള മനുഷ്യരും ഉണ്ടായിരുന്നോ എന്നു പഠിക്കപ്പെട്ടിട്ടില്ല.[1] എന്നാൽ സസ്യ-മൃഗജാതികൾ പഠനവിധേയമായതിന് തെളിവുക ളുണ്ട്. ഗോവയിലെ പോർച്ചുഗീസ് വൈദ്യനായിരുന്ന ഗാർഷിയ ഡാ ഓർട്ടയുടെ കൊങ്കൺതീരത്തെ സസ്യജാലത്തെ പറ്റിയുള്ള *Colloquios*[2] എന്ന പഠനവും (1563) ഡച്ച് ഭരണകാലത്ത് കൊച്ചിയിലെ ഗവർണറായി രുന്ന ഹെന്റിക് വാൻ റീഡ് പന്ത്രണ്ട് വാല്യങ്ങളിലായി നടത്തിയ സമാ ഹരണവും (*Hortus Indicus malabaricus*, 1678-1691) മലബാറിലെ സസ്യ ജാതികളുടെ വിവരങ്ങൾ യൂറോപ്പിലെത്തിച്ചു. ഉഷ്ണമേഖലയിലെ സസ്യ-ജന്തു ജാതികളെക്കുറിച്ചുള്ള വിവരശേഖരണത്തിന് അക്കാ ലത്തെ യൂറോപ്യൻ വർഗീകരണ വിദഗ്ധർ ആശ്രയിച്ചിരുന്നത് കോള നികളിൽ നിന്നുള്ള ഇത്തരം സമാഹരണങ്ങളെ ആയിരുന്നു. പഠന പദാർഥങ്ങളോടൊപ്പം കോളനികളിലെ കീഴാളജനതയുടെ അറിവു കളും കഷൽ കയറുകയും ആധുനികശാസ്ത്രജ്ഞാനത്തിന്റെ ഭാഗ മാവുകയും ചെയ്തിട്ടുണ്ട് എന്ന് റീഡിനെ സസ്യശേഖരണത്തിനും വിശകലനത്തിനും സഹായിച്ച ഇട്ടി അച്ചുതൻ വൈദ്യന്റെ ഉദാഹരണം എടുത്തുകാട്ടി റിച്ചാർഡ് ഗ്രോവ് സമർത്ഥിക്കുന്നു (Grove 1996).

ബ്രിട്ടീഷ് കൊളോണിയൽ കാലഘട്ടത്തിൽ വ്യാവസായികവിപ്ലവം നടക്കുന്ന യൂറോപ്പിലെ സാങ്കേതികവിദ്യകൾ കേരളത്തിലെത്തി. ഒപ്പം ആധുനിക വൈദ്യശാസ്ത്രവും, മറ്റ് ശാസ്ത്രീയ അറിവുകളും. മിഷനറി മാർ സ്ഥാപിച്ച ഇംഗ്ലീഷ് സ്കൂളുകളും 1857-ൽ മദ്രാസ് സർവ്വകലാശാ ലയുടെ ആരംഭവും പതിയെ ആധുനിക ശാസ്ത്രത്തോടും പടിഞ്ഞാ



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By Maneesh Dubey & Dr Kunal Sinha

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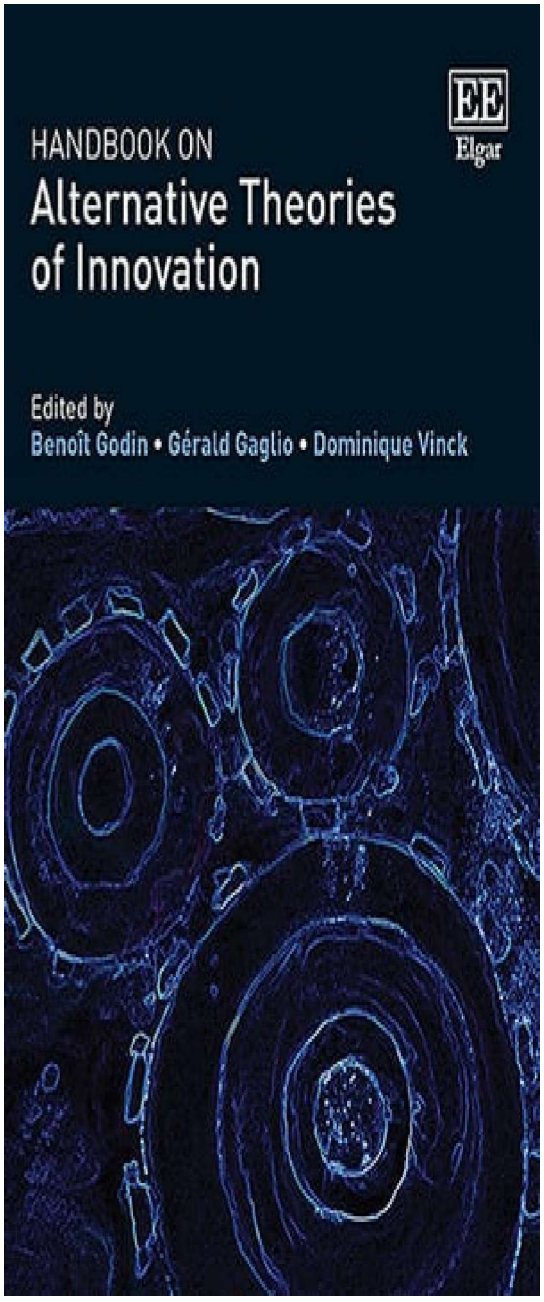


13. Grassroots innovation: mainstreaming the discourse of informal sector

Fayaz Ahmad Sheikh and Hemant Kumar

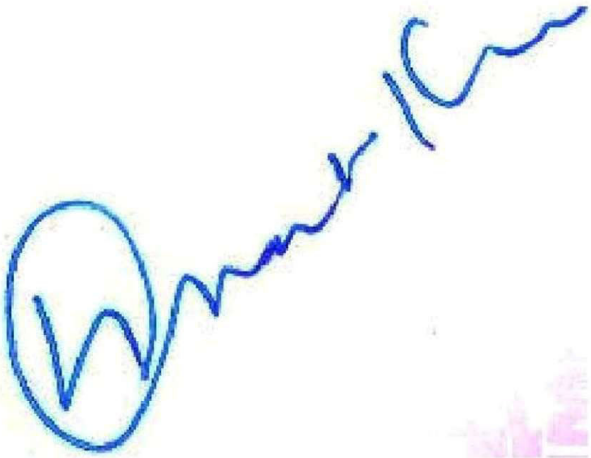
INTRODUCTION

Despite decades of extensive research, innovation discourse is devoid of careful discussion informal sector grassroots innovations (henceforth "GIs"). Producer innovation has remained at the heart of innovation research (Godin and Vinck 2017; von Hippel 2017) and is increasingly regarded as a holy grail for economic growth and a potent policy tool to overcome pressing human challenges (Habiyaremye et al. 2019). However, the producer innovation paradigm has been criticized for perpetuating exclusion and widening inequality (Heeks 2014; Santiago 2014). To serve the underprivileged and facilitate the process of inclusive policymaking, non-dominant innovation models are beginning to be encouraged (Bhatti 2016; Bhatti 2012). Lately, hybrid models of innovation have been proposed to tackle global concerns such as poverty, inequality, and climate change (UNCTAD 2017). As the demand for social justice gains momentum worldwide, inclusive innovation models such as "democratization of innovations" (von Hippel 2005), "rethinking business" (Ventresca and Nicholas 2011), and giving up "affluence" and "abundance" (Prahalad and Mashelkar 2010) are gaining ground.

Against this backdrop, inclusive models of innovation have captured development scholars' attention. GIs, which are mainly undertaken by unlettered people, artisans, farmers and others, represent one such category of inclusive innovations. These innovations are developed outside of formal organizational structures, without the engagement of recognized firms or planned R&D.

The long-standing contributions of informal sector innovations notwithstanding, the innate romanticism of the concept in modern times has spawned the belief that GIs were recently discovered and have no historical context. Yet the history of GIs boasts countless examples of the substantial contributions of unlettered and anonymous communities to technological revolutions (McCloskey 2016; Mokyr 2002; Phelps 2013; Rosenberg 1982). Moreover, the significance of innovations emanating from the informal economy has been documented by some of the most prominent economic historians.

However, the mainstream innovation literature reflects a bias towards formal sector innovations. The discourse has been dominated by debates around R&D, profitability, market structures, exchange value, scalability and large-scale commercialization of sector innovations. Excessive focus on innovations in the formal sector has seriously undermined GIs' potential. Moreover, interest in GIs has been further dampened by their failure to generate economic value. As Bhaduri (2016) argued in his Prince Claus Chair address on Development and Equity, the current discourse on knowledge has essentially focused on "formal sectors" of economies in the Global South. He maintained that "informal economies have remained largely excluded "due to the belief that innovative activities by agents





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EDITED BY

SANJAI BHATT

Through his creative genius, Sanjai Bhatt has edited a timely volume on the wrath of the pandemic COVID-19 in India. Bhatt has created a masterpiece in which the contributors to the volume come from varied backgrounds but are united by the social work profession in specific ways. These narratives are presented with gut-wrenching honesty and discuss the impact of COVID-19 on these authors' lives, including their coping and adaptation processes. This volume is a gem, and Enthusiastically recommend it to social workers and other helping professionals.

Pallassana R. Balgopal,
PhD, Professor Emeritus, School of Social Work,
University of Illinois, Urbana-Champaign, USA

Life under Lockdown is a book that will resonate with anyone who would be interested in unravelling and understanding the nuances of human interactions and exchanges as it evolved during the COVID-19 pandemic that brought societies to a halt. Well-timed, the book presents a logical and critical inquiry in the wake of lockdowns that shut the world's largest democracy for days, with imminent concerns emerging in public policy, social work, and social sciences. The essays assimilate perspectives from social, political, psychological, and even historical lenses. The book is bound to benefit students, social interventionists, and enthusiasts, generally curious to reflect on life during COVID-19 and its induced shocks.

Manoj Kumar Jha,
MP (Rajya Sabha) and Professor, Department of Social Work,
University of Delhi, India

Prof. Sanjai Bhatt has once again carried out a timely assignment of publishing this book on Life under Lockdown! My hearty congratulations to him and his team of 32 authors for bringing together a range of topics from existential, from work and family to retirement, from lockdown blues to emotional intelligence, and many more. The way he has introduced these articles in the Editorial, I am sure this will be a path breaking book for years to come.

Murli Desai,
Former Professor,
Tata Institute of Social Sciences, Mumbai, India

Life under Lockdown- Lived Experiences and Lessons Learnt is an edited book with contributions from 32 people during the COVID-19 pandemic. The contributors to this volume are social work professionals, educators, academicians, bureaucrats, researchers and even students. Prof. Bhatt presents the narratives of the COVID lockdown from different spheres of life and wove them together to present a volume that offers new perspective of any such situation ever faced in future. This book will help social work practitioners, academicians and people who have inclination towards social work or related disciplines.

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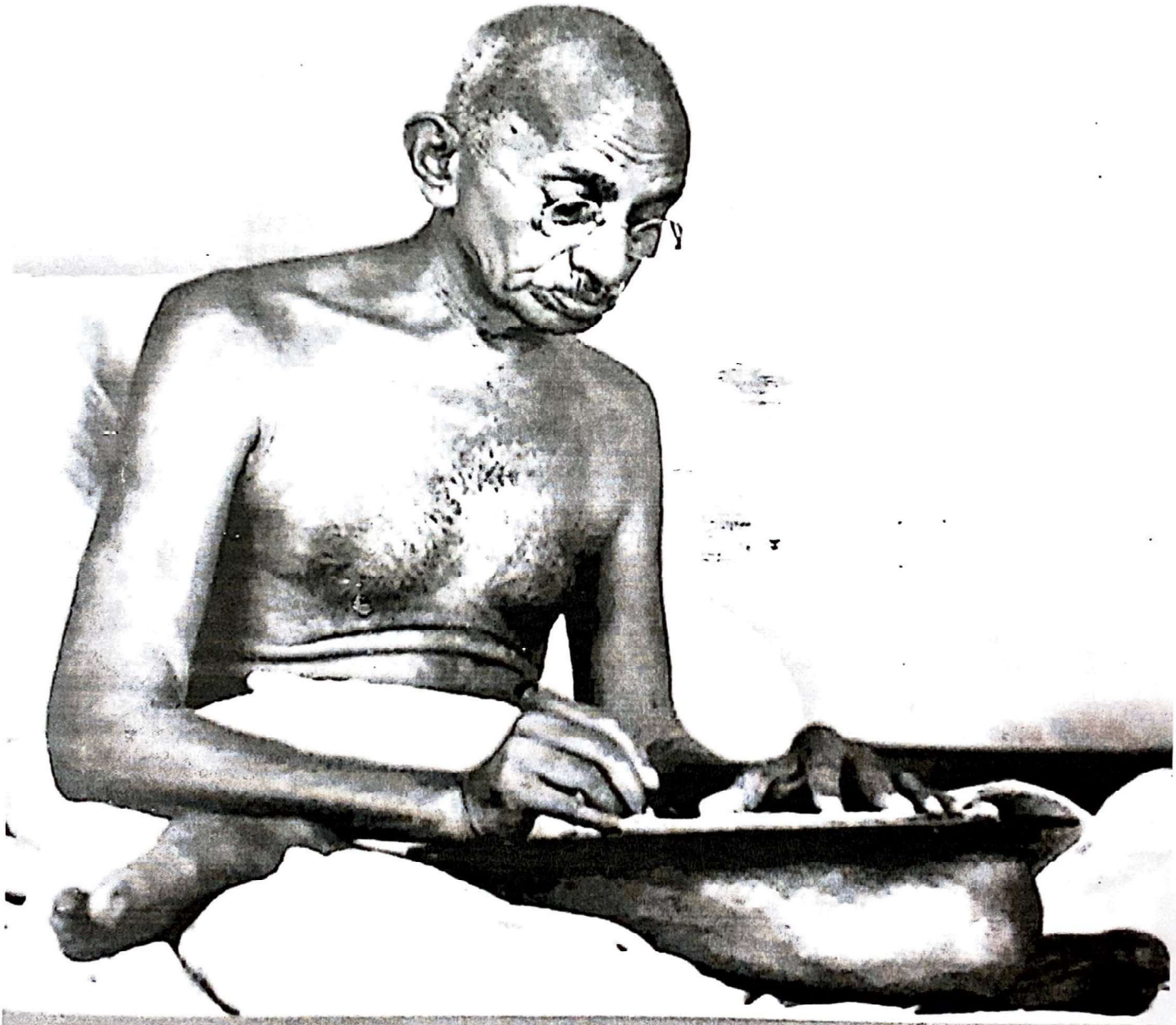
गाँधी

और 1980 के बाद का हिंदी-गुजराती साहित्य



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समकालीन हिंदी कहानियों में गाँधी स्मृति

–संजीव कुमार दुबे

आधुनिक भारत के इतिहास में विरले राजनेता हुए हैं, जिन्होंने भारतीय साहित्य को गहराई से प्रभावित किया है। महात्मा गाँधी ऐसे ही राजनेता थे, जिन्होंने समकालीन राजनीति ही नहीं अपितु समाज, संस्कृति, अध्यात्म और साहित्य को बहुआयामी रूप से प्रभावित किया है। हिंदी साहित्य के द्विवेदी युग और छायावाद के संधि स्थल पर गाँधी जी का उदय होता है। उदय काल से ही हिंदी कविताओं, कहानियों-उपन्यासों में गाँधी विचारों की अनुगूँज सुनाई पड़ने लगती है। राजनीति में आगमन से लेकर नश्वर शरीर के अवसान तक गाँधी हिंदी साहित्य की सभी विधाओं में दर्ज हुए हैं। 30 जनवरी 1948 में गाँधी जी की हत्या के बाद तो जैसे हिंदी साहित्यकारों श्रद्धांजलिमय के आँसुओं का सैलाब ही उमड़ पड़ा। इस दौर में अनेक कवियों ने गाँधी पर कविताएँ लिखीं। यूँ तो गाँधी जी ने स्वयं अपनी आत्मकथा लिखी थी, पर गाँधी के समग्र जीवन और विविध प्रसंगों पर अनेक कहानियाँ और उपन्यास लिखे गए हैं।

समाज, साहित्य और संस्कृति के नायक के रूप में किसी राजनेता के प्रतिष्ठित होने के पूर्व की तैयारी का जायज़ा लेना दिलचस्प होगा। गाँधी जी ने गंभीर तैयारी के साथ भारतीय स्वतंत्रता आंदोलन में कदम रखा था। भारतीय राजनीति में सक्रिय रूप से उतरने के पूर्व उन्होंने अपना एक घोषणा पत्र जारी किया था। 1909 ई. में जारी इस घोषणा पत्र को हम *हिंद स्वराज* के नाम से जानते हैं। चालीस वर्ष की उम्र में लिखी इस छोटी-सी पुस्तक में उनके बीस वर्ष के सार्वजनिक जीवन के अनुभवों का निचोड़ अभिव्यक्त हुआ है। बीस वर्षों के इन वृहद् अनुभवों के आधार पर भारत ही नहीं ब्रिटेन और दक्षिण अफ्रीका के विकट और विपरीत ध्रुवांत की सभ्यता समीक्षा इस पुस्तक में की गई है। विशाल अनुभव के एक छोर पर सभ्यता के शीर्ष पर बैठा हुआ ब्रिटेन है जो औद्योगिक

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नाटकों में गाँधी और गाँधी में नाटक

–प्रमोद कुमार तिवारी

महात्मा गाँधी अपने बचपन में सबसे ज़्यादा एक नाटक से प्रभावित हुए थे। साहित्य की अन्य विधाओं की तुलना में नाटक विशेष है, इसलिए महात्मा गाँधी और नाटक के संबंध पर बात करना उस रिश्ते को समझने की कोशिश है, जिसके कारण नाटक विशेष बन जाता है। सर्वविदित है कि नाटक एक सामूहिक माध्यम है, अपने रचना-विधान के स्तर पर भी और आस्वाद के स्तर पर भी। यह सामूहिकता इसकी बहुत बड़ी ताक़त है। चूँकि यह साहित्य, संगीत, चित्र, स्थापत्य आदि तमाम कलाओं को स्वयं में समाहित कर लेता है, इसीलिए यह अत्यंत ताक़तवर भी हो जाता है। इस ताक़त के उपयोग-दुरुपयोग का एक रूप हम फ़िल्मों में देख सकते हैं। नाटक और सिनेमा की दृश्यता और इसके विशेष प्रभाव के कारण ही नाटकों को लेकर ख़ूब विवाद होते रहे हैं। सामान्यतः कविता, कहानी, उपन्यास आदि को लेकर अब उस तरह विवाद नहीं होते, इनके लिए किसी सेंसर बोर्ड की ज़रूरत नहीं पड़ती, परंतु दृश्य माध्यमों के लिए पड़ती है।

यदि हम इस जीवन को एक नाटक मानते हुए गाँधी के जीवन को देखें, तो पाते हैं कि गाँधी ने संपूर्ण भारत को एक विशालकाय रंगमंच में तब्दील कर दिया और एक कसी हुई पटकथा के साथ अपने व्यक्तित्व को पहले नायक और बाद में महानायक के रूप में स्थापित किया। शायद यही कारण है कि गाँधी को गुज़रे अभी 75 साल भी नहीं हुए, परंतु वे लगभग आख्यान या कहें मिथक का रूप ले चुके हैं। और मिथकों की ख़ासियत यह होती है कि वे किसी एक पात्र में, यानी एक रचना में नहीं अँटते। वे कभी पुराने नहीं पड़ते क्योंकि नए समय के साथ नया रूप ग्रहण कर लेते हैं। गाँधी पर लिखा साहित्य इसका प्रमाण है। सिर्फ़ नाटकों की बात करें तो महात्मा गाँधी पर अनेक नाटक लिखे जा चुके हैं–प्रसन्ना जी का नाटक *बापू*, प्रदीप दलवी का नाटक *मैं नाथूराम*

1980 के बाद की हिंदी कविता में गाँधी

–गजेंद्र कुमार मीणा

आधुनिक गुजराती कविता के एक कालखंड का नाम गाँधी युग है। हिंदी में गाँधी के नाम पर किसी कालखंड का नामकरण नहीं है, किंतु आधुनिक हिंदी कविता के तीसरे चरण और विशेषकर सन् 1920 ई. के बाद की कविताओं पर यदि नज़र दौड़ाएँ तो हम पाएँगे कि गाँधी से प्रभावित होकर कविताएँ लिखी गई हैं। आधुनिक हिंदी कविता का परिदृश्य देखें तो ऐसा प्रतीत होता है कि हिंदी में किसी व्यक्ति को केंद्र में रखकर संभवतः सर्वाधिक कविताएँ गाँधी पर लिखी गईं। इसका मुख्य कारण गाँधी व्यक्ति नहीं, विचार है और यह विचार अधिकांश कवियों को जोड़ने-प्रभावित करने में सफल रहा है।

स्वाधीनता आंदोलन के दौरान हिंदी कविता में गाँधी की उपस्थिति प्रत्यक्ष और प्रभावी रूप में है। गाँधी और गाँधीवादी विचारों पर कविता लिखने वाले कवियों की काफ़ी संख्या है। स्वतंत्रता पूर्व के समय में अधिकांश कवि कमोबेश गाँधी से प्रभावित थे। अयोध्या सिंह उपाध्याय 'हरिऔध', जगन्नाथ दास रत्नाकर, लोचन प्रसाद पांडेय, रामनरेश त्रिपाठी, मैथिलीशरण गुप्त, माखनलाल चतुर्वेदी, सियाराम शरण गुप्त, बालकृष्ण शर्मा 'नवीन', सुमित्रानंदन पंत, सुभद्राकुमारी चौहान, सोहनलाल द्विवेदी, हरिवंशराय बच्चन, महादेवी वर्मा, रामधारी सिंह 'दिनकर', नागार्जुन, भवानीप्रसाद मिश्र, शिवमंगल सिंह 'सुमन', प्रभाकर माचवे, गिरिजाकुमार माथुर और नरेश मेहता आदि के नाम गाँधी और उनकी विचारधारा पर कई कविताएँ लिखने वाले कवियों में परिगणित किए जा सकते हैं। उक्त परिगणित कवि ही गाँधी से प्रभावित हुए थे और गाँधी पर कविताएँ लिखी थीं, ऐसा नहीं है। इसके अतिरिक्त भी कई कवि ऐसे हैं जिनका नाम यहाँ नहीं गिनाया जा रहा है। इन कवियों ने गाँधी और उनके महत्त्व को देखा-महसूसा था, इसलिए इनकी कविताओं में गाँधी और उनके विचार हैं। कुछ कवि तो गाँधी से इतने प्रभावित थे कि उन्होंने कई कविताएँ गाँधी की प्रशंसा में ही लिख दीं



गुजरात का स्वातंत्र्योत्तर हिन्दी लेखन

(प्रो. आलोक गुप्त अभिनंदन ग्रंथ)



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साहित्यिक-सांस्कृतिक सेतु: अनुवादक आलोक गुप्त

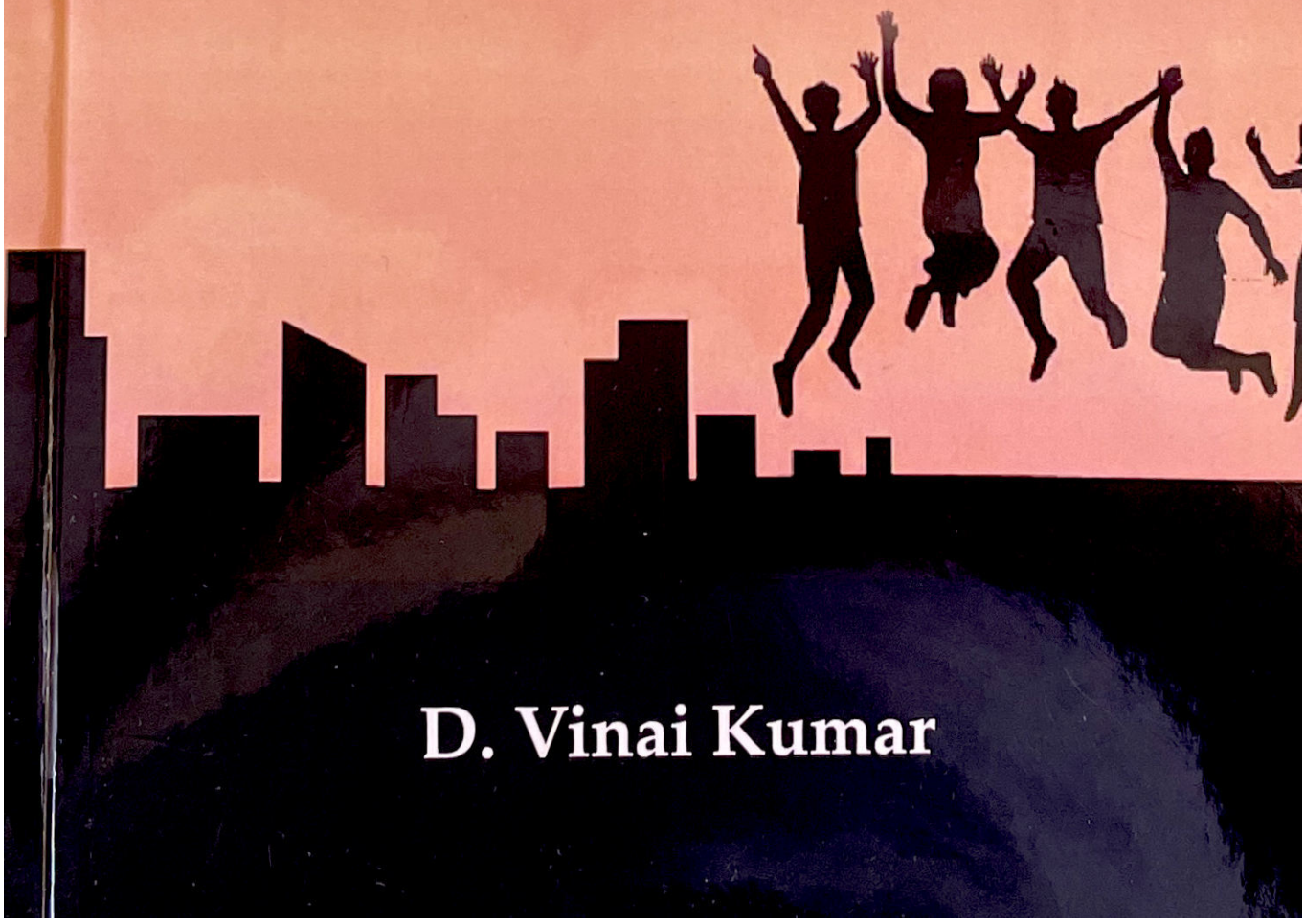
मनोरंजन सीमा

किसी भाषा के साहित्य का यदि अनुवाद न हो तो वह सिर्फ उसी भाषा का साहित्य बनकर रह जाता है। उस भाषा को जानने वाले तो उस साहित्य से [illegible] किन्तु नहीं जानने वाले तक वह साहित्य नहीं पहुँच पाता है। वह असल अर्थ में भारतीय साहित्य नहीं बन पाता है। एक भाषा का साहित्य अनुवाद होने के बाद ही दूसरी भाषाओं में पहुँच पाता है और यह कार्य अनुवादक करता है। भूमंडलीकरण के इस दौर में अनुवाद की उपयोगिता बढ़ी है तथा अनिवार्य-सा बन गया है।

गुजराती साहित्य की समृद्ध परम्परा है और इस परम्परा को बनाने में अनेक साहित्यकारों का योगदान है। ऐसे साहित्यकारों का साहित्य गुजराती तक ही सीमित नहीं रहा है। इनका साहित्य हिन्दी और अन्य भारतीय भाषाओं में अनूदित हुआ है। यही वजह है कि ये रचनाकार गुजराती के ही नहीं भारतीय साहित्य के भी प्रतिनिधि रचनाकार बन जाते हैं। इसी तरह हिन्दी का भी महत्वपूर्ण साहित्य अनूदित होकर गुजराती भाषा में प्रकाशित हुआ है।

अनुवाद को कला कहा जाता है और इस कला को जानने वाला ही एक भाषा के साहित्य-संस्कृति को दूसरी भाषा में ले जाने वाला सेतु बनता है। हिन्दी-गुजराती के सेतु के रूप में हम आलोक गुप्त को देख सकते हैं। उन्होंने गुजराती से हिन्दी और हिन्दी से गुजराती में कई महत्वपूर्ण रचनाओं का अनुवाद किए हैं। दोनों ही भाषाओं और संस्कृतियों पर समान विद्वत्ता रखते हैं। सन् 1981 से लेकर अब तक निरंतर अनुवाद करते रहे हैं। उनके अनुवाद में विधाओं के साथ विषयों की विविधता है। आलोक गुप्त ने गुजराती [illegible]

GERMAN - TELUGU
Proverbs Glossary



D. Vinai Kumar

This book is intended to bridge the German and Telugu cultures through proverbs. It contains around 297 proverbs. All the 275 German proverbs from the book titled Deutsche *SprichwörterfürAusländer*, VEB Verlag, Leipzig along with other 22 German proverbs have been chosen and each proverb has been provided with two equivalents / translations in Telugu. For a few proverbs three equivalents / translations have been cited. In case, exact / near equivalents could not be identified, the literal translation and / or translation through paraphrase of the given German proverb has been given. The equivalents / translations have been identified / done keeping the concept of the given proverb in mind. In some cases, where the concept of two or more German proverbs is the same, identical / similar Telugu equivalents / translations have been provided for them.

D. Vinai Kumar is an Assistant Professor in the Centre for German Studies at Central University of Gujarat, Gandhinagar, since August 2012. He also worked at EFL University from July 2007- May 2009 as Ad hoc Lecturer in the Department of German Studies and at University of Hyderabad from July 2010 to July 2012 as Guest faculty in the Centre for Study of Foreign Languages. His main research area is Translation Studies. Heis the co-editor of the book titled *Heinrich Böll's Six Short Stories* and translated the German story 'Es wirdetwasgeschehen' into Telugu. The book is published by the EFL University, Hyderabad.His other publications are a paper titled 'Cultural issues in translation' in the book *Enquires in Literature and Translation* published by M/s Lakshi Publishers, New Delhi. ISBN No. of the book is: 978-93-82120-71-1 and another paper titled 'German Translation Tradition' in the book *Studies in Literature and Translation* published by M/s Lakshi Publishers, New Delhi. ISBN No. of the book is: 978-93-82120-44-5. His recent paper on "Translation and Politics' is accepted by Peter Lang and is in print.

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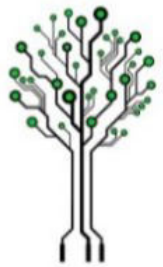

Roshan Jahel



GERMAN

Dr. ROSHAN LAL JAHEL
Centre for German Studies, Central University of Gujarat

ICT in German Language Teaching: Opportunities and Challenges

Abstract:

Though there have been constant efforts to create online teaching content and platforms, the sudden outbreak of Covind-19 pandemic has reinforced the need to adopt online learning tools and devices. The institutions are looking to build digital infrastructure for online teaching and making a case for adopting more and more technology and virtual classrooms beyond the Covid-19 situation and preparing for future with lesser physical and more virtual teaching environment. What are the advantages of using information and communication technology in the language classroom? To what extent technology can be incorporated in a language class. As far as the online or distance learning is concerned, to what extent can we replace the direct learning environment with the virtual

Roshan Jahel

Vinai Kumar Donthula

Politics in Translation

Abstract: If we look at the history of translation, the role of politics in translation can be clearly understood. After the Romans established their empire and started dominating, they translated the important works from Greek into Latin. They also translated the *Bible* into Latin. Coming to the Telugu-speaking region in India in South Asia, the translation/rewriting of the Sanskrit epic Mahabharata into Telugu by the poet Nannayyabhatta, who has translated the first two parvans[1] under the patronage of the King Rajaraja Narendra in the 11th Century AD, had a political motive. In the recent past, as Jeremy Munday says, the central intersection of translation studies and postcolonial theory is that of 'power relations'. Likewise in several instances politics plays a major role in translation.

Keywords: Bible translation, post-colonial theory, Bhakti movement, Indian tradition of translation

This chapter tries to highlight the role of politics in the translation of some of the important literary and religious works in the West and in India. It also gives a brief description of how translation theories and practices were used to shape a concept of nation in Prussia and how the German language evolved in around 400 years. Further, it gives an account of how Indian translation tradition is different from the Western tradition of translation and discusses two case studies in translation, where Venuti's two diverging concepts of translation – 'foreignization' and 'domestication' – are used.

Ever since 'Translation Studies' has become a multidisciplinary study, the term 'translation' can be defined in many ways, depending upon one's perspective. There are different theories of translation based on different perspectives of the scholars. Apart from linguistics, many other disciplines like literary theory, anthropology, sociology, cultural studies, history, philosophy, cognitive psychology, political science, etc. have contributed towards the understanding of 'Translation Studies'. Translation, to be more precise, inter-lingual translation deals with a source text written in a source language and a target text written in a target language. It deals with the clash between two cultures. As Alvarez and Vidal say:

> Contemporary studies on translation are aware of the need to examine in depth the relationship between the production of knowledge in a given culture and its transmission, relocation, and reinterpretation in the target culture. This obviously has to

1 The epic Mahabharata has 18 Parvans. They are like chapters.

> do with the production and ostentation of power and with the strategies used by this power in order to represent the other culture. Translation is culture bound. It makes us ponder, as Edward Said would put it, how knowledge that is non-dominative and non-coercive can be produced in a setting that is deeply inscribed with the politics, the considerations, the positions and the strategies of power. The translator can artificially create the reception context of a given text. He can be the authority who manipulates the culture, politics, literature, and their acceptance (or lack thereof) in the target culture. (1996: 2)

Going by Ludwig Wittgenstein's famous remark: "Die Grenzen meiner Sprache bedeuten die Grenzen meiner Welt,"(='The limits of my language mean the limits of my world'), we could describe translation as a builder of bridges. As Juliane House says, one can overcome the lingua-cultural barriers through translation. Translation mediates between different societies and cultures which speak different languages. It gives readers access to a message which already exists. There is always an orientation backwards to an existing previous message of the original text and an orientation forwards to how texts in a corresponding genre are composed in the target language in translation. Translation is a major means of constructing representations of other cultures. The questions concerning who wrote the text, when, why, for whom and who is now reading it, for what purpose, etc. help the translator understand the situational context. All these questions are reflected in how the text is written, interpreted and read (House 2014: 2–3).

One should also try to understand the politics of translation. Without politics, there is no policy and indeed no translation. If we look at the history of translation, the role of politics in translation can be clearly understood. After the Romans established their empire and started dominating, they translated the important works from Greek into Latin. They also translated the *Bible* into Latin. One can find several instances of politics and power involved in translation. The politics involved in the translation of the *Bible* and several other important works prove this point.

The translation of the *Bible* has witnessed lot of atrocities. Many translators lost their lives. Decades after his death, John Wycliffe's bones were exhumed and burnt and then scattered in the river. William Tindale was burned at stake, as he has translated the New Testament based on Lutheranism (Bassnett 2013: 10). Etienne Dolet was also burned at stake after he was condemned by the theological faculty of the Sorbonne University, apparently for adding the phrase *rien du tot* ('nothing at all') in a passage about what existed after death. The Roman Catholic Church was preoccupied with the 'correct' established meaning of the *Bible* to be transmitted. Any translation diverging from the accepted interpretation was likely to be deemed heretical and to be censured or banned. Martin Luther translated the *Bible* into East Middle German dialect, which later became the standard German version. He was heavily criticized by the Church for adding the word *allein* ('alone/only'), as there was no equivalent Latin word in the ST. He defended his translation in his

famous *Sendbrief vom Dolmetschen* ('Circular Letter on Translation') of 1530. His famous quote extolling the language of the people reads:

> You must ask the mother at home, the children in the street, the ordinary man in the market (sic) and look at their mouths, how they speak, and translate that way; then they'll understand and see that you're speaking to them in German. (Munday 2001: 22–23)

The writings of the scholars like Cicero, Horace and St. Jerome on translation had an influence on the translation of scriptures. Especially the translation of the *Bible* was a battle ground of conflicting ideologies for well over a thousand years in western Europe. The Reformation was a very turbulent period regarding translation. Translation became a state affair and a matter of religion. With the rise of nation states during the period, a number of monarchs who wanted to establish their absolute rule contributed to the Reformation. They did not like revenues of the country going to the Papal treasury. They seized the opportunity offered by Luther and established the Protestant churches in their country. They knew that these new churches will depend on them and accept their political authority.

As Lawrence Venuti says, translation theories and practices have been used to shape a concept of nation in Prussia during Napoleonic Wars. After Napoleon defeated Prussia, Schleiermacher in his sermons urged the congregations to resist French occupation and articulated a concept of the German nation. Schleiermacher felt that German language would be a key factor in this nationalist agenda and felt that it could be improved through translation. He argued that German language could most vigorously flourish and develop its own strength only through extensive contacts with the foreign (Venuti 2013: 126).

If we look at the evolution of medieval German, it has evolved into a literary language with the assistance of Latin in around 400 years – from 11th century to 14th century. Literary German had evolved into a comprehensive communicative system covering all areas of human activity and interest by 15th century. Clerics as well as educated laymen wrote in Latin or in German or in both. For instance, Johann Geiler von Kayserberg, the most popular 15th-century preacher, drafted most of his German sermons in Latin. As German gradually emancipated itself from Latin literary tradition, translations, parallel texts, compilations, adaptations and paraphrases, especially of literature for special purposes warranted the continuing contacts between the two cultures. Eventually, autochthonous German texts covering specific areas of knowledge were translated into other European languages including Latin in the 15th century.

In the recent past, as Jeremy Munday says, the central intersection of translation studies and post-colonial theory is that of 'power relations'. Post-colonial theory of translation gives us a framework to assess the dynamics of political power between languages and also the position of translations in a given linguistic/cultural context. To quote him further:

> Spivak's work is indicative of how cultural studies, and especially post-colonialism, has over the past decade has focussed on issues of translation, the transnational and colonization. The linking of colonization and translation is accompanied by the argument that translation has played an active role in the colonization process and in disseminating an ideologically motivated image of colonial peoples. (2001: 134)

Post-colonial theory moves away from the framework of the Western translation theories. It is sceptical about the ideology of the colonizer. However, some of the Western scholars like Peter Conrad, Ernest Gellner, Russell Jacoby and John MacKenzie express strong reservations about the works of Said, Bhabha and Spivak.

Indian tradition of translation is very distinct compared to the Western or European tradition. Indra Nath Chouduri in his paper "Towards an Indian theory of translation" states that

> [t]he ancient Indian view that translation is nothing but repetition also means that translation is clarification, interpretation which is obtained by repetitive utterances and therefore to an Indian society, steeped in an oral literary tradition of smriti and shruti, differing versions were the norms, not exceptions. The method of producing the authentic and 'pure' text perpetuated in Europe particularly during the period of colonial domination by the Europeans was an alien notion for Indians. To an Indian mind translation is rebirth where 'atma' the invariant core remains constant but other things take a new form.
>
> (2010. "Towards an Indian Theory of Translation". *Indian Literature, Vol. 54, No. 5.* Retrieved from http://www.jstor.org/stable/23348221)

In Indian context almost all the translations/rewritings of literary works were done from Sanskrit into other vernacular languages. Instances of translators translating literary works from the vernacular languages into Sanskrit are very rare or almost nil. Like the Latin in the West, Sanskrit was the language of elite or the educated upper class. Earlier in the Sanskrit dramas in India, the characters spoke variety of dialects apart from Sanskrit. While the upper-caste men and ascetics spoke Sanskrit, women spoke Prakrit. The other inferior characters spoke a variety of dialects like Magadhi, Pali and Sauraseni.

In the 6th century, the Bhakti movement spread from south India to other parts of India. It originated in Tamil Nadu in south India among Vaishnava Alvars, and it was a reaction to the hegemony of upper castes in Hinduism. During that time rigid caste system and untouchability prevailed in Hinduism. Knowledge and power were the privileges of the upper-caste elites. The saint-poets of the Bhakti movement tried to bring God down to the masses. They wanted to eliminate the middle men in the path of salvation. They sang in the language of the common man so that even the illiterates could understand. They opposed the elaborate rituals existing in Hinduism and emphasized on simple bhakti or devotion. The works of these poets were in local languages as opposed to Sanskrit (https://nptel.ac.in/courses/109104050/pdf_version/lecture2.pdf).

Coming to the Telugu-speaking region in India in South Asia, the translation/rewriting of the Sanskrit epic Mahabharata into Telugu by the poet Nannayyabhatta, who has translated the first two parvans[2] under the patronage of the King Rajaraja Narendra in the 11th century AD, had a political motive. N.C. Narsimha Acharya in his paper titled "The Andhra Mahabharatamu" says that

> The translation was undoubtedly the outcome or the Brahmanical reaction that set in the wake of the extermination and extinction of Buddhism and Jainism in the Telugu country. All Telugu literature prior to Nannayabhatta perished. There is no trace of the Buddhist and Jaina Bharatas now. Possibly Nannayabhatta' s rendering in the Kävya style was in answer to those that prevailed prior and upto his time, which were conceived as Buddhist or Jaina versions of the Mahäbhärata. If that was so, then it admirably answered the purpose.
>
> (1941. "The Andhra Mahabharatamu", *Annals of the Bhandarkar Oriental Research Institute, Vol. 22, No. 1/2.* Retrieved from https://www.jstor.org/stable/i40079365.)

The translation of Omar Khayyam's *Rubaiyat* by Edward FitzGerald into English and by Harivansh Rai Bachan into Hindi are apt examples of manipulation. Harivansh Rai Bachan's translation "Madhushala", which literally translates as 'house of wine', has become very popular in Hindi. FitzGerald took lot of liberties in his translation. His target audience were the English readership. He translated for his domestic readers and his was a free translation. He paraphrased many of the quatrains. Following is an extract from a letter written to E. B. Cowell in 1857 by Edward FitzGerald:

> It is an amusement for me to take what liberties I like with these Persians, who (as I think) are not Poets enough to frighten one from such excursions, and who really do want a little Art to shape them. (Lefevere 1992: 80)

Talking about the politics involved when the literature of the Third World gets translated, Gayatri Spivak in her article titled "Politics on Translation" gives the following instance:

> Let us consider an example where attending to the author's stylistic experiments can produce a different text. Mahasweta Devi's "Stanadāyini" is available in two versions. Devi has expressed approval for the attention to her signature style in the version entitled "Breast-Giver." The alternative translation gives the title as "Wet-Nurse," and thus neutralizes the author's irony in constructing an uncanny word; enough like "wet-nurse" to make that sense, and enough unlike to shock. It is as if the translator should decide to translate Dylan Thomas's famous title and opening line as "Do not go gently into that good night." The theme of treating the breast as organ of labor-power-as-commodity and the breast as metonymic part-object standing in for other-as-object – the way in which the story plays with Marx and Freud on the occasion of the

2 The epic Mahabharata has 18 Parvans. They are like chapters.

> woman's body – is lost even before you enter the story. In the text Mahasweta uses proverbs that are startling even in Bengali. The translator of "The Wet-Nurse" leaves them out. She decides not to translate these hard bits of earthy wisdom, contrasting with class-specific access to modernity, also represented in the story. In fact, if the two translations are read side by side, the loss of the rhetorical silences of the original can be felt from one to the other. (1993: 182–183)

Out of his concern for the problem of unequal power relations between cultures, Venuti came up with the concepts of 'foreignization' and 'domestication' based on the two alternative methods posited by Schleiermacher in his lecture in Berlin in 1813 – either to bring the text to the reader or to take the reader to the text (Bassnett 2013: 47).

I would like to give a brief account of two of the three case studies I have used in my PhD thesis with respect to domestication and foreignization strategies.

The book titled *jarman jaanapada kathalu* translated by P. Srinivas Reddy and others published by Peacock Classics, Hyderabad, has come up with the translations of 17 stories by Brothers Grimm into Telugu. It is not known whether the stories are directly translated from German into Telugu. It is believed that they are indirect translations from English. The stories have been adapted to the target language (Telugu) culture. Especially most of the cultural images – names of the characters, animals and food items – have been adapted to suit the Telugu culture. They no longer read as German stories, but as Telugu stories. It can be said that these stories are domesticated into Telugu.

Another text that is taken for case study is the German story titled "Reise im Boot", which is a translation of the English translation by Percy Eckstein of "Padava Prayaanam", a Telugu short story written by Palgummi Padmaraju. The story is basically about a boat journey of a couple belonging to the lower middle-class society. Their names are "Paddaalu" and "Rangi".

In the German story, the word "maridi" (='brother-in-law') is translated as "brother". It may be because of the difference in the cultural connotations associated with the word "maridi" in the source and target culture. The translations of the stock details are omitted in the German story. It is translated as tamarind and other goods. The word "kanduvaa" (= 'a piece of cloth, which is folded and worn on onside of the shoulder by men') is translated as "Tuch" (='towel/cloth/scarf'). The word "magajiira" (='manlike voice') is translated as "Baβnote" (='bass note'). The swear word "lanja" (='bitch'), used several times, is translated as "Miststück" (='bitch'); "Schlampe" (='slut'); "die Tochter einer Hündin" (='daughter of a bitch'); "Lügnerin" (='liar'); "die dreckige Hündin" (='dirty bitch') and "Gaunerin" (='female rogue'). We can say that foreignization strategy was used in the German translation.

Therefore, I would like to say that 'politics' plays an important role in translation and that both are interrelated, as the present-day political discourse is heavily dependent on translation with around 195 countries in the world having different national/official languages for correspondence.

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张振江　吉伟伟　主编

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અજયસિંહ ચૌહાણ

(૧૯૮૩)

ગુજરાતી કવિતાનું યુગદર્શન

પોતાના ઉદ્‌ભવકાળથી મનુષ્ય કોઈ ને કોઈ રીતે અભિવ્યક્ત થવા માગે છે. અભિવ્યક્તિની એવી નિજી આવશ્યકતાને કારણે ગુફાવાસી માણસ ગુફાચિત્રો કરતો થયો અને પશુ-પંખીઓની ચેષ્ટાઓનું અનુકરણ કરી અવાજના તાલે નૃત્યો કરતો થયો. એવા જ પ્રકૃતિજગતના અનુકરણોમાંથી ભાષાનો જન્મ થયો. દુનિયાની દરેક ભાષાને ઉદ્‌ભવકાળે પ્રેરણાપીયૂષ કવિતાએ પાયા છે. કવિતા માનવમનના ગહનતમ ભાવોને અભિવ્યક્ત કરે છે. કવિતાની વિભાવના આપતાં શ્રી આનંદશંકર ધ્રુવ નોંધે છેઃ

'કવિતા એ પરમાત્માની મૂર્તિ છે, શબ્દબ્રહ્મનો એ આવિર્ભાવ આત્મા ઉપર અલૌકિક પ્રકાશ પાડે છે. એની ઝળહળ જ્યોતિ જડ અને ચૈતન્ય પદાર્થોના ઊંડા અંધકારનો નાશ કરે છે. આ જડ જગતના ઊંડા મર્મો કવિઓએ પ્રથમ જણાવ્યાં છે. ત્યારપછી જ પદાર્થ વિજ્ઞાનશાસ્ત્રીઓને જણાયાં છે. પદાર્થ વિજ્ઞાનશાસ્ત્રીઓ પણ કલ્પનાશક્તિને બળે જ નવી શોધો કરી શક્યા છે. અંતરગુહામાં સંતાઈ રહેલા અનેક અજ્ઞાત સામર્થ્યો અને અશક્તિઓ, સદ્‌-અસદ્‌ વૃત્તિઓ અને વાસનાઓ કવિતાના પ્રકાશથી પ્રકટ થાય છે.'

ગુજરાતી કાવ્યપરંપરાનાં મૂળિયાં અગિયારમી સદીમાં હેમચન્દ્રાચાર્ય સંપાદિત લોકસાહિત્યના અપભ્રંશ દુહાઓમાં મળે છે. નરસિંહ, મીરાં, ભાલણ, અખો, પ્રેમાનંદ, દયારામ અને અન્ય સંત કવિઓની ધારાએ મધ્યકાલીન ગુજરાતી સાહિત્યને ઘડ્યું. અઢાર સો બાવનમાં છેલ્લા મધ્યકાલીન કવિ દયારામના મૃત્યુની સાથે મધ્યકાળ પૂરો થાય એ પહેલાં અઢાર સો પિસ્તાળીસમાં દલપતરામની 'બાપાની પીપર'ના પ્રકાશને અર્વાચીન યુગનાં પગરણ થઈ ચૂક્યાં હતાં.

ઓગણીસમી સદી સમાજ, સંસ્કૃતિ, શિક્ષણમાં આખા વિશ્વમાં પરિવર્તનકારી રહી. યુરોપમાં થયેલી ઔદ્યોગિક ક્રાન્તિને પરિણામે અનેક સામાજિક ઊથલપાથલો થઈ. ભારતમાં પણ આ જ સમયમાં અંગ્રેજ શાસનના મૂળિયાં દૃઢ થયાં. અંગ્રેજ પ્રજાના સંપર્કે આપણાં સમાજ સાહિત્ય-ધર્મ-સંસ્કૃતિ પ્રત્યે વિચારકો નવેસરથી વિચારતા થયા. આવા સંક્રાન્તિકાળે દલપતરામનો જન્મ થયો. પરંપરાગત શિક્ષણ અને ફાર્બસ જેવા અંગ્રેજ

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અધિકારીની મિત્રતાને કારણે પરંપરા સાથે અનુસંધાન જાળવીને પણ દલપતરામની કવિતા નવા વિષયો-સંવેદનોને તાગવા લાગે છે. મધ્યકાળમાં બહુધા પરલક્ષી રહેલી કવિતાના, આ સમયના અને ગુજરાતી કવિતાના મહત્ત્વના પ્રસ્થાનકાર દલપતરામ બને છે. દલપતરામથી ઉંમરમાં નાના નર્મદ પણ આ ગાળામાં કાવ્યપ્રવૃત્ત બને છે. નર્મદે થોડું પણ અંગ્રેજી ઢબનું શિક્ષણ લીધું હોવાને કારણે તથા અંગ્રેજી સાહિત્યના સંપર્કને પરિણામે તેની કવિતા અર્વાચીનતા તરફ વધુ ઢળેલી છે. આત્મલક્ષી સંવેદન, સમાજ સુધારો, દેશાભિમાન જેવા વિષયોને કારણે નર્મદને અર્વાચીનોમાં આદ્ય તરીકે ગણવામાં આવ્યા. 'નર્મકવિતા'માંથી પસાર થતાં આપણે એ જોઈ શકીએ છીએ. આ જ ગાળાના બીજા મહત્ત્વના વિવેચક નવલરામ પંડ્યાએ પણ કાવ્યો લખ્યાં. તેમનાં કાવ્યોમાં પણ સમાજસુધારો જ કેન્દ્રમાં હતો. બાળવિવાહ, વિધવાવિવાહ વિશે નવલરામે કાવ્યો લખ્યાં. બાળવિવાહની બદીને કટાક્ષમય રીતે રજૂ કરતું 'જનાવરની જાન' જેવાં કાવ્યો આપણે જોઈ શકીએ છીએ. આ ત્રણ કવિઓ ઉપરાંત કવિ હીરાચંદ, હરગોવનદાસ કાંટાવાળા, ભોળાનાથ દિવેટિયા જેવા કવિઓએ પણ પોતાની સ્વતંત્ર પ્રતિભાએ કાવ્યસર્જન કર્યું. ઈ.સ.૧૮૪૫માં 'બાપાની પીપર'ના પ્રકાશનથી તે ૧૮૮૫માં 'ક્લાન્તકવિ'ના પ્રકાશન સુધીના સમયગાળાને સુધારકયુગ તરીકે ગણવામાં આવે છે.

સુન્દરમ્ કહે છે તેમ 'પ્રાચીનો અને અર્વાચીનોની વચ્ચે સેતુ તરીકેનું જે સ્થાન દલપતરામનું છે, તેવું જ સ્થાન અર્વાચીન કવિતાના પહેલા અને બીજા સ્તબક વચ્ચે બાલાશંકરનું છે.' પંડિતયુગ તરીકે ઓળખાનાર આ સમયગાળામાં કવિતાક્ષેત્રે અનેક નવપ્રયાણો થયાં. બાલાશંકર કંથારિયાની કવિતામાં સંસ્કૃત, વ્રજ, અરબી-ફારસી શૈલીઓ પ્રગટી, તો સાથે સાથે ગઝલ જેવા અરબી-ફારસી સ્વરૂપનું સૌપ્રથમ ઈયત્તા અને ગુણવત્તા એમ બંને રીતે ખેડાણ કરી, એ સ્વરૂપને ગુજરાતીમાં દૃઢ કર્યું. 'કલાન્તકવિ' ની કવિતામાંથી પસાર થતા આપણે એ જોઈ શકીએ છીએ. આ યુગને સાક્ષરયુગ પણ કહેવામાં આવ્યો. સૌપ્રથમવાર અંગ્રેજી કેળવણી મેળવેલા સાક્ષરો આ યુગમાં સાહિત્ય સર્જનક્ષેત્રે પ્રવૃત્ત થયા. રાજ્યસત્તા હંમેશા પ્રજાજીવન પર ઊંડી અસર કરતી હોય છે. ઈ.સ.૧૮૫૭નો પ્રથમ સ્વાતંત્ર્યસંગ્રામ અંગ્રેજોએ દાબી દીધો. રાણી વિક્ટોરિયાએ ઢંઢેરો કરી ભારતની સત્તા ઈસ્ટ ઇન્ડિયા કંપની પાસેથી પોતાને હસ્તક લીધી. આપણી દૃષ્ટિએ સંગ્રામ દાબી દેવાની ઘટના વિશેષ મહત્ત્વની હતી. આ ઘટનાને એ સમયના કવિઓએ 'દેશમેં આનંદ ભયો જે જે વિકટોરિયા'(નર્મદ), 'શુભ સંવતે ઓગણીપંદરા'માં રુડું રાણીજીનું રાજ' (દલપતરામ) વધાવ્યું હતું. અંગ્રેજ શાસનને પરિણામે ભારતમાં લોર્ડ મેકોલેના કહેવાથી અંગ્રેજી ઢબની કેળવણીની શરૂઆત થઈ. મુંબઈ, મદ્રાસ, કલકત્તામાં યુનિવર્સિટીઓની

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સ્થાપના થતાં નરસિંહરાવ દિવેટિયા, બ.ક.ઠાકોર, ન્હાનાલાલ, કાન્ત, કલાપી, ગોવર્ધનરામ જેવા કવિઓની એક આખી પેઢી આ શિક્ષણ પ્રણાલીમાં તૈયાર થઈ. એનો મોટો ફાયદો એ થયો કે અંગ્રેજી સાહિત્યનો અભ્યાસ તો થયો જ પણ સાથે સાથે સંસ્કૃત સાહિત્યનો સંપર્ક પણ વધ્યો. પરિણામે આપણી પરંપરાઓ પ્રત્યે આ કવિઓ સભાન થયાં. નરસિંહરાવ દિવેટિયાએ પાલ્ગ્રેવની 'ગોલ્ડન ટ્રેઝરી' પરથી પ્રેરણા લઈ 'કુસુમમાળા' કાવ્યસંગ્રહ આપ્યો. 'કુસુમમાળા'નાં કાવ્યપુષ્પો 'રંગ રૂપ ગંધવિહીન' (મણિલાલ નભુભાઈ દ્વિવેદી) હોવા છતાં વિષયની એક નવી દિશા તેણે ખોલી આપી. મૂળે ઇતિહાસના પ્રોફેસર બલવંતરાય ઠાકોરે ઇટાલિયન કાવ્યસ્વરૂપ સૉનેટને ગુજરાતીમાં રોપ્યું અને ઉત્તમોત્તમ સૉનેટ રચનાઓ આપી સૉનેટ સ્વરૂપને દૃઢમૂળ કર્યું. માત્ર કવિતા જ નહીં પણ કાવ્યના સ્વરૂપ વિષે પણ બ.ક.ઠાકોરે વિચારણા કરી માટે તેમને કવિતાશિક્ષકનું બિરુદ મળ્યું. માત્ર લાગણીના ઊભરાઓની વિચારણા સામે તેમણે વિચારપ્રધાન કવિતાની વાત કરી. 'મ્હારાં સૉનેટ'માં આપણે એમની કાવ્યભાવના કવિતા સ્વરૂપે જોઈ શકીએ છીએ. મણિશંકર રતનજી ભટ્ટે ('કાન્ત') પોતાની નિજી સિસૃક્ષા ને જરૂરિયાતમાંથી ખંડકાવ્ય નામનું નવું સ્વરૂપ નિપજાવ્યું. ગ્રીક ટ્રેજેડી અને સંસ્કૃત દીર્ઘકાવ્યના સંયોજને કરીને ઉત્તમ ખંડકાવ્યો તેમણે આપ્યાં. 'વસંતવિજય', 'ચકવાકમિથુન', 'અતિજ્ઞાન' જેવાં ખંડકાવ્યોમાં નિયતિની નિષ્ઠુરતા સંસ્કૃત તત્સમ પદાવલિ અને અનેક છંદોના પ્રયોગે આલેખી. ટી.એસ. એલિયટે તો ઘણી પાછળથી 'ઓબ્જેકટીવ કો-રીલેટીવ'ની વાત કરી, કાન્તનાં ખંડકાવ્યોમાં એ વિશેષરૂપે પ્રયોજાયેલી છે.

ત્યારબાદ સુરસિંહ તખ્તસિંહ ગોહિલ 'કલાપી'એ રાગ અને ત્યાગ વચ્ચેની પરિસ્થિતિને વ્યક્ત કરતાં કાવ્યો આપ્યાં. લાગણીના અતિરેકવાળી હોવા છતાં એમની કવિતાનાં કામણ એક સદી પછી પણ સામાન્ય ભાવકના મન પરથી ઓછાં થયાં નથી. ગઝલ, સૉનેટ, ખંડકાવ્ય એમ અનેક સ્વરૂપોમાં તેમણે કાવ્યલેખન કર્યું. 'હમીરજી ગોહિલ' નામે પોતાના પૂર્વજ પર મહાકાવ્ય લખવાનો પડકાર પણ તેમણે ઝીલ્યો. 'રૂડી ગુજરાતી રાણી વાણીના વકીલ' દલપતરામના નાના પુત્ર ન્હાનાલાલે પોતાનાં કાવ્યોમાં ગુજરાતી સ્ત્રીહૃદયના ભાવોને વ્યક્ત કર્યા. વિપુલ પ્રમાણમાં એટલું જ સત્ત્વશીલ કાવ્યસર્જન કરી, ન્હાનાલાલ તે સમયમાં મહાકવિનું બિરુદ પામ્યા. કવિતાનાં અનેક સ્વરૂપોમાં વિષય-સંવેદન અને સ્વરૂપની રીતે નવપ્રસ્થાન કરનાર આ મહત્ત્વના કવિઓ ઉપરાંત ત્રિભુવન પ્રેમશંકર 'મસ્ત કવિ', ગોવર્ધનરામ ત્રિપાઠી, અરદેશર ફરામજી ખબરદાર જેવા કવિઓએ પણ પંડિતયુગની કવિતામાં પોતાનું નિજી યોગદાન આપ્યું.

વીસમી સદીના બીજા દસકામાં ભારતીય ઉપખંડ અને આમ તો સમગ્ર વિશ્વને

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પ્રભાવિત કરનાર શકવર્તી ઘટના બની. મોહનદાસ કરમચંદ ગાંધી દક્ષિણ આફ્રિકામાં સત્યાગ્રહની લડાઈનો સફળ પ્રયોગ કરી ભારત પાછા આવ્યા. એમનો પ્રભાવ તત્કાલીન આઝાદીની લડતમાં જ નહીં પણ સાહિત્ય તેમ જ જીવનમાં બધાં ક્ષેત્રોમાં પડ્યો. ગુજરાતી સાહિત્ય પરિષદના પ્રમુખ તરીકે તેમણે 'કોશિયો પણ સમજી શકે તેવી ભાષા'માં સાહિત્ય રચવાની હિમાયત કરી. અત્યાર સુધી ભદ્ર વર્ગ દ્વારા જ અને જાણે કે ભદ્ર વર્ગનાં જ સંવેદનોને આલેખતી કવિતાની સામે તેમણે સામાન્ય માણસની વાત કરી. ઉમાશંકર જોશી, સુન્દરમ્, ઝવેરચંદ મેઘાણી, કૃષ્ણલાલ શ્રીધરાણી, ત્રિભુવન વ્યાસ, મનસુખલાલ ઝવેરીનાં કાવ્યોમાં આપણે એ જોઈ શકીએ છીએ. સુન્દરમે-ઉમાશંકરે વૈયક્તિક ભાવો ઉપરાંત દલિતો-પીડિતો-વંચિતોની વેદના, ભાવ-સંવેદનો 'બામણા-ગામની ભંગડી', 'તેર સાતની લોકલ', 'દળણાંના દાણા', 'જઠરાગ્નિ' જેવાં કાવ્યોમાં આલેખ્યાં. ઉમાશંકરે 'વિશ્વશાંતિ'માં ગાંધીમૂલ્યો સત્ય-અહિંસા-પ્રેમ દ્વારા વસુધૈવ કુટુંબકમ્નો મંત્ર દૃઢ કર્યો. પંદર વર્ષના આ ટૂંકા ગાળા પછી ઈ.સ.૧૯૪૦માં પ્રહ્લાદ પારેખ વિષય અને અભિવ્યક્તિનો વળી પાછો મોટો વળાંક આણે છે. ગાંધીયુગનું જ સંતાન હોવા છતાં જાણે કે એ બધાથી અલિપ્ત રહી માત્ર સૌંદર્યબોધ આ કાવ્યોમાં પ્રગટાવ્યો. પ્રહ્લાદ પારેખની કવિતાને પોંખતાં ઉમાશંકર જોશીએ એને 'નીતરાં પાણી' કહીને આવકારી. પછી તો સૌન્દર્યાભિમુખ કવિતાનો આખો યુગ આવ્યો. રાજેન્દ્ર શાહ, નિરંજન ભગત, ઉશનસ્, જયન્ત પાઠક જેવા કવિઓએ ગાંધીયુગમાં ગાંધીમૂલ્યોના વહનનું સાધન બનેલી કવિતાને નવા રૂપે પ્રયોજી. આ કવિઓ પર ગાંધીજી કરતાં રવીન્દ્રનાથ ટાગોરનો પ્રભાવ વધુ છે. કવિતા આ કવિઓ માટે નિજાનંદ છે. એટલે એ કહે છે:

'હું તો બસ ફરવા આવ્યો છું!'
હું ક્યાં એકે કામ તમારું કે મારું કરવા આવ્યો છું?'
'નિરુદ્દેશે
સંસારે મુજ મુગ્ધ ભ્રમણ
પાંશુ-મલિન વેશે...
'નિરુદ્દેશે'
'કેવળ ફરવાને નીકળ્યો છું જાણે સંધ્યાકાળે
એકે કામ નથી કરવાનું મારે આ જનમારે'
'આવ્યો છું તો લાવ જરા અહીં મળતો જાઉં
આ મેળે જન લાખ, ભલા કેં ભળતો જાઉં,'

ઉશનસે ઉચિત રીતે જ આ કવિતાને 'કામણગારી' કવિતા કહી છે.

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ઔદ્યોગિક ક્રાન્તિ, શહેરીકરણ, વૈજ્ઞાનિક શોધખોળોને પરિણામે માનવીય સંબંધોમાં પડેલી તિરાડો અને સિમેન્ટ-કૉંક્રિટનાં જંગલો વિશે યુરોપમાં તો આપણાથી એક સદી પહેલાં ફ્રેન્ચ બોદલેર 'દૂરિતનાં પુષ્પો' રચે છે. આપણે ત્યાં નિરંજન ભગત સૌ પ્રથમ પોતાની કવિતામાં એ વાત લઈને આવે છે, એટલે નિરંજન ભગતની કવિતા સૌંદર્યાભિમુખ તો છે જ પણ સાથે સાથે શહેરીકરણની વંધ્યતાને પણ આલેખે છે. જ્યારે રાજેન્દ્ર શાહ પ્રેમ-પ્રકૃતિનાં અવનવાં રૂપોને પોતાનાં ગીતો-સોનેટ-છંદોબદ્ધ કાવ્યોમાં આલેખે છે. ઉશનસ્ આદિમ વનો અને અનેક વિષયોનું વૈવિધ્ય સોનેટમાં લાવે છે. જયન્ત પાઠકમાં છૂટી ગયેલા વતન-ઘર-વનો પ્રબળ રૂપે કાવ્યરૂપ પામ્યાં. આ જ કવિઓ સાથે આપણે વેણીભાઈ પુરોહિત તથા બાલમુકુન્દ દવેને પણ મૂકી શકીએ.

ઓગણીસમી સદીના મધ્યભાગમાં ઔદ્યોગિક ક્રાન્તિ અને વૈજ્ઞાનિક શોધખોળોને પરિણામે યુરોપમાં એક પ્રકારની સ્વછંદતા આવી, મૂલ્યહ્રાસ થયો. નિત્સેએ કહ્યું 'ભગવાન મરી પરવાર્યા છે.' ડાર્વિને પોતાની શોધો દ્વારા સાબિત કર્યું કે આપણે કોઈ સ્વર્ગમાંથી આવ્યા નથી. આપણે દૈવી સંતાનો નથી. પણ હજારો વર્ષની ઉત્ક્રાંતિનું પરિણામ છીએ. સિગ્મંડ ફ્રોઇડે અજાગ્રત મનના પડદાઓ પાછળનાં રહસ્યો છતાં કર્યાં. આમ સદીઓ પુરાણી વિચારણાઓ, પરંપરાઓ સાથે વિચ્છેદ થયો ને માનવજીવનમાં એક પ્રકારની અંધાધૂંધી ફેલાઈ. માણસ પણ મશીન બન્યો. આની તીવ્ર અસર સમકાલીન ઘટના-પ્રસંગો સાથે આપણે ત્યાં વીસમી સદીના મધ્યમાં થઈ.

વીસમી સદીની શરૂઆતમાં જ માનવજાતે બે વિકરાળ વિશ્વયુદ્ધો જોયાં. આપણે ત્યાં અહિંસાએ કરીને પ્રમાણમાં ઓછી ખુવારીએ મળેલી આઝાદીમાં ભાગલા છતાં માનવજાતે કદી ન જોયેલો ભીષણ કત્લેઆમ જોયો, ગાંધીજીની હત્યા થઈ. આ બધાંને કારણે એક પ્રકારની હતાશા-નિરાશા, એકલતા, છિન્નભિન્નતા સંવેદનશીલ માણસોને ઘેરી વળી. એમાંથી આધુનિક કવિતાનો પિંડ રચાયો. ઉમાશંકર જોશીના 'છિન્નભિન્ન છું' કાવ્યમાં આ અસ્તિત્વની છિન્નતા પહેલવહેલી પ્રગટ થઈ માટે એને આધુનિક કવિતાની નાન્દી કહેવામાં આવ્યું.

'છિન્નભિન્ન છું
નિશ્છંદ કવિતામાં ધબકવા કરતા લય સમો,
માનવજાતિના જીવનપટ પર ઊપસવા મથતી કોઈ ભાત જેવો,
ઘેરઘેર પડેલ હજી નવ-હાથ-લાગ્યા ભિક્ષુકના ટુક જેમ
વિચ્છિન્ન છું.'

આ જ વિચ્છિન્નતાનો ભાવ અને નિશ્છંદ કવિતા જાણે કે આધુનિકતાનો યુગમંત્ર

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બની ગઈ. આવનાર કવિતાનો વર્તારો ઉમાશંકરના 'સપ્તપદી' સંગ્રહમાંથી તેમ જ 'શોધ' જેવી રચનાઓમાંથી મળી જાય છે.

શીર્ણવિશીર્ણ થતા જતા આસપાસના જગત, જાતીય વૃત્તિ, અસ્તિત્વ સાથે જોડાયેલ પીડાઓ, સાર્ત્ર, કેમ્યૂ, આયોનેસ્કો, બેકેટ જેવા સર્જકોના પ્રભાવને કારણે એબ્સર્ડીટીનો મહિમા આ યુગમાં થયો. સુરેશ જોષી, ગુલામમોહમ્મદ શેખ, લાભશંકર ઠાકર, સિતાંશુ યશશ્ચંદ્ર, ચિનુ મોદી, રાવજી પટેલ જેવા આધુનિક કવિઓની કવિતામાં આપણે આ ભાવ જોઈ શકીએ છીએ.

સુરેશ જોષીએ પોતાના કાવ્યસર્જન કરતાં કરતાં કાવ્યઆસ્વાદ, કાવ્યવિવેચન, સંપાદનની પ્રવૃત્તિથી આપણી કવિતાને જુદો આયામ આપ્યો. માલાર્મેના શબ્દના સાંગીતિક આંદોલનોનો અને વાલેરીના શુદ્ધ કવિતા તરફના અભિગમનો આ યુગના કવિઓ પર સૌથી મોટો પ્રભાવ પડ્યો. ચિત્રકળાના અભિગમો પણ આ સમયની કવિતામાં આવ્યા. સંસ્કૃત વૃત્તોના વપરાશમાંથી અછાંદસ તરફનું વલણ વધ્યું. આ સંદર્ભે સુરેશ જોષી કહે છેઃ

'છન્દોની બાબતમાં સંસ્કૃત વૃત્તોનો વપરાશ આપણે હજી છોડી શક્યા નથી તે એક સૂચક ઘટના છે....કૃત્રિમ કાવ્યાભાસી ઇબારત ઊભી કરવામાં સંસ્કૃત વૃત્તોની જવાબદારી ઓછી નથી. શબ્દોના ક્લેશકર વિશ્લેષ, લઘુગુરુમાં લેવાતી છૂટ, સંસ્કૃત શબ્દોનું ભરણું આ બધાંનો પણ વિચાર કરવાનો રહે. આ વૃત્તોને કારણે પ્રવેશતું તત્ત્વ કંઈક યાંત્રિકતા સ્વરૂપનું છે.'

ગીત-ગઝલ-સોનેટ તેમ જ અન્ય સ્વરૂપો આ સમયના કવિઓને અભિવ્યક્તિના ઊંડાણને તાગવા અસમર્થ લાગવાથી એ અછાંદસ તરફ વળ્યા. હજારો વર્ષોની છંદ પરંપરા સાથે અચાનક વિદ્રોહ કર્યો એ આ સમયની મોટી ઉપલબ્ધિ છે. ભાષાને આ કવિઓએ સાધન તરીકે નહીં પણ સાધ્ય તરીકે પ્રયોજી. ... કમનસીબે અભિવ્યક્તિનું જે મહત્ત્વનું સાધન માનવ જોડે છે તે અપૂર્ણ છે. આ સંવેદન આધુનિક સમયના મોટા ભાગના કવિઓની કવિતામાં મળે છે.

'નામોની કાઢું નનામી
ક્રિયાપદોના પગ ભાંગું
શબ્દોનો પૂંછડીએ ચોંટેલી
સૃષ્ટિને ઝાટકી નાખું.
છતાંય જો ન છોડે
હઠીલા રોગ જેવા શબ્દો

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તો કવિતાની કલ્પના કર્યાના બધા દોષ
હગી નાખું રોજ સવારે.
મને વળગે, એકબીજાને વળગે,
મારી નજર સામે થાય નાગા,
એકબીજાને સંભોગે.
નકટા જણ્યા કરે ભૂંડણની જેમ,
અને આરોગે એકબીજાને..'
'ભાષાની ભીતર?
ભાષાને ભીતર જેવું શું?
ભાષા તો શબ્દો
અક્ષરનો મેળ
સેળભેળ જે સૃષ્ટિની સ્ફૂર્તિ
એનો અવાજ અંશ
એ અંશે ઉપજાવ્યા અક્ષર
અક્ષરના કંઈ મેળ વિવિધ ને
એમ બની ગઈ ભાષા.'

શબ્દની શોધથી આ સમયની કવિતાએ અનેક નૂતન પ્રસ્થાનો કર્યાં. લાભશંકર ઠાકર 'વહી જતી પાછળ રમ્યઘોષા'માં સંસ્કૃત પદાવલિ યોજે છે પણ પાછળથી એ તેમાંથી નીકળી અરૂઢ પદાવલિ તરફ જાય છે તેમ તેમની કવિતા પ્રલાપોવાળી, પ્રત્યાયનના પ્રશ્નો ઊભી કરતી થાય છે. તો આ જ સમયના મહત્ત્વના કવિ સિતાંશુ યશશ્ચંદ્રના 'ઓડિસ્યુસનું હલેસું'માં સર્રિયલ કાવ્યો વિશેષ છે. આ કવિતા પણ આધુનિકયુગમાં પોંખાઈ. આજે એમાંની ઘણી રચનાઓ પ્રલાપોથી વિશેષ કશું નિપજાવતી નથી, પણ એમના બીજા સંગ્રહ 'જટાયુ'માં ભાષા અને અભિવ્યક્તિની નવીન રીતિઓ દ્વારા આધુનિક સંવેદન વધારે ધારદાર બને છે. છેલ્લા સંગ્રહ 'વખાર'માં કમિટેડ પોએટ્રી દ્વારા નોખી મુદ્રા પ્રગટે છે. આમ આધુનિકયુગના કવિઓમાં માત્ર સિતાંશુની કવિતા આજ સુધી સતત બદલાતા સમયસંદર્ભ પ્રમાણે બદલાતી રહી છે. ચિનુ મોદી ગઝલમાં વિશેષ નવીનતા દાખવતા રહ્યા. એ સિવાય 'વિ-નાયક' કે 'કાલાખ્યાન'માં પરંપરાના અનુસંધાનથી પ્રયોગશીલતા દાખવતા રહ્યા. રાધેશ્યામ શર્મામાં આધુનિકતાનું સાતત્ય ન રહ્યું. આ બધામાં રાવજી પટેલની કવિતામાં આધુનિક સંવેદન, સર્રિયલ અનુભવો, ભાષાની તિર્યક્તા કાવ્યરૂપ રૂપે યોગ્ય સંયોજન પામી

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પ્રગટ્યાં. રાવજીની કવિતા વિશે સતીશ વ્યાસ યોગ્ય કહે છે:

'આપણો જાનપદી અસબાબ, ત્યાંના ખેતરાઉ સંદર્ભો, ત્યાંની મુક્ત પ્રફુલ્લતા સમી પ્રકૃતિનો નિબિડ સંસ્પર્શ લઈને આવેલા આ (શરીરરુગ્ણ) કવિની વાણી આમરણ નિરામય રહી છે. અનાયાસ એણે વાણીનાં નવાં તાજાં સીમાંકનો કર્યાં છે. અનુભૂતિના તીવ્ર બળે એની ભાષાને પણ બળૂકી બનાવી છે. વિવેચનીય ઘાટઘૂટની તમા રાખ્યા વિના એણે, આધુનિક વિવેચનાએ સંઘરી રાખવું પડે એવું ભાષાકર્મ સિદ્ધ કર્યું છે.'

ને એટલે જ રાવજી આજે પણ એટલો જ આસ્વાદ્ય છે. આધુનિકતાની સૌથી મોટી ઉપલબ્ધિ એટલે ભાષાની બહાર નીકળવાની મથામણ, આધુનિકોએ એક સદીથીય જૂની અર્વાચીન ગુજરાતી ભાષાને ગતાનુગતિકતામાંથી બહાર લાવી અવનવા રૂપે અજમાવી જોઈ. અનુઆધુનિકોને એનો સીધો લાભ મળ્યો. આમ છતાં ઉપરથી ઓઢેલા હતાશા-નિરાશા જેવા ભાવો અનુભૂતિજન્ય ન હોવાથી એક પ્રયુક્તિથી વિશેષ રહેતા નથી. અર્થવિલંબન પણ નર્થતા કે દુર્બોધતા તરફ વિશેષ ઢળે છે. એમ આધુનિક કવિતા 'એક કુંઠિત સાહસ' બની રહે છે. સિતાંશુ કે રાવજીની જે કવિતા આજે ત્રણ દાયકા પછી વાંચવી ગમે છે કે આનંદ આપે છે એ પણ પરંપરાના વિચ્છેદની નહીં પણ પરંપરાના અનુસંધાનની કવિતા છે. 'જટાયુ'માં જોનાથન લિવિંગ્સ્ટનકૃત 'સીગલ'નો પ્રભાવ હોવા છતાં મધ્યકાલીન પરંપરાના અનુસંધાનને કારણે એ આજે પણ એટલી જ મહત્ત્વની રચના છે. રાવજીની કવિતામાં રહેલાં લોકબાની, લોકતત્ત્વોનો વિનિયોગ એટલી જ તીવ્રતાથી આકર્ષે છે. આ જ સમયમાં લખતા રઘુવીર ચૌધરીની કવિતા પરંપરા સાથે રહીને પણ પ્રયોગશીલ વલણ ધરાવે છે. સમકાલીન સમયસંદર્ભો તો ખરા જ સાથે સાથે વૈયક્તિક સંવેદનો, સમાજજીવન એમની કવિતાઓમાં આલેખિત થતાં રહ્યાં છે. ઉપરોક્ત કવિઓ સિવાય આધુનિક સમયગાળામાં વાહવાહ મેળવનાર મોટા ભાગની કવિતા આજે માત્ર આનંદ ખાતર કેટલી વંચાય છે એ પ્રશ્ન પૂછી શકાય. અનુગાંધીયુગ સુધીના કવિઓને સામાન્ય ભાવકથી માંડી વિદગ્ધ ભાવક પણ આનંદ ખાતર વાંચે છે. કવિતાની પહેલી શરત તો મમ્મટ કહે છે એમ 'અવિલંબિત પરમ આનંદ' જ છે. આજે એવા આંતરિક આનંદ માટે મોટા ભાગની આધુનિક કવિતા પાસે કયો ભાવક જાય છે? આનું મહત્ત્વનું કારણ છે કે એમાં આવતાં ભાવ-સંવેદન અનુભૂતિજન્ય નહોતાં, ઓઢેલાં હતાં. આખરે તો સર્જકની ખુદવફાઈ જ એના શબ્દ કે સર્જનને તારે છે.

આધુનિક સમયમાં ઉછરેલા કેટલાક કવિઓ આધુનિકતાની વિશેષતાઓ અને મર્યાદાઓથી સભાન રહી પોતાની નિજી ભૂમિકાએ કાવ્યપ્રવૃત્ત થયા. એ વિશે જયદેવ શુક્લ લખે છે :

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'આધુનિકતાના આ સમયમાં પરંપરા સામેનો વિદ્રોહ શરૂ થાય છે. શબ્દ-ભાષા સભાનતા સાહિત્યના અભિવ્યક્તિના અવનવા પ્રયોગો અજમાવાય છે એથી ભાષામાં નવા સ્વાદ મળે છે. નવી ભાષાતરેહો રૂપ પામે છે. સાથે સાથે 'સંસ્કૃતિ નહીં કૃતિ' વિચાર કેન્દ્રમાં આવે છે. વળી શબ્દના, કૃતિના અર્થને છોડવાના, અન્-અર્થ સુધીના આત્યંતિક પ્રયોગો પણ થાય છે. એ દરમિયાન 'રે' સામયિકના પ્રથમ પૃષ્ઠ પર વાંચી શકાય છે: 'રે'માં પ્રગટ થતી કૃતિઓ અમે સમજીએ જ છીએ, એવું કોઈએ માની લેવું નહીં.' આને કારણે લેખનમાં વિફરાટ અને દિશાહીનતા વધે છે. એ દિવસોમાં તો આધુનિકો જે કંઈ કરે તેનાં યશોગાન ચાલતાં હતાં. આ દરમિયાન, આધુનિકો પછીના કેટલાક તરુણ કવિઓને પ્રતીતિ થતી ગઈ કે પુરોગામીઓને પગલે પગલે જવાથી આપણી સર્જકતા ઝાઝી પાંગરી નહીં શકે. તેમણે નિકટના પુરોગામીની વિશેષતાઓ ને મર્યાદાઓને ઝીણી નજરે પ્રમાણીને સંયત રીતે, કાચબાગતિએ પોતાનો માર્ગ કંડારવા માંડ્યો. પણ, 'અહો રૂપમ્'ના વધામણાંથી તરબતર એ સમયના સાહિત્યકારોને આ યુવાનોના નૂતન આવિષ્કારોથી સભર અને સંક્રમણશીલ સ્વરો ભળાયા નહીં કે સંભળાયા નહીં.'

આ કવિઓ એટલે હરીશ મીનાશ્રુ, મણિલાલ હ. પટેલ, સંજુ વાળા, દલપત પઢિયાર, યજ્ઞેશ દવે, વિનોદ જોશી, નીતિન મહેતા, જયદેવ શુક્લ, ભરત નાયક, જયેન્દ્ર શેખડીવાળા, નીરવ પટેલ - આ બધા કવિઓએ પુરોગામીઓની વિશેષતાઓનો પોતાની કવિતામાં વિનિયોગ કર્યો તો સામે પક્ષે એમની મર્યાદાઓથી સભાન રહ્યા.

ઉછીના કે બનાવટી સંવેદનો તેમ જ બીબાંઢાળ અભિવ્યક્તિરીતિઓમાં રાચતી કવિતાને સ્થાને આ કવિઓએ 'સંસ્કૃતિ' અને 'કૃતિ' બંનેની જિકર કરી 'પરિષ્કૃતિ'ની ખેવના રાખી. આપણી સાહિત્યિક અને સાંસ્કૃતિક પરંપરાઓ સાથે અનુસંધાન જાળવી કશુંક નવું નિપજાવવાની મથામણ રાખી. એના પરિપાક રૂપે જ આ સમયના કવિઓ પાસેથી 'શિખંડી', 'તુણ્ડિલતુણ્ડિકા', 'ધ્રિબાંગસુંદર એણી પેર ડોલ્યા', 'પોળોના જંગલો'માં જેવી રચનાઓ મળી. પોતાની કવિતાને બોલકી થવા દીધા વગર અસ્તિત્વના પ્રશ્નો જેવી અનેક સંવેદનાઓને નીતિન મહેતા, જયદેવ શુક્લ, યજ્ઞેશ દવે જેવા કવિઓએ પોતાની કવિતામાં કવિતાની શરતે આલેખી. બદલાતા સાહિત્યને નૂતન પરિમાણોમાં અવલોકવા હરીશ મીનાશ્રુ જેવા સર્જકોએ 'પરિષ્કૃતિ'નો સંપ્રત્યય આપ્યો. અનુઆધુનિકોનો આ એક ગંભીર પુરુષાર્થ હતો પણ એ સંપ્રત્યયમાંથી કશુંક સારું નિપજી આવે એ પહેલાં 'આધુનિકતાનું પુચ્છ', 'સંઘગાન', 'દેડકાઓનું ડ્રાઉં' કરીને એની ટીકા કરવામાં આવી. એની યોગ્ય ભૂમિકાની વાત કરતાં હરીશ મીનાશ્રુ લખે છે:

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'એ વિમર્શમાં સ્થાપિત વિવેચક-સર્જકોએ જો ઉન્નત-ભ્રૂ થયા વિના ચિંતન મનનની ભૂમિકાએ સંવાદ રચ્યો હોત, સંપૂર્તિ કરી હોત તો, સંભવ છે કે રૂડું પરિણામ મળી રહેત. 'પરિષ્કૃતિ' ઇલ-ડિફાઇન્ડ સંજ્ઞા છે એવું પણ પ્રતિપાદિત કરી શકાયું હોત. તો એવી ચેષ્ટામાંથી પણ 'વેલ-ડિફાઇન્ડ' સુધી જવાની સંભાવના શોધી શકાત.'

આજે ચંદ્રકાન્ત ટોપીવાળા, શિરીષ પંચાલ જેવા વિવેચકો આધુનિકોત્તર કવિતા અને 'પરિષ્કૃતિ'ને ગંભીરતાથી જોતા ગયા છે. તાજેતરમાં જ મહેમદાવાદ કોલેજમાં 'સાંપ્રત ગુજરાતી સાહિત્ય' પરના પરિસંવાદમાં બીજરૂપ વક્તવ્ય આપતાં ચંદ્રકાન્ત ટોપીવાળાએ 'પરિષ્કૃતિ'ને આજે ફરીથી જોવાની જિકર કરી. શિરીષ પંચાલે, જયદેવ શુક્લે, બકુલ ટેલરે પણ 'સમીપે' સામયિકનો એક આખો વિશેષાંક આ સમયના કવિઓ વિષે કર્યો એ પણ આ જ વાતને અનુમોદન આપે છે.

જ્યારે સુમન શાહ જેવા વિવેચક આજે પણ આ કવિઓને 'આધુનિક જ ગણે છે' કારણ કે એ આપણી કવિતાને પશ્ચિમના અનુઆધુનિકતાવાદની દૃષ્ટિએ જુએ છે. પણ આપણે તો આપણી પોતાની દૃષ્ટિથી આપણા આધુનિકતાવાદને જોવાનો છે. આપણે આપણી દૃષ્ટિથી જોઈએ તો આ બધા જ કવિઓ અતિઆધુનિકતાવાદને કશી દાર્શનિક પીઠિકા નથી. જેવાં વિધાનો નહીં કરે, આપણે પોતે આપણા સાહિત્યના સઘન અભ્યાસ કરી એની પીઠિકા રચવી પડશે. આધુનિકોત્તર કવિતા-વાર્તામાં પ્રગટેલા આ નવા ઉન્મેષોમાંથી આપણે આ નવી કવિતાની કેટલીક લાક્ષણિકતાઓ તારવી શકીએ.

- આ કવિઓની કવિતામાં માત્ર ભાષા કે શબ્દ નહીં પણ જીવનવિચાર પણ કેન્દ્રમાં આવ્યો.

- પરંપરા સાથે રહીને પણ પ્રયોગશીલ બનવાનું વલણ બળવત્તર બન્યું.

- આધુનિક કવિતાની અર્થહીનતા કે દુર્બોધતાને સ્થાને અર્થવિલંબન કરતી કવિતા આવી.

- પોતાના મૂળ-કુળ તરફ પાછા વળવાનું વલણ વધ્યું. (ગ્રામચેતના)

- પોતીકા સંવેદનનું, પોતીકા સમાજ સંદર્ભે, ભાષાસંદર્ભ સાથેનું આલેખન થયું.

- 'ગ્લોબલ'ની સાથે 'લોકલ' પણ એટલું મહત્ત્વનું ગણી એની વાત આ કવિઓએ કરી.

- મધ્યકાલીન સ્વરૂપો તો પ્રયોગશીલ રીતે પ્રયોજાયાં સાથે સાથે મધ્યકાલીન જ્ઞાનમાર્ગ - ભક્તિમાર્ગની ભજનપરંપરા સાથેનું અનુસંધાન પણ જોડાયું.

-પુરોગામીઓની કૃતિઓના સંદર્ભોનો નૂતન પરિપ્રેક્ષ્યમાં સર્જનાત્મક વિનિયોગ થયો(Intertextuality)

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- અત્યાર સુધી હાસિયામાં રહેલાં લોકોની વાત કેન્દ્રમાં આવી. (નારીચેતના, આદિવાસીચેતના, દલિતચેતના)

ઉપરોક્ત લાક્ષણિકતાઓ આપણે આ સમયના મહત્ત્વના કવિઓમાં જોઈ શકીએ છીએ. આધુનિકતા સાથેનું અનુસંધાન શરૂઆતમાં નીતિન મહેતા, જયદેવ શુક્લમાં વધુ છે, પણ પછી તે પણ એમાંથી બહાર આવી જાય છે. નીરવ પટેલ, કાનજી પટેલ, મણિલાલ પટેલ, દલપત પઢિયાર, વિનોદ જોશી, સંજુ વાળાની કવિતામાં આધુનિકતાથી તદ્દન જુદો જ ભાવ, ભાષા પણ તદ્દન જુદી અને નવી કવિતા છે એના સંકેતો યોગ્ય રીતે જ પામી ગયેલા ચંદ્રકાન્ત ટોપીવાળાએ લખ્યું:

'હવે આધુનિકતાવાદના ઓસરતાં પાણી છે...આજે હવે આપણે દેશીવાદ તરફ, આપણાં મૂળિયાં તરફ, દલિતો સહિત આપણી ઓળખ તરફ પાછા વળી રહ્યાં છીએ.'

વૈશ્વિક રીતે જોઈએ તો પણ ઝાક દેરિદા-રોલાં બાર્થ સત્તાના આજ કેન્દ્રો તૂટવાની વાત કરે છે ને એમાંથી અનેક કેન્દ્રો રચાય છે. દરેક કેન્દ્રને પાછું પોતાનું વર્તુળ છે.

આગળ વાત કરી એ કવિઓની કવિતા વિષય અને અભિવ્યક્તિના નવા નવા આયામો રચતી હોવા છતાં આ બધા કવિઓની ફરિયાદ રહી છે કે એમની કવિતાને આપણાં વિવેચને યોગ્ય રીતે જોઈ નથી. (સમીપે અંક ૧૦-૧૧) એ કવિઓ તો એટલે સુધી કહે છે કે '...અનુઆધુનિક કવિઓ વિશે જ્યારે જેટલી અને જેવી જેના દ્વારા વાતો થવી જોઈએ તે થઈ નથી. અછાંદસ, ગીત કે ગઝલ જેવાં સ્વરૂપોમાં લાભશંકર ઠાકર, સિતાંશુ યશશ્ચંદ્ર, રમેશ પારેખ, અનિલ જોશી, મનોજ ખંડેરિયા, ચિનુ મોદી સુધી વાત અટકી જાય છે, કેમ જાણે એ પછી ચોરાનો વંશ ખાલી ગયો હોય કે સમ ખાવા જેટલુંય સારું ન થયું હોય તેવું ચિત્ર ઊપસે છે. બ.ક. ઠાકોર, સુન્દરમ્ કે ઉમાશંકર જોશીએ તેમના સમયની ઊગતી પેઢીમાંથી ઉત્તમ તારવી બતાવ્યું હતું.આજના જે પૂર્વસૂરિઓ પાસે અપેક્ષા છે તે બીતાં બીતાં પગલાં ભરે છે. અનુઆધુનિક વિશે બ્લેક એન્ડ વ્હાઇટમાં કહેવા એટલા તૈયાર નથી. અમે તો કહીએ છીએ કે 'આ ઉઘાડી પીઠ, ચાબખા મારી અમને સબોડી નાખો. કાંઈક આંગળી ચીંધો હકદાર હોઈએ તો પીઠ થાબડો પણ તમારા બંધ હોઠનું મૌન indifference સહેવાતું નથી.'

(આધુનિકોત્તર કવિતા', ૨૦૧૩)

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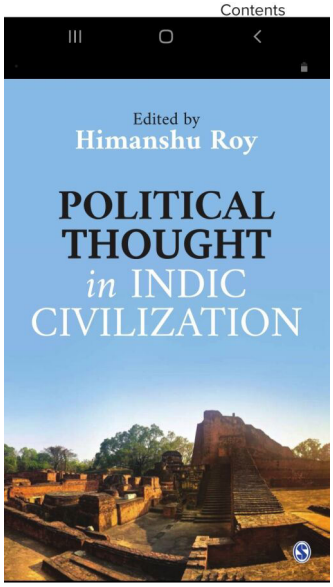

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Global Perspectives

Against Social Isolation: Disability Metaphors and Personal Battles

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Abstract

The current COVID-19 pandemic has brought about change in the structures and categories of discursive production, while at the same time has successfully retained the institutionalized difference between bodies, gender, class, caste, and race. This article attempts to understand how the "deviant body" continues to be the marker of one's disability despite experiences felt collectively as a result of disabling circumstances caused by COVID-19.

Keywords: disability, social distancing, isolation

Against Social Isolation: Disability Metaphors and Personal Battles

Isolation, loneliness, gloominess, and dreariness are words that translate the emotions of many individuals at this moment. Confinement, isolation, seclusion, or quarantine. People are finding this difficult to deal with, and social distancing seems like moving mountains. We are told the world is grappling with physical, social, emotional, and economic disability. From availing healthcare facilities, doing grocery shopping, and socializing with families and friends to going to one's workplace, every single activity has become a hard nut to crack.

Different disability metaphors are being used to recount these experiences generated by the current pandemic. The confinement caused by restrictions on movement or travel is often described as physically disabling. Economic slowdown has been referred to as a paralyzed economy. The inability to socialize has been defined as social atrophy. Moreover, collective unhappiness is being referred to as "depression" or "madness." Casual conversations use disability references at regular intervals. Utterances like "I have gone mad" or "the lockdown has made everyone limp" have gained currency. Due to the lack of words to translate the unfamiliarity of the current pandemic, disability metaphors have come to the rescue to interpret the experiences in familiar terms. These metaphors are not merely linguistic signs. They unfold the tactics of the association between the experiences caused by the situation like the current pandemic and disability experiences in general. This association also unravels the ways in which disability is perceived.

The use of disability metaphors to capture bleakness, gloominess, and despair renders disability as a tragedy and a label to be denied. It fosters notions of dependence, deviance, and abnormality and associates them with disability, as words and phrases such as "normal" and "the new normal" have become everyday words. The association of current experiences with disability further suggests that external factors can cause the inability to carry out day-to-day functions and activities. It also indicates that disability has become a collective experience and hence, various institutions are collectively working on creating a conducive environment which can reduce disability caused by physical and social factors.

However, the use of disability metaphors to make sense of the pandemic does not help in fully grasping the experiences of those living with physical impairment. Occasional and transient episodes of functional impairment, isolation, or dependence differ from those stemming from the interaction between physical impairment and a disabling social environment. The functional impairment caused by the social environment to the persons with

"normative bodies" is not considered as disability, as the locus of their impairment does not lie in their bodies. However, for many people categorized as "disabled," there is a perception that isolation, despair, and penury are their essential traits. As a result, social isolation or social distancing is something with which many with physical impairments are not unfamiliar.

As discussed above, the clichéd understanding of the disabled as dependent, sorrowful, or burdensome compels many with disabilities to hide their pain behind the camouflage of a happy demeanor. Their requests for modification of their environment to make it suitable to their needs is taken as disability. They are frequently urged to pass as non-disabled or, at times, may be relegated to complete isolation. Be it a workplace, a family function, a festival, or a get-together, many with disabilities have to find ways of coping with social isolation. She or he either suppresses her or his emotions or finds solace in talking to a fellow being who shares a similar emotional state. Moreover, this social isolation felt by those with physical disabilities is normalized to such an extent that it goes unnoticed, and, hence many with disabilities may develop "immunity" against social exclusion and isolation.

A considerable amount of time, effort, oscillation, and negotiation have gone into developing an anti-body for social seclusion. "The normalcy of the body" has always been additive to or derivative of the understanding of disability and people with disabilities, and this understanding has rendered many with disabilities invisible from the social scene. This phenomenon has underwritten, circumscribed, and silenced the desire of people with disabilities. People with disabilities are represented in an archetypal manner in various cultural forms, and these representations keep the stereotypes such as "malnourished, disfigured, untidy, and shabby" afloat. These images reinforce the notion that penury, dependence, miseries, and agony are the essence of disability. As a result, a person with a "normative body" is shocked when encountering someone with a physical impairment who is confident, when having to work under a person with a physical impairment, or when a person with a physical impairment is spotted in a bar, a club, a jewelry shop, a rock show, or a pub or is seen on a date with someone. I will now delve into some of the experiences which I as a person with vision impairment have had.

Once at the wedding of my close friend, I was in a traditional outfit with a little makeup on my face and straightened hair. One of my acquaintances came to me and gave me a tight hug. I could make out that she was in tears. When I asked her why, she replied: "how can god be so cruel! Such a beautiful girl is punished with…" Her tears filed a charge sheet

against my eyes, accusing them of not only rendering me functionally impaired but defacing my otherwise good-looking face. She pitied my eyes not for their inability to fulfill their designated function, but for disrupting aesthetic pleasure. My eyes are always ostracized and are told to vacate the unfitting abode and settle down in an ashram which befits them. If I were in shabby attire with uncombed hair, my look would not have generated so much pity, because blindness and untidiness are seen by many to go hand in hand.

The memories of similar exclusionary remarks are resurrected in my mind. Once I accompanied my friend to the bank. While entering, I was stopped by a stranger. He extended his hand towards me and offered me a chocolate. I was completely baffled by his gesture. In the state of cluelessness, I could not react. Meanwhile, my friend who was also taken aback finally asked why he offered a chocolate exclusively to me. He did not answer but started unleashing a series of questions: "Can't she see at all? Why has she come to the bank? How does she pass her time?" His questions answered my friend's question. He offered me a chocolate thinking that it might help me in momentarily relieving myself from the agony and allow me to relish the taste of sensory pleasure. My presence at a public place threatened him, as his eyes were habituated only with having glimpses of imperfect bodies either in a circus or in a fair.

Once I had participated in a drama workshop held by our college and as part of it, we performed a skit. One of my sighted friends played a blind girl, and I played station master. While we were performing, a comment came from the audience: "Such a beautiful girl playing a blind girl!" The girl in the audience could not resolve the disruption caused by surfacing of the image threatening the stereotypical image of the blind. She could not see me playing other than "the blind" and seeing the sighted one playing "the blind."

All these narratives exhibit our intolerance to bodily imperfection. The intolerance worn by people having so called "normative bodies" shuns those deemed deviant from participating in social life, and, as a result, people with physical impairments may gradually start withdrawing themselves from social gathering and public places, which eventually may leave them *socially disabled.*

The current outbreak of COVID 19 has increased the disability of the persons with physical challenges, but it has not altered the ways in which persons with physical challenges are perceived by persons with so-called normative bodies, despite their feeling 'disabled' by the current pandemic. That is to say that the existing obliviousness about the challenges faced

by persons with physical impairment due to the inadequacy of attention paid to their needs (such as accessible and universally designed infrastructure, access to information, healthcare facilities, and so on) is coupled with the complete ignorance on the part of the authorities about the barriers caused by the current pandemic to the physically challenged in carrying out daily activities. Inequities in distributing essential goods, providing essential services, and so on during lockdown has led to the erasure of physically challenged persons from the scene. The very interpretation of notions like "essential goods" and "essential services" did not take into account providing assistive technologies like hearing aids, screen reader software, care giving services to persons with chronic illness, and so on, for example, which are indispensable to mitigating the sufferings and pain caused by physical impairment. These disabling circumstances increase the disability of persons with physical impairments.

As a person with vision impairment, I could not anticipate what would be coming my way. When the lockdown was announced as a precautionary measure to curb the spread of COVID19, I had no idea about its repercussions on my personal and professional life. Like any other citizen, I had to adapt to the new ways of life including behavioral changes at home and in the workplace, buying groceries, availing myself of healthcare services, and attending gatherings. Work from home became the "new normal," and changes began to be introduced to normalize this new normal. Digital platforms became the substitute for physical architecture, and companies developing various applications began to entice consumers by ensuring smooth functioning and uninterrupted work. Online platforms assumed the role of facilitator of communication, and professionals began to dispense their duties online. Teaching and learning also shifted online.

Being moderately good at internet surfing, I could manage to gather information pertaining to the developments that took place due to the outbreak of COVID19. However, my knowledge of internet surfing was not enough to drive me through this sudden transition. In the wake of COVID19, teachers were asked to conduct classes online. Buzz started around which applications were more suitable to the needs of both teachers and students. I found myself stumbling, completely nonplussed, anxious, and confused. My colleagues started imparting lessons online, but I kept on figuring out which application was friendlier to persons with vision impairments. Struck by guilt, I made desperate attempts to educate myself in the new methods of teaching.

During this time, I realized that the discussion around suitability had hardly taken into account persons with physical impairments. While incessant training sessions were held on the use of online platforms to reduce the disability of persons with normative bodies, persons with physical impairments had started feeling more disabled. The strategic ignorance on the part of the so called "normative people" about the challenges faced by persons with physical impairments left the physically impaired to sink or swim. Unlike some who suffered disproportionately due to the unavailability of a support system in terms of linguistic, human, financial, and technical assistance, I could manage to orient myself with the basics of these applications.

In the midst of these challenges, discussions with others with similar physical impairments served as a ray of hope and motivation. People in disability sub-cultures with sound knowledge of technology came to the rescue and helped me enhance the skills required for new modes and methods of teaching and learning and helped me survive among the fittest. However, digital technology did not prove to be a magic stick in terms of addressing the challenges posed by digital inequities. Inaccessible websites and electronic journals, the closure of physical libraries, and the absence of human assistance all continued to create challenges in searching relevant materials, thereby rendering both teaching and learning difficult. The circulars on continuation of academic activities during the lockdown gave me pangs of anxiety and guilt, as the disabling physical and social environment made me perceive myself as unproductive.

The pandemic brought about unprecedented challenges on the personal front, too. Many with normative bodies, despite feeling disabled by circumstances, continued to exhibit what might be considered eugenic attitudes towards persons with physical impairment. The casual conversations and the debates and discussions on media were rife with remarks on the necessity of being selective in saving the lives of the able-bodied. The strategic decision of prioritizing the lives of young, able-bodied people by many countries made me question the worth of my own life, and this feeling of worthlessness was reinforced by my helplessness in carrying out my day-to-day activities. Being a person with vision impairment, I use my tactile sense in navigating through places. Moreover, touching various surfaces is something which is quite usual for persons with vision impairment. However, the precautionary measures such as maintaining social distance and keeping oneself away from touching possibly contaminated surfaces made everyday life more difficult and challenging. My hesitation in asking for

human assistance grew stronger, and strategies I used during the pre-COVID19 era, such as drinking less water in order to suppress the urge to urinate in order to come across as less dependent, now became the only viable options in mitigating the fear of infecting others. From withdrawing cash from ATMs to buying sanitary napkins, every single activity appeared as a mammoth task. The fear of aged parents contracting the disease, the absence of any other human assistance, and people's fear of touching a person with vision impairment all hampered my ways of negotiating the world.

In her 1996 book *The Rejected Body*, Susan Vendell suggests disability is relative to one's social, physical, and cultural environment. With my privileged subject position, I could reduce my disability by devising various strategies. That is to say that the knowledge of English, good financial support, educated family, and friends combined to serve as a support system in addressing the challenges thrown up by the pandemic. However, the issues and challenges of those whose disability intersects with lower economic strata, lower caste, and marginalized sexual orientation have gone unnoticed. Their challenges were largely invisible during pre-COVID times, and they are now. Many have lost not only their jobs but their own lives or those of family members due to the lack of adequate familial, societal, and financial support. Hunger and sickness have taken a toll on their physical and emotional well-being. I have come across accounts of visually impaired patients who were stranded with their sickness in healthcare centers and hospitals. They struggled not only in orienting themselves to new surroundings but in finding assistance for sickness. Their humiliation and the reluctance of authorities kept them from articulating their needs.

The current pandemic is wielding its power on humanity. Humans are finding ways of challenging this power and in bringing their lives back to normal. Collective endeavors are being made to reduce the disability caused by these unprecedented times. However, in this survival war, ableism has colored the societal attitude, and the issues of bodies deemed 'deviant' have not been paid adequate heed. While a few efforts have been made to save the lives of individuals with physical impairments, many persons with "deviant" bodies have been segregated from the collective of normative bodies. Biological determinism has relegated their bodies to inhabitable zones.

So called "normative persons" expect the civil society and the state to provide them with adequate means to cope with the crisis. At the same time, demands on the part of the persons with physical impairment are considered as dependence. Here I am reminded of the

words of a so-called abled person overheard objecting to the Persons with Disability Act: "Why should government waste money and resources by investing them in a small section of the society which is incapable of accomplishing most of the tasks." Such majoritarian and utilitarian approaches devalue the disabled community by highlighting their supposed incapability in increasing social, cultural, and economic capital. It is believed that if the factors causing functional impairment are resolved, much of disability can be reduced.

However, the irony is that the attitude shaped by the ideology of normalcy fosters the view that if resources are spent in enhancing the ability of normative bodies during a crisis, it can contribute to the economic growth of the country, whereas persons with physical challenges cannot produce a return. In actuality, the disability of persons with physical impairments can be reduced, and their functionality and productivity can be enhanced by addressing both their needs of accessibility and the challenges posed by rigid and biased societal attitudes. It is high time to understand that developing tolerance for difference is key to the formation of a healthy society. By extending cooperation and support and by ensuring every individual's participation, we can reduce the impact of ableism and the challenges linked to disability. The state, the society, and its resources belong to every individual, and each body should matter to the society and the state.

Zarana Maheshwari is an assistant professor at the Centre for Comparative Literature and Translation Studies, Central University of Gujarat, Gandhinagar.

Against Social Isolation: Disability Metaphors and Personal Battles by Zarana Maheshwari is licensed under a Creative Commons Attribution 4.0 International License. Based on a work at https://rdsjournal.org.

Invisibility of Disability in Academia

Zarana MaheshwariPosted August 27, 2020
Tagged in Differentially abled, Disability, Equality

Summary

My experience of being a person with disability and my interaction with persons with disability allow me to posit that the absence of the knowledge about the lived experiences of the disabled and the preconceived notions about normalcy allow to attach different social meanings to impaired bodies and these meanings question the knowledge of the disabled .

Full Article

"Disability is everywhere in history, once you begin looking for it, but conspicuously absent in the histories we write" (Baynton 30). "The eugenic notions of normativity" (Davis 11), "biological determinism" (Davis 11) and utilitarian notions have led to systematic erasure of the individuality of the disabled in particular and disabled community in general. Our day-today conversations are replete with casual reference to disability metaphors. The remarks such as "have you gone mad?", "why don't you turn your blind eye" flow plentifully from our mouth. Popular media keeps disability imagery afloat in order to invoke pity and sympathy. Literary texts devise disability as "narrative prosthesis" (Mitchel and Snyder 224) to reach their resolution. The wheelchair users, blind persons walking with cane, persons in crutches fall upon the sight of the abled individuals without fail. However, the agency of the disabled has never been acknowledged in the histories that we write (Beynton 30). The disabled have been eliminated from the categories of "thinking beings", as the deviance of their bodies is taken to be the marker of their underdeveloped cognitive capabilities (Ghai 75-91). The eradication of the disabled from epistemological realm is advocated by philosophers and is sustained by various institutions be it religion or science.

Even the academic institutions, which are founded on the premise of producing and disseminating knowledge, legitimize their discriminatory attitude, and fail to recognize different ways of learning and knowing of the disabled by producing and reproducing the discourses of normalcy (Ghai 75-91). The present article attempts to bring to the fore the invisibility of disability in academia, the measures that have been taken to address the issues pertaining to disability and suggest the measures that can be taken in order to render the academia conducive to academic, social and cultural development of the persons with disability.

"State of the Education Report for India: Children with Disability" 2019 (UNESCO) suggests that three-forth of the children with disability at the age of five years and one-fourth between 5-9 years do not attend school. The report also suggests that the number of dropout students has increased in successive years. As per the survey conducted by NCPEDP (The National Centre for Promotion of Employment of Disabled People) (reported in Daily Pioneer), only 0.5 percent of the persons with disability have been enrolled in higher education institutes. It is to be noted that a robust legislative framework has been introduced in order to ensure inclusion and full participation of the persons with disability. Chapter 3 of the RPWD act 2016 has provision for imparting inclusive education to the children with disability. In order to ensure their academic and social development which is consistent with the goal of inclusion, it insists on providing them with opportunities for sports and recreation. The act lays emphasis on creating buildings and campuses barrier free and accessible to persons with disability in order to achieve their full participation. Thus, social inclusion and inclusive education are enshrined in the acts and policies for persons with disability. Some of the higher education institutes have made attempts to comply with the policies and schemes for the persons with disability and have made the buildings and campuses accessible by building ramps, accessible toilets, procuring assistive devices and so on. However, as per All India Survey of Higher Education 2015/16 conducted by the Ministry of Human Resource Development, the enrollment of students with disability in

higher education continues to be low as compared to SC, ST and OBC students. It suggests that accessibility is only one of the factors which keeps persons with disability away from academic institutions. Sankalpa Satapathy in her article "Attitudinal Barriers in Education: Experiences of Women with Disabilities in Odisha" posits that not only disabling physical environments, but disabling social environments also cause educational exclusion of the disabled people. According to Srilatha Juvva, Professor at Centre for Disability Studies and Actions at Tata Institute of Social Sciences, for inclusion to take place, both physical as well as attitudinal access are required. Apart from persistent gap between policies and their implementation, the institutional reluctance for recognition of the disabled as social, cultural aesthetic and political beings emerges as a huge attitudinal barrier in the way of students with disability.

The academia, which has scientific temper and rationality at its core, has failed in assigning agency to the disabled. Instead of encouraging disabled to unleash their curiosity, fostering their inquisitiveness, evolving tools to enhance their learning, allowing them to emerge as knowledge producers, the disabled themselves become the objects of gaze, curiosity and amazement due to their difference (Ghai 78). Due to the absence of level playing ground, the disabled grapple with becoming knower, and end up becoming the objects of knowing.

I, being a person with vision impairment, had not fully grasped my bodily deviance, until I was left bewildered, clueless and embarrassed, when I heard some giggles and laughter when I went close to the blackboard to identify white letters written on it with my residual vision. Despite my blindness, I was admitted in a regular school. I have used the word "despite" with a purpose, as my observations suggest that admitting students with special needs in special schools has been the norm. This very norm has fostered the strategic ignorance of the "abled bodies about the disabled. This particular incident forced me to take my difference as defects, and the urge forgetting it repaired grew stronger and stronger. I wanted to be the part of the rest of the group and hence, I began efforts to pass as abled. These efforts kept me away from articulating my needs, difficulties I faced in adapting to the curriculum which could not accommodate my ways of learning and perceiving. Participating in co-curricular activities remained a far cry. Mass-drill classes used to bring spells of anxiety, as my drills hardly match with the group, and my drills were reduced to center of attraction for others and embarrassment for me. These unsuccessful efforts of passing as abled relegated me to social isolation. The futile hours spent in the school had to be compensated at home and family members engaged themselves in giving lessons.

Most of the academic institutions hold a view that admitting students to the colleges and universities ensures inclusive education (Ghai 80). However, they do not fully grasp the challenges posed by societal attitude. The disabled students encounter new sets of challenges while transitioning from schools to colleges and universities, as they are away from home or rehabilitation centers. They have to grapple with numerous challenges, from meeting expenses of assistive devices, finding accessible accommodation, getting access to information in suitable mode to socializing with other students. It becomes all the more challenging for students sharing other marginal identities such as caste, gender, sexual orientation or religion. Social isolation emerges as a huge attitudinal barrier in the way of acquisition of the knowledge and academic performance. The ignorance and curious gaze of the so called abled in universities and colleges result into exoticising of the disabled and the disabled are plunged into social exile. The disabled end up answering or responding to the questions loaded with stereotypes, flurry of shock and amazement. Due to the absence of accessible buildings, laboratories, libraries, toilets, canteens, hostels, transport, the disabled students have to be confined to limited space. Their time and energy are spent in working out the ways for overcoming the barriers either by pleading, taking endless rounds of the offices or by taking favors of the abled bodies. Their academic achievements cannot be at par with their abled counterparts, as time continues to be the criterion of assessing academic excellence. Moreover, to prove their academic excellence, the disabled have to run on the track which is designed as per the needs of majoritarian abled bodies, as academic institutions do not hold Paralympics.

Ignorance and silence continue to exist when it comes to disabled employees engaged in academia. The invisibility of disability prevails at administration and academic level in most of the academic institutions. Apart from physical barriers such as inaccessible infrastructure, inaccessible modes of communication, the disabled employees encounter attitudinal barrier and are subjected to social isolation. My experience of being a person with disability and my interaction with persons with disability allow me to posit that the absence of the knowledge about the lived experiences of the disabled and the preconceived notions about normalcy allow to attach different social meanings to impaired bodies and these meanings question the knowledge of the disabled . Hence, the contribution made by the disabled people is hardly recognized by the institutions. The lack of willingness to accord equal status to disabled academicians pervades in academia too and hence, the disabled are ignored sidelined and are rendered invisible in decision making. As professor Anita Ghai observes: "the academia at large usually knows very little, if anything, about knowledge of disability, preserving discrimination against disability (80)." In her view, the equal opportunity cells in the universities engage with concessional issues (81). However, disability as knowledge system is not yet a part of academia. Moreover, it has been observed by the disability studies scholars that the interdisciplinary courses that are offered in humanities and social sciences do not account disability studies as an integral component. In their view, the courses that are exclusively designed to engage with the experiences of the marginal identities, do not acknowledge disabled as having shared identity in culture, politics, economics and so on (Ghai 75-91).

Conferences, workshops, seminars play a vital role in enhancing one's skills, enriching knowledge and networking. However, they remain difficult terrains to travel for the disabled. The disabled participants grapple with numerous hurdles ranging from inaccessible venue, inaccessible transportation, and the absence of human assistance to exhausting schedules of various academic programmes, socializing over lunch and dinner and so on. As a result, the academicians with disability prefer to avoid attending various academic meets, which subsequently hampers their academic growth and their academic profile in the larger context.

The world at present is teetering because of the invasion of unanticipated dreadful disease Covid19 in all walks of life. The current pandemic has confiscated personal, political, social space of all individuals and has rendered every individual economically, socially and culturally disabled. The work from home is no more a perk; rather it has become the norm. Various institutions are working hard in order to reduce disability by catering to the needs of their employees in order to keep disruptions and disturbance at bay. Incessant training sessions are being conducted on the usage of various applications on different online platforms. However, the disabled students and employees as usual are abandoned in this wonderland, and they have been knocking the doors of NGOs and civil societies. Their very right to education is at stake. The issues pertaining to accessible reading material, the availability of assistive devices and human assistance, accessible websites and applications are not paid adequate heed. These disabling circumstances and the absence of adequate support and guidance have aggravated the disability of the persons with disability.

Susan Wendell is of the view that disability is relative to person's social, cultural and physical environment (37). In her view, a great deal of disability can be reduced by doing away with the preconceived notion that "everyone is healthy, non-disabled, young but adult (37)." The need of the hour is to bring about the change in familial and societal attitude towards disabled and academia can contribute to serving the cause. The academia should encourage disability studies to emerge as an academic discipline, as it can help, in Professor Anita Ghai's words, create a body of knowledge to make us reflect about the experiences of the disabled. Moreover, the academic institutions by collaborating with various government and non-government organizations can organize various sensitizing programmes to promote accessibility, spread awareness about the challenges faced by the persons with disability and to promote tolerance for difference. Moreover, strengthening of database through research can contribute to filling up the gap between existing policies and their implementation. It can also provide useful insights on charting out effective plans for achieving inclusion. The academic institutions can provide mentorship to persons with disability to identify their individual needs such as dealing with the stigma attached to disability, having suitable modes of communication, modes of transport, access to information, suitable curriculum and so on, thereby improve their academic performance. The institutions can also strive for helping persons with disability with

networking and socializing by holding cultural events, get-togethers and so on. Networking helps not only in improving inter-personal relationships but inculcates a sense of belonging among persons with disability. Moreover, visual representation in form of sculptures, graffiti, posters and paintings can also contribute to increasing the visibility of the persons with disability.

To sum up, it is high time to recognize disabled as social, cultural, political, economic and aesthetic beings. It is to be noted that socially and culturally constructed disability relegates the persons with disability to social isolation and creates a vicious cycle of irresolvable challenges. Further, disability is not a homogeneous category. If disability is coupled with other marginal identities such as caste, gender, race, sexual orientation and religion, it poses complex sets of challenges, and addressing them asks for more nuanced approaches and analysis to study disability.

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A MITTAL PUBLICATION

GENDER DYNAMICS AND THE EMERGING ISSUES IN 21ST CENTURY

ALIVA MOHANTY • SAYANTANI BEHURA
GEETANJALI NAIK • SUPRIT PANIGRAHI



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NATURE AND THE NATION: Revisiting the Dynamics of Gender and Eco-criticism in Periodicals for Children in Colonial Bengal

STELLA CHITRALEKHA BISWAS & ZAKIA FIRDAUS

Introduction

The idea of ecocriticism and the associated gender dynamics in children's literature has emerged as a relatively recent area of academic interest in the twenty-first century. Regardless of the considerable amount of research being already extant in the realm of children's literature,it is still a very potent area for further development and exploration, opening up new avenues for examining the propagation of eco-consciousness and "environmental literacy" (Bhalla, 2012, p. 1) across disciplines, that prove relevant to the trends of thought in the present century. Before delving into the core argument of the paper, a brief introduction is required to be given about the historiographical developments in Bengali children's literature. The socio-cultural shifts occurring in Bengal during the wake of colonial modernity under the British rule paved the path for a complete reconstruction of the region and the lives of the native people. Industrialization, urbanization of Calcutta, population migration from the villages and mofussil towns to the main city,

radical shifts in the economic prospects of people, the advent of print capitalism, the birth of a consumerist market in book publishing, a massive reconfiguration of formal education and schooling systems, etc.- all of these remain very well documented in the existing historiographies of Bengal. However, the realm of popular Bengali children's literature which brought about subtler reformations in the ideologies surrounding child-rearing within the private domain of the home and the family appear to have garnered the interest of scholars only in the recent years. Apart from the existing records or bibliographic compilations of Bengali children's literature, the scope for further research exploration and critical findings remain quite ample. The shifts occurring in the discursive practices of pedagogy in Bengal during the early years of the nineteenth century gave way to the origin and proliferation of popular native juvenile literature that sought to free this area from the clutches of imperial hegemony. Didactic books serving utilitarian purposes that had been in circulation owing to the imperialist agendas of the British rulers were soon outpaced in popularity by native Bengali literature that strove to combine leisure with instruction for the holistic development of the child's mindset. This brought about a significant reconfiguration of the very concept of native childhood, the Bengali intelligentsia striving to subtly accommodate this apolitical area into a larger project of nationalism. Beginning with the popular juvenile periodicals and then expanding into various sub-generic forms, Bengali children's literature can be looked at as an area laden with consciously crafted native ideologies of socio-cultural roles, identity, gender hierarchies and value ideals that sought to mould the target readership through an indigenized method of instruction.

The Advent of Bengali Juvenile Periodicals

Ecocritical tendencies in Bengali children's literature can be traced back to the early juvenile periodicals that happen to be one of the most popular generic forms within this realm. These periodicals first emerged as heavily influenced by their imperial predecessors like the *Boys' Own Paper* and others,therefore inevitably bearing the mark of being a mimic genre initially. However, soon enough, efforts were made on the part of the editors and contributors of these magazines to wrench this kind of literature from the grip of a foreign effect and establish it as an independent genre in its own right. Periodicals such as *Abodh-Bandhu*('The Innocents' Friend', 1866)*Jyotiringan*('The Firefly', 1869)*Balak-Bandhu*('The Child's

Friend', 1878) *Sakha* ('The Friend', 1883)*Balak*('The Child', 1885) *Sathi*('The Companion', 1893) *Mukul* ('The Bud', 1895), etc. came out that coupled the main content with illustrations to appeal to the fascination of the readers and ensure a lasting impression on their minds. Written in a language that would make for the easy understanding of the readers and oftentimes even incorporating colloquial terms for the same, these magazines consisted of a wide array of articles on various miscellaneous issues, ranging from scientific facts and discoveries to travel and exploration, topographical accomplishments, miscellaneous anecdotes with morals at the end, interesting stories, and so on. These magazines went on to become a part of the sanctioned, legitimized means of entertainment for children, striving to obliterate the pernicious influence of so-called "bad" books that were in proliferation due to the booming business of the native 'Bat-tala' press that published cheap books and even erotica. Within the diegetic space of these magazines, the contributors seemed to harp upon ingraining within their young readership a patriotic love for their motherland and its natural wealth. Herein lies the roots of the initial attempts to awaken an eco-consciousness within the child readers and deal with discursive ideas about Nature in a very innovative manner.

Nature and Native Childhood

Researchers have identified a definite strain within Bengali juvenile magazines to motivate the readers towards a definite nationalist agenda of growing up to be apt future inheritors of the nation. Against this backdrop, Nature plays a crucial role, if not directly, then at least implicitly but very significantly. Poems, stories, factual articles and even illustrations bore the mark of patronizing an affinity towards Nature and the wonders it has to offer to the child's mindset. Even the travel and expedition stories, geographical discoveries and adventure pieces appeared to have embedded within them an ideological strain of instructing the child readers into harnessing an empathetic understanding and kinship with Nature, allowing themselves to be nurtured on its laps and in turn contributing to the glory of their mother-nation. In some of the issues of these magazines, childhood came to be associated with the pristine beauty of Nature and children to tender saplings that had to be protected at all costs from the harshness of the materialistic world. They directly appealed to the readers to consider themselves as precious jewels for their guardians and priceless gems on the bosom of their unfortunate

motherland. The association of childhood with Nature is one of the chief components of Romanticism, and through this allegory is upheld a symbiotic relationship between Nature and mankind. The first issue of the second volume of *Sakha* in 1893 begins with the quote "The Child is the Father". Quite obviously, this quote can be analyzed from various perspectives, and also very pertinently from the angle of ecocriticism. It is through the shaping of eco-consciousness within the young minds of the child readers that the writers laboured to bring them up as ideal citizens of their native motherland. Throughout the diegetic space of these juvenile magazines, Nature looms large as an omnipresent backdrop in most sorts of writings, be it fact or fiction. Poems and stories, accompanied by illustrations, depict children of both sexes (though, predominantly male) frolicking about in the laps of Nature and allowing themselves to corporeally as well as spiritually connect with the physical world outside. It is interesting to note that though these magazines pivoted upon the binaries of the 'good boy' and the 'bad boy', harping upon the necessity of cultivating various virtues of character through the portrayal of miscellaneous anecdotes of exemplary personalities (both Western and Indian), the importance of intellectual development was reckoned to be incomplete without physical training and bodily discipline. Articles began emphasizing upon the necessity of sports, outdoor games and activities, exercises, body-building, travels and adventures inspiring the readers to include themselves readily within these essential requisites for the project of nation-building. "It is through such insistence that these periodicals strove to counter the colonial stereotypes of civilized and uncivilized, rational and irrational, manly and effeminate while inculcating a nationalist spirit within the young minds of the male readers" (Biswas, 2019, p. 6). These virtues of physical competence, virility and mettle could be realized only against a natural backdrop where the environment had a major role to play. The celebration of ideal role models for the young generation to follow was posited in the natural space outdoors, beyond the stringent routine of the classrooms or the confining boundaries of the home.

Beckoning the child readers to inculcate within themselves the zest for developing physical agility, in turn, served the purpose of strengthening their bond with and understanding of Nature. It is against a natural backdrop that various outdoor games and constructive activities were shown to be performed and leading to the mental growth and social bonding of the participants. Nature

implicitly facilitated the native mastery over a domain which had so far been marked exclusively by foreign achievements. Previously, the arena of sports or physical activity was seen to be chalked off solely for the flaunting of British superiority, excellence and imperial masculinity. However, the outcome of physical exertion in natural, native surroundings was reflected in the "dreams of a future nation" (Gangopadhyay, 2012, p. 227) that was heralded by the manly native champions of independent rule. Thus, the larger cultural, racial and political implications of the ideal of Bengali masculinity which can be understood as bred in the laps of Nature to an extent, led to "an anti-imperialist streak" (Biswas, 2019, p. 9) which further paved the path for "an implicit cultural battle between the colonizer and the colonized, the latter trying to outreach the former by subverting the very tropes of masculinity, racial superiority and hegemony" (Biswas, 2019, p. 9). It is in the natural environment that the stereotype of the "effeminate Bengali" man could be rectified and corrected to a certain extent. This strain remained strong and even decisive in the adventure stories and expedition accounts of Bengali heroes that began to be published serially in these magazines from the latter half of the nineteenth century onwards. The shift from the microcosmic sphere of sports and outdoor games towards the macrocosmic sphere of adventures and expeditions (either for sport or for discoveries), strove to glorify "the model of the 'manly' Bengali man who remained dauntless, composed and unperturbed in the face of perils or danger and emerged victorious out of sheer courage, determination, command over self and physical virility" (Biswas, 2019, p. 7). This implicated not only the urge to mould oneself with rational, scientific and geographical knowledge about the natural environment but also the will to undertake a metaphorical journey into the heart of Nature to emerge as a complete man. It was an essential requirement within the narrative space of these adventure and expedition pieces to push the male heroes, in a very formulaic manner, outside the supposedly emasculating influences at home and into the unfamiliar world outside to enrich and discipline themselves in the laps of Nature. This rite of passage, very interestingly enough, takes place only in the drive towards establishing a bond with Nature, away from the restraining influences of civilization or the sheltered spaces of the home. Nature provides these male heroes to prove their competence, dexterity, fortitude and resilience, qualities which served very important ends in an era of fervent nationalism. In fact, in his book

titled *Heroes of Bengal*, H.K. Sarkar opines that: "Heroes are not born for the hearth, but for the field of action" (Sarkar, 1923, p. 10). This adult-monitored socio-cultural ideology makes its presence vividly felt in the pedagogical exercises of positing the Bengali hero's exploits, achievements and glories against the rich canvas of Nature, and subsuming the strain of eco-consciousness within a larger nationalist project.

Gender Dynamics in Bengali Juvenile Periodicals

The realm of Bengali juvenile periodicals has been often looked like a highly gendered space which has led to the asymmetrical bifurcation of gender roles, identities and notions on nationalism. While it is clear that the prime agenda of the intellectuals was to inspire Bengali boys towards a definite native ideal, girls were somehow relegated to liminal roles within the diegetic space of such narratives. The magazines contained accounts of exemplary personalities who happened to be all men, with no traces whatsoever of women being a part of these intellectual or adventurous pursuits. The articles on sport and physical exertion also directly and emphatically appealed to the male readers to orient themselves into this new ideal of native excellence, with the female readers being completely left out of such considerations. While boys were encouraged to go out and explore the possibilities in the world outside, girls were rather implicitly trained to accommodate themselves into remaining content within the domestic ideal of docile womanhood. Boys were urged to engage in outdoor activities whereas girls were instructed in the basics of household chores or drawing room arts, something that was deemed fit to their 'softer' mettle and feminine disposition. Owing to the still strictly conservative mindset of traditional Bengali society, women's participation in the public sphere was still looked down upon with disapproval. Despite the woman's question and education of women in Bengal having gathered significant momentum by this time already, women were still bound within domestic concerns and any digression from this conventional path was not regarded in a favourable light. It is due to this reason that one can trace very few women writers or intellectuals during this era or any outstanding female achievement in the public sphere as such. However, despite all these issues, it is interesting that the target readership of the juvenile periodicals consisted of both boys and girls (from children to adolescents or even young adults), as can be verified from the various letters addressed to the editors

of these magazines that often appeared in serialized issues. It is therefore obvious enough that despite an asymmetrical bifurcation of gender roles being propagated through the contents of these magazines, it was also understood that readers from both sexes equally participated in the wealth of knowledge or information that they had to offer. Nature, being metaphorically expanded to signify the mother-nation in the pages of these magazines, provided the scope for both boys and girls to share in its bounty, if not physically then at least imaginatively. The love for Nature is an aspect which enabled children from both sexes to relate to the concept of patriotism and develop a consciousness towards ecological concerns and concepts together. The sympathetic understanding of Nature can be allegorically linked to a genuine and deep, unbiased adoption of a love for the mother-nation and mental preparation for the struggle towards emancipating her.

Eco-consciousness and Nationalism

The British attitude towards Nature, as can be deduced from the English periodicals for children, appear to be underlined with a strong imperialist and colonialist tendency. A propagandist notion about the idea of British hypermasculinity was perpetrated through popular British juvenile literature that depicted the manly, robust Englishman with "an interest in new-found geographies and optimism of wielding a manly control over them..." (Gangopadhyay, 2012, p. 181). The mark of this strain was felt not just in the adventure stories, robinsonades or accounts of expeditions undertaken by brave British men to unknown, distant, impenetrable, an almost impregnable wilderness of faraway lands, but also in the accounts of cartographic activities that documented the British trying to exert control over previously uncharted territories and thereby contribute to colonial expansion. Thus, a manly control over Nature, what can be understood in ecofeminist terms as exploitation of mother earth, is the forceful exertion of patriarchal domination over a 'feminized' natural landscape. Within the apparent motive of satiating the British boys' appetite for adventure, while also trying to instil within their minds a fierce sense of patriotism and racial superiority, also lay "the elements of territorial annexation, the display of masculine strength and energy, and the manoeuvering of power and control within the boys' own spheres..." (Gangopadhyay, 2012, p. 185). This obsession with visualizing the world outside as a space to be brought under imperial control, notwithstanding the

violence towards Nature caused in the process, was regarded as a legitimate indoctrination of English boys to "enable them to participate in the most exciting and the most expansive project of the greatest nation on earth" (Gangopadhyay, 2012, p. 184). Herein lies the departure of the attitude which the native Bengali ideology fosters towards Nature. Nature, in Bengali juvenile literature, is not portrayed as something to be wielded domination over but rather presented in highly picturesque terms, symbolic of its lushness and abundance. Nature is also compared to a mother who bestows her nurturing care upon mankind and rejuvenates the spirits of the native male heroes who are metaphorically equated to be her sons. This cannot be dismissed as merely a typical Oriental outlook on Nature or a sort of "'feminine' Indian attitude" (Chando Roy, 2018, p. 19) but rather the sublimation of Nature into a greater national imaginary of the motherland. It should be regarded as "a conscious attempt on the part of the writers to foster a sense of communal and national pride through developing a sympathetic understanding of the natural wealth of the country. This is a pertinent reason that accounts for the allegorical glorification of the native hero leaving the protective influence of the birth mother and stepping into the unfamiliar world outside to prove himself as a devoted son towards the mother-nation" (Biswas, 2019, p. 6).

The symbolic idea of Nature evolving to get merged with the discursive notion of the nation heralds an innovative, indigenized approach towards the collaboration of eco-consciousness with pedagogic instruction. Not only are the child readers allowed to open up their minds to a plethora of facts and discoveries pertaining to the natural world outside, but they are also inspired to know more about the flora and fauna of their nation to accommodate themselves in the race towards rationalism and modernity. Some of the poems and stories included within the juvenile magazines dwell upon the theme of urging Bengali boys to leave their idleness and frolic in the laps of Nature. This imagery of vitality coupled with descriptions of the pristine beauty of Nature conveys a sense of reinvigoration and rejuvenation, an analogical wiping away of all that is old and withered only to be replaced with that which is new, young and fresh. In certain stories like *Buro Angla* (which translates as 'The Thumb Sized Boy') written by Abanindranath Tagore, the idyllic beauty of Nature is shunned by the truant child protagonist who has then meted out his nemesis through various mysterious machinations and finally reconciled in harmony with

the former. Again, factual articles on various botanical or zoological findings, geographical expeditions or travelogues tend to arouse a curious interest in learning more about Nature within the children's mindsets. Coupled with a nostalgic, romantic strain of associating childhood with Nature, the articles of the juvenile magazines also aimed to educate the readers about the socio-cultural diversity across various regions and landscapes in Bengal. These literary journeys can be perceived as "a 'pure' and 'pristine' retreat, where the author can regress into the childhood of his past, into an unalloyed innocence of nature" (Gangopadhyay, 2012, p. 201-202). Thus, Nature becomes a dynamic medium within the diegetic space of Bengali juvenile literature, serving multifold functions against the backdrop of a native socio-cultural scenario. While the English periodicals presented heroes attempting to tame Nature and the variety of wildlife inhabiting it, thereby asserting the invincibility of imperial domination, the Bengali periodicals treated the concept of Nature with a delicate fondness and a greater patronizing mindset. In this context, Satadru Sen's observation seems apt: according to him, natural landscapes in Bengali juvenile literature "were typically constructed as the innermost refuge of the colonized child: a space charged with escapism, innocence, femininity and 'other' mindsets that might be experienced as nostalgia" (Sen, 2004,n.p.). This strain of nostalgia for a previous agrarian, country setup with an abundance of lush Nature is understood as a metaphorical remembrance of the past, free from the infiltrating touches of colonialism and the resultant processes of industrialization as well as urbanization. In the light of these analogical associations, Nature is equated to the mother-nation, "self-effacing...endowed with nurturing and replenishing virtues" (Gangopadhyay, 2012, p. 203).Sirishchandra Majumdar in his article titled 'Nadiya Bhraman' (translated as 'Travels of Nadiya) published in the *Balak*magazine crucially remarks: "What more can our verdant Bengal want? We are the children of this lush and green land, why then instead of happy songs should we be voicing sorrowful tunes day in and day out?...Those fields are storehouses of eternal wealth, the sugarcane and date trees shower you with honey; with her blue sky and green meadows, and her vines ever-laden with fruits and flowers Bengal's nature is always ready to embrace you!" (Majumdar, 2008, p. 519).

Conclusion

It is very interesting that the allegory of "such nostalgic, feminine geographies of the motherland" (Gangopadhyay, 2012, p. 203) celebrated in Bengali juvenile periodicals, is encumbered with baggage of ecocritical and, in turn, nationalist aspirations. Nature is not just symbolically and traditionally regarded infertile, feminine terms but is also perceived as a potent space for the discursive formation of the masculine native hero. Again, despite the problematics of gender involved in such an ideological strain, it is Nature that facilitates the equal participation of children from both sexes in nationalist aspirations in a subtly different way. The development of an eco-consciousness within the mindsets of the child readers during their formative years makes it possible for them to be grouped (though homogeneously) as being future inheritors of the nation and share in common aspirations, nationalist or patriotic visions and develop a love for their native motherland. It is against the discursively constructed canvas of Nature that a native reclamation of authority is made possible over an area which had till then been marked by foreign hegemony. Thus, the celebration of Nature and the implications of this within the larger construct of the nation implicates not just a nostalgic, proud reliving of the past but also the prospective project of struggling to emancipate the motherland through the agency of competent, independent native heroes. The "natural sense of relatedness" (White, 2016, p. 82) to the natural world that the child readers possess in their instincts is sharpened through the medium of such kind of literature by an "apolitical politicizing" (Gangopadhyay, 2012, p.20) of a fluid domain and subsuming it within the drive towards building up a sense of nationalist responsibility, which is undoubtedly informed by activities marked by a sustainable attitude towards Nature.

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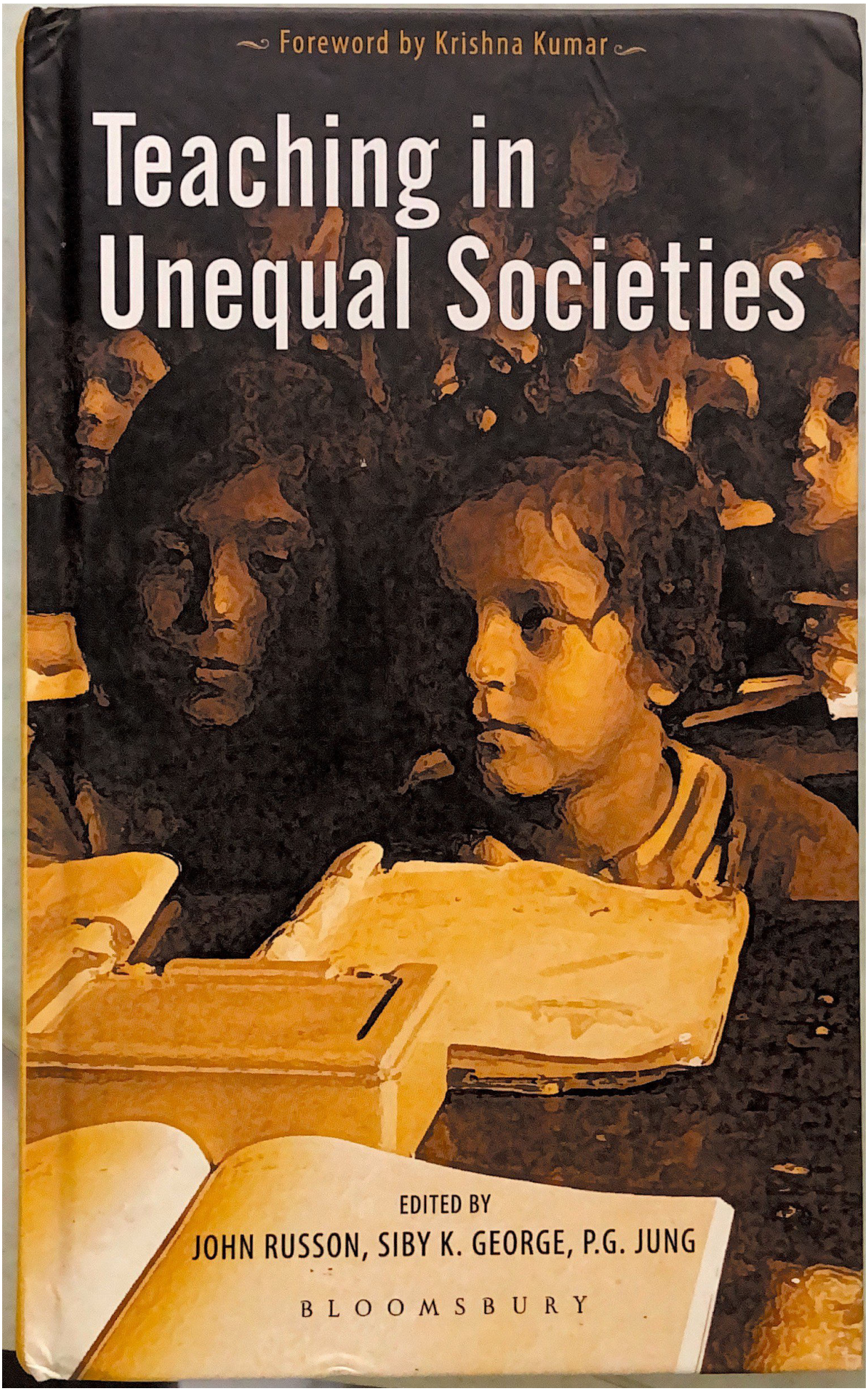
Foreword by Krishna Kumar

Teaching in Unequal Societies



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Teaching in Unequal Societies

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The 'Debased Native Mind' in Colonial Discourse: Education Policies in 19th Century Gujarat

dhārā k. chotāi

'To provide for the education of the great body of the people seems to be impossible,' wrote Holt Mackenzie, secretary to the Bengal government in the Territorial Department, in his report of July 1823 (*Selections from Educational Records* 1920: 59). The statement suggests that even until the third decade of the 19th century, the colonial government was not very convinced of its project of imparting education to the 'natives' of India,[1] or it could be inferred that it was grappling with the question of developing an apparatus for mass education in colonial India. The difficulties encountered by the colonial master were both of a practical as well as of an epistemological nature. The persistent urge to read the human mind in the fashion of the humanist tradition—the belief that man is the supreme creation of God, and, though once fallen, he has the capacity to rise and excel as the 'paragon of animals' (Shakespeare 2003: 143)—seems to have been the driving principle in justifying the ways of man to man[2] under the schema of colonialism. To put it in other words, the humanist tradition served a twofold function in the colonial schema: first, it solicited conscientious approval in the name of humanism, and second, it entrusted the coloniser with the responsibility of fashioning their subjects in the mould of the humanist tradition. The drive of humanism is clearly evident in the following statement by Alexander Kinloch Forbes, a scholar of the Gujarati language and an administrator in the western province of colonial India:



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The eclectic mix of personal essays, poems and scholarly articles and the teachings of Guru Nanak that form this volume have come from contributors of not only the Sikh community in India, Pakistan and the diaspora, but also from people belonging to other faiths who have been touched by the mystique of the faith of Baba Nanak.

By placing the personal records alongside with the scholarly insights into His teachings, what we have understood is that there is a Nanak for each one of us – a Nanak within each one of us – and it is this Nanak which abides in our consciousness and whom we need to seek out and discover.

This book is, therefore, meant both for the initiated as well as the uninitiated. The lay readers will get a glimpse into the richness of thought and experience that an acquaintance with Guru Nanak brings with it. For the scholarly, the insights by the contributors who have dedicated their lives to an understanding of Sikhi will help in opening newer vistas of the Gurbani. The plurality of views expressed mirrors the free thinking and the respect for human beings and the upholding of human dignity that Nanakji propagated, practiced and stood for.

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