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Chapter - 1

Regional Identity and Political Transformation in Nigeria

Ghazali Bello Abubakar

Abstract

For many decades, in fact, from the grassroots of its existence, regional identity has been playing a significant role in the Nigerian political system. Hausa-Fulani, Igbo and Yoruba altogether account for around 50% of the overall population (Muslims who are dominantly in the North estimate around 60%, whereupon Christians from the South account for 40% and 10% are other traditional beliefs). Meanwhile, this huge number of people is equally divided along tribal and religious lines. Besides, northerners – who are dominantly Muslims – preponderantly, consider political participation as a means of meeting regional needs much far better than the national interests, likewise southern communities. Nigeria is a result of amalgamating two disparate protectorates: North and South by the then British Governor-General, Lord Lugard to ameliorate easy administration of the two different blocs whose disunity converted into a future populous African nation. Religious, tribal, and regional differences are prominently important while implementing policies that have to do with politics, economic and social settings, and therefore, cannot be given an abstracted glance. This paper hypothesizes that the regional sentimentalism and outcomes of the 1914 marriage between north and south have impacted on political transformation in Nigeria, especially after the 1999 general elections. These elections stood not only to symbolize slogan of liberalism but trial so to explore the extent of potential attraction and assemblage of the two regions. The paper concludes that the regional identities instead of national interests are responsible for lack of the strong political institutions and economic shambles throughout the modern history of Nigeria, as the interconnectivity so far seems to fail in terms of addressing the key national issues disturbing the entire chances for progress.

Keywords: political transformation, engagement, north-south, traditional differences, unity and diversity

Background

Nigeria, a onetime British colonized country, was two regions: South and North protectorates that are equally divided along religious and tribal lines. The political independence was achieved on the 1st October, 1960, likewise many African countries (1960s championed the title of "*year of Africa*"). The two dominantly disparate south and north regions were in need with different strategies ideally. Dissimilarities are never limited on historical background, but extended to orientation, tradition and culture, and to some extent, physical appearance as well. Consequently, in the aftermath of the independence, the feeling of belonging and patriotism was not so popular among Nigerians (Carland, 1985).

It was not in the plan to acquire more land in West Africa after Lagos, which had during those days served as sea-border used to safeguard Royal Commercial Interest was captured (Charles, 2014). North and southern Nigeria are inherently dissimilar and equally divided along ethnic identity and religious dogmatism. In pre-colonial Nigeria, the two regions were not in touch. Rather, the British administrators (colonial troika) set them united through the means of amalgamation for merely cushy access and control. Hence, it was not appeared to safeguard Nigeria's solidarity. Perhaps it was all about ensuring cheap administration and easy use of both human and natural resources available in the areas (Carland, 1985).

Upon the amalgamation, several important factors were not being taken into consideration, and perhaps, that galvanized the future relations between the regions so much difficult in terms of leadership, distribution of power and resources, education and infrastructures. Prior to the plan that had brought about the united Nigeria (amalgamation); cultural adherences, history and background were not being put into consideration. Above all, the two Abrahamic faiths namely: Islam and Christianity (Hughes, 2012) those predominantly remain symbols for North and South respectively, are artificially neutralized from their cultures and traditions overnight to satisfy the ostensible unity and conglomeration.

Notwithstanding all accomplished by the British colonial imperialists to ensure a concrete bridge that could permanently cement North and South, the regional intermarriage according to Momah (2013), inculcates stagnation and severe economic condition, especially the one of 1980s. This interconnectivity between the two asymmetrical sides according to him has been able to realize independent Nigeria by 1960. Six years later; in January, 1966 the first bloodbath in the name of military coup occurred against the

then a young independent Nigeria. The coup had immediately led to a devastated civil war (Biafra), which has in its capacity, been able to play a defeatist role in galvanizing political and socio-tribal crises in the country over the course of assassinating some key political figures (Momah, 2013).

This strife soon turned to endemic civil war that has epidemically caused loss of thousands of lives of innocent Nigerians. This civil ferment shadowed the entire nation for almost 36 months' time. The state of anarchic bedlam over the courses of why assassination and how administrative structure of this new-born nation supposed to come to light, become a perplex between Hausa/Fulani in the Muslim predominant north, the region that lost the number one figure in the nation, Sir Abubakar Tafawa Balewa, first and the only Prime Minister of Nigeria followed by the Premier of northern region, Sir Ahmad Bello, the Sardauna of Sokoto in 1966 (Mbachu, 2011).

An Igbo man and senior military officer in the Nigerian Army, Major-General Johnson Aguiyi-Ironsi, had quickly climbed to the highest office in the country after the January 1966 coup. Ironsi took advantage of the chaotic havoc and seized the power. This makes him the second person to lead Nigeria after Balewa. The 1966 coup d'état marked starting point of the social mistrust, political gaps and brinkmanship, power hunger for regional interests, economic and financial crises between Igbos from the Southeast and Hausa-Fulani from the Northern region, until today.

As much of the coup planners were Igbos from the east, Hausas from the north managed to consider the opportune incidence as a plan to ruin down their stance in the country's widely central administration. Hence, the northern military officers therein saw reprisal as inevitable as admissible. On 29th July, 1966 Ironsi was killed by northern military officers in what they called "July counter coup". This incidence had circuitously paved the way for Major-General Yakubu Gowon, a young army officer from the north to take over the country for another long uninterrupted eight years.

Thematic Definition

Many scholars admit from cross-border perspective-that a region can be cluster of more than one country, or a zone in a particular nation. In the line of the above, Africa, Europe, Asia, likewise south and north Nigeria each stands to identify region. Adam Lupel views region as a political project that goes beyond the evolutionary integration of a geographical unit (Lupel, 2004). Region is however, used to refer to a narrowly particular side or zone in a country as shortly remarked earlier. Cambridge Advanced Lerner's

Dictionary (3rd edition) defines regionalism as a sort of feeling "loyal to a particular part of a country and want it to have more political independence". (Cambridge Dictionary, 3rd edition). Thompson adduces that region is a huddle of states that are geographically proximate, interact extensively, and have shared perceptions of various phenomena (Thompson, 1973). Russett furthers to define region on geographic proximity, social, cultural homogeneity, shared political attitudes and political institutions, and economic interdependence (Russett, 1967).

Regional Sentimentalism and the Game of Political Affinity

In more than one nation colonized by the British Empire, single system was used to administer affairs and activities of the colonies. In Kenya, Ghana or even India for example, single system was used as control panel. In Nigeria the two asymmetric regions: South and North administered separately until 1914 that has played a significant role in creating the gap between the two regions.

However, colonizing Nigeria was not a result of merely British discovery of a land, but was a determination and vision, which were part of the forces that have strengthened British ambition to extend and therefore bring massive areas under their control. British colonialists reached an area known today Nigeria somewhere in the late 19th century only to meet two real disparate parts who were autonomously independent from one another ethnically, tribally and religiously. Northern and Southern regions that make future Nigeria have never demonstrated a symbol of homogeneity simply because their peoples and tribes are widely different. Regardless with these differences, for the sake of effective administration, the colonialists therein decided to tighten the knot between them somewhere in the 1914 (Agbese, 2012).

Obviously, mixture of different things of different shapes gives a wonderful combination. This is what was expected by North-South amalgamation too. Instead, division, rivalry and unnecessarily antagonism on the basis of ethnicity or tribe soon overtake the newly innocent independent nation amidst national development. By now, it is exact one hundred years past on this historic (suppose) togetherness. But the atrocious detail is that, throughout this span of time, Nigeria as one country, has so far failed to prove any competitive progress. Thus, regional sense of belonging instead of patriotic nationalism takes advantage to bolster corruption, mismanagement and other malfeasances. Alternatively, good governance, rule of law and social development are overtaken by regional sentimentalism (Olaniyan, 2003).

In historical tale of colonial legacies in Nigeria, Ibrahim Gambari (2008) observes that the colonial rule created some waves of challenges and burden especially in the post-independence Nigeria for nation-building. Colonial administration divided Nigeria into pieces under the banner carrying a passive slogan campaigning for Southernization and Westernization with different land tenure, educational and judiciary systems as well as local government administration. Most of the 1950s and 1960s Nigeria's elites had their education, therefore, world outlook guided by regional institutions. Some had very little and or had no further understanding of their immediate region (Gambari, 2008).

These together with the natural dissimilarities had easily made it possible for hateful disdain, fear and prejudice to prevail. Even during the struggle of independence, Nigerian nationalists were in reality regionalists; never they were united neither had a single ambition. Of course, they were striving to achieve the prime goal of freedom out of the colonial bondage, simultaneously, were fighting based on the broadly different regions they came from as much as their fighting against imperialists.

Throughout decolonization process, Nigeria proved to have a very peculiar attribute. India, Ghana, South Africa and Tanzania won their independence through centrally rallying figures like Mahatma Gandhi, Kwame Nkrumah, Nelson Mandela and Julius Nyerere. Whereupon in the case of Nigeria, each of its three main regions namely: east, north and west sent its representative. Nmandi Azikiwe represented east, Sir Ahmad Bello north, and Obafemi Awolowo west. This is how Nigeria gained independence. This genesis until today makes nation-building virtually seldom in nature. It was very fortunate that the nation wasn't seized to exist, had also never succumbed to the artificially man-made challenges (Gambari, 2008).

The founding fathers therein, adopted a system that could better suit the natural being of the nation. That was federalism so that the united Nigeria can be maintained through diversified and inevitable regional and tribal differences. Sadly, the absence of integrity among the two sides to maintain the policy advocated and federalism adopted during the post-independence era, soared the famous civil strife in 1960s which soon transformed to historic civil war in the country (Gambari, 2008).

North-south zone-phobic attitude becomes a realistic affair in Nigeria. Ostensibly, Nigerians as far as regions are concerned; developing region over the expensive cost of nation is a paramount operation. In fact, the

interest of the region or zone is prioritized than the Nigeria's group of interests as a nation. Therefore, for the sake of place of birth whether it is in the north, east or west could, at any given time, seize Nigeria's interest to be perused.

North-South and the Sleazy Factor of Engagement

From the very beginning, in pre-1914, there were no historic documents that could assert connection between the two communities. Thus, dissimilarities and even incomparability were so much clear. However, the major target of the imperialists while amalgamating the two sides was not building a solidly stronger Nigeria, but a smooth governing, which served them much better than it served Nigerians. Hence, the policy of "divide and rule" was adopted deliberately. The colonial imperialists therefore, seized the chance to subjugate the local indigenous population and implant roots of mutilation in the future Nigeria (Ajayi, 1992). To ensure this according to Salami (2009), the British established treaty with northern elders to create chances for them including political appointments and finally handover power through their men. In turn, the elders would protect the colonial interests especially the economic one (Salami, 2009).

Northern region was feebly weak as it was suffering from insufficient well-trained indigenous manpower. This was the major rising issue that the premier of the region, Sir Ahmad Bello observed, and do believed that to fully utilize the independence obtained the problem of illiteracy must be addressed. Northern side with not sub-regional sectarianism had a crucial place and thus role to play in shaping the destiny of newly born nation, Nigeria, unlike south where the region is equally divided along tribal and linguistic lines: east and west (Igbo and Yoruba) Dan Agbese (2012: 33). As far as the north is concerned, though zones are there but only to identify geo-political demarcation. Sir Ahmad Bello was, alone, the premier of the entire northern region while Azikiwe and Awolowo were the two champions representing east and west from the main south (Malachy and Nwobi, 2014).

The premier had soon realized that the unity of entities in the north could not balance the advancement of large trained indigenous southerners. Thus, the next upcoming years must be extreme for the north until if solving strategies would be given chances otherwise, north could find itself in dilemma by either depending on expatriates or face immediate collapse as a result of not being able to produce enough manpower equivalent to their needs. The policy of indigenizing public services was introduced by East and West regions of the main South, which has subsequently, became mandatory

for the North, too. This policy put public services under regional control. North, who was facing the challenge of less and very limited manpower was compelled to hire expatriates from Egypt, Pakistan, India and Sri Lanka for professional activities such as pharmacists, doctors, and teachers who delivered their services in laboratories, hospitals and schools (Agbese, 2012).

The first and foremost struggles being carried out by the premier and his ministers were said to be all but soaring up north to balance south in different forms. He paid visitations to various secondary schools and delivered pep talk as well as alacrity of hopes that could be dashed only with young talents and well-trained students who carried along with them a sentimentalism of their region. It was encouragement to share with their stakes in armed forces, western education in general, and other competitive advantages that would mean and serve a lot in the central government. In the south or at least east and west were also doing their best to maintain the current status and beyond. This kind of attitude ensures that regional interests oversize and or overpower national objectives (Mbachu, 2011).

Nigeria's integrity supposed to be the first priority and therefore non-negotiable due to the element of benefits that could only be achieved in unity. Instead, over the time, the integration soared suspicious and mistrust among as many as 240 ethnic nationalities. As a result, conflicts and civil strife on the basis of ethno-religious border-line are taking place constantly. Incrementally, by 1998 the only alternative seen to tailor the enlarged gap bridging off the differences was democracy; a system in which the entire citizens will be given chance to exercise their rights to cast their vote in universal franchise so to take part in the formation of newly elected government regardless with the region they come from (Malachy and Nwobi, 2014).

In 1999 Nigeria once again, returned to civilian governance with the aim that the tension would melt down as decisions will now onward be carried out on consensus basis by the constituent representatives in the National Assembly. Appointments and positions in the central government are divided by six geo-political zones. Though, the Nigeria's constitution hasn't provided for such kind of dialysis. This policy, apart from being unconstitutional, it apprehensively galvanizes more tension that nowadays threatens the golden unity of the nation. At the top level, what could be the interest of elites or elderly ones seldom serve the interest of the nation at large. Ruling class (as the situation may have warranted), either at the position of governor, senator, representative, minister, head of parastatals, etc. or at some other highly political appointments at the federation; the

prime concern is put on ethno-zonalism not competency, sincere and patriotism (Malachy and Nwobi, 2014).

Ostensibly, during Good Luck Ebele Jonathan's Administration, the northerners were allegedly censured for sponsoring Boko Haram insurgency so to destabilize the government led by Ijaw person from South-South geo-political zone. In turn, Niger Delta militants (Avengers), Biafra agitators and other similar groups who demonstrate their willingness to secession are plunged by southerners so that the government of Muhammad Buhari (2015-2019, 2019-2023), a former military Head of States from the north, will remain inactive.

This unintentionally and unanimously, set two sides to play *Game Theory* where two players are on the ground and each chooses to move rationally so to maximize its payoff. This theory according to Joshua S. Goldstein and Jon C. Pevehouse (2009) was first used extensively in International Relations during the 1950s and 1960s by IR scholars to explain the Soviet-U.S. nuclear warfare contingencies. Different kinds of situations are represented by different levels of games (Joshua and Pevehouse, 2009).

Conclusion

With such a great inevitability, Nigeria is destined to face the challenge of its time as well as arduousness of its nature. As a modern nation, it has no alternative but enduring struggle to accept the reality of being heterogeneous. The reality of being a nation made up of by differences only to reflect a diversification of disparity of so many identities. The heterogeneous nature of Nigeria had been the fact that different independent entities were joined together to form a nation themed Nigeria. To form southern region, west and east were united in the 1906, eight years later on, the North, the region, which was rich in its culture and tradition was also amalgamated with the South to easily move together as a future sovereign country. However, neither either of the regions had ever felt ready to sacrifice beyond their area of origin. North for northerners, and south for southerners, and this has been the tradition throughout these decades. North was an independent area, proud with its huge financial and income taxation guided by some sophisticatedly sufficient economic policies. The Islamic culture since ever before administers entire northern affairs.

Thus, it was "uneasy to join states and cultures without a national consciousness or unity" (Calvocoressi, 2005). In the aftermath of Second World War, the southern region, which appeared a bit matured compared to northern region in terms of trained manpower and skilled laborers, tried to

persuade for independence, while northern region was on the position of objection as the future Nigeria would not guarantee further advantageous privileges with the then current condition of education and manpower of the north. Sadly, this inevitable face-to-face bring about regional sentimentalism whose interest overtake national objectives. However, these ups and downs effect political participation and reduce the broader influence of political parties from national level to the regional degree, and to some extent, to state level. Since then, the complex perplexity occupies Nigerian politics until today.

To carry out this study in order to expand from where previous studies stop, many recent works on regionalism, regional identity and political transformation are being reviewed and analyzed. Most of these works have been largely carried out to specifically draw much attention on region that concentrates deeper on a group of nations come together and form solid body for an interest or more. However, many of these researches are conducted by political economists as it obviously deals with regional political stability and economic prosperity leading to national integrity and progress. In other words, this paper tries to fill gaps left behind by existent literatures on regional identity in Nigeria's political transformation.

I tried to analyze negative impact that could be led by regional identity such as national disintegration, political instability and economic shambles. In the final stage, I conclude by outline some key important contingencies for future researches, emphasizing on the need to restructure the country back to its real and ideal nature rather than an artificial constructions, which has eventually been given to the country over the course of so many implications. As it is till now discovered that those implications seldom to favor the huge disparate population neither its well-being; future investigators could once again study the situation and observe the condition so to provide wider analyses and propose proper solutions should the case remain adamant.

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Chapter - 2
Instructional Material has on Impact on the Clientele Group

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Chapter - 2

Instructional Material has on Impact on the Clientele Group

Kethavath Naresh

Abstract

Audio visual education or multimedia-based education (MBE) is instruction and comes under Electrical department of the organisation, where particular attention is paid to the audio and visual presentation of the material with the goal of improving comprehension and retention.

After the use of training films and other visual aids during World War II, audiovisual technology gradually developed in sophistication and its use became more widespread in educational establishments such as schools, colleges, universities, museums and galleries, as well as at tourist destinations.

Children learn best by observing and copying the behaviours of adults. It is therefore evident that learning is more effective when sensory experiences are stimulated. These include pictures, slides, radios, videos and other audiovisual tools. According to the Webster dictionary, audio-visual aids is defined as "training or educational materials directed at both the senses of hearing and the sense of sight, films, recordings, photographs, etc. used in classroom instructions, library collections or the likes". More recently, audio-visual aids were also widely used during and after World War II by the armed service. The successful use of picture and other visual aids in U.S armed forces during World War II proved the effectiveness of instructional tools. There are various types of audiovisual materials ranging from filmstrips, microforms, slides, projected opaque materials, tape recording and flashcards. In the current digital world, audiovisual aids have grown exponentially with several multimedia such as educational DVDs, Power Point, television educational series, and other online materials. The goal of audio-visual aids is to enhance teacher's ability to present the lesson in simple, effective and easy to understand for the students. Audiovisual material make learning more permanent since students use more than one

sense. It is important to create awareness for the state and federal ministry of education as policy makers in secondary schools of the need to inculcate audiovisual resource as main teaching pedagogy in curricula. The outcome is to promote the audiovisual material in secondary schools because they lack the resource to produce them. The visual instruction makes abstract ideas more concrete to the learners. This is to provide a basis for schools to understand the important roles in encouraging and supporting the use of audiovisual resource. In addition, studies have shown that there is significant difference between the use and non-use of audiovisual material in teaching and learning.

Keywords: audio visual aids, clientele group, instructional material

Introduction

Audio Visual Aids are also called instructional material. Audio literally means "hearing" and "visual" means that which is found by seeing. So all such aids, which endeavour to make the knowledge clear to us through our sense are called "Audio Visual Aids" or Instructional Material. All these learning material make the learning situations as real as possible and give us firsthand knowledge through the organs of hearing and seeing. Therefore, any device which can be used to make the learning experience more concrete and effective, more realistic and dynamic can be considered audio visual material.

We learn through our sense organs. Senses are the ways of knowledge. All the sense organs help us in understanding the environment. Most of the knowledge, which we acquire from the school, comes through our ears and eyes.

Clientele Group: The people who use or benefit from an agency can help provide influence for an agency, if the people who use an agency are politically powerful, then agency budgets are less likely to be cut, agency initiatives are more likely to be successful in congress etc.

Audio Visual Aids: Audio Visual Aids are those sensory objects or images which initiate or stimulate and reinforce learning.

Visual aids are any instructional device that can be seen. But not heard.

Audio aids are any instructional device that can be heard but not seen.

Purposes

Verbal instructions

Best motivation

Clear images

Variety of stimulation

Opportunities to handle and manipulate

Positive transfer of learning

Classification of AV Aids

A.V. aids can be broadly divided into 2 types based on their operation.

1. Projected aids
2. Non projected aids

Projected Aids

1. Film
2. Film strips
3. Opaque projector
4. OHP-overhead projector

Non Projected Aids

Audio Aids	Graphic Aids	Display Boards	Activity Aids
Radio Television recordings	Charts Cartoon Diagrams Flash cards Graphs Maps Photographs Pictures Posters models	Black board Bulletin boards Flannel boards Magnetic boards Peg board	Demonstration Experimentation Field trips

Common Classification

Auditory Aids

Any instructional device that can be heard but not seen. E.g. Tape records, Microphones, Amplifier, Ear phones, etc.

Visual Aids

Any instructional device that can be seen, but not heard. It has 2 types

Not Requiring Projection: e.g. Chalkboard, Flannel graph, Exhibits, Posters, etc.

Requiring Projection: e.g. Slides, Film Strips, Epidiascopes, OHP, etc.

Audio-Visual Aids

Any instructional device that can be heard as well as seen. E.g. Sound Films, Closed circuit Televisions.

Traditional Aids

Traditional practicing Medias. E.g. Puppet shows, Folks songs, Drama, etc.

Miscellaneous: E.g. Dramatization, Booklets, Newspapers, Magazines.

Aids through Activity: E.g. School Journey, Objects, Specimens, and Model collections, etc.

Characteristics of Good Teaching Aids

They should be meaningful and purposeful

They should be accurate in every aspect

They should be simple

They should be cheap

They should be improvised as for as possible

They should be up-to-date

They should be easily portable

They should motivate the learners

Sources OF AV Aids

Government

Educational organizations

Professional organizations

Nongovernmental organizations

National and international voluntary organisations.

Disadvantages of AV Aids

In effectiveness of the aids.

Lack of facilities for training

Absence of electricity

Improper selection of aids.

Chalk Board

It is the most commonly used AV aid.

It is also known as black board.

It gives motivation and gives instruction concrete and understandable.

Types of Chalk Board

Fixed

Portable

Characteristics of Blackboard

Size-5mx 6m

Surface-rough

Dull-to eliminate glare

The writing should be easily eliminated with duster

The chalkboard should be mounted on an appropriate height within the reach of teacher and visibility of students

Skills Involved in Effective Use of Chalk Board

The 'STANCE' it has been observed that most convenient place to stand is towards the (L) side of the chalkboard, as this allows you to turn from the chalkboard to the class.

Take half stick of chalk and hold the chalk between the thumb and forefinger.

Write in sequence as head line.

The margin space for the top and bottom of the board should be equal.

Try to keep 2/3rd part of the board when drawing.

Use duster from top to bottom and again from top to bottom by lifting rather by rubbing to avoid dust allergy.

Front row of the students to be atleast 8 feet away from it.

Do not talk as you write.

Face the group after writing and continue the discussion.

Use coloured chalks.

Do not stand in front of the board, stand at one side.

Advantages

It is convenient for group teaching.

It is economical and it can be used over and again.

It can be used for drill and revision.

It can be used for drawings and illustrations from the textbooks.

Limitations:

It makes students dependent on the teachers.

It does not care for the individual needs of the students.

It makes the chalk board to spread and inhaled by the teachers and students.

Constant use of black board makes it smooth and glare.

Charts: It defined as combination of graphic and pictorial material designed for the orderly and logical visualizing of relationships between key facts and ideas.

Purposes

To show the relationships by means of facts and figures.

To show continuity in process.

For presenting the material symbolically.

For showing development of structure.

Preparation of Charts

Prepare charts are sheets of thick white or light coloured paper.

Fibre tipped round point and Chisel-Point colour Markers.

Drawing aids and Adhesives.

Before Making a Chart

One should plan the content in terms of the objectives and decide the layout.

The layout should be “balanced” and should use the space effectively.

Principles

The size of the chart, the size of the letters and the contrast of the display materials should be such that it is readable by the farthest viewer.

Standard chart paper in sizes 90x60cm and 70x55cm is suitable for most purposes.

The size of letters for the Captions, labels and keywords written on a chart should be between 2 and 3mm.

The thickness of the lines should be between 2 and 3mm.

Light coloured chart paper should be used e.g. Yellow, light green and white are better suited for dark coloured pens. E.g. black, blue, red and orange.

Simple hand-drawn charts with non- decorative lettering are more effective than elaborately drawn.

One chart should convey just one idea or one principle.

Preservation of Charts: Cover the charts with brown paper or old newspaper.

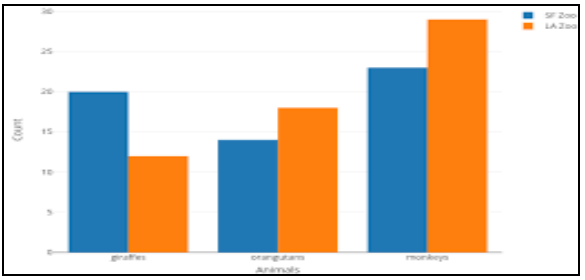
Types of Charts

1. Narrative chart
2. Tabulation chart
3. Chain chart
4. Bar chart
5. Pie chart
6. Flow chart
7. Evolution chart
8. Pull chart
9. Line chart
10. Tree chart

Tabulation Chart

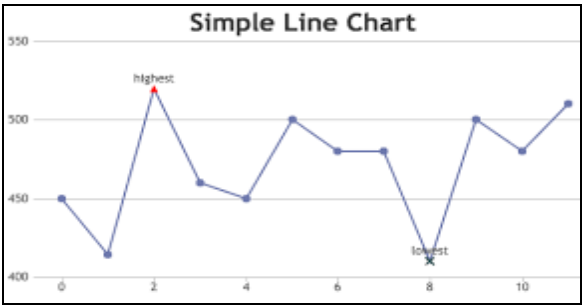
Payment Method	Coupon Applied	Product Category	Region	Price	Units	Sales
Master Card	Yes	P2	East	$19.95	2	39.90
Master Card	Yes	P3	West	$22.95	1	22.95
Master Card	No	P4	East	$19.95	1	19.95
Master Card	No	P1	North	$22.95	5	114.75
Visa	No	P1	West	$22.95	1	22.95
Visa	No	P1	East	$19.95	3	59.85
Paypal	No	P1	South	$22.95	2	45.90
Paypal	No	P1	South	$22.95	1	22.95
American Express	Yes	P2	Mid-West	$19.95	1	19.95
American Express	Yes	P2	South	$22.95	1	22.95
Visa	Yes	P2	Mid-West	$19.95	2	39.90
Paypal	Yes	P3	South	$22.95	2	45.90

Bar Chart

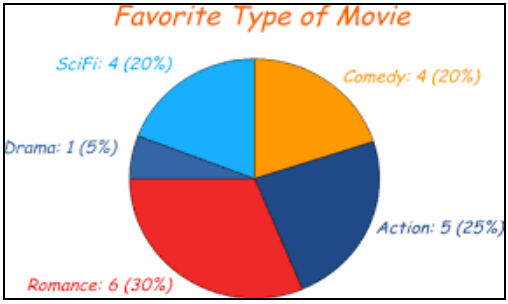


Narration Chart

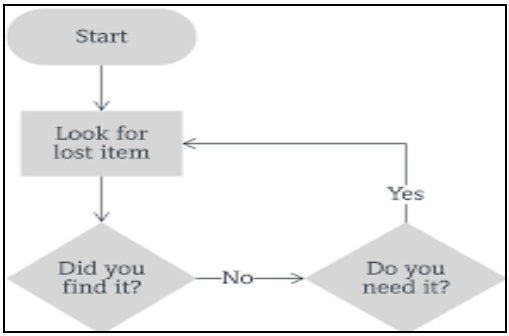
Line Chart



Pie Chart

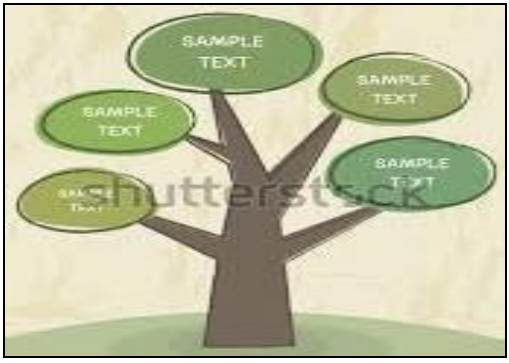


Flow Chart



Evolution Chart

Tree Chart



How to Use the Charts Effectively

Students should be involved in the preparation of charts.

Charts should be so large that every detail depicted should be visible to every pupil in the class wherever be is sitting.

Teacher should make sure that there is provision for hanging the chart at a vantage point.

A chart should give neat appearance.

A teacher should have pointer to point out specific factors in the chart

Straight pins, stables, pre board clips, paper clips may all be used.

Charts should be carefully stored and preserved for use in future.

Posters: Posters are simple graphic visual aid which conveys single idea or single subject.

Principles of Poster Making

Brevity: A poster must be brief, so that it can be read in the shortest time possible not more than five words is best. The message should be clear.

Simplicity: Too many words should not be used on a paper.

Idea: A poster must tell its story, at a glance. Hence illustrations and captions should be large enough.

Layout: The poster must be organized properly to convey the idea, Bold simple styled letters will be easy to read expressive letters also can be used to attract attention and to convey the idea.

Colour: Colours when used properly make the poster more attractive. Black or Yellow is recognized to be the most striking combination.

Lettering: Letters should be legible and of appropriate size.

Poster Size: This usually confirm to the paper sizes available such as 10”x15”, 15”x20”, 20”x30” etc. these can be used horizontally

Materials Used for Making Poster:

1. Poster papers
2. Stencil
3. pencil
4. brush
5. erasers
6. scale
7. Compass
8. picture
9. colours
10. glue

Steps in Making Poster

Selected the topic

Select the message

Organizing the message conveying a single idea with minimum words.

Prepare a caption.

Position the message and caption

Tryout different layouts and colour schemes.

Pretest the paper before use.

Rules to Use Poster

It should be planned for the specific people.

It should stop the people and make them to look.

Use pleasing colours and must be timely

It should be placed where people pass or gather together.

Graphs: A diagram showing the relation between variable quantities, typically of two variables.

Types

1. Pie graph
2. Bar graph
3. Line graph
4. Pictorial graph (pictures)

Flash Cards

Flash cards are small cards of generally 25×30cm in size which are shown for a few moments before the class to send across a message or impart an idea.

Flash cards would be used along with the other graphic aids to make the lesson effective.

Preparation of Flashcards

Cut a chart paper and cut it into four equal parts to get the flash cards.

Write the content on it either in the free hand or using lettering stencils and sketch pen.

Also the height of writing on the flash card is to be large enough so that the whole class can see the flash card properly.

It is advisable to make a rough card on an ordinary paper first and then transfer it on the chart paper or cardboard flash cards.

Structure

They consist of a series of cards approximately 10x12 inches each with an illustration pertaining to a story or talk to be given. The message on the cards must be brief and to the point.

The flash cards and the pictures there in should be large enough for a group to 30 to 50. Use colour to make it attractive.

The number of cards should be 10 to 12 in a set.

Using the Flash Cards

Give brief introduction about the lesson to the students.

Give instructions to the students about their actions while you flash the cards.

Flash the card in front of the class by holding it high with both your hands so that all the students can see it.

Add more information to the student's responses

Advantages

The flash cards can be used to introduce and present the topics.

Flash cards can be used to review the topic.

Flash cards can be used to develop the cognitive abilities of recognition and recall of students.

Meaning of Flip Chart: Individual charts are fixed to some support and as the lesson progresses.

Preparation of Flipchart

Write an interesting story or description about the topic which includes all the points that need to be told.

Decide which is to be drawing, pictures, illustrations would be appropriate.

Test the materials before preparing the actual flip chart.

Cut heavy paper or pieces of cardboard to the desired size for the

Glue the illustrations on one side of a card, the talking points on the other.

Number of sheets can range from 8 to 12.

Drill 2 holes at the top of the plywood board (40x50cms) approximately 13cm from each end. Drill two matching holders in the wooden strip.

Place the wooden strip over the sheets and insert the bolts throughout the holes in the strip as indicated in the margin. Secure firmly with wing nuts.

Make sure while presentation flip chart to be straight and pictures are not covered by fingers, scale to be use for explanation

Picture

It provides an environment of reality from learner's point of view which is the main criterion in the selection of pictures.

It should be relevant to the topic and it should be coloured, accurate and suitable size watched by all students easily.

Too many pictures should not be displayed in one lesson.

After showing the pictures it should be removed from the view of the students.

Photo Graphs

Exact visual recording of things which occur in real life situation

It may be black and white or coloured

It may be mounted or unmounted

This may be used in Personal teaching situations

Visual display in exhibition or bulletin boards

Projected with an opaque projector suited to teach illiterate

Models

Models are three dimensional recognizable limitations of an object with increase, decrease or exact size. They are replies of objects, eg. Models of eye, ear or other organs of human body.

Preparation of Models

Identification of purpose of model.

Being knowledgeable about the model.

Collection of materials to be used.

Proper planning to prepare the model.

Drawing the model with exact measurement.

Preparing the model with exact measurement.

Preparing the model as much as real and attractive.

Pre testing the model to check it.

Mounting and labelling the model.

Materials Used for the Preparation of Models

Cardboard: suitable thickness can easily be cut desired shapes could be formed. Pasted and given a better look by coloured paper.

Clay, Wax: (available in several colours) could be melded easily to desired shape.

Easily Workable Materials: Thermocole, fevicol, sand paper, water colour and brush.

Plaster of Paris: duplicate copies of objects with plaster of paris could be made easily.

Wood: hard wood, light wood and easily workable balsa wood.

Metal: in the form of sheets, rods, tubes, angles, wires, etc.

Plastic: PVC, Aery materials, etc.

Thermocole Models: Thermocole could be easily cut with a knife or an electricity heated wire.

Flannel Board: Flannel board is the board where we place the prepared items and remove them when needed.

Pupils may be often asked to fix these to arouse their creative interest.

Principles of Flannel Graph

One piece of rough textured cloth will adhere or stick to another.

The backing material may be wall board, Masonite, plywood, softwood, heavy cardboard etc.

Rough textured materials that may be used include cotton, flannel, khadhi.

Any colour of flannel may be used, but slightly dark green or blue seems better than others.

Articles Required

Wooden or plywood board

Khaddar cloth or velvette cloth

Flannel pictures

Gum

Steps of Preparation

To prepare the flannel graph take a frame, with a firm surface made of any board like plywood, fiber board, Masonite etc. of 30”x40” or any size.

Tightly stretch a dark coloured background flannel or cloth and fasten securely to the board with drawing pins. Now the flannel board is ready for use.

Apply a flannel graph on the board with a slight downward movement with firm pressure to avoid the material sliding off the surface.

Stick the flannel in an organized manner and number it properly.

Puppets: A puppet is a manipulative doll dressed as a character and the performer is a person.

Types of Puppets:

1. Stick puppet
2. String puppet
3. Finger/Glove puppet
4. Shadow puppet

String Puppet

Shadow Puppet

Principles

Puppet actions should be accompanied by short dialogues which are easily understandable.

Plays must be based on action rather than words.

Need to have skill in the use of puppets.

Need special training in the preparation.

Prepare according to pupil's experience.

It should have adequate preparation.

The teacher should prepare herself before using to the students.

It should be appropriate to the age and intelligence.

Not more than 4 characters are recommended.

Questions introduced at the beginning and answer comes out at the end.

Preparation of Puppets

Stick Puppets

Prepare drawings, colour them with paints or pens.

Each figure should have two faces, one for each side of the puppets.

The expressions on each side should be very different.

Paste the illustrations onto a piece of thick poster paper or cardboard.

Cut out the figures.

Paste two sides of each face together, inserting a flat wooden stick between the two pieces of thick paper.

Glove Puppets

Glove puppets can be made by tracing the outline of your hand on piece of cloth and stitching along the outline.

The face, hands, dress can be painted after this.

Preparation for Puppet Play

Prepare a Script for the Play

The story should involve conversation between the characters, it should be humorous and entertaining.

Each message, idea or point of view should be introduced and developed in a logical order.

Have a commentator introduce the characters and make comments on the points brought out in the play

Keep the story simple and suitable to the audience.

Prepare puppets of the different characters identified for the play.

Have the puppeteers who will handle the puppets practice the play until they are comfortable with their puppets.

Finished the play with the commentator asking questions to the audience such as, what do you think? Who do you think is right?

Bulletin Board: It is a board on a wall in which notices can be fixed.

Principles for Effective Use

Location: Information material and notices should be kept separate from those of current events for an understudy.

Placement: Near educational administrator's office, near library, each classroom, clinical conference room in wards, in hostel.

Visibility: Adequate light natural or electric filled and fixed within the eye level.

Organization: Organize around a central theme of content, material should be dated to ensure that it doesn't stay on the board too long.

Appearance: should appear neat, in order and attractive. Arrange mounted materials in S, Z, or V direction and follow the sequence.

Characteristics of Notice Board

Size of notice board: The notice board comes in various size and kinds. The type and size used will depend on the purpose for which it is used and the approximate number of people it will serve.

Materials Required for NB:

a) Wooden board or cardboard or plywood or thermo coal
b) Coloured papers
c) Flannel cloth or khadi cloth
d) Pair of scissors
e) Paste or gum or fevicol
f) Straight or coloured pins
g) Letters, pictures
h) Material, notice etc

Preparing of NB: Prepare one central theme, select the photographs and drawings, arrange them in Z, S, and V direction and complete the notice board by using pins.

Overhead Projector: The name comes from the fact that the projected image is behind and over the head of the speaker.

Methods of Using Overhead Projector

The projector should not be subjected to mechanical vibrations.

Provision for voltage fluctuation should be taken care of by using a voltage stabilizer or by having a suitable choke in series.

Halogen lamps particularly will not with stand heavy surge in voltage. The lamp should not be touched by hand.

OHP should not be kept on continuously for long periods. Otherwise the projector may get very hot in spite of the cooling arrangements.

The Fresnel lens is protected by a glass plate on top. It is necessary to remove dust or dirt on the protecting glass and also from the outside lens surface.

The OHP should be kept necessarily in a fixed place so that the rotated projection axis meets the screen normally.

Transparencies are tri-acetate sheets of dimension 20x25 or 25x25cms square, leaving the margin of 2- 3cm, matter clearly written over the surface can be suitable mounted on suitable cart board mounts and presented on the screen.

Using an OHP

Place an OHP on a stable table with the objective lens facing the screen behind the teachers

Put the cord plug into a power wall socket switch on the blower first and then the bulb

Place the acetate or cellophane transparency on the glass top.

Move the objective lens and mirror to assembly up and down to get the image in focus on the screen.

Explain about the material on the transparency sitting behind the OHP with a small pointer.

Do not keep the OHP too low as it will make a image distorted i.e. image will get wider at the top and narrower at the bottom. This distortion is called key stoning.

Do not keep the bulb for a long time. It can overheat the projector and damage the acetate transparencies as well as the bulb.

Advantages

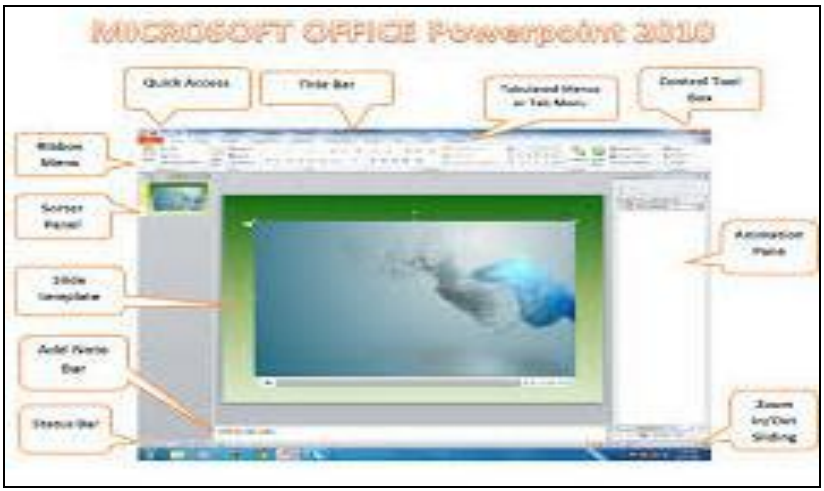
It permits the teacher to stand in front of the class while using the projector thus enabling her to point out features appearing on the screen.

It can be used in a fairly lighted room

Material projected can be changed easily and quickly

To make marginal notes on transparencies for the use of teachers

Power Point



Using Power Point

Practice with equipment

Slides should be concurrent with verbal content

Pause to allow audience to redirect attention

Talk to audience

Explain graphics

Use verbal cues for next slide

One topic per slide

3-7 bullets/slide

Keywords: 32 point for text/40 point for headings

Errors

a) Use “special effects” sparingly

b) They rarely add anything to the presentation

c) And can be extremely annoying and distracting!

Font Errors

Funky fonts are distracting and hard to read

This is a sans serif font (Arial)

This is a serif font

Font Errors: Size too small is hard to see, and this is smaller than the minimum resolvable acuity for most of the audience

Beyond minimum resolvable acuity

Make big enough to see easily

Font Size

Titles - 40 to 72 pt

Text - 28 to 40 pt

NEVER smaller than 28 pt

Font Errors: Alignment

This passage is more difficult for you to read because it is centred, instead of left justified. Don’t do this.

This passage is left justified and easier for you to read. Do this.

Font Colors: chromatic aberration of the eye causes different colors in the slide to appear to be at different depths; and makes it hard to read don't do it!

Avoid This: This section has lower contrast than what comes next and is harder to read and Do this.

White on black is easy to see.

Television: Television is being acknowledged as a powerful medium of mass education.

Using a Television as a Class Room Instructional Aids

Procure in advance the information from the programme manual about the background and objectives of educational programme.

Collect other instructional materials that relate to the program with you and instruct students to watch in the classroom.

Discuss about the programme topic and build up a background of the students to have a meaning of the programme.

Motivate students to watch the program critically and for specific details.

During the programme, draw attention of students to certain important aspects with short phrases.

After the programme follow up session should be carried out and other instructional aids used to reinforce learning.

Finally, test the students on their learning gains after the program and its application.

Before the program, starts make the necessary adjustments of colour, contrast, brightness, volume, tone, treble and tuning.

Advantages

Television appeals to eyes, ear and emotion.

It can directly show the current happening and live shows happening even in the remote parts.

Television equipment is the compact piece of equipment which is easy and convenient to handle.

The TV can work as a powerful medium of mass education.

It can impart experiences which are out of physical reach.

In television programs, well planned verbal descriptions are aided with audio visual presentations also.

TV programs can easily be made to include the latest information and findings to update the knowledge of students and teachers both.

Hand Outs

The briefing of a session in single sheet.

Use simple, clean language with short sentences.

It needs sketches; graphs should be drawn and labelled.

Give titles, subtitles and underline the key words.

Suitable colours can be used.

Handouts can be given in advance to orient interested group.

Types

1. Leaflet
2. Pamphlets
3. Brochure

Leaflet: Single sheet of paper folded to make a full page of printed matter.

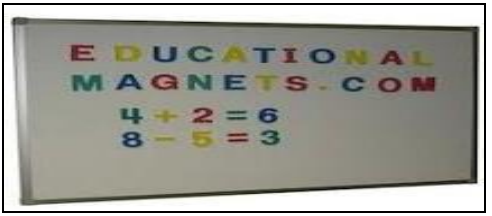
Pamphlets: Paper can be folded into two or three or five, the matter will be printed either single side or both sides.

Brochure: A small book with pictures and information.

Objects: Brought from its natural settings into the class room to supply the type of sensory experience that will make the instruction more meaningful and impressive. (E.g.) thermometer, forceps etc.

Specimen: Part of real objects taken from the natural settings. It is simple and shows quality or structure. (E.g.) section of lung

Magnetic Board



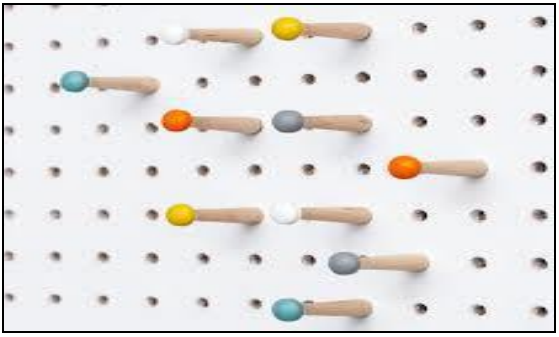
Magnetic particles are used to mount the objects in the board.

It is rarely used in educational institutions.

It is difficult to maintain compared to the normal boards.

It is so expensive.

Peg Board



Letters and numbers are inserted in the board for the purpose of display.

It is mostly used in hospitals and government institutions just for displaying census. (E.g.) Number of our patients per day.

It is also difficult to maintain because dirt accumulates in the holes.

The numbers and words attached in the board easily gets damaged and

Rules of using Objects and Specimens

Plan your teaching with certain simple and direct observations of the object or specimen referred to.

Ask questions from the students to elicit more details and features of the object or specimen under observation.

Clarify and emphasize important structural details of the object or specimen under observation.

Advantages

Collection of objects and specimen by students requires interaction with others leading to development of social skills and values.

Students when collect and display objects and specimen derive satisfaction of contributing to the school and teacher something worthwhile.

Student's power of observation and firsthand experience is enhanced by collection of objects and specimens.

Collection of objects and specimen can become an interesting educational pursuit of the teachers and students alike.

Cartoons

A cartoon is humorous picture which gives a subtle message.

It makes learning more interesting and effective as it creates a strong appeal to the emotions.

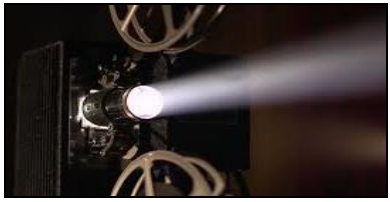
Advantages

A cartoon can be effectively used to initiate certain lesson.

A cartoon can be used to motivate students to start a discussion.

A cartoon can be used for making lesson lively and interesting.

Film Projector



Film Strip

Film strip is a continuous strip of film consisting of individual frames or pictures arranged in sequence usually with explanatory titles.

Each strip contains from 12 to 18 or more picture.

It is a fixed sequence of related still on a roll of 35mm film or 8 mm film.

Advantages

It is an economical visual material.

It is easy to make and convenient to handle and carry.

Takes up little space and can be easily stored.

Provides a logical sequence to the teaching procedure and the individual picture on the strip can be kept before the students for a length of time.

Filmstrip can be projected on the screen or wall or paper screen as the convenience.

Instructions for Using

Preview film strip before using them and selected carefully to meet the needs of the topic to be taught.

Show again any part of the filmstrip needing more specific study.

Use filmstrips to stimulate emotions, build attitudes and to point up problem.

Follow up session and summary is essential.

Slide Projector

A slide is a small piece of transparent material on which a single pictorial image or scene or a graphic image has been photographed or reproduced otherwise.

Moderate slides range in size from 2×2 or 4.5×4 inches.

Slides can be made from photographs and pictures by the teachers and pupils by taking photographs and snapshots when they go on the fieldtrips for historical, geographical or scientific excursions.

The arrangements of the slides are in sequence order.

A teacher needs to use imaginatively and creatively to make the best use of.

Advantages

Help in retention of the material taught in the minds of the pupils.

Attract attention and Arouse interest.

Assist lesson development and Test student understanding.

Review instruction and facilitate student teacher participation.

Microscope: It is a piece of equipment that makes very small objects look big enough for you to be able to see them.

Purposes

1. Magnification of an object.
2. Maximisation of resolution.
3. Optimisation of the contrast between structures, organisms and background.

Radio: The most common form of public education and entertainment is radio receivers.

Using Radio for Classroom Teaching

Procure and study in advance the nature and contact of the radio lesson.

Prepare the students for the radio lesson by informing them about the background of the lesson.

Allow the students for radio lesson and use as a teacher note down the important points covered by it.

Follow up session is must.

It can be recorded for clarification.

Advantages

Good for mass education.

Effective for distant education.

Can arouse positive emotions.

Used for introduction or review of lesson.

Kinds of Radio Lesson

1. Talk
2. Discussion
3. Dramatization

Tape Recorder

A tape recorder is a portable electronic gadget to record, reproduce, erase and re-record sound.

This device can be used without much fuss by anybody by operating the following press buttons attached to the recorder, i.e. stop, play, rewind, forward, and pause and eject.

Do's for using Tape Recorder

Adequate practice and familiar with the equipment.

Prepare before the class.

It should be recorded from the sources such as radio programmes, sound tracks, TV programmes etc.

It can be used for recording the interviews, talks and discussions of various experts.

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Chapter - 3
Violence against Women

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Chapter - 3

Violence against Women

Rama Nishad and Dr. Manju Mahananda

Abstract

Violence against women is now acknowledged as health of the public trouble and human rights violation of universal significance. It is an influential key risk for women's poor condition, with far reaching outcomes for both their fleshly and mental soundness. There is a requirement to get better the extent and nature of the different forms of violence against women. Brutality against women and girls is one of the harshest forms of gender discrimination and stands as a rudimentary obstacle to equivalent participation of women and men in social, economic, and political arena. Such violence hinders gender equality and the attainment of a array of development outcomes. The stoppage of, and answer to, such cruelty needs coordinated action across multiple sectors. The purpose of this chapter is to provide the reader with basic information on the characteristics and consequences of violence against women and girls. It also provide direction on how to integrate violence against women and girls preclusion and give worth services to violence survivors across a range of blooming assignments. This glossary aims to explain different types of interpersonal violence that are directed towards women and girls.

Keywords: violence, violation, human rights, gender discrimination, political arena, survivors

Introduction

Violence against women (VAW), also known as gender-based violence and sexual and gender-based violence (SGBV) is, collectively, violent acts that are primarily or exclusively committed against women and girls. Sometimes considered a hate crime, this type of violence is gender-based, meaning that the acts of violence are committed against women and girls expressly because they are female. The UN Declaration on the Elimination of Violence Against Women states, "violence against women is a manifestation of historically unequal power relations between men and

women" and "violence against women is one of the crucial social mechanisms by which women are forced into a subordinate position compared with men. “Any act of gender-based violence that results in, or is likely to result in, physical, sexual or mental harm or suffering to women, including threats of such acts, arbitrary deprivation of liberty, whether occurring in private or public life”-As defined by United Nations. Violence against women can fit into several broad categories. These include violence carried out by "individuals" as well as "states". Some of the forms of violence perpetrated by individuals are: rape, domestic violence, sexual harassment, reproductive coercion, female infanticide, prenatal sex selection, obstetric violence, and mob violence; as well as harmful customary or traditional practices such as honor killings, dowry violence, female genital mutilation, marriage by abduction and forced marriage. Some forms of violence are perpetrated or condoned by the state such as war rape; sexual violence and sexual slavery during conflict; forced sterilization; forced abortion; violence by the police and authoritative personnel; stoning and flogging. Many forms of VAW, such as trafficking in women and forced prostitution are often perpetrated by organized criminal networks.

Types

Rape

Rape is a type of sexual assault, usually involving sexual intercourse. Rape is usually perpetrated by men against boys, women, and girls; women are usually assaulted more often than boys and girls and usually all by someone they know. Victims of rape can be severely traumatized and may suffer from posttraumatic stress disorder; in addition to psychological harm resulting from the act, rape may cause physical injury, or have additional effects on the victim, such as acquiring of a sexually transmitted infection or becoming pregnant.

Violence against Victims

Following a rape, a victim may face violence or threats of violence from the rapist, and, in many cultures, from the victim's own family and relatives. Violence or intimidation of the victim may be perpetrated by the rapist or by friends and relatives of the rapist, as a way of preventing the victims from reporting the rape, of punishing them for reporting it, or of forcing them to withdraw the complaint; or it may be perpetrated by the relatives of the victim as a punishment for "bringing shame" to the family. This is especially the case in cultures where female virginity is highly valued and considered

mandatory before marriage; in extreme cases, rape victims are killed in honor killings. Victims may also be forced by their families to marry the rapist in order to restore the family's "honor".

Marital Rape

Marital rape, also known as spousal rape, is non-consensual sex perpetrated by the victim's spouse. Once widely condoned or ignored by law, spousal rape is now repudiated by international conventions and increasingly criminalized. Still, in many countries, spousal rape either remains legal, or is illegal but widely tolerated and accepted as a husband's prerogative.

Domestic Violence

Women are more likely to be victimized by someone that they are intimate with, commonly called "intimate partner violence" or (IPV). Instances of IPV tend not to be reported to police and thus many experts believe that the true magnitude of the problem is hard to estimate. Women are much more likely than men to be murdered by an intimate partner. According to WHO, globally, as many as 38% of murders of women are committed by an intimate partner. A UN report compiled from a number of different studies conducted in at least 71 countries found domestic violence against women to be most prevalent in Ethiopia.

Honor Killings

Honor killings are a common form of violence against women in certain parts of the world. In honor killings, women and girls are killed by family members (usually husbands, fathers, uncles or brothers) because the women are believed to have brought shame or dishonor upon the family. These killings are a traditional practice, believed to have originated from tribal customs where an allegation against a woman can be enough to defile a family's reputation. Women are killed for reasons such as refusing to enter an arranged marriage, being in a relationship that is disapproved by their relatives, attempting to leave a marriage, having sex outside marriage, becoming the victim of rape, dressing in ways that are deemed inappropriate.

Dowry Violence

The custom of dowry, which is common in South Asia, especially in India, is the trigger of many forms of violence against women. Bride burning is a form of violence against women in which a bride is killed at home by her husband or husband's family due to his dissatisfaction over the dowry provided by her family.

Forced Marriage

A forced marriage is a marriage in which one or both of the parties is married against their will. Forced marriages are common in South Asia, the Middle East and Africa. The customs of bride price and dowry that exist in many parts of the world contribute to this practice. A forced marriage is also often the result of a dispute between families, where the dispute is 'resolved' by giving a female from one family to the other.

Acid Throwing

Acid throwing, also called acid attack, or vitriolage, is defined as the act of throwing acid onto the body of a person "with the intention of injuring or disfiguring [them] out of jealousy or revenge". The most common types of acid used in these attacks are sulfuric, nitric, or hydrochloric acid. Perpetrators of these attacks throw acid at their victims, usually at their faces, burning them, and damaging skin tissue, often exposing and sometimes dissolving the bones. The long term consequences of these attacks include blindness and permanent scarring of the face and body.

Sexual Harassment

Sexual harassment is abusive, uninvited and unwelcome behavior of a sexual nature, typically in the work/studying place, which may include intimidation, bullying or coercion of a sexual nature, or the inappropriate promise of rewards in exchange for sexual favors. It can be verbal or physical, and it is often perpetrated by a person in a position of authority against a subordinate.

Human Trafficking and Forced Prostitution

"Trafficking in persons" shall mean the recruitment, transportation, transfer, harbouring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs.

Factors Contributing to Violence against Women

- Strictly enforced Gender roles
- Association of masculinity with toughness and dominance

- Punishment of women and children as an accepted value
- Violence accepted as a standard way to resolve conflicts
- Stress associated with poverty

Effects of Violence against Women

Violence against Women can Cause Long-Term Physical and Mental Health Problems: Violence and abuse affect not just the women involved but also their children, families, and communities. These effects include harm to an individual's health, possibly long-term harm to children, and harm to communities such as lost work and homelessness.

The short-term physical effects of violence can include minor injuries or serious conditions. They can include bruises, cuts, broken bones, or injuries to organs and other parts inside of your body. Some physical injuries are difficult or impossible to see without scans, x-rays, or other tests done by a doctor or nurse.

Short-Term Physical Effects of Sexual Violence can include

- Vaginal bleeding or pelvic pain
- Unwanted pregnancy
- Sexually transmitted infections (STIs), including HIV
- Trouble sleeping or nightmares

Violence against women, including sexual or physical violence, is linked to many long-term health problems. These can include:

- Arthritis
- Asthma
- Chronic pain
- Digestive problems such as stomach ulcers
- Heart problems
- Irritable bowel syndrome
- Nightmares and problems sleeping
- Migraine headaches
- Sexual problems such as pain during sex
- Stress
- Problems with the immune system

Many women also have mental health problems after violence. To cope with the effects of the violence, some women start misusing alcohol or drugs

or engage in risky behaviors, such as having unprotected sex. Sexual violence can also affect someone's perception of their own bodies, leading to unhealthy eating patterns or eating disorders.

A serious risk of physical abuse is concussion and traumatic brain injury (TBI) from being hit on the head or falling and hitting your head. TBI can cause:

- Headache or a feeling of pressure
- Loss of consciousness
- Confusion
- Dizziness
- Nausea and vomiting
- Slurred speech
- Memory loss
- Trouble concentrating
- Sleep loss

Long-Term Mental Health Effects of Violence against Women can include:

- **Post-Traumatic Stress Disorder (PTSD):** This can be a result of experiencing trauma or having a shocking or scary experience, such as sexual assault or physical abuse.[6] You may be easily startled, feel tense or on edge, have difficulty sleeping, or have angry outbursts. You may also have trouble remembering things or have negative thoughts about yourself or others. If you think you have PTSD, talk to a mental health professional.
- **Depression:** Depression is a serious illness, but you can get help to feel better. If you are feeling depressed, talk to a mental health professional.
- **Anxiety:** This can be general anxiety about everything, or it can be a sudden attack of intense fear. Anxiety can get worse over time and interfere with your daily life. If you are experiencing anxiety, you can get help from a mental health professional.

Violence against women has physical and mental health effects, but it can also affect the lives of women who are abused in other ways:

- **Work:** Experiencing a trauma like sexual violence may interfere with someone's ability to work. Half of women who experienced

sexual assault had to quit or were forced to leave their jobs in the first year after the assault. Total lifetime income loss for these women is nearly $250,000 each.

- **Home:** Many women are forced to leave their homes to find safety because of violence. Research shows that half of all homeless women and children became homeless while trying to escape intimate partner violence.
- **School:** Women in college who are sexually assaulted may be afraid to report the assault and continue their education. But Title IX laws require schools to provide extra support for sexual assault victims in college. Schools can help enforce no-contact orders with an abuser and provide mental health counseling and school tutoring.
- **Children:** Women with children may stay with an abusive partner because they fear losing custody or contact with their children.

Key Facts

- Violence against women-particularly intimate partner violence and sexual violence-is a major public health problem and a violation of women's human rights.
- Global estimates published by WHO indicate that about 1 in 3 (35%) of women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence in their lifetime.
- Most of this violence is intimate partner violence. Worldwide, almost one third (30%) of women who have been in a relationship report that they have experienced some form of physical and/or sexual violence by their intimate partner in their lifetime.
- Globally, as many as 38% of murders of women are committed by a male intimate partner.

WHO Typology Table

Throughout the life cycle

Phase	Type of Violence
Pre-birth	Sex-selective abortion; effects of battering during pregnancy on birth outcomes
Infancy	Female infanticide; physical, sexual and psychological abuse
Girlhood	Child marriage; female genital mutilation; physical, sexual and psychological abuse; incest; child prostitution and pornography

Adolescence and adulthood	Dating and courtship violence (e.g. acid throwing and date rape); economically coerced sex (e.g. school girls having sex with "sugar daddies" in return for school fees); incest; sexual abuse in the workplace; rape; sexual harassment; forced prostitution and pornography; trafficking in women; partner violence; marital rape; dowry abuse and murders; partner homicide; psychological abuse; abuse of women with disabilities; forced pregnancy
Elderly	Forced "suicide" or homicide of widows for economic reasons; sexual, physical and psychological abuse

Empowering Women to Prevent VAW by Informing/Educating Her

- About the awareness
- About the training programmes
- On functioning of Judiciary.
- On fundamental rights and duties.
- On security measures.
- On provision of penalties against different types of crimes.
- On Police agencies and their working.
- On scientific steps in crime investigations.

Welfare Schemes for Women in India

1. Mother and Child Tracking System (MCTS)

The Mother and Child Tracking System was launched in 2009, helps monitor the health care system to ensure that all mothers and their children have access to a range of services, including pregnancy care, medical care during delivery, and immunizations. The system consists of a database of all pregnancies registered at health care facilities and birth since 1 December 2009.

2. Support to Training and Employment Programme for Women (STEP)

The Ministry has been administering 'Support to Training and Employment Programme for Women (STEP) Scheme' since 1986-87 as a 'Central Sector Scheme'. The STEP Scheme aims to provide skills that give employability to women and to provide competencies and skill that enable women to become self-employed/entrepreneurs. The Scheme is intended to benefit women who are in the age group of 16 years and above across the country. The grant under the Scheme is given to an institution/ organisation including NGOs directly and not the States/UTs. The assistance under STEP Scheme will be available in any sector for imparting skills related to

employability and entrepreneurship, including but not limited to the Agriculture, Horticulture, Food Processing, Handlooms, Tailoring, Stitching, Embroidery, Zarietc, Handicrafts, Computer & IT enable services along with soft skills and skills for the work place such as spoken English, Gems & Jewellery, Travel & Tourism, Hospitality.

3. UJJAWALA: A Comprehensive Scheme for Prevention of trafficking and Rescue, Rehabilitation and Re-Integration of Victims of Trafficking and Commercial Sexual Exploitation

Objective of the scheme is to prevent trafficking of women and children for commercial sexual exploitation through social mobilization and involvement of local communities, awareness generation programmes, generate public discourse through workshops/seminars and such events and any other innovative activity. · To facilitate rescue of victims from the place of their exploitation and place them in safe custody. To provide rehabilitation services both immediate and long-term to the victims by providing basic amenities/needs such as shelter, food, clothing, medical treatment including counselling, legal aid and guidance and vocational training.

4. Swadhar Greh (A Scheme for Women in Difficult Circumstances)

The scheme envisions a supportive institutional framework for women victims of difficult circumstances so that they could lead their life with dignity and conviction. It envisages that shelter, food, clothing, and health as well as economic and social security are assured for such women. It also envisions that the special needs of these women are properly taken care of and under no circumstances they should be left unattended or abandoned which could lead to their exploitation and desolation.

Objectives: Under the Scheme, Swadhar Greh will be set up in every district with capacity of 30 women with the following objectives:

a) To cater to the primary need of shelter, food, clothing, medical treatment and care of the women in distress and who are without any social and economic support

b) To enable them to regain their emotional strength that gets hampered due to their encounter with unfortunate circumstances

c) To provide them with legal aid and guidance to enable them to take steps for their readjustment in family/society

d) To rehabilitate them economically and emotionally

5. Nirbhaya Fund

Nirbhaya Fund was announced by the Finance Minister in his 2013 budget speech, with Government contribution of Rs. 1000 Crores for empowerment, safety and security of women and girl children. The Fund is administered by Department of Economic Affairs of the finance ministry.

6. Nari Shakti Puraskar

Nari Shakti Puraskar (formally Stree Shakti Puraskar) (Women Power Award) is a series of India's national honours conferred on individual women for their exceptional achievement. The award is given in six categories, by the Ministry of Women and Child Development, Government of India. It recognises the spirit of courage of a woman in difficult circumstances, who has established this spirit of courage in her personal or professional life. The award also recognises the pioneering contribution of an individual in empowering women and raising women's issues.

7. Protection of Women from Domestic Violence Act, 2005

The Protection of Women from Domestic Violence Act 2005 is an Act of the Parliament of India enacted to protect women from domestic violence. It was brought into force by the Indian government from 26 October 2006. The Act provides for the first time in Indian law a definition of "domestic violence", with this definition being broad and including not only physical violence, but also other forms of violence such as emotional/verbal, sexual, and economic abuse. It is a civil law meant primarily for protection orders and not meant to penalize criminally. The act does not extend to Jammu and Kashmir, which has its own laws, and which enacted in 2010 the Jammu and Kashmir Protection of Women from Domestic Violence Act, 2010.

UN Declaration on Violence against Women

- **Article 1:** For the purposes of this Declaration, the term "violence against women" means any act of gender-based violence that results in, or is likely to result in, physical, sexual or psychological harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or in private life.
- **Article 2:** Violence against women shall be understood to encompass, but not be limited to, the following:

a) Physical, sexual and psychological violence occurring in the family, including battering, sexual abuse of female children in the

household, dowry-related violence, marital rape, female genital mutilation and other traditional practices harmful to women, non-spousal violence and violence related to exploitation.

b) Physical, sexual and psychological violence occurring within the general community, including rape, sexual abuse, sexual harassment and intimidation at work, in educational institutions and elsewhere, trafficking in women and forced prostitution.

c) Physical, sexual and psychological violence perpetrated or condoned by the State, wherever it occurs.

- **Article 3:** Women are entitled to the equal enjoyment and protection of all human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field. These rights include, inter alia:

  a) The right to life

  b) The right to equality

  c) The right to liberty and security of person

  d) The right to equal protection under the law

  e) The right to be free from all forms of discrimination

  f) The right to the highest standard attainable of physical and mental health

  g) The right to just and favourable conditions of work

  h) The right not to be subjected to torture, or other cruel, inhuman or degrading treatment or punishment

- **Article 4:** States should condemn violence against women and should not invoke any custom, tradition or religious consideration to avoid their obligations with respect to its elimination. States should pursue by all appropriate means and without delay a policy of eliminating violence.

NGO's working on VAW

International:

- ARROW, Kuala Lumpur (http://www.asiaconnect.com.my/arrow)
- Coordination of Women's Advocacy, Switzerland (E-mail:cwwa@iprolink.ch)
- Health and Development Policy Project,, Maryland, USA (E-mail: hdpp@ig.ap.org)

- Isis-Women's International Cross Cultural Exchange, Uganda (Email: isis@starom.co.ug)
- Latin American and Caribbean Women's Network against Domestic and Sexual Violence, Chile (E-mail: isis@reuna.cl)
- Match International Centre, Canada (E-mail: mathint@web.apc.org)
- Women in Law and Development, Africa, Zimbabwe

National

- Chetna (Ahmedabad)
- Shakti (Jaipur)
- Human rights law network (New Delhi)
- Mahila Mandal INDL Cooperative Society LTD (Delhi)
- Nari Raksha Samiti (Delhi)

Conclusion

To achieve lasting change, it is important to enact and enforce legislation and develop and implement policies that promote gender equality by:

- Ending discrimination against women in marriage, divorce and custody laws
- Ending discrimination in inheritance laws and ownership of assets
- Improving women's access to paid employment
- Developing and resourcing national plans and policies to address violence against women.

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Chapter - 4
Agroforestry: Tool for Improving Soil Fertility

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Chapter - 4

Agroforestry: Tool for Improving Soil Fertility

Kumari Beauty and Vijay Kant Singh

Abstract

Agroforestry has been in practice for thousands of years. However agroforestry as a science has evolved recently. Agroforestry or agro-silviculture is a land use management system in which trees or shrubs are grown around or among crops or pastureland. It combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy, and sustainable land-use systems. Apart from meeting rural wood based demands, agro forestry system helps in improvement of soil fertility as a long term benefit. It is believed that agroforestry promotes more efficient cycling of nutrients than agricu1ture. Agroforestry systems are thus perceived to improve or maintain soil fertility promote soil conservation, reduce soil degradation and achieve sustainable production. This practice helps in increasing productivity, improving nutrient cycling and also improving the socio-economic status of farmers. The study on how trees improve soil fertility by litter or root residues has been discussed in this chapter. These studies have shown the amelioration of soil properties and overall increase in nutrient level below the trees. However the beneficial effect of trees on agriculture systems is a recent area of investigation. Many of the perceived benefits of trees in agroforestry systems are still hypothetical. This chapter reviews the perception of agroforestry systems in improving soil fertility.

Keywords: pastureland, conservation, degradation, nutrients

Introduction

Soil provides a source of stability for the plants and raw materials-water, nutrients, and oxygen which is necessary for plant growth. The history of mankind shows that the civilizations that have flourished have always intensively used soils for food production. However, in recent years, land degradation-caused primarily by massive deforestation especially in most developing countries it has become a major environmental concern. The

removal of fertile top soil layer lowers the fertility of the remaining soil and thus induces lower productivity. The lower food productivity, in turn, increases dependency upon forest products further enhancing deforestation. The recent trend in soil conservation measures includes the control of soil erosion and maintenance of soil fertility. It is an accepted fact that decline in soil fertility is caused by soil erosion through removal of organic matter and nutrients and through various kinds of physical, chemical and biological degradation. It is envisaged that agroforestry can play a vital role in maintaining soil fertility. The evidence from most indigenous agroforestry systems, as recognized by the farmers, shows a positive trend in the maintenance of soil fertility. Furthermore, one of the main tenets of agroforestry is that nitrogen fixing trees enhance soil fertility.

Agroforestry

Tropical Asia, where increasing human population pressure and mounting levels of land degradation make arable lands scarce. Land degradation and crop losses signifying poverty, hunger, and famine are pervasive, especially in the small-holder farms of tropical Asia. This, coupled with the adverse effects of enhanced atmospheric CO_2 levels increases the threat to Asian food security in the 21stcentury. Agroforestry emerges as a promising land use option to surmount the problem of land degradation and the imminent "food crisis". Diversified production and consequently greater food diversity and sustainability, as well as the potential for increasing the purchasing power of the rural people are intrinsic features of these traditional land use systems. Agroforestry practices are implicitly assumed to have higher productivity than monospecific systems, especially on degraded sites, because diverse assemblages have a greater likelihood of containing species with strong responses to resources compared to species-poor assemblages.

Agroforestry is an age-old land use system that has been practised for thousands of years by farmers by all over the world. The most appropriate definition, perhaps, is stated by Nair (1984) as: "Agroforestry is a land use that involves deliberate retention, introduction, or mixture of trees or other woody perennials in crop/animal production fields to benefit from the resultant ecological and economic interactions."

Agroforestry, in general, consists of three basic criteria:

- Agroforestry is a distinct land use system that combines trees or shrubs with agricultural or horticultural crops or livestock
- Agroforestry systems, in ideal form, are both stable and sustainable

- Integration of trees into agricultural systems may result in more efficient use of sunlight, moisture, and plant nutrients (Nelliat *et al*. 1974) than is generally possible by mono-cropping of either agricultural or forestry crops

Soil Fertility and Degradation

We have stressed above that the major adverse effect of soil erosion is lowering of fertility, and that this is the main reason why measures should be taken for its control. The hazard of water erosion is at its most serious on sloping land, in virtually all climates, that of wind erosion on land of any slope in the semi-arid zone. In these two, very extensive, sets of environmental conditions, control of erosion is an essential step in maintaining soil fertility. Land on which there is no substantial erosion hazard, level or nearly level land in the sub humid and humid zones, is frequently subject to soil degradation or lowering of fertility, originating for the most part in what is loosely described as 'over-cultivation'. The potential of agroforestry to reduce or eliminate such lowering of soil fertility is at least as important as that of controlling erosion. In reality the two problems are not independent. Most land is liable to some degree of erosion and to other forms of soil degradation, both leading to lowering of fertility and loss of sustainability. On level ground, it is fortunate that one cause of fertility loss that of erosion, is absent. On sloping lands, water erosion is more likely to be the main cause of fertility loss, but most other forms of soil degradation will also be present. In this section, we are concerned with more general soil problems, applicable to lands that are subject to soil erosion but also to areas where there is no erosion hazard or where erosion has successfully been controlled.

Land Productivity and Soil Fertility

Land productivity is the capacity of land to support the growth of useful plants, including crops, trees and pastures, on a sustained basis. It is a property not of soil alone but of land, where land refers to all features of the physical environment that affect potential for land use. As well as soils, land includes elements of climate, hydrology, landforms, vegetation and fauna. It is impossible to consider the productivity of a soil in isolation from other factors. Climate and landforms for the most part are not open to modification by man. This applies also to some soil properties, such as profile depth and texture.

However, many soil properties can be modified, for better or worse, by land use and management. It is this fact which accounts for the major role of

soils in agricultural research and farm management. Soil fertility is therefore the capacity of soil to support the growth of plants, on a sustained basis, under given conditions of climate and other relevant properties of land. The inclusion of a sustained basis in this definition refers to the capacity for continuing support for plants. Some initially productive soils have unprotected stores of nutrients and rapidly lose their fertility if transferred from natural vegetation to managed ecosystems.

Basic rocks possess natural recuperative powers, enabling them to restore nutrients from rock weathering. A narrower view of fertility is sometimes encountered, namely the content of available nutrients. This leads to a myopic view of soil management, to the neglect of physical and biological properties. It is better to refer to this aspect as nutrient content.

Problems of Soil Degradation and Low Soil Fertility

The recognized forms of soil degradation are erosion, physical, chemical and biological degradation, salinization and pollution, where chemical degradation includes both acidification and lowering of nutrient content. They are closely linked: biological degradation influences both soil physical properties and nutrients, whilst erosion is a cause of both biological degradation and loss of nutrients. All these forms of degradation lead to lowering of soil fertility and land productivity.

However, it is the combined effect of lowering of soil organic matter, deterioration of physical properties, lowering of nutrient content and (in some cases) acidification that is commonly referred to as decline in soil fertility. A number of governments and international agencies have made estimates of the proportions of agricultural land suffering from 'slight, moderate and severe' soil degradation. Viewed as precise figures, they are of very dubious value, since no soil-survey organization has yet systematically applied objective methods of assessing soil degradation. Still less can we distinguish where fertility is still declining from where a condition of low-level equilibrium has been reached. A start has been made in devising methods (FAO, 1979). Degradation assessment is an aim of the Global Environmental Monitoring System (GEMS) of the United Nations Environment Programme (UNEP), and attempts are being made to include it in the Soils and Terrain data base of the International Society of Soil Science. There can be no doubt that over very large areas under rain fed agriculture in the tropics and subtropics, soil fertility is less than it was 10, 20 or 50 years ago. Older farmers can be prompted to express this view. In the present context, it is appropriate to cite experience in applying the

method of agroforestry diagnosis and design. Following the identification of distinctive land-use systems, this method is directed first at finding out the kind and severity of problems existing in these systems, and then at diagnosis of their causes. It has been applied, for example, within the All India Coordinated Research Programme in Agroforestry and the ICRAF Agroforestry Research Networks for Africa. Decline in soil fertility, sometimes expressed as low crop yields, is one of the most frequent problems observed over a wide range of environments. Soil degradation not only lowers the crop yields obtainable on the basis of intrinsic soil fertility; it can also substantially reduce the response to fertilizers or other inputs. This lowers the economic margin on fertilizer application, tending to perpetuate the situation of low inputs with low outputs. A partial exception to the above generalization is the case of swamp rice cultivation. On the one hand, this system contains natural mechanisms for maintenance of soil fertility; on the other, at least some use of manures and fertilizers is now normal in many countries. There are certainly problems of decline in soil fertility, but these are of a distinctive nature.

Agroforestry as a Practical Management Option

To what extent do the same constraints apply to agroforestry? This question is critical as a prerequisite for research into the benefits, for soil fertility as in other respects, of agroforestry. The more widely applicable is agroforestry, as a practical option in farm management, the more necessary it is to appraise its benefits and improve techniques.

Type of Land

At an early stage in the modern awareness of agroforestry, it was said to be particularly suited to marginal lands, those with environmental hazards such as drought, erosion or low soil fertility. If this were so, then the extent of its potential application would be substantially reduced, although large areas would still remain. Evidence from the ICRAF agroforestry systems inventory shows that this is not the case. Agroforestry systems are found in humid regions, on gently sloping land and on some of the most fertile soils, as well as in more difficult environments. For example, the Chagga home gardens system is found on relatively rich soils, whilst systems of intercropping and grazing under coconuts occur mainly on level, alluvial land, in both cases under plentiful rainfall (Nair, 1984-88a, 1987b).

Current agroforestry research is found in fertile areas as well as marginal, area in the country. The reason for the early presumption was that land-use problems were generally most serious in marginal lands, and these

were where help from agroforestry was first sought. In the early years of the ICRAF Collaborative Programme, steeply sloping environments were over-represented, and they are also common in the systems inventory. Certainly, there are some sets of environmental and social conditions in which the potential for agroforestry is particularly high: densely populated, steeply sloping lands are one such, frequently having problems of erosion, fertility decline, forest clearance and fuel wood shortage (Young, 1986b, 1989c). For one major environment, that of alluvial plains, the potential of agroforestry is probably less than on erosional landforms, although research may prove this to be false.

Role of Tree

Trees in agroecosystems can enhance soil productivity through biological nitrogen fixation, efficient nutrient cycling, and deep capture of nutrients and water from soils (Nair, 2011c). Even the trees that do not fix nitrogen can enhance physical, chemical and biological properties of soils by adding significant amount of above and belowground organic matter as well as releasing and recycling nutrients in tree bearing farmlands (Jose, 2009).

Ecological intensification of cropping systems in fluctuating environments often depends on reducing the reliance on subsistence cereal production, integration with livestock enterprises, greater crop diversification, and agroforestry systems that provide higher economic value and also foster soil conservation. Maintenance and enhancement of soil fertility is vital for the global food security and environmental sustainability. Although India is self-sufficient in terms of food production currently, but for a population expected to rise further (James, 2011), country will need to enhance both the food production as well as tree biomass. The next green revolution and concurrent environmental protection will have to double the food production (Myers, 1999).

Maintaining and enhancing the soil fertility of farmlands to grow food grains as well as tree biomass can help meet the demand in future. Ecologically sound agroforestry systems such as intercropping and mixed arable livestock systems, involving legume-based rotations, which reduce water runoff and improve soil fertility can increase the sustainability of agricultural production while reducing on-site and off-site consequences and may be a road to sustainable agriculture (Rasmussen, 1998; Lal, 2008). Although tree species have potential to conserve moisture and improve fertility status of the soil in agroforestry systems, legumes are the most effective for promoting soil fertility. In addition, deep rooted species could

reduce competition for nutrients and moisture with crops by pumping from deeper layers of soil (Das and Chaturvedi, 2008).

Land use System

Agroforestry may hold promise for regions where success of green revolution is yet to be realized due to lack of soil fertility. A useful path, complementary to chemical fertilizers, to enhance soil fertility is through agroforestry. Alternate land use systems such as agroforestry, agro-horticultural, agro-pastoral, and agro-silvi-pastoral are more effective for soil organic matter restoration (Manna *et.al*. 2003). Soil fertility can also be regained in shifting cultivation areas with suitable species. For instance, a field experiment to study the N_2 fixation efficiency suggests that planting of stem cuttings and flooding resulted in greater biological N_2 fixation, 307 and 209 kg N ha^{-1} by *Sesbania rostrata* and *S. cannabina*, respectively. Thus, *S. rostrata* can be used as a green manure by planting the stem cuttings under flooded conditions (Patel *et al*. 1996). Even in the dry regions, the mean annual litter fall by neem trees can be 6059 kg ha^{-1} at the density of 400 trees ha^{-1} with potential return of 98, 2.25, 32 and 131 kg ha^{-1} of available nitrogen, phosphorous, potassium and Calcium (Pandey *et al.* 2010). Through a combination of mulching and water conservation, trees in agroecosystems may directly enhance the crop yields of coarse grains. For instance, in the arid region of Haryana, the effect of *Prosopis cineraria*, *Tecomella undulata*, *Acacia albida* and *Azadirachta indica* on the productivity of *Hordeum vulgare* (barley) was found to be positive. *P. cineraria* enhanced the grain yield by 86.0%, *T. undulata* by 48.8%, *A. albida* by 57.9% and *A. indica* by 16.8% over the control. Biological yield was also higher under the trees than that in the open area. The soils under different tree canopies were rich in organic carbon content, moisture availability and nutrient status (Kumar *et al.* 1998b).

Thus agroforestry is potentially applicable to a very wide range of types of land in the tropics. Different practices are applicable in different environments, for example, multipurpose windbreaks in semi-arid areas, or trees for soil conservation on sloping lands. Research into land evaluation for agroforestry is needed to identify those kinds of environment which are particularly suited to specified agroforestry practices (Young, 1984a).

Extent of Land

A constraint of extent of land was noted to apply to fallowing and green manuring, meaning that these practices required land over and above that needed for productive purposes. In the context of agroforestry, there are two critical questions:

1) If trees are grown with herbaceous plants (crops or pastures), is the output from the herbaceous plants reduced?
2) If the answer to the above is yes, then does the output from the trees more than compensate for the loss in production from the herbaceous plants?

Expressed in economic terms, the first question becomes, in a given combination of trees with herbaceous plants, are these two components complementary (the presence of one increases output from the other), supplementary (no mutual interactions), or competitive (the presence of one reduces output from the other).

There are examples, from traditional systems and recent research, of both gains and losses in crop or pasture production as a result of the presence of trees. If it were to be found that under a wide range of environments and designs trees led to a loss of food-crop production, then this would seriously reduce the potential of agroforestry. In some spatial agroforestry practices, such as boundary planting or trees on conservation works, the tree component occupies otherwise unproductive land. In others, notably hedgerow intercropping, there is an inevitable reduction in the area under crops (perceived by laymen as one of the major obstacles to agroforestry). Also, a fall-off in crop yield close to the tree/crop interface is commonly observed.

Supply Constraints

The main inputs required in agroforestry, additional to those in agriculture, are supplies of tree germplasm and seedlings. Whilst there may be temporary local shortages, there are no intrinsic supply constraints. Local tree nurseries are simple and relatively cheap to construct. There is nothing in agroforestry development projects comparable to the level of expense involved in, say, construction of dams or roads. The supply constraint of fertilizers is likely to be reduced or unchanged. In present day agroforestry development, the major costs are research and training. While these will continue to be necessary, their magnitude at present is a temporary phenomenon, stemming from the rapid growth in awareness of the potential of agroforestry for development. With respect to inputs and capital, therefore, agroforestry is a relatively undemanding form of development, with no serious supply constraints. Agroforestry is also a highly practicable management option at the farm level. It requires neither substantial capital nor machinery, and the necessary skills for tending trees can be learnt by farmers with limited formal education.

How we Know that Trees Improve Soils

Underlying all consideration of the role of agroforestry in maintenance of soil fertility is the fundamental proposition that trees improve soils. Before examining the processes and evidence in detail, it is worth setting out how we know that this is true.

1. The soil that develops under natural woodland or forest, the classic brown earth of temperate regions or red earth of the tropics, is fertile. It is well structured, has good moisture-holding capacity, is resistant to erosion and possesses a store of fertility in the nutrients bound up in organic molecules. From time immemorial, farmers have known that they will get a good crop by planting on cleared natural forest.
2. The cycles of carbon and the major nutrients under natural vegetation have been demonstrated, most notably in rain forest but also in savannah and semi-arid ecosystems. These cycles are relatively closed. Thus, not only can we observe the fact that trees maintain soil fertility, but the details of how this is achieved are known.
3. The practice of shifting cultivation provides a demonstration of the capacity of forest to restore fertility. Nowadays this practice is often treated as environmentally undesirable, and certainly this is so once population pressure on land has forced the shortening of fallows. Given enough land and thereby length of fallow, however, this is a sustainable practice, and provides a demonstration of the capacity of forest or woodland to restore the fertility lost during cultivation.
4. Reclamation forestry, the afforestation of eroded or otherwise degraded land, has demonstrated the power of trees to build up soil fertility.
5. Finally, among these background considerations, is the almost invariable decline in soil fertility that follows complete forest clearance.

Processes by which Trees Maintain or Improve Soil Fertility

Processes, which augment additions to the soil:

- Maintenance or increase of soil organic matter through carbon fixation in photosynthesis and its transfer via litter and root decay
- Nitrogen fixation by some leguminous and a few non-leguminous trees

- **Nutrient Uptake:** The taking up of nutrients released by rock weathering in deeper layers of the soil
- **Atmospheric Input:** The provision by trees of favourable conditions for input of nutrients by rainfall and dust, including via through fall and stem flow
- Exudation of growth-promoting substances by the rhizosphere

Processes that reduce losses from the soil:

- Protection from erosion and thereby from loss of organic matter and nutrients
- **Nutrient Retrieval:** Trapping and recycling nutrients which would otherwise be lost by leaching including through the action of mycorrhizal systems associated with tree roots and through root exudation
- Reduction of the rate of organic matter decomposition by shading.

Processes that affect soil physical condition:

- Maintenance or improvement of soil physical properties (structure, porosity, moisture retention capacity and permeability) through a combination of maintenance of organic matter and effects of roots
- Breaking up of compact or indurated layers by roots
- Modification of extremes of soil temperature through a combination of shading by canopy and litter cover

Processes which affect soil chemical conditions:

- Reduction of acidity, through addition of bases in tree litter
- Reduction of salinity or sodicity.

Soil biological processes and effects:

- Production of a range of different qualities of plant litter through supply of a mixture of woody and herbaceous material, including root residues
- Timing of nutrient release: the potential to control litter decay through selection of tree species and management of pruning and thereby to synchronize nutrient release from litter decay with requirements of plants for nutrient uptake
- Effects upon soil fauna
- Transfer of assimilate between root systems

Organic Matter and Soil Fertility

Of all the effects of trees, that of maintaining soil organic matter levels through the supply of litter and root residues is the major cause of soil fertility improvement. It is the prime mover, from which stem many of the other soil improving processes. (Table 1).

Table 1: Effects of organic matter on soil fertility

Primary Effects	Consequences
Physical Effects Binding of particles, root action leading to improved structural stability, balance between line, medium and large pores	Improved root penetration, erosion resistance and moisture properties: water-holding capacity, permeability, aeration
Chemical Effects Nutrient source, balanced supply, not subject to leaching, with slow, partly controllable, release Complexing and enhanced availability of micronutrients **Increased Cation Exchange** Improved availability of P through blocking of fixation sites	Including better response to fertilizers, non-acidifying source of N, mineralization of P in available forms Better retention of fertilizer nutrients
Biological Effects Provision of a favourable environment for N fixation Enhanced faunal activity	Enhance nutrition uptake capacity

Functions of Organic Matter in Maintaining Soil Fertility

- Under all land-use systems, maintains good soil physical conditions, including water-holding capacity
- **Under Low-Input Systems:** Provides a balanced supply of nutrients, protected against leaching until released by mineralization
- **Under Medium and High-Input Systems:** Leads to more efficient use of fertilizers through improved ion-exchange capacity, greater recycling and supply of micronutrients

Need for Management

The foregoing description implies that integration of trees into the production systems may be the more rational choice as intensification of crop production may be challenging especially on the small farmsteads on degraded sites. Indeed, many positive traits are associated with agroforestry practices, which arrest soil degradation, reclaim degraded sites, and thereby promote food security. Furthermore, if planned with consideration for each

species growth characteristics, mixed systems should, theoretically, be more productive than monospecific production systems. However, such beneficial effects are not universal and in certain tree herbaceous crop mixtures, the negative and neutral effects predominate. This, in turn, calls for appropriate management strategies to optimize the combined production of tree and field crops growing in association.

Inter-specific competition for site resources is the foremost production decreasing function in integrated tree-herbaceous crop production systems. Managing competitive interactions and regenerating fertility of the degraded sites, therefore, assume special significance. Ideally, in agroforestry, the components exploit different vertical layers both above and below ground which signifies greater resource utilization efficiency. This pre-supposes that species with divergent growth characteristics be mixed for optimizing resource use/capture. Hence, efforts are needed to model and assess the long-term impacts of the multipurpose trees (MPTs) on site productivity/ competitive interactions. Specific characteristics of the MPTs (e.g. spreading roots/crowns/allelopathy etc.) are important in this respect. Farmers can play a lead role in the development and testing of MPT technology, assessing on-station trials, conducting researcher designed and farmer-designed trials, and providing feedback to researchers. Nonetheless, such attempts have been made seldom and agro-foresters need to develop improved technologies involving MPTs through partnerships with farmers.

Although trees are expected to improve soil fertility, the extent to which different agroforestry practices accomplish this depends on tree species, stocking level, growth rate and the input of litter. It should be greatest where fast growing trees are integrated at a high density and when tree pruning's and litter are incorporated into the soil. Achieving synchrony in nutrient release through organic matter turnover (TSBF, 2003) is yet another challenging task. This calls for proper selection of tree/ green manure species, which requires a thorough understanding of the rates and patterns of decomposition and nutrient release (Jamaludheen and Kumar, 1999; De Costa and Sangakkara, 2006).

Nutrient export from the site is another critical concern in the context of short-rotation, high-yield tree production systems on farmer's field, especially if the nutrients removed through frequent harvests exceed the inputs. Needless to mention that fast growing exotic trees such as *Acacia auriculiformis* and *Paraserianthes falcataria* often result in marked loss of nutrients from the site when whole tree harvesting is resorted to (Kumar *et al*., 1998 a). A slight reduction in the tree parts removed from the site may,

however, bring about a reduction in the magnitude of such nutrient exports. That is, returning leaves and small twigs to the site at the time of harvest may be a worthwhile management option to restrain nutrient export from the site.

Conclusion

Trees in agro ecosystems can be present in a different number of arrangements and species combinations that depend mostly on objectives of the farmers as well as the environmental conditions of the region. In general, it is better to say that a huge diversity of species is more favourable, as it results in a more complete occupation of space above and below the soil, and the variation in the characteristics of the litter produced can maintain a greater level of soil biodiversity, with positive effects on fertility.

The intentional use of trees in farming systems occurs in many parts of the globe; however, many of their benefits that go much beyond soil improvement are still difficult to visualize or quantify in economic terms or only appear in the long term, such that many farmers are hesitant to invest in trees. A better understanding of the positive effects of trees on soils, and an economic analysis of what this represents in terms of nutrients and other benefits, is an important step towards increasing the use of trees on farms.

Soil improvement under trees and agroforestry systems is in great part related to increases in organic matter, whether in the form of surface litter or soil carbon. Therefore, besides their role in above-ground carbon sequestration, agroforestry systems also have a great potential to increase carbon stocks in the soil and certainly merit consideration in mechanisms that propose payments for mitigation of greenhouse gas emissions to reduce climate change.

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Chapter - 5
Synthesis and Comparison of Nanoparticles Conjugated Tannase by Feeding and Pulses Methods and using it as Antibacterial Agent

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Chapter - 5

Synthesis and Comparison of Nanoparticles Conjugated Tannase by Feeding and Pulses Methods and using it as Antibacterial Agent

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Abstract

Au, Pt, SnO_2 and SiO_2 nanoparticles were prepared by laser ablation and examined by transmission electron microscopy (TEM), X-ray diffraction pattern and UV-Visible absorption spectroscopy. Conjugation of SiO_2 nanoparticles to tannase by feeding and pulses methods were prepared and characterized by TEM, X-ray diffraction pattern and UV-Visible spectrum. SiO_2 nanoparticles conjugated partially purified tannase by feeding showed higher effectiveness and higher significant level against all tested UTI causing in comparison with ciprofloxacin antibiotic, SiO_2 nanoparticles alone, partially purified tannase alone and partially purified tannase by pulses. So that we can conclude that feeding method was the best method for enhancement partially purified tannase activity to maximum level thus SiO_2 nanoparticles conjugated partially purified tannase may be useful antibacterial agent for the treatment of urinary tract infection.

Introduction

Tannin acyl hydrolase (EC 3.1.1.20) is commonly referred as tannase, it catalyzes the hydrolysis of the ester and depside bonds in hydrolysable tannins like tannic acid to release gallic acid and glucose. Tieghem accidentally discovered this unique enzyme in 1867 (Teighem, 1867) who demonstrated the formation of gallic acid when two fungal species were exposed to an aqueous solution of tannins. These fungal species were later identified as *Penicillium glaucum* and *Aspergillus niger* (Lekha and Lonsane, 1997). Van Teighem was the first scientist that demonstrated the formation of a gallic acid due to the action of fungus in 1867.

The tannase is an inducible enzyme and in solid state fermentation could be synthesized by filamentous fungi like *Aspergillus* and *Penicillium*. The

tannin-containing materials were used for production of gallic acid by tannase. The tannase consist of an esterase and depsidase activities (Toth and Barsony, 1943). The tannase was characterized and purified from plant and fungal sources by Madhava Krishna-Bose and Dhar-Bose in 1960 (Lekha and Lansony, 1997). Since tannase was purified and characterized from *Aspergillus* sp. by Libuchi *et al*. (1967) and Yamada *et al*. (1968). On other hand, Libuchi *et al*. (1967) developed a spectrophotometric assay for determination of tannase activity, which was based on estimation of decreasing the absorbency at 310 nm, there were two main types of determination for tannase activity one depending on hydrolysis of tannic acid using standard curve of tannic acid (Mondal *et al*., 2001), while the other depending on the formation of gallic acid by using standard curve of gallic acid (Sharma *et al*., 2000). Different studies on source production, purification, characterization, immobilization and application of tannase were published and found that apart from filamentous fungi (Lekha and Lonsane, 1997) and bacteria (Deschamps *et al*., 1983) have the ability to produced tannase.

Specificity of Tannase (Mode of Hydrolyzing Action)

According to a research reported by Libuchi *et al*. (1972), it showed that tannase led to hydrolysis of tannic acid completely to gallic acid and glucose through formation of 2, 3, 4, 6-tetragalloyl glucose and two kinds of mono galloyl glucose as shown in figure (1).

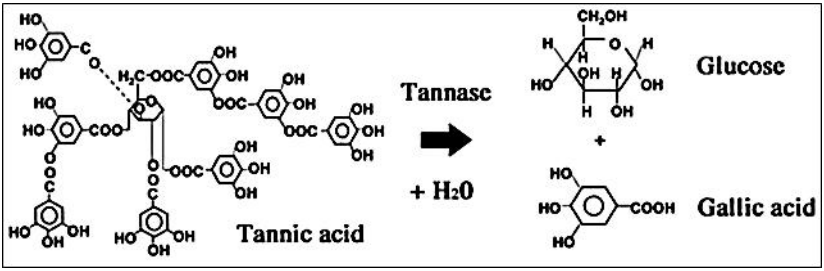


Fig 1: Mode of action of tannase on tannic acid

Tannase Producers

Numerous reports have been extensively resulted in discovery of great variety of tannase producers. The bacteria, yeast and molds are considered the prominent tannase producers (table 1).

Table 1: Tannase producing organisms

Bacteria	**References**
Achromobacter spp.	Lewis and Starkey, (1969)
Bacillus pumilus	Deschamps *et al*., (1983)
Selenomonas ruminantium	Skene and Brooker, (1995)
Bacillus licheniformis	Mondal *et al*., (2001)
Rhodococcus sp.	Nadaf *et al*., (2011)
Bacillus sphaericus	Raghuwanshi *et al*., (2011)
Lactobacillus planetarium	Kanan *et al*., (2011)
Klebsiella pneumoniae	Sivashanmugam and Jayaraman, (2013)
Corynebacterium sp.	Deschamps *et al*., (1983)
Pseudomonas solanacearum	Deschamps *et al*., (1983)
Citrobacter freundii	Kumar *et al*., (1999)
Bacillus cereus	Mondal *et al*., (2001)
Lactobacillus pentosus	Nishitani *et al*., (2004)
Lactobacillus faecalis	Nishitani *et al*., (2004)
Enterococcus faecalis	Goel *et al*., (2005)
Pediococcus pentosaceus	Guzman-Lopez *et al*., (2009)
Lactobacillus buchneri	Guzman-Lopez *et al*., (2009)
Pseudomonas aeruginosa	Selwal *et al*., (2010)
Serratia ficaria	Belur *et al*., (2010)
Serratia marcescens	Belur *et al*., (2010)
Fungi	**References**
Aspergillus oryzae	Bradoo *et al*., (1996)
Penicillium variable	Sharma *et al*., (2007)
Aspergillus niger	Siala *et al*., (2009)
Aspergillus tamarii	Costa *et al*., (2008)
Paecilomyces variotii	Nadu, (2012)
Yeast	**References**
Candida spp.	Aoki *et al*., (1976)
Pichia spp.	Deschamps and Lebeault (1984)
Debaryomyces hansenii	Deschamps and Lebeault (1984)

Nanoparticles

The term of nanoparticles refers to any particle that has three dimensions in nanometer scale and contains small enough number of constituent atoms or molecules. The nanoparticles differ in their optical, structural, electronic and thermal properties in comparison with their bulk

counterparts and exist in different shapes such as spherical, triangular, cubical, pentagonal, rod-shaped, shells, ellipsoidal and others (Elechiguerra *et al*., 2005). Recently, metal nanoparticles were prepared by various chemical and physical methods. Since, the nanoparticles are required to be non-aggregated and smaller than 50 nm in diameter, therefore, thin layers of dense metal can be synthesized and there are many applications in preparing these nanoparticles in small size and in different shapes (Zhu *et al*., 2005).

The metal nanoparticles such as Ag, Au, Cu and Pt NPs are considered a great source of interest because of their novel electrical, optical, physical, chemical and magnetic proprieties (Sen *et al*., 2003; Siekkinen *et al*., 2006). The nanoparticles have many biophysical, biochemical and biotechnological applications due to their unusual physical proprieties, as a result to their sharp plasmon absorption peak at the visible region. The resonance frequencies strongly depend on the shape and size of the particles besides the optical proprieties of the nanoparticles (Prikulis *et al*., 2004).

Some metals such as silver has been used as a disinfectant beside its role as catalyst in the enzyme reactions (Chargot *et al*., 2008). Also copper is a cheap material, highly conductive, widely used in the industry and possessing a valence shell electron structure similar to the other two coinage metals. Furthermore, it is serving as precursors for the fabrication of conductive structure by ink-jet printing (Zhang *et al*., 2009) and formation of nanomaterials of $CuInSe_2$or $CuInxGal\text{-}xSe_2$semiconducting for photodetectors and photovoltaics (Lua and Zangari, 2006). But in the resent years fabrication of Cu nanoparticles has received less attention in comparison with Au and Ag nanoparticles (Zhang *et al*., 2009).

The small size platinum nanoparticles distributed on smooth non catalysts are important as model systems for particle shape investigation the adoption of platinum catalysts for interactions involving fuel cell systems (Lua and Zangari, 2006).

Different techniques were used for preparation of nanoparticles such as reduction method, sol-gel process and solvent evaporation of hydrophobic colloids and pulsed laser ablation (Zhu *et al*., 2005; Sen *et al*., 2003; Siekkinen *et al*., 2006).

Pulsed laser ablation in liquids (PLAL) is considered a popular top-down approach for synthesis of nanoparticles from a target immersed in liquid where the bulk materials were broken down to smaller particles by an intense laser beam and alternative method for conventional chemical reduction methods (Kadhim *et al*., 2014). Laser ablation technique has many

advantages like simplification, which leads to safe and stable handling of the colloids without by-products and impurities and needs less time and low cost (Jiang *et al*., 2005). In this technique a laser pulse is focused on a target immersed in liquid. The laser ablation process starts in interaction of the laser pulse with the solid target and production of plasma plume on the surface expanded after absorbing the energy transfer from excited electrons to the crystal lattice because of photon-atom interaction, which leads to very rapid heating and breakdown of the laser-brightened area, wherein the solvent in contact itself are vaporized (Pearce *et al*., 2004; Bajaj and Soni, 2010; Moniri *et al*., 2017).

Properties of Nanoparticles

1. Nanomaterials may have a much lower melting point or phase temperature stage and significantly reduced lattice constants due to a large portion of surface atoms in the total amount of atoms.
2. Mechanical properties of nanomaterials may reach to the theoretical probabilities that have higher ordered size of magnitude than that in the bulk form, the increasing in mechanical strength returns to reduce of disorders.
3. Optical properties of nanomaterials differ significantly from the bulk form, where the peak optical absorption for the semiconductor nanoparticle shifts to a short wavelength because the band gap increased. Also the color of metallic nanoparticles may be changed with their sizes as a result to surface plasmon resonance.
4. Magnetic properties of nanomaterials also differ from their bulk in the nanometer scale the super magnetism appears as a results to the large surface energy while the ferromagnetism of the bulk materials disappears.
5. Catalytic properties, the catalysis include acceleration of the rate of a chemical reaction by the addition of a substance called a catalyst that is not consumed during the reaction and recycled as the reaction progresses.

1. Gold Nanoparticles

Gold nanoparticles is considered one of the most important materials because of its unique optical, spectroscopic and catalytic proprieties (Aswathy and Philip, 2012; Bratescu *et al*., 2013). Au nanoparticles have important applications in different fields due to their physical and chemical properties that depend on their shape and size. The reduction of $HAuCl_4$ with different reduction agents and in the presence of some stabilizers led to

synthesis of Au nanoparticles (Kaur *et al*., 2012; Xu *et al*., 2013). The goal in modern nanotechnology field may obtain metal nanoparticles by using environmentally friendly methods.

2. Platinum Nanoparticle

Platinum nanoparticles received considerable interest in different industrial applications due to its excellent proprieties as a catalyst in the production of hydrogen from methane, reduction of pollutant gases in automobile exhaust besides to the direct methanol fuel cell (DMFC) (Bell, 2003;). The catalytic property of platinum nanoparticles depends on the shape of the synthesized nanoparticles (Narayanan and El-sayed, 2004), so that the shape and size of platinum nanoparticles in the catalysis field are most important matters. Platinum nanoparticles are synthesized by reduction of Pt (IV) orPt (II) precursor in solution phase by reducing agents such as hydrogen, sodium borohydride or alcohol (Teranishi *et al*., 1998; Teng *et al*., 2006) and in the presence of capping agents such as organic molecules or polymers.

3. Tin Oxide Nanoparticle

The SnO_2 nanoparticles were synthesized by different chemical and physical methods. Due to its excellent electrical and catalytic proprieties, the tin oxide has a wide range of electrochemical and catalytic applications such as environmental monitoring and catalysts by gas sensory, so that the small particle size of SnO_2 and large surface area are essential to perform these applications (Luhua *et al*., 2005).

4. Silica Nanoparticle

Silica nanoparticles (SNPs) have variety of technological application like industrial manufacturing, bio sensing, drug delivery, packaging, adsorption, composite and ceramics materials besides to catalytic applications. Silica nanoparticles have many proprieties such as the high ratio of surface area to volume, low toxicity and high stability of chemical and physical properties that allowed them to be combined or functionalized with different functional species or molecules. Sodium silicate used as a silicon source for an industrial production of silica, where sodium silicate produced from quartz sand and sodium carbonate by smelting at 1300 ^{o}C since it requires a large quantity of energy and further purification (Seleem *et al.,* 2009).

5. UV-Visible Spectrum

In the present research, absorption spectra of the Au, Pt, SnO_2 and. SiO_2 colloidal nanoparticles prepared as thin films on glass substrate by drop casting method, Nanoparticles were measured by a UV-visible spectrophotometer in the wavelength range 300 to 900 nm, which was taken as a reference. The variation of absorbance (A) with wavelength (nm) for Au, Pt, SnO_2 and SiO_2thin films were about 535, 330, 340 and 320 nm respectively, as shown in figure (2). According to this figure it was shown that the increasing in the absorption spectra was attribute to increasing in the particle size as recorded by (Cueto *et al*., 2011). Furthermore, the alteration in the concentration for each metal nanoparticle. The value of λ_{max} is differ according to each type of metal nanoparticles i.e. the Au nanoparticle gave λ_{max} about 535 nm which differ to Pt ≅ 330 nm, SnO_2≅340 nm and SiO_2≅320nm.

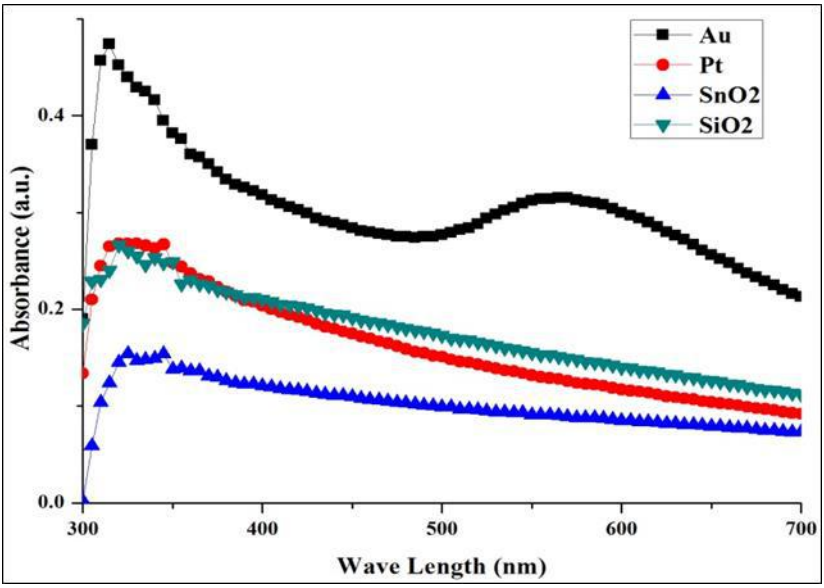
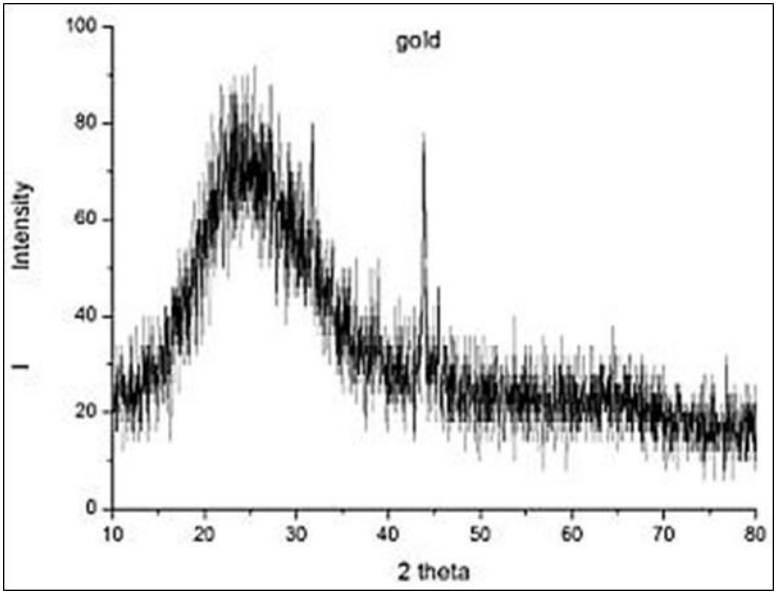


Fig 2: Absorbance of Au, Pt, SnO_2 and SiO_2 thin films

6. XRD Investigation

XRD spectrum of Au, Pt, SnO_2 and SiO_2 nanoparticles were presented in Figure (3). X-ray diffraction measurement was performed for the dried film from the concentrated suspension on a glass slides.


gold
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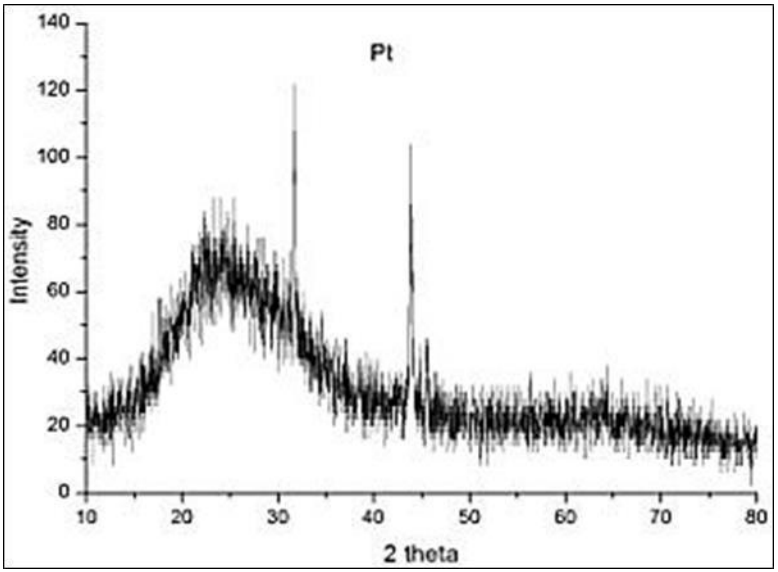
Pt
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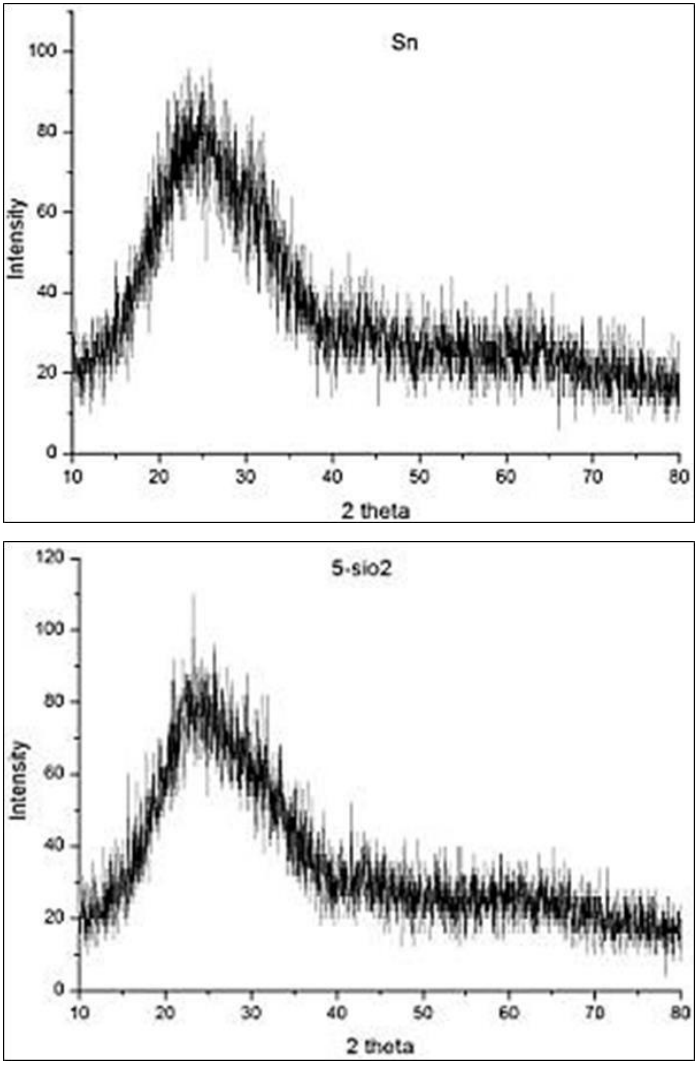


Fig 3: XRD spectrum of Au, Pt, SnO_2 and SiO_2 nanoparticles on glass slide

The XRD spectrum showed the crystalline structures of Au, Pt, SnO_2 and SiO_2 nanoparticles that were identified at 2θ=(43.8614, 22.8920, 22.2976), (43.8514, 31.6753, 45.5204), (24.6816, 22.8854, 21.8777) and (22.7158, 21.7780, 21.0764) respectively.

The crystallite size '*D*' of the nanomaterials particles generated by laser ablation was estimated by using the standard Eq. (1) known as the Scherer formula (Dorset, 1998).

$$D = \frac{k\lambda}{\beta cos\theta} \quad (1)$$

Where k=constant$(0.89 < k > 1)$, λ=wavelength of the X-ray, β=Full Width at Half Maximum (FWHM) of the diffraction peak, and θ=diffraction angle.

The crystallite size of (200) oriented Au, (111) oriented Pt, (110) oriented SnO_2 and (100) oriented SiO_2 calculated using the above mentioned Eq. (1) which has been (13, 28.8, 10.9and 4.7 nm), respectively.

7. TEM Investigation

The difference among Au, Pt, SnO_2 and SiO_2 nanoparticles that prepared by laser ablation in deionized water can be confirmed by TEM images. Figure (4) showed TEM images of nanoparticles prepared by laser ablation in deionized water of (a) Au NPs, (b) Pt NPs, (c) SnO_2 NPs and (d) SiO_2 NPs. These synthesized nanoparticles have spherical shapes and the average size of Au, Pt, SnO_2 and SiO_2 nanoparticles were 25, 17, 18 and 15 nm, respectively.

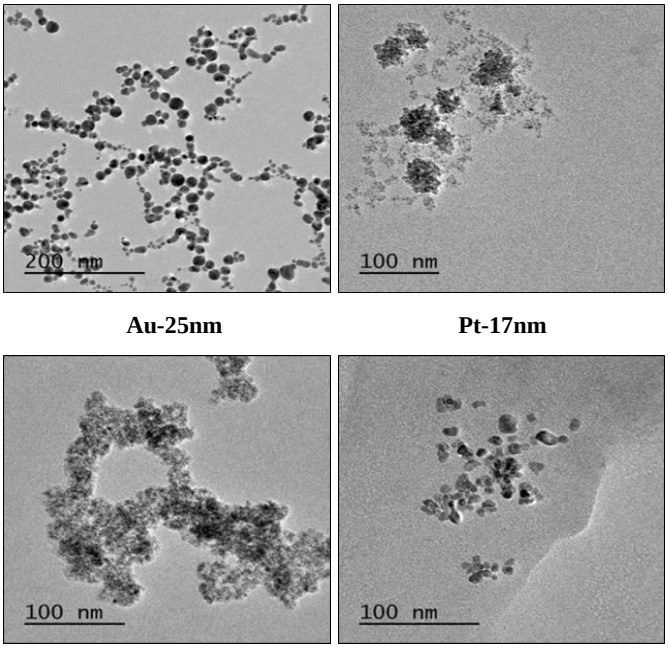


Fig 4: TEM images of (a) Au NPs, (b) Pt NPs, (c) SnO_2 NPs and (d) SiO_2 NPs prepared by laser ablation in deionized water

Conjugation of Nanoparticles to Tannase

The prepared nanoparticles of Au, Pt, SnO_2 and SiO_2 when added separately as a feeding to production medium that consist of nutrient broth supplemented with 2% (w/v) ber leaves led to an increase of tannase activity at different levels ranged between 95-129 U/ml with higher level of tannase activity 129U/ml when SiO_2 nanoparticles added to the production medium in comparison with the control (crude extract without any nanoparticles) that had tannase activity80 U/ml (figure-3.13). So that SiO_2 nanoparticles considered the best material nanoparticles among the other used materials nanoparticles by enhancement tannase activity. In contrast, the fractionated tannase when pulsed with SiO_2 pellet to produce nanoparticles by the laser ablation the tannase activity increased to 119 U/ml. According to these results it can be concluded that SiO_2 nanoparticles could be used as an activator to tannase activity through feeding better than used as pulses.

The conjugation between nanoparticles and tannase had increased the enzyme's activity due to the large surface area of each nanoparticle that had area volume then the ratio of area to volume would be higher, therefore: the presence of nanoparticles would be a good surface and medium to binding of the enzyme with its substrate (tannins) then increasing its activity. According to figure (5) the increasing in the tannase activity was differed depending on the type of nanoparticles. The presence of SiO_2 nanoparticles recorded the highest activity followed by SnO_2, Pt and Au nanoparticles due to the difference ratio of surface to their volumes since SiO_2<SnO_2<Pt< Au.

Furthermore, the prepared nanoparticles played an important role as cofactor to enzyme's work. They increased the binding between the enzyme's active site and its substrate which mean that SiO_2 nanoparticles played as cofactor with tannase more than the other nanoparticles with a sequence SiO2>SnO_2>Pt>Au.This conclusion agreed with Gupta *et al.* (2011);Ansari and Husain (2012) and Verma *et al*. (2013) which reported that nanoparticles can react with the primary amine of lysine on a protein to form covalent bonds and referred that nanoparticles act in enzyme immobilization as very efficient support materials, because of their properties as cofactors that determine biocatalysts efficiency such as an effective enzyme loading specific surface area and mass transfer resistance. Also, Basavaraja *et al*. (2008) and Malarkodi and Annadurai (2013) demonstrated that the presence of amide groups and aliphatic group's residues in proteins led to a strong ability to bind with nanoparticles, therefore; the protein may be covered with synthesized nanoparticle.

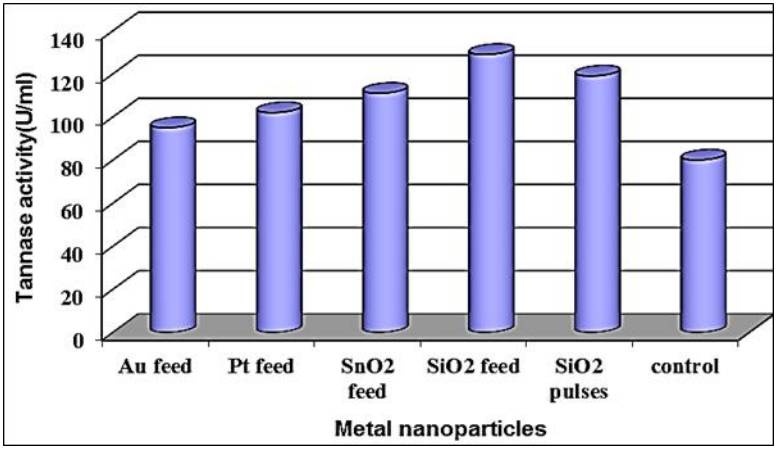


Fig 5: Tannase activity when materials nanoparticles were used as feeding and as pulses

Characterization of SiO_2 Nanoparticles Conjugated Fractionated Tannase by Feeding Method

The fractionated tannase andSiO_2 nanoparticles conjugated fractionated tannase by feeding and pulses methods were characterized by:

8. UV-visible Spectrum

The unique characteristics of the nanoparticle-tannase before and after conjugation can be observed from maximum absorption spectra with wave length by red shift from (349.9 nm) to (352.6 nm). This is could be explained that the enzyme had created a shell around the SiO_2 NPs and this shell of enzyme was more thickness when the SiO_2 NPs was added as feed, this causing the energy that required for electron transport was less and this causing red shift (more λ max, less energy). While, when the addition ofSiO_2 NPs produced by pulses the lambda max was decreased to 347.2nm and causing blue shift and this can be explained to the thickness of enzyme's shell aroundSiO_2 NPs was more causing this blue shift (less λ max, more energy). Figure (6), the peak attributed to changes in nanoparticles size as a result to quantum confinement. While Red-shift in the peak refers to increasing in mean particle size and the presence of agglomerates and related to scattering of light by particles that aggregate into big particles (Moniri *et al*., 2017).

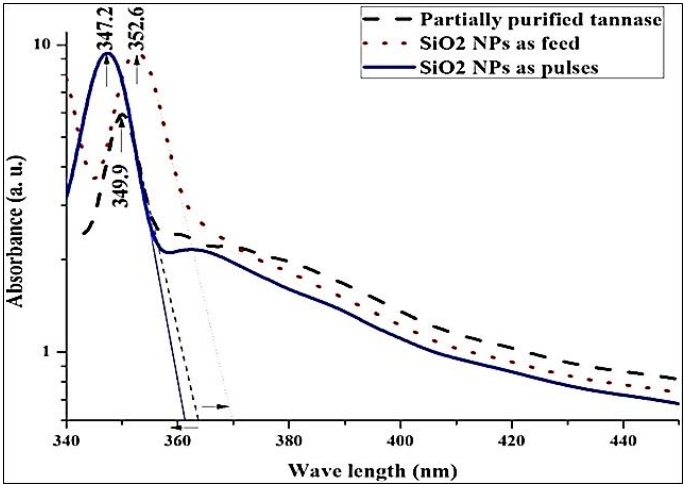


Fig 6: Absorbance of fractionated tannase, SiO_2 nanoparticles conjugated fractionated tannase by feeding and SiO_2 nanoparticles conjugated fractionated tannase by pulses

9. XRD Investigation

According to smaller average of grain size, it was chosen SiO_2 nanoparticles with crystallite size 4nm as a feeding in production medium for increasing tannase activity and as SiO_2 NPs pulses when SiO_2 nanoparticles were induced by ablated SiO_2 target immersed in partially purified tannase. XRD patterns of partially purified tannase thin film can be seen in figure (7). The x-ray diffraction of the prepared sample was with $K_{\alpha}cu$ at wavelength of λ=0.15059nm which is utilized to investigate the structural properties of tannase thin film shown in figure (7).

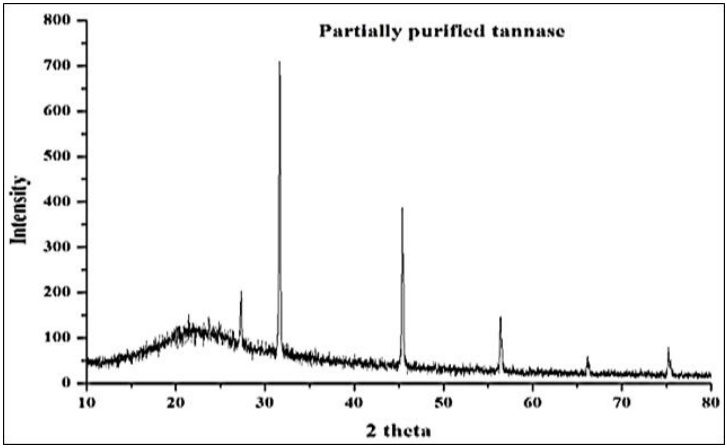


Fig 7: XRD pattern of fractionated tannase

Figure (7) shows that preferential orientation of fractionated tannase at 2θ= (31.6533, 45.3942, 56.4185) corresponds to (100), (110) and (111) characteristic peaks with cubic structure. The value found for the crystal size is 52 nm.

The XRD investigation for thin film of SiO_2 nanoparticles as a feed in the production medium is shown in figure (8). An increasing can be seen in the grain size of fractionated tannase to 64 nm when used as a feeding in the production medium. The increasing in the crystal size of fractionated tannase resulted from high conjugation of tannase enzyme with SiO_2 nanoparticles and led to an increase in the tannase activity. An increasing crystal size of enzyme caused by its high conjugating with SiO_2 NPs led to increasing the enzyme activity (Allan and David, 2004).

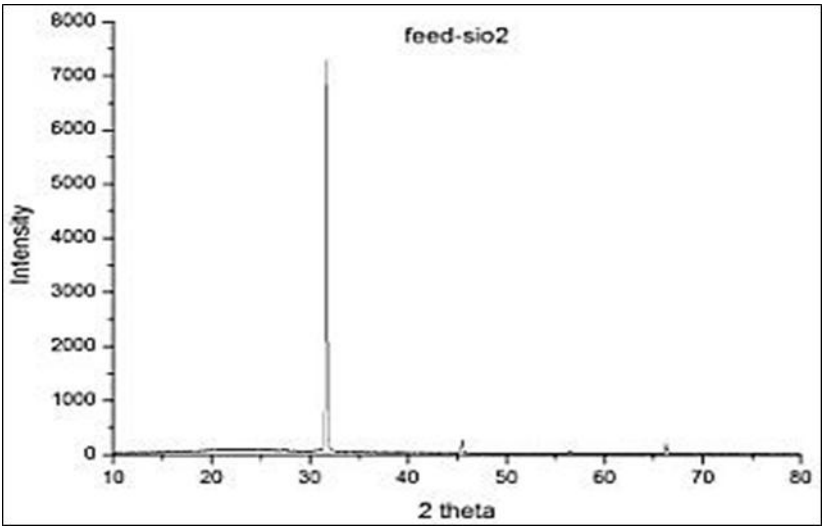


Fig 8: XRD patterns of SiO_2 nanoparticles conjugated fractionated tannase by feeding

Also, XRD spectrum of the fractionated tannase when pulsed with SiO_2 nanoparticles pulses is shown in figure (9). According to this figure, the crystal size of fractionated tannase was increased to 54 nm. This result confirms that the tannase enzyme was conjugated to SiO_2 nanoparticles.

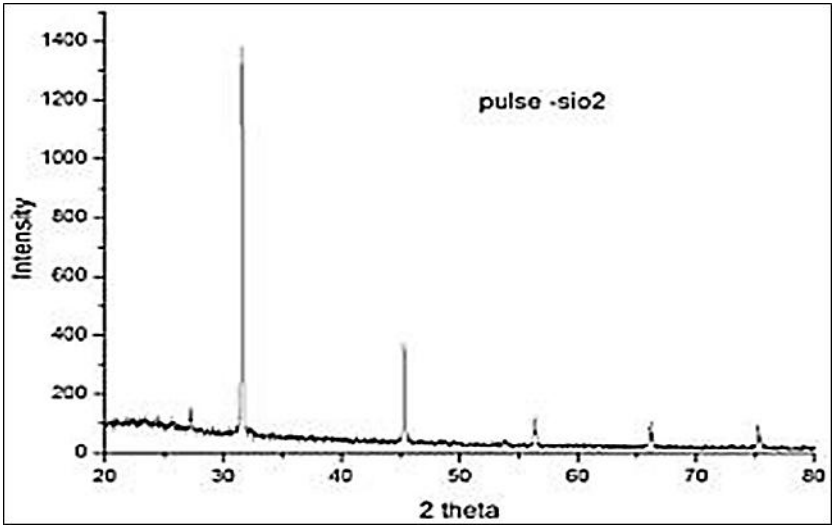


Fig 9: XRD patterns of SiO_2 nanoparticles conjugated fractionated tannase by pulses

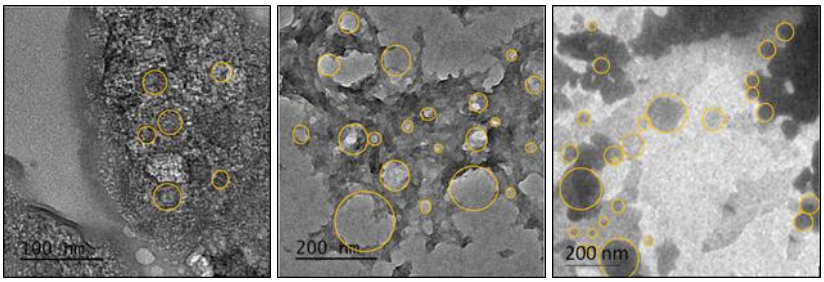
The calculated parameters of the XRD results can be summarized in table (2).

Table 2: Parameters of the XRD results for fractionated tannase, SiO_2 nanoparticles conjugated fractionated tannase by feeding and pulses methods

Samples	D(nm)	2θ (Deg)	(hkl) Plane
fractionated tannase	52	31.6533	(100)
SiO_2 feeding	64	31.7376	(100)
SiO_2 pulses	54	31.6173	(100)

10. TEM Investigation

The TEM technique was used to visualize the shape and size of the fractionated tannase and SiO_2 nanoparticles conjugated fractionated tannase by feeding and pulses methods. Figure (10 A) revealed that fractionated tannase well distributed with aggregation in buffer in size of 75 nm. In contrast, SiO_2 nanoparticles conjugated fractionated tannase by feeding as shown in figure (10 B) with size of 153 nm. Also, SiO_2 nanoparticles conjugated fractionated tannase by pulses with size of 92 nm (figure-10C).



A **B** **C**

Fig 10: TEM images of (A) fractionated tannase, (B) SiO_2 nanoparticles conjugated fractionated tannase by feeding; (C) SiO_2 nanoparticles conjugated fractionated tannase by pulses

Detection of Antibacterial Activity of Ciprofloxacin, SiO_2 Nanoparticles, Fractionated Tannase, SiO_2 Nanoparticles Conjugated Fractionated Tannase by Feeding and Pulses

The antibacterial activity of ciprofloxacin, SiO_2 nanoparticles, fractionated tannase, SiO2 nanoparticles conjugated fractionated tannase by feeding and SiO_2 nanoparticles conjugated fractionated tannase by pulses was studied in Muller Hinton agar against different causing UTI infection. The results revealed that ciprofloxacin showed high effectiveness with high significant level toward *E. coli* and *Staphylococcus aureus* standards and low effectiveness toward Gram- positive and some Gram-negative tested bacteria. It is also showed no significant level against *E. coli* and *Enterobacter aerogenes* (figure-11).

The results demonstrated that SiO_2 nanoparticles and fractionated tannase had antibacterial activity against UTI causing. The SiO_2 nanoparticles had higher effectiveness with high significant level against Gram-positive bacteria, while against *Serratia marcescens* and *Enterobacter aerogenes* revealed low effectiveness with low significant level and lowest effectiveness and significant level was toward *E. coli, K. pneumoniae* and *P. aeruginosa* in comparison with standard strains. When fractionated tannase was used it showed higher effectiveness with high significant level against *Streptococcus agalactiae* and *K. pneumoniae* in comparison with *P. aeruginosa* that had lower significant level (figure-11). According to these results it is noticed that SiO_2 nanoparticles and fractionated tannase had higher antibacterial activity against UTI causing in comparison with ciprofloxacin antibiotic.

When fractionated tannase was conjugated to SiO_2 nanoparticles by feeding and pulses, the antibacterial activity was increased with high

effectiveness (high diameter of inhibition), with high significant level for all tested Gram-positive and Gram-negative bacteria in comparison with ciprofloxacin antibiotic, SiO_2 nanoparticles alone and fractionated tannase alone (figure-12). On the other hand, SiO_2 nanoparticles conjugated fractionated tannase by feeding showed higher effectiveness and higher significant level against all tested UTI causing in comparison with pulses method. So that it can conclude that feeding method was the best method for enhancement fractionated tannase activity to maximum level in comparison with pulses method.

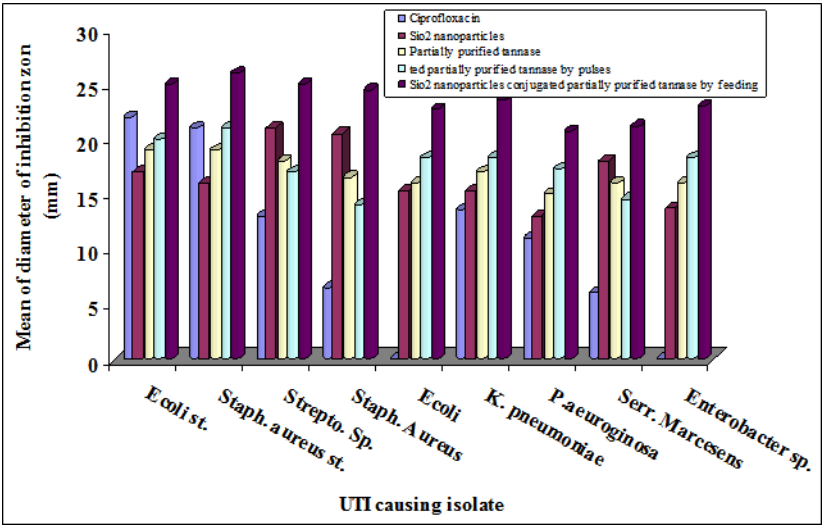


Fig 11: Mean of diameter of inhibition zone for UTI causing bacteria

Fig 12: The inhibition zones produced by SiO_2 nanoparticles, fractionated tannase, SiO_2 nanoparticles conjugated fractionated tannase by feeding and pulses against *K. pneumoniae*

Colloidal silica is a very versatile material so that a wide variety of forms and size may be prepared from it. Silica nanoparticles have high

thermal and chemical stability, highly modified surface (high surface area) besides too good biocompatibility. Therefore; they are used as a system to deliver drugs such as antibiotics since they are loaded with different antimicrobial agents for the prevention and treatment of different infections (Dong *et al*., 2011).

Enzymes were used as a strategy for the development of antimicrobial nanoparticles such as lysozyme coated mesoporous silica nanoparticles that used as antibacterial agents and revealed a good antibacterial activity both *in vitro* and *in vivo* without hemolytic side effect and low cytotoxicity. This type of nanoparticle (lysozyme coated mesoporous silica nanoparticles) had first, lower level for resistance in comparison with antibiotics; second, selective damage of the bacterial walls; an enhance of lysozyme stability by electrostatic interactions and thus increased an antibacterial efficacy of lysozyme nanoparticles (Li and Wang, 2013, Camporotondi *et al*., 2013) without being toxic to the surrounding cells and tissues.

The nanoparticles had better penetration ability through the cell wall and more effective compared to antibiotics (Al-Ogaili *et al*., 2015). The nanoparticles easily enter into bacterial cell and lead to high inhibition zone (Kim *et al*., 2007). Silica nanoparticles were used as a carrier of gentamicin and had a high efficacy of treatment in comparison with free drug against murine salmonellosis, where gentamicin molecules entrapped in the sol-gel matrix and saved in biologically active form so that upon their release they showed high levels of bactericidal effects (Seleem *et al*., 2009).

Sharmiladevi *et al.*, (2016) demonstrated that silica nanoparticles revealed antibacterial activity against both Gram positive and Gram negative microbes and the mechanism of action of mesoporous silica nanoparticles of cell death as mentioned by Tian *et al*., (2009).

Vithiya *et al*., (2014) was associated with the electrostatic interaction of phosphate groups on the microbial cell wall and the cationic head group of the mesoporous silica nanoparticles. Where the organic tail region embeds itself in the lipid bilayer and thus leads to the free flow of electrolytes out of the microbe and causes the cell death.

The mesoporous silica nanoparticles was used as delivery systems for antimicrobial peptides (AMPs) and found that positively charged mesoporous silica nanoparticles stimulates the membrane interactions dependent on nanoparticle properties in comparison with free peptide (Braun *et al*., 2016).

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Chapter - 6
Agenda 2063: What Hope for the Control of Transboundary Movement of Hazardous Waste in Africa?

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Chapter - 6

Agenda 2063: What Hope for the Control of Transboundary Movement of Hazardous Waste in Africa?

Elvis-Imo I. Gina

Abstract

The Agenda 2063 is a strategic framework for the socio-economic transformation of the African Continent in the next fifty years. This paper interrogates whether the Agenda 2063 caters for the control of transboundary movement of hazardous wastes into Africa. It observes that while there are no direct provisions relating to the protection of the environment under the Agenda 2063, it can nevertheless be gleaned from Aspiration-1 of the Agenda. The Agenda 2063 does not draw up new plans for the achievement of its goals, rather it recommends the implementation of existing ones, thus this paper examines the existing framework for the control of transboundary movement of hazardous wastes in Africa, albeit the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal 1989; and the Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movements and Management of Hazardous Wastes within Africa 1991, and whether in line with the Agenda 2063, these conventions have been effective in protecting the African Continent from being a dumping ground for foreign wastes. It discusses the intentional transboundary movement of hazardous wastes into Africa, and argues that such transboundary movement often does not take the form of "a thief in the night", rather, it is a game of conspiracies and intrigues, directly or indirectly implicating the government of the state of import and/or some unscrupulous individuals, who conspire with the merchants-of-death. The paper also interrogates the benefits, if any, of the toxic waste trade to the African continent, as well as efforts by the continent to curb the menace of illegal dumping of wastes into Africa.

Introduction

The Agenda 2063 is the direct result of the decision of the African Union to rise to the challenge of mapping out a vision to inspire and guide Africa's transformation agenda for the next fifty years. Agenda 2063 aims at achieving

an integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in global space. It reflects the African People's desire for shared prosperity and well-being, for unity and integration, for a continent of free citizens and expanded horizons, where the full potential of women and youth, boys and girls are realised, and with freedom from fear, disease and want.

The Agenda 2063 contain seven aspirations for the Africa we want, as follows;

- A prosperous Africa based on inclusive growth and sustainable development
- An integrated continent, politically united and based on the ideals of Pan-Africanism and the vision of Africa's Renaissance
- An Africa of good governance, democracy, respect for human rights, justice and the rule of law
- A peaceful and secure Africa
- An Africa with a strong cultural identity, common heritage, shared values and ethics
- An Africa whose development is people-driven, relying on the potential of African people, especially its women and youth, and caring for children
- Africa as a strong, united, resilient and influential global player and partner

While the Agenda 2063 does not on the face of it specifically touch on environmental protection, but the elaboration of Aspiration one, includes a vision of an Africa, which shall have environmentally sustainable and climate resilient economies and communities. Realising this vision necessitates protecting the continent from being used as a dumping ground for foreign wastes. There is therefore a need to assess the regulatory framework for the transboundary movement of hazardous wastes in Africa and whether it is in line with the goals of Agenda 2063.

Aspiration-1 of the Agenda 2063 is in conformity with Principle-1 of the Rio Declaration [1] which puts human beings at the centre of concerns for sustainable development. In the same vein, Principle 21 of the Stockholm Declaration [2], enjoins all states to ensure that activities within their jurisdiction and control do not cause damage to the environment of other states

[1] The United Nations Conference on Environment and Development (The Earth Summit), 1992.
[2] The United Nations Conference on the Human Environment, 1972.

or areas beyond the limits of national jurisdiction. This Declaration, made in 1972, over four decades ago already caters for, albeit in principle, the intentional and unintentional transboundary movement of hazardous wastes. It must however be noted that the Stockholm and the Rio Declarations are simply, as they are called mere declarations, which are non-binding, and at best merely advisory. The Agenda 2063 aims to implement these international instruments, as well as its regional instruments to achieve its desired goals.

Hazardous Wastes and Other Wastes

Wastes in everyday parlance refers to refuse, litter, rubbish, debris, dross, junk, detritus, scrap, dregs, garbage, leavings, remains, trash, effluent, etcetera. Wastes are materials, substances or by-products eliminated or discarded as no longer useful or required after the completion of a process. They are substances which are discarded after primary use.

Waste according to the Business Dictionary is resources consumed by inefficient or non-essential activities, unwanted materials left over from a production process or output which has no marketable value, process or material that does not (from the point of view of the customer) add value to a good or service; material discharged to, deposited in, or emitted to an environment in such amount or manner that causes a harmful change [3].

The United Nations Statistics Division (UNSD) Glossary of Environment Statistics 1997, describes wastes as:

Materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his or her own purposes of production, transformation or consumption, and of which he/she wants to dispose.

Article 3(1) of the Waste Framework Directive 2008/98EC of the European Union, defines waste as "an object the holder discards, intends to discard or is required to discard [4]".

The Basel Convention in Article 2(1) provides a definition of wastes as substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law [5], it however does not define hazardous waste, but it classifies hazardous wastes for the purposes of the convention.

Nigeria's national law, the Harmful Waste (Special Criminal Provisions

[3] http://www.businessdictionary.com
[4] http://www.eur-lex.europa.eu/legalcontent
[5] The Basel Convention on the Control of Transboundary Movement of Hazardous Waste and their Disposal, 1989.

Etc) Act [6] does not define hazardous waste, but it defines harmful waste to mean, any injurious, poisonous, toxic or noxious substance and, in particular, includes nuclear waste emitting any radioactive substance if the waste is in such quantity, whether with any other consignment of the same or of different substance, as to subject any person to the risk of death, fatal injury or incurable impairment of physical and mental health and the fact that the harmful waste is placed in a container shall not by itself be taken to exclude any risk which might be expected to arise from the harmful waste.

The National Environmental Standards and Regulations Enforcement Agency (NESREA) Act [7] in section 37 defines 'hazardous substance' as any chemical, physical, biological or radioactive material that poses a threat to human health and the environment or any such substance regulated under international conventions to which Nigeria is a party or signatory and include any substance designated as such by the president by Order Published in the Federal Gazette.

Regulation 106 of the National Environmental (Sanitation and Wastes Control) Regulations 2009 [8], defines hazardous waste to mean any waste or combination of wastes that exhibits ignitable, corrosive, reactive, or toxic characteristics and poses a substantial danger, now or in the future, to human, plant or animal life, and which therefore cannot be handled or disposed of without special precautions.

Regulation 54 of the National Environmental (Food, Beverages and Tobacco Sector) Regulations 2009 [9], define hazardous wastes to mean:

Solid, liquid or gas wastes that can cause death, illness or injury to people or destruction of the environment if improperly treated, stored, transported or discarded. Substances are considered hazardous waste if they are ignitable (capable of burning or causing fire); corrosive (able to corrode steel or harm organisms because of extreme acidic or bases properties); reactive (able to explode or produce toxic cyanide or sulphide gas), or toxic (containing substances that are poisonous). Mixtures, residues or materials containing hazardous wastes are also considered hazardous wastes (listed hazardous wastes).

There are different kinds of hazardous wastes: wastes generated from industrial activities, such as chemical, metal and furniture manufacturing

[6] CAP H1 Laws of the Federation of Nigeria, 2010.
[7] CAP 164 Laws of the Federation of Nigeria, 2010.
[8] Regulations made pursuant to section 34 of the National Environmental Standards and Regulations Enforcement Agency (NESREA) Act
[9] Regulations made pursuant to section 34 of the National Environmental Standards and Regulations Enforcement Agency (NESREA) Act

processes, which are shipped from the countries where they are generated in the developed world and fast emerging economies to developing countries for disposal. Hazardous wastes may also take the form of end-of-life or near end-of-life used electrical and electronic equipment (UEEE), which are often imported into Africa, and largely patronised by the masses, especially in Nigeria, where these used products are widely known as *tokunbos* [10]. The markets and shops are flooded with tokunbo fridges, air conditioners, gas/electric cookers, television sets, mobile phones, electric iron, and generally household appliances and kitchen utensils, as well as tokunbo cars and spare parts, which are often touted as being better than the brand new ones. The reality is that most of the UEEE contain hazardous substances, mainly heavy metals, such as lead, mercury, cadmium and organic polychlorinated biphenyls and brominated flare retardants that can have adverse effects on the environment and human health [11].

Transboundary Movement of Hazardous Waste

The transboundary movement of hazardous wastes may be intentional or unintentional. It is unintentional where for instance, chlorofluorocarbons, carbon (iv) oxide, sulphur dioxide or other substances released into the atmosphere travel with the prevailing wind across national jurisdictions and their impacts are felt in places unrelated to where they were released and cause damage. Although the release and transboundary movement of these harmful substances may be unintentional, but they are however released in the course of intentional industrial activity.

The transboundary movement of hazardous waste may be intentional where hazardous wastes move from one jurisdiction to another in the form of a toxic waste trade, where the receiving country is a willing participant or in the form of illegal dumping, where the receiving country may be an innocent victim, or perhaps not really innocent as it often happens that some unscrupulous citizens and even government officials are directly or indirectly linked to such illegal dumping.

Rapid industrialisation by the Organisation for Economic Cooperation and Development (OECD) Countries and the fast emerging economies have resulted to increased waste generation, which has outstripped the natural ability of the environment to assimilate such wastes, giving rise to an urgent need for alternative means of waste disposal. Stringent environmental

[10] A Yoruba name originally given to Nigerian children born overseas, now used for goods imported into Nigeria.

[11] Amokaye Oludayo G. Environmental Law and Practice in Nigeria 2nd Edition (Lagos, MIJ Professional Publishers Limited), 2014, 445.

regulations in the countries, where these wastes are generated as well as public awareness about the dangers of improper waste management have resulted to increase in the cost of local disposal and management of wastes, making it more economically viable to arrange for the export of wastes generated in their countries to developing countries for disposal. Thus, the last few decades have witnessed an unprecedented rise in the export of hazardous wastes in the form of industrial or electronic wastes into the African continent, making it some form of dumping ground for wastes generated in foreign countries. While on the one hand, it is cheaper and more profitable for the generators of wastes to export such wastes than to effectively dispose and manage same in their countries, on the other hand, high level of poverty and low level of environmental awareness in developing countries, have made them willing participants in the toxic waste trade or innocent victims of illegal dumping of toxic wastes.

The transboundary movement of hazardous waste pose serious threat to human health and environment, particularly in view of the fact that the geographical range of the transboundary movement of hazardous waste can sometimes go beyond the disposal location and extend to passage states, particularly in the events of accident along the way.

The developed world generates about 90 percent of hazardous wastes in the global community, amounting to about 500 million tons per year [12]. It is reported that approximately 10 percent of hazardous waste generated is transported across international borders [13], in the form of a toxic waste trade or illegal dumping.

The increase in the manufacturing of new electronic products as well as increase in the number of products built with shorter life spans has resulted in the explosion of e-wastes. As the global market for new high-technology electronic products continue to grow, so does the amount of discarded electronic products. Several states in the United States and the European Union have introduced legislation making manufacturers responsible for products reaching the end of their lives [14]. However, in spite of the efforts of

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[12] Okonkwo Theodore, International Protection of the Environment: Law and Practice (Lagos, Fine Finishing Limited), 2014, 341.

[13] Pamela S Chasek, David L Downie, Janet Walsh Brown. Global Environmental Politics 4th Edition (Boulder: Westview Press) 129, quoted in Okonkwo Theodore, International Protection of the Environment: Law and Practice ibid 341, 2006.

[14] A form of Producer Responsibility Approach, where the producer/manufacturer pays for the recycling of their products. See generally, Promote Good Laws: State Legislation, Electronics Takeback Coalition. Available @ http://www.electronicstakeback.com/promote-good-laws/state-legislation Accessed March 12, 2018.

the forward looking states in the United States, it would seem that a loophole in the national legislation, exempting e-waste from regulation under the Resource Conservation and Recovery Act, as well as the refusal of the United States to ratify the Basel Convention on the Control of the Transboundary Movement of Hazardous Waste and their Disposal, means that when e-waste cannot readily be recycled at the domestic level, whether for economic or environmental reasons, it is still sold to brokers, who look for the best prices on the global market [15].

E-waste disposal is especially problematic when human health and environment are exposed to hazardous chemicals during the process of dismantling electronic products. E-wastes contains approximately 1,000 chemicals, including mercury, lead, oxide cadmium, polyvinyl chloride, which are especially hazardous to human health [16]. The Basel Action Network and the Silicon Valley Toxics Coalition report that, an estimated 50-80 percent of the e-waste collected for recycling in the Western U.S is not recycled domestically, but sent to Asia for recycling [17].

The Nigeria Experience (The Koko Incident)

In 1988 two Italian firms arranged for the storage of 18,000 drums of hazardous waste in the port town of Koko, a community in the then Bendel State, now part of Delta State, Nigeria. The containers were disguised as building materials and offloaded into a local man's vacant yard for $100 per month. It took the alertness of Nigerian students in Italy to blow the lid on this evil scheme. By the time Nigerian authorities became aware, the drums were leaking and people were getting sick. The landowner, Sunday Nana, confirmed that he had agreed to let foreign importers use his land for the said sum. Italian authorities responded by insisting the chemicals deposited at Koko were not harmful but merely coal tars, paint waste, and industrial solvents. But an independent analysis of the material by a British environmental group determined that 28 percent of the waste contained polychlorinated biphenyl (PCB), a combustible that could produce a highly toxic compound called dioxin. But Nigerian government reacted swiftly, not only did it demand that Italy remove the waste, it arrested at least 14 Nigerians involved in the smuggling and threatened them with a firing squad. It was later discovered that

[15] Jim Puckett *et al*, "Exporting Harm: the High-Tech Trashing of Asia, Basel Action Network. Available @ http://www.ban.org/e-waste/technotrashfinalcomp.pdf pages 3 and 14; cited in Terada Christine, "Recycling Electronic Wastes in Nigeria: Putting Environment and Human Rights at Risk, North-Western Journal of International Human Rights. 2012; 10(3):154.
[16] Jim Puckett ibid 5 and 9
[17] Jim Puckett ibid 4

an Italian importer, Gianfranco Raffaelli, who was then living in Nigeria, had over the years, managed to divert ships from their legal destinations to smaller port cities like Koko, where cargo inspections were either compromised or deliberately forgiving or even nonexistent. It was Raffaelli who paid off Sunday Nana. When the story broke, he fled the country on June 2 without a passport, apparently able to bypass immigration at the airport in Lagos. It was reported that Koko residents and the environs that were exposed to the toxic waste, which contained PCBs, dimethyl formaldehyde, and asbestos fibers, suffered nausea, paralysis, and premature births. Sunday Nana himself died of throat cancer. Even Nigerian Port Authority workers who helped transport the poison back onto the Italian ship walked away with chemical burns, despite having worn protective suits. It took 21 years before Ninety-four victims of the dumping were awarded a total of $264,666 as compensation after a class action lawsuit against the Nigerian Ports Authority.

The Cote d'Ivoire Experience (The Probo Koala Incident)

In 2006, the Probo Koala, a ship owned by the Trafigura Beheer BV offloaded 500 tons of toxic waste to an Ivorian waste handling company which disposed of it at the port of Abidjan. The local contractor, a company called Tommy, dumped the waste at 12 sites across the city. This incident caused 17 deaths and injury to over 30,000 persons. In the days after the dumping, almost 100,000 Ivorians sought medical attention after Prime Minister Charles Konan Banny opened the hospitals and offered free healthcare to residents of the capital. It was reported that, Trafigura originally planned to dispose of the waste at the port of Amsterdam in the Netherlands. The company refused to pay Dutch company Amsterdam Port Services (APS) for disposal after APS raised its charge from €27 to €1,000 per cubic meter [18]. The Probo Koala was reportedly turned away by several countries before offloading the toxic waste at the Port of Abidjan [19]. An inquiry in the Netherlands in late 2006 confirmed the composition of the waste substance.

Trafigura denied that any waste was transported from the Netherlands, saying that the substances contained only tiny amounts of hydrogen sulfide, and that the company did not know the substance was to be disposed of improperly. However, in early 2007, after two Trafigura officials who travelled to Côte d'Ivoire to offer assistance were arrested and subsequently

[18] "Document" @ http://www.amnesty.org/enAccessed March 12, 2018, see also "In Pictures: Ivorian Toxic Waste" BBC News, September 7, 2006. Available @ http://www.news.bbc.co.uk/2/hi/in_pictures/5322760.stm

[19] David Leigh and Afua Hirsh, "Papers Prove Trafigura Ship Dumped Toxic Waste in Ivory Coast. The Guardian Thursday, March 14, 2009.

attacked in jail [20], the company paid US$198 million to the Ivorian government for clean-up, without admitting wrongdoing [21]. A series of protests and resignations of Ivorian government officials followed this deal.

In 2008, a civil lawsuit in London was launched by almost 30,000 Ivorians against Trafigura. In May 2009, Trafigura announced it would sue the BBC for libel after its News night program alleged the company had knowingly sought to cover up its role in the incident. In September 2009 The Guardian obtained and published internal Trafigura emails showing that the traders responsible knew how dangerous the chemicals were. Trafigura agreed to a settlement of £30 million (US$42.4 million) to settle the class action suit against it [22]. Following revelations by local press and government on the extent of the illnesses involved, the nine-month-old transitional government of Prime Minister Charles Konan Banny resigned. The government vowed to provide treatment and pay all medical costs associated with the waste dump [23].

The Somalia Experience

In 2004, containers of hazardous waste were found on the shores of southern Somalia. Hydrogen Peroxide toxic waste and radioactive materials were also found in parts of Central and Southern Somalia. According to the United Nations Environment Program (UNEP), some firms took advantage of Somalia's lack of functioning government at the time, to dump wastes off its coast for years [24].

Zimbabwe

In the late 1980s, 275 barrels of toxic waste, disguised as commercial cleaning fluid was shipped to Zimbabwe, using grants from the United States Agency for International Development. The United States exporters responsible for the incident were later imprisoned for fraudulent practices [25].

Guinea

About 15,00 tons of harmful waste from municipal incinerators in Philadelphia was dumped on the Island of Kassa, near the capital of Guinea in the late 1980s. It was reported that a Norwegian company was hired to dispose

[20] "Toxic Waste Prisoners Attacked" BBC News Africa, November 14, 2006. Available @ http://www.news.bbc.co.uk Accessed March 12, 2018.
[21] "Trafigura to Pay $198m to Ivory Coast" Reuters, February 13, 2007.
[22] "How UK Oil Company, Trafigura Tried to Cover Up African Pollution Disaster" *The Guardian* September 17, 2009
[23] "Ivory Coast Government Disbanded Over Toxic Toxic Waste Scandal", Voice of America, September 7, 2006. Available @ http://www.voanews..com
[24] http://www.somalitalk.com
[25] http://www.wates360.com

of the waste which was labelled as raw materials for building bricks, but in reality, contained a dangerous mixture of heavy metals as well as toxic dioxins. The waste was later returned to the United States.

Kenya

In Kenya, an estimated 16,000 tons of electronic wastes are shipped into the country annually. The United Nations Environment Program (UNEP), reports that the annual generation of e-wastes in Kenya stands at 11,400 tons from refrigerators, 2,800 tons from televisions, 2,500 from personal computers, 500 tons from printers and 150 tons from mobile phones. To tackle the problem, Kenya in 2010, established an e-waste management project, large-scale recycling facility located in the nation's capital, Nairobi.

South Africa

In 1989, 120 drums of wastes, containing sludge laced with mercury from the United States was dumped in South Africa. Again, the Basel Action Network recently uncovered an attempt to illegally export e-waste from the United States to South Africa. According to reports, the e-waste was collected in collaboration with Western Pennsylvania Humane Society under the pretence that it would be recycled in the United States, but was loaded and shipped to Durban South Africa.

One thing that runs through almost all the incidents of dumping of hazardous wastes in African countries is the conspiracy and connivance of some citizens and/or government of the receiving countries with the waste merchants.

The Major Reasons for the Drastic Rise in the Toxic Waste Trade are

In view of the risk to human health and environment, countries in the developed world, where these wastes are generated, have introduced stringent environmental regulations which impose greater liability on the generators of wastes; there is also the problem of rising cost of safer recycling processors; all of which have made it more expensive to manage such wastes domestically, than to export same to cash-strapped developing countries for a meagre sum, compared to the cost of managing and disposing such waste in their own country.

Another reason is the lax in environmental laws of most developing countries, particularly in the African continent. There is an absence of adequate laws to protect the environment from the menace of transboundary movement of hazardous wastes. For instance, Nigeria did not have any such law until what is today known as the Koko incident of 1988. As a matter of fact, prior to 1988, Nigeria had not enacted any law, that could strictly

speaking be termed an environmental protection law. The existing laws in the Pre-Koko Era [26] were enacted to regulate oil exploration in Nigeria [27].

Closely related to the foregoing, is the absence of adequate enforcement mechanism of existing environmental protection laws. This problem is exacerbated by unnecessary bureaucracy and bottlenecks, as well as lack of adequate manpower for the effective implementation of environmental laws.

There is also the issue of poverty and ignorance which is prevalent among developing countries. Low level of environmental awareness about the dangers of improperly managed wastes, as well as high level of poverty have made African countries willing participants in the toxic waste trade, or victims of illegal dumping, orchestrated by the greed of some of its own citizens. The Federal Environmental Protection Agency (FEPA) guidelines drives home this point as follows:

Realising the low-level of environmental awareness in developing countries, coupled with the non-existence of environmental protection laws, and the abject poverty of these nations, the developed countries have, within the past decade, embarked upon "Toxic Waste Trade" or "illegal dumping of toxic wastes" in poor debt strapped developing countries.

Rob Edwards reports that tens of thousands of tons of toxic waste from Scotland are being illegally dumped in Africa and Asia every year through organised criminal gangs [28]. According to the report, the Scottish Environmental Protection Agency stopped eight major shipments in 2010. Approximately 100,000 tons of old television, computers and other electrical products are thrown away every year in Scotland, and about half of this number go unaccounted for upon disposal, as the illegal exports are often disguised as legitimate recycling operations, with e-waste hidden behind a few rows of properly packaged and functioning televisions [29].

E-wastes, in the form of second hand products, such as, computers, cell phones, fax machines, electric iron, blenders, refrigerators and deep freezers, television sets, microwave ovens, etcetera, are daily shipped into the African

[26] The period before the dumping of toxic waste in the port town of Koko, 1988.

[27] See for example the Oil Pipelines Act; the Petroleum Act; Associated Gas Re-Injection Act etc. it is interesting that Nigeria reacted to the Koko incident with the enactment of two laws in: the Federal Environmental Protection Agency (FEPA) Act, now repealed by the National Environmental Standards and Regulations Enforcement Agency (NESREA) Act Cap 164 Laws of the Federation of Nigeria; and the Harmful Waste (Special Criminal Provisions Etc) Act now Cap H1 Laws of the Federation of Nigeria, 1988, 2010.

[28] Rob Edwards, Exposed: Scotland's Toxic Waste is Poisoning Africa and Asia Sunday Herald, September 26, 2010.

[29] See Rob Edwards Ibid

Continent. For instance, an estimated 500 Containers of second hand electronics are imported into Nigeria every month, with each container holding 500 computers [30], and three-quarters, that is, a whopping 75 percent of these imported products are junks, that cannot be repaired or reused. About 45 percent of Nigeria's e-waste is shipped from the United States and another 45 percent comes from the European Union, and at least one-third of the content of each shipping container is broken beyond use and transferred to dumps [31].

Nigeria is not known to have e-waste recycling facility, yet e-waste continues to be shipped into the country daily. Lagos, the commercial nerve centre of the country, as well as other major cities across the country are flooded with imported e-wastes, which are afterwards dumped in several sites spread around the city. Young boys are seen scavenging around these dumpsites daily. The CNN reports that these children burn cables and wires to recover reusable metals like copper wire, and in the process, toxic chemicals and metals are released into the surrounding atmosphere [32].

The unregulated dismantling of e-waste has led to illness in grazing animals, tainted vegetables and contaminated drinking water. It is reported that these e-wastes and are smelted in peoples' backyard, in order to recover basic components such as lead, thereby exposing the community to high risk of lead poisoning. The report adds that excess heavy metals have been found in the soil and plants in Nigeria [33].

Regulatory Framework for the Transboundary Movement of Hazardous Waste

The first international effort to regulate hazardous waste trade was by the Organisation for Economic Cooperation and Development (OECD), which developed a set of principles to control the movement of hazardous waste among countries in the OECD. It further proposed a draft for an international agreement to regulate movement of hazardous waste across national jurisdictions in 1985. However, this responsibility was taken over by the United Nations Environment Program (UNEP) in 1982, when its Governing Council created a Working Group to focus on the disposal of hazardous waste

[30] Sonny Aragbe-Akpore, "Red Alert on Used Computers, Electronic Devices" *The Guardian* (December 27), 2005. Available at *http://www.ban.org/ban_news/2005/051227_nigeria_html*

[31] Liz Carney, "Nigeria Fears E-waste Toxic Legacy" BBC News, December 19, 2006. Available @ http://www.news.bbc.co.uk/3/hi/africa/6193625.stm

[32] Christian Purefoy, CNN West Africa Correspondent, Serious Contamination: Threats from Africa's Mounting E-waste CNN News (April 9), 2009.

[33] Liz Carney (supra)

[34]. This Working Group produced the Cairo Guidelines and Principles for Environmentally Sound Management of Hazardous Wastes in 1985 and was adopted by the UNEP Governing Council in 1987. The focal point of the guidelines was the Prior Informed Consent (PIC) system. Thus the guidelines stipulated that exporting states should notify the receiving states of the content of shipments of hazardous materials and should get the consent of the receiving state before export. The exporting state was also required to ascertain that the receiving state has disposal requirements as stringent as those in the exporting state. However, the Guidelines were not legally binding on the states. The process for the negotiation of an international, legally binding agreement on the control of transboundary movement of hazardous waste was included in the Cairo Guidelines, and this birthed the Basel Convention.

The Basel Convention on the Control of Transboundary Movement of Hazardous Waste and their Disposal 1989

The Basel Convention aims to address the risk of damage to human health and environment caused by hazardous wastes and other wastes and the transboundary movement thereof, and to address the growing threat to human health and the environment posed by the increased generation and complexity, and transboundary movement of hazardous wastes and other wastes [35]. The convention is premised on a set of principles, which includes:

- A reduction in the generation of hazardous wastes to the minimum in terms of quantity and/or hazard potential
- As far as is compatible with environmentally sound and efficient management, hazardous wastes should be disposed of in the state where they were generated
- The transboundary movement of hazardous waste be strictly regulated and only permitted when conducted under conditions which do not endanger human health and the environment

Although the convention provides a definition of waste, it however does not define hazardous waste, but Article 1, titled 'Scope of the Convention', classifies hazardous wastes for the purposes of the convention as follows:

The following wastes that are subject to transboundary movement shall be "hazardous wastes" for the purposes of this convention:

a) Wastes that belong to any category contained in Annex I, unless they do not possess any of the characteristics contained in Annex III

[34] UNEP Governing Council Resolution 10/24, May 31, 1982.
[35] The Preamble to the Basel Convention

b) Wastes that are not covered under paragraph (a) but are defined as, or are considered to be, hazardous wastes by the domestic legislation of the party of export, import or transit [36].

The scope of hazardous waste for the purposes of the convention is not limited to those covered under it, but extends to the definition of hazardous waste as provided by the domestic legislation of the countries of import, export or transit [37].

By Article 4 of the Convention, parties may prohibit the import of hazardous wastes or other wastes into their territories, and other parties shall not permit the export of such wastes to the parties which have prohibited such import. And where the import is not prohibited, such wastes shall not be exported unless the state of import consents in writing to the import [38].

Article 4 (2) stipulates that, each party shall take appropriate measures to:

a) Ensure that the generation of hazardous wastes and other wastes within it is reduced to a minimum, taking into account, social, technological and economic aspects

b) Ensure the availability of adequate disposal facilities, for the environmentally sound management of hazardous wastes and other wastes, that shall be located, to the extent possible, within it, whatever the place of their disposal

c) Ensure that persons involved in the management of hazardous or other wastes within it take such steps as are necessary to prevent pollution due to hazardous wastes and other wastes arising from such management and, and if such pollution occurs, to minimize the consequences there of for human health and the environment

d) Ensure that the transboundary movement of hazardous wastes and other wastes is reduced to the minimum consistent with the environmentally sound and efficient management of such wastes, and is conducted in a manner which will protect human health and the environment against the adverse effects which may result from such movement

e) Not allow the export of hazardous wastes or other wastes to a state or group of states belonging to an economic and/or political integration organisation that are parties, particularly developing countries, which have prohibited by their legislation all imports, or if

[36] Article 1 (1) (a) and (b) of the Basel Convention
[37] Article 3 of the Basel Convention
[38] Article 4 (1) (a)-(c) of the Basel Convention

it has reason to believe that the wastes in question will not be managed in an environmentally sound manner, according to criteria to be decided on by the parties at their first meeting

f) Require that information about a proposed transboundary movement of hazardous wastes or other wastes be provided to the states concerned, according to Annex V A, to state clearly the effects of the proposed movement on human health and the environment

g) Prevent the import of hazardous wastes and other wastes if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner

h) Co-operate in activities with other parties and interested organisations, directly and through the secretariat, including the dissemination of information on the transboundary movement of hazardous wastes and other wastes, in order to improve the environmentally sound management of such wastes and to achieve the prevention of illegal traffic.

Article 4(3) criminalises the illegal traffic in hazardous wastes. The convention also enjoins parties to require that hazardous wastes or other wastes to be exported, are managed in an environmentally sound manner in the state of import or elsewhere [39].

Parties shall take appropriate measures to ensure that, the transboundary movement of hazardous wastes only be allowed if:

a) The state of export does not have the technical capacity and the necessary facilities, capacity or suitable disposal sites in order to dispose of the waste in question in an environmentally sound and efficient manner

b) The wastes in question are required as a raw material for recycling or recovery industries in the state of import

c) The transboundary movement in question is in accordance with other criteria to be decided by the parties, provided those criteria do not differ from the objectives of this convention [40].

The state of export cannot transfer the obligation to require that the wastes in question are managed in an environmentally sound manner to the states of import and transit [41]. The state of export shall notify or shall require the

[39] Article 4 (8) Basel Convention
[40] Article 4 (9) Basel Convention
[41] Article 4 (10) Basel Convention

generator or exporter to notify, in writing, through the channel of the competent authority of the state of export, the competent authority of the states concerned of any transboundary movement of hazardous wastes. And the state of import that is the receiving state is required to respond in writing, consenting or denying permission for the movement of the waste in question [42]. The transit state is also required to consent or deny permission, and the state of export shall not allow the transboundary movement to commence until it has received the written consent of the transit state [43]. This provision is indeed laudable, particularly in view of the fact that accident can occur on the way outside the jurisdictions of the state of export and import.

Where a transboundary movement of hazardous waste cannot be completed, the state of export shall ensure that the wastes in question are taken back into the state of export by the exporter, if alternative arrangements cannot be made for their disposal in an environmentally sound manner, within 90 days, from the time that the importing state informed the state of export and the secretariat [44].

Where transboundary movement of hazardous wastes or other wastes is carried out without the notification and consent of all the parties concerned, or where consent was obtained through falsification, misrepresentation or fraud, such transboundary movement shall be deemed to be illegal traffic [45].

Where the transboundary movement of hazardous waste is deemed to be illegal, as a result of the conduct of the exporter or generator, the state of export shall ensure that the wastes in question are taken back by the exporter or generator, or if necessary, by itself into the state of export [46]. Where the transboundary movement of hazardous wastes is deemed illegal traffic as a result of the conduct of the importer or disposer, the state of import shall ensure that the wastes in question are disposed of in an environmentally sound manner by the importer or disposer, or if necessary, by itself within 30 days from the time the illegal traffic came to the attention of the state of import [47]. Where the responsibility for the illegal traffic cannot be assigned either to the exporter or generator or to the importer or disposer, the parties concerned or other parties, as appropriate, shall ensure through co-operation, that the wastes in question are disposed of as soon as possible in an environmentally sound

[42] Article 6 (1) and (2) Basel Convention
[43] Article 6 (4) Basel Convention
[44] Article 8 Basel Convention
[45] Article 9 (1) (a)-(e) of the Basel Convention
[46] Article 9 (2) (a) Basel Convention
[47] Article 9 (3) Basel Convention

manner either in the state of export or state of import or elsewhere as appropriate [48]. State parties are enjoined to introduce appropriate national/domestic legislation to prevent and punish illegal traffic [49].

The Basel Convention opened for signatures in 1989 and entered into force in 1992. Some parties, particularly the developing countries were dissatisfied, that the convention did not go far enough, as it did not prohibit waste export to any location except Antarctica. It only required notification and consent system, known as Prior Informed Consent (PIC) System. This system only made legal what would otherwise have been illegal dumping, as hazardous waste traders took advantage of the situation and justified all exports as moving to recycling destinations. The dissatisfaction birthed several regional waste trade bans, including the Bamako Convention. Curiously, the perceived discontent with the Basel Convention did not dissuade African countries from ratifying it. The Basel Convention was amended by the Basel action Network (BAN) Amendment in 1995. The BAN Amendment prohibits the export of hazardous wastes for any purpose from countries listed in a proposed new annex to the convention (mainly OECD countries) to other parties of the convention. It enjoins party states to prohibit export of hazardous wastes for recovery and final disposal except to OECD countries. It also banned the export of wastes intended for recovery and recycling. The BAN Amendment was introduced to protect developing countries, which did not have the capacity to deal with such wastes, from the imports of hazardous waste from developed countries.

There are currently 186 parties to the convention, comprising 185 countries and the European Union. Although Haiti and the United States have signed the convention, but have not ratified it. One reason for this is that the definition of waste material under the convention includes things such as scrap iron and steel which many countries want or need. During the negotiation, some developed countries led by the United States strongly opposed a ban on waste from the Northern hemisphere to the southern hemisphere. The United States was interested in ratifying the convention without the BAN Amendment, because it is the producer of most of the world's e-wastes, the bulk of which are sent through unregulated channels to developing countries. The possibility that the United States might ratify the Basel Convention without the amendment has caused major controversy, sufficient that some environmental activists would prefer that the United States remain outside of

[48] Article 9 (4) Basel Convention
[49] Article 9 (5) Basel Convention

the agreement [50]. Allowing the United States to ratify without the ban would give it an economic free-ride, as it would then be able to trade hazardous wastes with other member states without been bound by the prohibition against sending wastes to developing countries.

The Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa [51]

The Bamako Convention was negotiated pursuant to Article 11 of the Basel Convention, which encourages parties to enter into bilateral, multilateral and regional agreements on hazardous wastes to help achieve the objective of the convention. The Bamako Convention is an African countries' initiative, which seeks to cater for the needs of African countries, supposedly not taken care of by the Basel Convention, which they viewed as a purely developed countries initiative. It recognises the sovereignty of states to ban the importation into and the transit through their territory of hazardous wastes and substances, and that such effective control and minimisation of transboundary movement of hazardous wastes will act as an incentive, in Africa and elsewhere, for the reduction of the volume of waste generated.

The Bamako Convention is similar in verbiage to the Basel Convention, as the latter Convention drew largely from the former. It however, appears to be a more restrictive framework for regulating the transboundary movement of hazardous wastes than the Basel Convention.

By Article 3 (1) of the Convention, each state must within six months of becoming a party to this convention, inform the secretariat of the convention, of wastes other than those listed in Annex 1 of this Convention, considered or defined as hazardous under its national legislation and of any requirements concerning transboundary movement procedures applicable to such wastes.

Just as in the Basel Convention, the Bamako Convention does not provide a definition of hazardous waste. The definition provided by the national legislation of each state as to what constitutes hazardous waste is adopted in respect of such state. There is therefore no uniformity in the definition of hazardous waste, as different states may have different definitions as to what constitutes hazardous waste in their countries. One danger of this is that, some definitions may be wider in scope than others, depending on the level of

[50] Basel Action Network, "Why the United States Must Ratify the Entire Convention or Not at All" Briefing Paper No. 2 (December 1999) cited in Okonkwo Theodore, International Protection of the Environment: Law and Practice (Lagos, Fine Finishing Limited), 2014, 350.
[51] The Bamako Convention, 1991.

technological development, so that what constitutes hazardous waste in one country may not in another country. This lack of uniformity in definition may lead to disputes and conflicts among parties. It may also occasion difficulty in the enforcement of the relevant law, as enforcement authorities may face the dilemma as to which definition of the disputing parties to adopt.

Article 4 (1) of the Bamako Convention imposes a total ban on the import of hazardous waste into Africa. It enjoins all parties to take appropriate legal, administrative and other measures within the area under their jurisdiction to prohibit the import of all hazardous wastes for any reason, into Africa from non-contracting parties. Such import shall be deemed illegal and a criminal act. Such ban extends to dumping of hazardous wastes at sea, seabed and internal waters.

While it is understood that the above provision is hinged on the realisation that the African continent has in recent years served as a dumping ground for nuclear and industrial wastes from the developed world, it is misleading to assume that the dumping of toxic wastes takes the pattern of a thief-in-the-night. The vast majority of the transactions in toxic waste do not take place between national governments, but sometimes between government of the importing state and multinational corporations in the state of export, and more often between individuals and/or corporate entities in the state of export and state of import. Due to laxity in the enforcement of the relevant laws in most African countries, most of the transactions in toxic waste often take place without the knowledge of the national government of the state of import, (where the government is not a party to the transaction).Credence to this view is found in Omorogbe's observation:

These countries have not been innocent victim; and in most cases, there are contractual arrangements between their governments and multi-national corporations. The contracts have been entered into because of the financial gains involved, ignorance of the dangers of such actions and what are seen as overriding needs of development [52].

The point being made is that, the dumping of toxic waste hardly occurs without the complicity of some unscrupulous members in the state of import, or government authorities. A case in point is the Nigeria, 'Koko incident' of 1988, in which toxic waste imported from Italy through the connivance of some unscrupulous Nigerians was dumped in the port town of Koko in the then Bendel State in Nigeria, for a meagre sum of $100 that is, Five Hundred Naira (N500.00) monthly.

[52] Omorogbe Y., The Growth of Environmental Law in Developing Countries: Problems and Prospects (MIMEO) 1; cited in Atsegbua *et al.* (supra), 48-49.

The case of Guinea-Bissau is also illustrative. About 3.5 million tons of toxic wastes, consisting of pharmaceutical and industrial wastes were exported from Switzerland, the United Kingdom and the United States. It is reported that the country officials also signed a five-year contract for the burial of 15million tons of toxic wastes sent by European Pharmaceutical companies and tanneries, but later repudiated the contract following the public outcry.

In the Probo Koala Incident in Cote d' Ivoire, seven Ivorians were indicted and brought to trial in Abidjan for their complicity in the dumping. The head of the Ivorian contractor who dumped more than 500 tonnes of toxic liquid wastes was sentenced to 20 years in prison in November 2008.

The Convention enjoins each state party to impose strict, unlimited liability as well as joint and several liability on hazardous waste generators. They are also enjoined to ensure that the generation of hazardous waste within the area under their jurisdiction is reduced to a minimum taking into account social, technological and economic aspects [53]. The imposition of strict liability under the convention, relieves the courts of the obligation to set the legal standard necessary for proof and liability. It would also serve as a deterrent for would be offenders.

Parties are enjoined to adopt and implement the preventive and precautionary approach to pollution problems [54].

While the Basel Convention provides three conditions under which the transboundary movement of hazardous waste may be allowed, the Bamako convention provides for two [55]. It is ironic that the transboundary movement of hazardous wastes usually takes place with the developed countries, who have the technical capacity and necessary facilities to manage such wastes within their jurisdiction, being the exporters and the developing countries who do not have the requisite technical capacity and necessary facilities as the importers. It is interesting to note that it is the developed countries who are in a position to recycle or use the wastes in question as raw materials that often seek to export such waste to developing countries, who are ill-equipped to manage and dispose such wastes.

If the conditions stipulated for the transboundary movement of hazardous waste in the Basel Convention is taken seriously, then it would be that the toxic waste would be traded majorly among the OECD countries and perhaps the fast emerging economies, and the African continent would be spared any part in it.

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[53] Article 4 (3) (b) and (c) of the Bamako Convention
[54] Article 4 (3) (f) Bamako Convention
[55] See Article 4 (9) (a)-(c) of the Basel Convention and Article 4 (3) (n) (i)-(ii)

Parties are enjoined to introduce appropriate national legislation for imposing criminal penalties on all persons who have planned, carried out, or assisted in illegal importing [56].

Ironically, while African countries are parties to the Basel Convention, the same cannot be said of the Bamako Convention, which entered into force on April 22, 1998 and to date has only 27 parties. Key players in the continent, such as Nigeria, South Africa, Kenya, Ghana, Algeria, etcetera are not parties to the Bamako Convention. While Nigeria has signed the convention, it has up to date not ratified it. Perhaps this is a subtle protest against the total ban of the transboundary movement of hazardous waste by the Bamako convention and a tacit approval of the continuous flow of hazardous wastes into their countries.

Domestic Legislations

The importance of domestic laws as part of the regulatory framework for the control of transboundary movement of hazardous wastes cannot be over emphasised. This is evident in the definition of waste provided under the Basel and Bamako Conventions. Article 2(1) of the Basel Convention defines wastes as substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law [57]. Also very instructive is the obvious reference to domestic legislation in the classification of hazardous waste under the Basel Convention and the Bamako Convention as follows:

a) Wastes that are not covered under paragraph (a) but are defined as, or are considered to be, hazardous wastes by the domestic legislation of the party of export, import or transit [58].

It is also instructive that both the Basel and Bamako Conventions made references to the national definitions of hazardous wastes [59].

In Nigeria, the national law and principal legislation on environmental protection is the National Environmental Standards and Regulations Enforcement Agency (NESREA) Act. While the national legislation on the transboundary movement of hazardous waste is the Harmful Waste (Special Criminal Provisions Etc) Act. It is remarkable that the Harmful Waste Act came into existence before the Basel Convention and its Bamako counterpart.

[56] Article 9 of the Bamako Convention
[57] See also Article (1) (1) of the Bamako Convention
[58] Article 1 (1) (b) of the Basel Convention; see also Article 2 (1) (b) of the Bamako Convention
[59] See Article 3 (1) of the Basel Convention and Article 3 (1) of the Bamako Convention

The National Environmental Standards and Regulations Enforcement Agency (NESREA) Act provides a definition of 'hazardous substance' as any chemical, physical, biological or radioactive material that poses a threat to human health and the environment… [60] And section 27(1) and (2) of the Act prohibits and criminalises the discharge in such harmful quantities of any hazardous substance into the air or upon the land and waters of Nigeria or at the adjoining shoreline.

It would seem that the perceived efforts made at the international, regional and domestic levels to curb the menace of transboundary movement of hazardous waste has not achieved any remarkable result, as wastes from the developed world are still exported on a daily basis to developing countries, who are unequipped to handle them.

It is reported that Ghana is one of the countries where e-waste from all over the world "go to die". The Agbogbloshie region, nicknamed "Sodom and Gomorrah" by the locals is the worst hit by the menace of e-wastes. Agbogbloshie, a former wetland, is now known as one of the world's biggest dumps, where scores of workers burn waste and strip valuables from obsolete electronics [61] Another equally very bad situation is that of Nigeria, where, as already observed an estimated 500 containers of e-waste enter the country monthly, with a whopping 75 percent ending up at dumpsites.

The Benefits of the Toxic Waste Trade to Africa

The transboundary movement of hazardous waste, whether in the form of toxic waste trade or illegal dumping, occur for purely economic reasons. On the part of the generators and exporters of wastes, it is the desire to maximise profit, by cutting costs of management and disposal of such wastes at domestic level.

On the part of the importing states, particularly, African countries, the transboundary movement of hazardous wastes, whether in the form of a toxic waste trade or the illegal dumping of wastes are embarked upon for pure financial gains, whether on the part of the country as a willing participant in the toxic waste trade, as shown in the case of Guinea Bissau; or illegal dumping facilitated by greedy and unscrupulous citizens, as in the "Koko Incident", the "Probo Koala Incident", etcetera.

Atsegbua *et al*, Observe

The reason for this export of harmful wastes abroad, which may be characterised as a new form of slavery, colonialism or poison tourism is purely

[60] Section 37 of the NESREA Act CAP N164 Laws of the Federation of Nigeria, 2010.
[61] http://www.earthwatchmedia.org

economic. Most of the exporters of industrial waste have the technological means of effectively dealing with this poison within their own boundaries. However, it is cheaper to export the waste than to treat it at home [62].

The Learned Authors Further Observe That

These wastes continue to be generated for economic reason. Stringent environmental regulations and heightened public awareness mean that, if these wastes were to be disposed of within the territories where they were generated, the costs involved will be quite enormous, therefore, they arrange for their disposal in countries with little or no knowledge of the dangers involved and in consideration of an amount which appears large to the cash strapped country, but which is a small fraction of what the company would have paid to dispose of it within its own territory [63].

In spite of the perceived financial gains to the government or the unscrupulous individuals who connive with waste merchants to poison innocent citizens, it cannot be seen, what benefits the toxic waste trade holds for the African continent.

- First, where the government is directly or indirectly involved, the money realised may not be sufficient to properly manage and dispose such wastes, that is, if the government is mindful to do so, and even where it has the intention to do so, corruption at government quarters, may ensure that proper disposal does not take place, as the funds for such disposal may be swallowed by snakes and monkeys [64].
- Secondly, the financial benefit does not equal the damage done to human health. In most cases, the damage to human life and health may be irreversible, as for instance, death and some diseases. A case in point is the South African incident, where a three-year old girl died from ingesting material from a dumpsite near her grandmother's house in Cape Town. Again, Nana, the landowner, who offered his land for the dumping of toxic waste in the Koko incident in Nigeria, reportedly died of throat cancer shortly after the incident. The $100 monthly pay obviously could not save him. The Probo Koala Incident reportedly occasioned at least 17 deaths and 30,000 injuries, it is needless to say that, the money received, was not worth any of the lives lost or the suffering to the injured.

[62] Atsegbua *et al*. (supra) 50
[63] Atsegbua *et al*. (supra) 48
[64] An obvious reference to the Nigeria incident, where a snake allegedly swallowed N30 million in the office of Joint Admissions and Matriculation Board (JAMB)

- Thirdly, the financial benefit does not equal the environmental damage occasioned. The financial benefit to the conniving citizens of the state of import, which is only a fraction of the cost of disposal in the countries where these wastes are generated, is hardly enough for a proper clean-up of the environment. For instance, it was reported in the Probo Koala Incident that, Trafigura originally planned to dispose of the wastes at the port of Amsterdam in the Netherlands. The company refused to pay Dutch company, Amsterdam Port Services (APS) for disposal after APS raised its charge from €27 to €1,000 per cubic meter. The Probo Koala was reportedly turned away by several countries before offloading the toxic waste at the Port of Abidjan.

Recommendations and Conclusion

It is doubtful if the existing framework for the control of transboundary movement of hazardous waste in Africa can meet the Agenda 2063 goal because, in spite of the bilateral and multilateral agreements on the control of transboundary movement of hazardous wastes into Africa, the movement of hazardous wastes into Africa, either in the form of toxic waste trade or illegal dumping has continued unabated. For instance, in April 2010, Maersk Line Vessel, MV Nashville, laden with toxic wastes, comprising 70 storage (lead) batteries classified as Basel Code A1180 and broken televisions was arrested at Tin-can Island, Lagos, Nigeria. The vessel which was said to have arrived Nigeria on April 9, 2010, had discharged some of its hazardous content at the Federal Ocean Terminal at Onne in Rivers State. The vessel left Onne and arrived Lagos on April 11, 2010 and was arrested based on a memo from NESREA to the Nigerian Ports Authority (NPA) [65]. Other examples include the 2006 Probo Koala incident of Cote d' Ivoire and the Somalia Incident of 2004 [66].

The question that naturally arises is why has the toxic waste trade continued in spite of the ban at both the regional and international levels? The common answer is poverty. While it is true that poverty is prevalent in Africa, it is not the case that we cannot watch television unless used second hand television sets are shipped to us from abroad. Or that we cannot use computers and cell phones unless the used ones are shipped to us. Africans were using televisions, electric irons, blenders, refrigerators, etcetera, long before this

[65] Godwin Oritse, Godfrey Bivbere. Radioactive Toxic Waste Dumped in Nigeria Again Vanguard, 2010. (April 16,) http://www.vanguardngr.com/2010/04/16/toxic-waste-ship-arrested-in-lagos

[66] Discussed in pages 5 and 6 above

toxic colonialism, and we will continue to use these electrical and electronic devices and more, even after this toxic trade comes to an end. But, we must end it. A big step towards ending it is to re-orientate our minds to recognise that we are not inferior to the original users of the second hand products we are patronising. The only thing worse than poverty, is poverty mentality. It is all in our minds, and that to my mind is a major part of our problem. Achieving the Agenda 2063 goals therefore calls for an overall change in attitudes, values and mind sets by the African people, and inculcating the values of discipline, honesty and integrity.

The realisation of the Agenda 2063 goals would require a sound economic management, holistic and integrated development at the continental, regional and national levels on a short, medium and long term.

National governments within the African continent must demonstrate the political will to put an end to the practice of African countries being used as dumping grounds for foreign wastes. The starting point in this regard is to ratify the Bamako Convention, which we observed has not been ratified by key players in the African continent [67]. Curiously, only 27 out of 55 countries in Africa have ratified the Bamako Convention, while these same countries have all ratified the Basel Convention. The only plausible explanation would be that they do not support the total ban on transboundary movement of hazardous waste imposed by the Bamako Convention. It is necessary that Africa countries not only ratify the Bamako Convention, they must also domesticate it.

The government in the developed world must also demonstrate the political will to give a decent burial to this toxic colonialism by imposing heavy tariffs on outgoing cargos, so that the cost of exporting such wastes would be higher than the cost of recycling or disposing them in the countries where they are generated. This would provide the necessary incentive to manage and dispose such waste locally.

While this discuss has focused mainly on regulating the transboundary movement of hazardous waste into Africa, achieving the sustainable development goal of Agenda 2063 goes beyond protecting African environment from transboundary wastes, and would require the adequate enforcement of the regulatory mechanism for the control of hazardous wastes generated locally, within the continent. This is so because, as the continent continues on the path of industrialisation and technological development, there would be a surge in the generation of hazardous wastes within the continent.

[67] Nigeria, Ghana, South Africa, Kenya, Algeria, Morocco, Malaw, i etcetera

South Africa is one of the few countries in Africa that is fast industrialising, and as such has to contend with hazardous waste generated locally. On February 22, 2001, it was reported that Cape Town had become the dumping ground for hazardous waste generated in the Eastern Cape, following the shutting down of Port Elizabeth's dumpsite, which had become unsafe. About 100 trucks of hazardous wastes were being transported from Port Elizabeth to Cape Town monthly. The wastes include solvents, oil, paint sludge and liquids containing high levels of chloride which are generated mainly by the motor and leather tanning industries in Port Elizabeth and East London [68].

In February 2017, reports broke of another massive dump in Koko by an international oil company. It was reported that for months, residents noticed the wastes coming in barges and trucks. It was gathered that a Nigerian Company, Ebenco Global Link Ltd, was responsible for this incident, but the company argued that the wastes were not toxic but mere sludge brought for recycling, and that Koko was chosen as a simple "recycle" location. The company told the people that the waste was wealth to them because they were going to be recycled [69]. An independent test carried out by another member of the community proved the wastes to be toxic [70]. Interestingly, the waste in this particular incident was not imported, but allegedly, locally generated wastes from a multi-national oil company in the Niger Delta. The back and forth argument between some leaders of the community, government officials and some members of the community as to the toxicity or otherwise of the said wastes made very interesting reading in the weeks following the incident. According to the Nigerian Tribune:

….There is a conspiracy of silence as those whose voice should resonate on the matter are afraid of attacks from hoodlums and security agents. Allegations are also rife that some community leaders, health and environmental officials of the local government headquarters and some security agents have been compromised to sweep the issue under the carpet [71].

Hazardous wastes whether generated locally or imported from a foreign country would still be hazardous, because its toxicity is not diminished by the

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[68] Melanie Gosling. "Hazardous Wastes Dumped in Cape Town" IOL News South Africa; February 22, 2001. Available @ http://www.iol.co.za/news/south-africa/hazardous-wastes-dumped-in-cape-town-58920

[69] "Panic as Another Toxic Scare Hits Koko" Available @ http://www.nigeriacommunicationsweek.com/ng/news

[70] 30 Years After, another Toxic Waste Scare Hits Koko, as Suspect Sends Soldiers, Hoodlums after Journalists. *Nigerian Tribune* February 27, 2017. Available @ http://www.tribuneonlineng.com/30-years-another-toxic-waste-scare

[71] Nigerian Tribune Ibid

fact that it was generated locally. A case in point is the Cape Town Incident in South Africa, where Jordan Lewis, a three-year old child died from ingesting toxic material from the dumpsite near her grandmother's home. The waste in question allegedly belonged to Protea Chemical, an indigenous manufacturer and distributor of chemicals and polymers.

It is reported that the city of Cape Town spends a whopping R200 million annually to clear illegal dumpsites [72]. While it is important to clear dumpsites, the millions spent in the course of such clearing can be saved, if manufacturing companies can reuse the bulk of industrial waste they generate. Amokaye, advocates, the integrated use of natural resources and industrial wastes as secondary raw materials; the ecological safe disposal of hazardous industrial waste; and the cleaning up of existing dumps containing industrial hazardous wastes [73]. The key lies in the implementation of the Basel policy of minimising the generation of wastes through a system of Reduce, Reuse, and Recycle.

On a general scale, there is high hope for the success of the Agenda 2063, because unlike others before it, the Agenda 2063 does not set up new plans for the achievement of its goals, rather it recommends the implementation of the existing ones, such as the Lagos Plan of Action, the Abuja Treaty, the Minimum Integration Program, the Program for Infrastructure Development in Africa (PIDA), the Comprehensive Africa Agricultural Development Program (CAADP), the New Partnership for Africa's Development (NEPAD), Regional Programs as well as National Plans. The effective implementation of these plans is crucial to the achievement of Agenda 2063, while it is hoped that this initiative would be extended to the control of transboundary movement of hazardous wastes into Africa.

[72] eNCA News South Africa, April 25, 2013.

[73] Amokaye OG. Environmental Law and Practice in Nigeria (Lagos, MIJ professional Publishers), 2014, 445.

Chapter - 7
Plastic Industry Waste: Sources, Management and Recycling

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Chapter - 7

Plastic Industry Waste: Sources, Management and Recycling

Usha Kaushik

Abstract

Plastic is a material consisting of any of a wide range of synthetic or semi-synthetic organic compounds that are malleable and can be molded into solid objects. The word plastic is derived from the Greek (plastikos) meaning "capable of being shaped or molded", from (plastos) meaning "molded". It refers to their malleability, or plasticity during manufacture that allows them to be cast, pressed, or extruded into a variety of shapes-such as films, fibers, plates, tubes, bottles, boxes, and much more. Most plastics contain organic polymers. The vast majority of these polymers are based on chains of carbon atoms alone or with oxygen, sulfur, or nitrogen as well. Plastic wastes constitute 10% of municipal waste stream. Accumulation occurring at natural terrestrial, freshwater, marine water and mountain peaks. Inadvertent soil contamination with small fragments as a consequence of spreading sewage sludge. Complete ban of plastic is not possible as there is no such an exact alternative. Discriminate usage of plastic objects to be as usage of jute bags and metal water bottles, which can also prevent health hazards. And saying no for plastic carry bags. Supporting only biodegradable and bioplastics. Helping in segregation, collection and recycling of plastics by separating plastic and other solid waste, may form some of the better solutions. Only by the better coordination between public, private and people could solve the problem of plastic wastes.

Keywords: plastic, biodegradable, bio plastic, sewage waste, malleability

1. Introduction

Plastic is a material consisting of any of a wide range of synthetic or semi-synthetic organic compounds that are malleable and can be molded into solid objects.

IUPAC definition: Generic term used in the case of polymeric material that may contain other substances to improve performance and/or reduce costs.

The word plastic is derived from the Greek (plastikos) meaning “capable of being shaped or molded”, from (plastos) meaning “molded”. It refers to their malleability, or plasticity during manufacture that allows them to be cast, pressed, or extruded into a variety of shapes-such as films, fibers, plates, tubes, bottles, boxes, and much more.

Plastics are typically organic polymers of high molecular mass, but they often contain other substances. They are usually synthetic, most commonly derived from petrochemicals, but many are partially natural.

Due to their relatively low cost, ease of manufacture, versatility, and imperviousness to water, plastics are used in an enormous and expanding range of products, from paper clips to spaceships. They have already displaced many traditional materials, such as wood, stone, horn and bone, leather, paper, metal, glass, and ceramic, in most of their former uses. In developed countries, about a third of plastic is used in packaging and another third in buildings such as piping used in plumbing or vinyl siding. Other uses include automobiles (up to 20% plastic), furniture, and toys. In the developing world, the ratios may be different for example, reportedly 42% of India’s consumption is used in packaging (Andrady *et al*., 2009) Plastics have many uses in the medical field as well, to include polymer implants.

2. History

The development of plastics has evolved from the use of natural plastic materials (e.g., chewing gum, shellac) to the use of chemically modified, natural materials (e.g., natural rubber, nitrocellulose, collagen, gala lite) and finally to completely synthetic molecules (e.g., bake lite, epoxy, polyvinyl chloride).molecules (e.g., bake lite, epoxy, polyvinyl chloride).

Early plastics were bio derived materials such as egg and blood proteins, which are organic polymers.

In 1600 BC, Mesoamericans used natural rubber for balls, bands, and figurines. Treated cattle horns were used as windows for lanterns in the middle Ages. Materials that mimicked the properties of horns were developed by treating milk-proteins (casein) with lye.

The development of plastics also accelerated with Charles Goodyear's discovery of vulcanization to thermoset materials derived from natural rubber in 1800’s.

Parkesine is considered the first man-made plastic. The plastic material was patented by Alexander Parkes, In Birmingham, UK in 1856.

The world's first fully synthetic plastic was bake lite, invented in New York in 1907 by Leo Baekeland who coined the term 'plastics'.

Among the earliest examples in the wave of new polymers were polystyrene (PS), first produced by BASF in the 1930s, and polyvinyl chloride (PVC), first created in 1872 but commercially produced in the late 1920s.

Polyethylene terephthalate (PET)'s discovery is credited to employees of the Calico Printers' Association in the UK in 1941. It is one of the few plastics appropriate as a replacement for glass in many circumstances, resulting in widespread use for bottles in world.

In 1954, polypropylene was discovered by Giulio Natta and began to be manufactured in 1957.

In 1954, expanded polystyrene (used for building insulation, packaging, and cups) was invented by Dow Chemical.

The success and dominance of plastics starting in the early 20th century led to environmental concerns regarding its slow decomposition rate after being discarded as trash due to its composition of very large molecules. Toward the end of the century, one approach to this problem was met with wide efforts toward recycling.

3. Common Plastics and Uses

- Polyester (PES)-Fibers, textiles.
- Polyethylene terephthalate (PET)-Carbonated drinks bottles, peanut butter jars, plastic film, microwavable packaging.
- Polyethylene (PE)-Wide range of inexpensive uses including supermarket bags, plastic bottles.
- High-density polyethylene (HDPE)-Detergent bottles, milk jugs, and molded plastic cases.
- Polyvinyl chloride (PVC)-Plumbing pipes and guttering, shower curtains, window frames, flooring.
- Polyvinylidene chloride (PVDC) (Saran)-Food packaging.
- Low-density polyethylene (LDPE)-Outdoor furniture, siding, floor tiles, shower curtains, clamshell packaging.
- Polypropylene (PP)-Bottle caps, drinking straws, yogurt containers, appliances, car fenders (bumpers), plastic pressure pipe systems.
- Polystyrene (PS)-Packaging foam/"peanuts", food containers,

plastic tableware, disposable cups, plates, cutlery, CD and cassette boxes.

- High impact polystyrene (HIPS)-Refrigerator liners, food packaging, vending cups.
- Polyamides (PA) (Nylons)-Fibers, toothbrush bristles, tubing, fishing line, low strength machine parts: under-the-hood car engine parts or gun frames.
- Acrylonitrile butadiene styrene (ABS)-Electronic equipment cases (e.g., computer monitors, printers, keyboards), drainage pipe.
- Polyethylene/Acrylonitrile Butadiene Styrene (PE/ABS)-A slippery blend of PE and ABS used in low-duty dry bearings.
- Polycarbonate (PC)-Compact discs, eyeglasses, riot shields, security windows, traffic lights, lenses.
- Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS)-A blend of PC and ABS that creates a stronger plastic. Used in car interior and exterior parts and mobile phone bodies.
- Polyurethanes (PU)-Cushioning foams, thermal insulation foams, surface coatings, printing rollers (Currently 6th or 7th most commonly used plastic material, for instance the most commonly used plastic in cars).

4. Special Purpose Plastics

- Maleimide/bismaleimide Used in high temperature composite materials.
- Melamine formaldehyde (MF)-One of the amyloplasts, and used as a multi-colorable alternative phenolics, for instance in moldings (e.g., break resistance alternatives to ceramic cups, plates and bowls for children) and the decorated top surface layer of the paper laminates (e.g., Formica).
- Plastarch material-Biodegradable and heat resistant, thermoplastic composed of modified corn starch.
- Phenolics (PF) or (phenol formaldehydes)-High modulus, relatively heat resistant, and excellent fire resistant polymer. Used for insulating parts in electrical fixtures, paper laminated products (e.g., Formica), thermally insulation foams. It is a thermosetting plastic, with the familiar trade name Bakelite that can be molded by heat and pressure when mixed with a filler-like wood flour or can be cast

in its unfilled liquid form or cast as foam (e.g., Oasis). Problems include the probability of moldings naturally being dark colors (red, green, brown), and as thermoset it is difficult to recycle.

- Polyepoxide (epoxy) Used as an adhesive, potting agent for electrical components, and matrix for composite materials with hardeners including amine, amide, and boron trifluoride.
- Polyether ether ketone (PEEK) Strong, chemical and heat-resistant thermoplastic, biocompatibility allows for use in medical implant applications, aerospace moldings. One of the most expensive commercial polymers.
- Polyetherimide (PEI) (Ultem)-A high temperature, chemically stable polymer that does not crystallize.
- Polyimide-A high temperature plastic used in materials such as Kapton Tape.
- Polylactic acid (PLA)-A biodegradable, thermoplastic found converted into a variety of aliphatic polyesters derived from lactic acid which in turn can be made by fermentation of various agricultural products such as corn starch, once made from dairy products.
- Poly Methyl methacrylate (PMMA) (acrylic)-Contact lenses (of the original "hard" variety), glazing (best known in this form by its various trade names around the world; e.g., Perspex, Oroglas, Plexiglas), for vehicles. It forms the basis of artistic and commercial acrylic paints when suspended in water with the use of other agents.
- Polytetrafluoroethylene (PTFE)-Heat-resistant, low-friction coatings, used in things like non-stick surfaces for frying pans, plumber's tape and water slides. It is more commonly known as Teflon.
- Urea-formaldehyde (UF)-One of the amyloplasts and used as a multi-colorable alternative to phenolics. Used as a wood adhesive (for plywood, chipboard, hardboard) and electrical switch housings.
- Furan-Resin based on furfuryl alcohol used in foundry sands and biologically derived composites.
- Silicone-Heat resistant resin used mainly as a sealant but also used for high temperature cooking utensils and as a base resin for industrial paints.
- Polysulfone-High temperature melt processable resin used in

membranes, filtration media, water heater dip tubes and other high temperature applications.

5. Characteristics and Composition

Most plastics contain organic polymers. The vast majority of these polymers are based on chains of carbon atoms alone or with oxygen, sulfur, or nitrogen as well. The backbone is that part of the chain on the main "path" linking a large number of repeat units together. To customize the properties of a plastic, different molecular groups "hang" from the backbone. The structure of these "side chains" influence the properties of the polymer. This fine tuning of the repeating unit's molecular structure influences the properties of the polymer.

Most plastics contain other organic or inorganic compounds blended in. The amount of additives ranges from zero percentage (for example in polymers used to wrap foods) to more than 50% for certain electronic applications. The average content of additives is 20% by weight 0of the polymer.

Many of the controversies associated with plastics are associated with the additives. Organotin compounds are particularly toxic.

5.1 Fillers

Fillers improve performance and/or reduce production costs. Stabilizing additives include fire retardants to lower the flammability of the material. Many plastics contain fillers, relatively inert and inexpensive materials that make the product cheaper by weight. Typically fillers are mineral in origin, e.g., chalk. Some fillers are more chemically active and are called reinforcing agents. Other fillers include zinc oxide, wood flour, ivory dust, cellulose and starch.

5.2 Plasticizers

Since many organic polymers are too rigid for particular applications, they are blended with plasticizers (the largest group of additives), oily compounds that confer improved rheology.

5.3 Colorants

Colorants are common additives, although their weight contribution is small.

6. Thermoplastics and Thermosetting Polymers

There are two types of plastics: thermoplastics and thermosetting polymers. Thermoplastics are the plastics that do not undergo chemical

change in their composition when heated and can be molded again and again. Examples include polyethylene, polypropylene, polystyrene and polyvinyl chloride. Common thermoplastics range from 20,000 to 500,000 amu, while thermosets are assumed to have infinite molecular weight. These chains are made up of many repeating molecular units, known as *repeat units*, derived from *monomers*; each polymer chain will have several thousand repeating units.

Thermosets can melt and take shape once; after they have solidified, they stay solid. In the thermosetting process, a chemical reaction occurs that is irreversible. The vulcanization of rubber is a thermosetting process. Before heating with sulfur, the polyisoprene is a tacky, slightly runny material, but after vulcanization the product is rigid and non-tacky.

6.1 Other Classifications

Other classifications are based on qualities that are relevant for manufacturing or product design. Examples of such classes are the thermoplastic and thermoset, elastomer, structural, biodegradable, and electrically conductive. Plastics can also be classified by various physical properties, such as density, tensile strength, glass transition temperature, and resistance to various chemical products.

7. Pollutants from Plastic

Plastics Release Pollutants:

- Poly brominated di-phenyl ethers (PBDE)
- Nonylphenols
- Bisphenol A
- Phthalates

Plastics Absorb Hydrophobic Pollutants

- Polychlorinated biphenyls (PCBs)
- Dichloro Diphenyl Trichloro ethane (DDT)
- Dichloro Diphenyl Dichloro ethylene (DDE)
- PVC when burned result in emissions of the deadly poisons named *dioxin*.
- Dioxins are highly persistent compounds, with the potential to become increasingly concentrated in living tissues as they move up the food chain. *It is often considered to be the man-made compound most toxic to animals.*

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8. Impacts of Plastic Industry Wastes

8.1 Accumulation in Different Habitats

- Plastic wastes constitute 10% of municipal waste stream.
- Accumulation occurring natural terrestrial, freshwater, marine water and mountain peaks.
- Inadvertent soil contamination with small fragments as a consequence of spreading sewage sludge (Zubris & Richards 2005)
- 50-80% of shoreline debris (Barnes *et al*., 2009).
- Despite buoyant found in sea bed 1000 m deep @ 10,000 items ha^{-1}.
- Plastic is carried into streams, rivers and the sea with rain water and flood events (Thompson *et al.,* 2005).

8.2 Plastic Debris-Environment and Wild Life

- Aesthetic problems, hazard to maritime activities fishing and tourism.
- Ingestion and entanglement by wildlife.
- Transport of non-native and alien species.
- Enter of organic contaminants into food chain.
- Some accounts of effects of debris from terrestrial habitats, for example ingestion by the endangered California condor, *Gymnogyps californianus* (Mee *et al*., 2007)
- Phthalates and BPA affect reproduction in all studied animal groups and impair development in crustaceans and amphibians.

8.3 Plastics Impacts in Human Beings

- BPA-poses brain, behavior and prostate gland of fetuses, infants and children.
- Urine levels of BPA and cardiovascular disease, type 2 diabetes and abnormalities in liver enzymes are some disorders (Lang *et al*., 2008).

- The very high exposure of premature Infants in neonatal intensive-care units to both BPA and phthalates is of great concern (Calafat *et al*., 2009).
- Less has been published on effects of the flame retardant TBBPA, but there is evidence of effects on thyroid hormones, pituitary function and reproductive success (Talsness *et al*., 2009).

9. Methods of Plastic Waste Management

9.1 Recycling

- Recycling of plastics through environmentally sound manner-to protect environment from pollution and to conserve energy.
- Plastics recycling technologies four general types
- **Primary:** Waste/scrap into a product similar to those of original product.
- **Secondary:** Waste/scrap into materials that have characteristics different from those of original plastics
- **Tertiary:** Involves the production of basic chemicals and fuels from plastics waste/scrap.
- **Quaternary:** Recycling retrieves the energy content of waste/scrap plastics by burning/incineration. This process is not in use in India.

9.2 Plasma Pyrolysis Technology

- Feeder- plastic wastes are fed
- Primary chamber 8500 ^{o}C-wastes dissociate into CO, H, CH_4, other hydrocarbons
- Induced draft fan drains pyrolysis gases and plastic wastes-combusted in presence of air.
- Secondary chamber 10,500 ^{o}C-H_2O and CO_2 are formed.
- **Advantages:** No formation of Dioxins and furans.
- The CPCB has initiated the study in association with Facilitation Centre for Industrial Plasma Technologies (FCIPT), Institute of Plasma Research (IPR).
- Planning to install 15 Kg/h waste disposal capacity plants at hilly and pilgrimage in consultation with State Government.

9.3 Waste Plastic used in the Construction of Roads

- Films (Carry Bags, Cups) thickness up to 60micron (PE, PP and PS).
- Hard foams (PS) any thickness.
- Soft Foams (PE and PP) any thickness.
- Laminated Plastics thickness up to 60 micron (Aluminum coated also) packing materials used for biscuits, chocolates, etc.,
- Poly Vinyl Chloride (PVC) sheets or Flux sheets should not be used in any case.

Process of Laying Polymer Coated Bitumen Road

Step 1: Plastics waste (bags, cups, thermocol) made out of PE, PP and PS cut into a size between 2.36 mm and 4.75mm using shredding machine, (PVC waste should be eliminated).

Step 2: The aggregate mix is heated to 165 °C and transferred to mixing chamber.

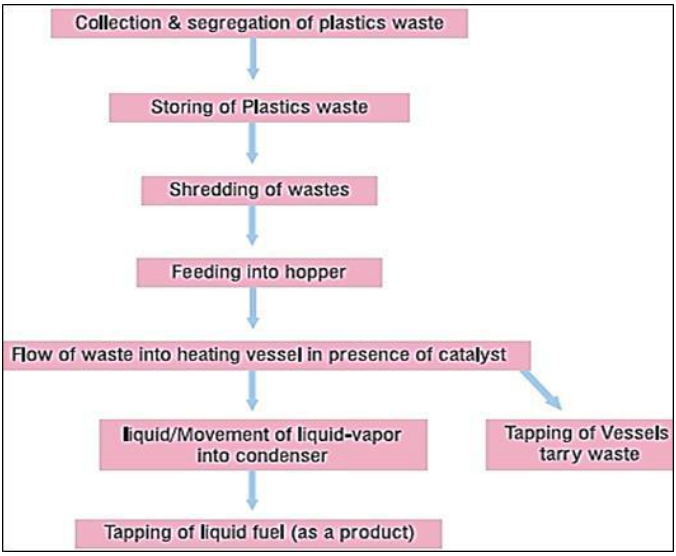
Similarly the bitumen is to be heated up to a maximum of 160 °C to have good binding and to prevent weak bonding.

Step 3: At the mixing chamber, the shredded plastics waste is to be added. It get coated uniformly over the aggregate within 30 to 60 seconds, giving an oily look.

Step 4: The plastics waste coated aggregate is mixed with hot bitumen and the resulted mix is used for road construction. The road laying temperature is between 110 °C to 120 °C. The roller used is 8 ton capacity.

9.4 Conversion of Plastics Waste into Liquid Fuel

- A research-cum-demonstration plant was set up at Nagpur, Maharashtra.
- Process random de-polymerization into liquid fuel in presence of a catalyst.
- The entire process in closed reactor vessel followed by condensation.
- Temperature 2700 °C to 3000 °C.



- In 1988, to assist recycling of disposable items, the Plastic Bottle Institute of the Society of the Plastics Industry devised a now-familiar scheme to mark plastic bottles by plastic type.
- A plastic container using this scheme is marked with a triangle of three "chasing arrows", which encloses a number giving the plastic type.

10. Biodegradable Plastics

- Bioplastics are a form of plastics derived from renewable biomass sources, such as vegetable fats and oils, corn starch or micro biota.
- Bioplastics which are designed to biodegrade can break down in either anaerobic or aerobic environments, depending on how they are manufactured.
- There is a variety of bioplastics being made; they can be composed of starches, cellulose, or other biopolymers.
- Applications-packaging materials, dining utensils, food packaging, and insulation.

11. Plastic Waste Management Rules, 2016 by Central Pollution Board (CPCB)

- Increase minimum thickness of plastic carry bags from 40 to 50 microns.

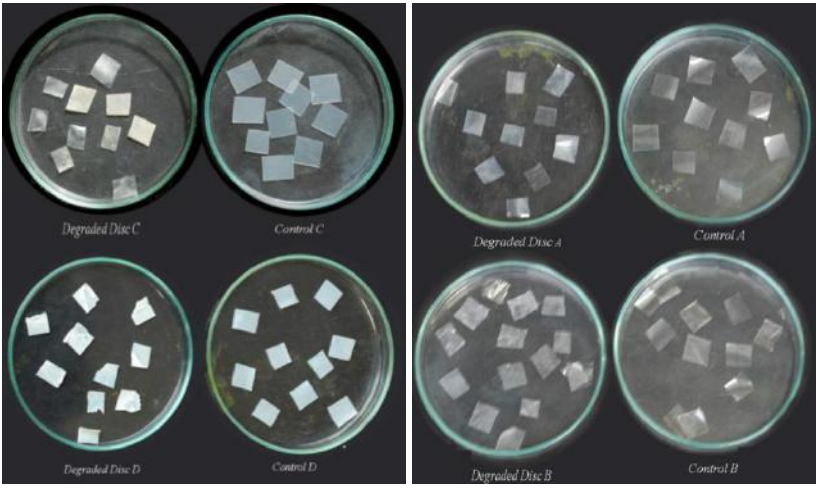
- Expand the jurisdiction of applicability from the municipal area to rural areas.
- Collect back system of plastic waste by the producers/brand owners.
- Collection of plastic waste management fee through pre-registration of the producers
- To promote use of plastic waste for road construction.
- Central Pollution Control Board (CPCB) mandated to formulate the guidelines for thermoset plastic (plastic difficult to recycle).

12. Case Study

Biodegradation of Plastics by Pseudomonas Putida Isolated from Garden Soil Samples

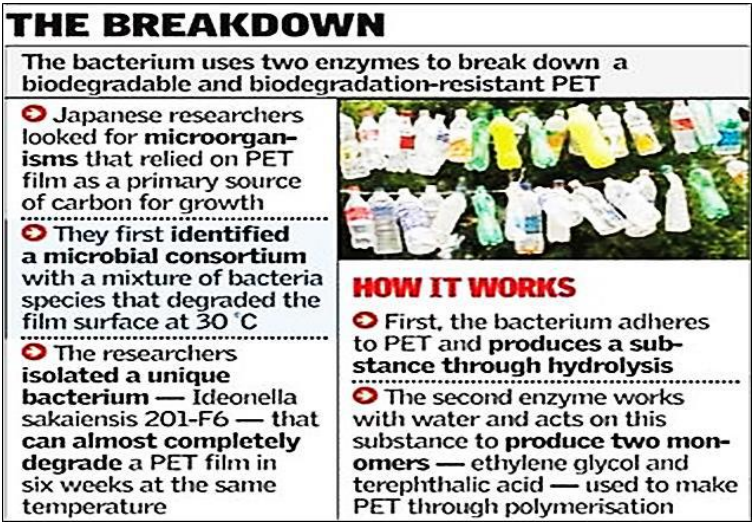
Saminathan, P., Sripriya, A., Nalini, K., Sivakumar, and Thangapandian, V.

An attempt was made to isolate *Pseudomonas putida* from garden soil samples and to characterize its degrading ability on plastic material. This work has revealed that the garden soil is a good source of microbes capable of degrading plastic materials. *P. putida* have the ability to convert the complex plastic material was determined in terms of weight loss of the material. It degrades the plastic material up to 75.3% within a month. The plastic samples tested were polythene bag, plastic bag, plastic cup and milk cover. Among the plastic samples, milk cover was found to be more degradative (75.3%) plastic material.



The plastic samples used in this present study were plastic cup (Sample A), polythene bag (B), plastic bag (C), milk cover (D).

Loss in tensile properties and weight loss are the most relevant practical criterions determined during the degradation of plastic. The surface of plastic materials has turned from smooth to rough with cracking. This may due to the compounds secreted extracellularly by the microbes that may break the complex molecular structure of plastics.



Conclusion

As with many environmental concerns, there is no simple solution to the issue of plastic and its subsequent disposal or recycling. The quantity of debris in the environment as a whole will continue to increase unless we all change our practices. Complete ban of plastic is not possible as there is no such an exact alternative. Discriminate usage of plastic objects to be as usage of jute bags and metal water bottles, which can also prevent health hazards. And saying no for plastic carry bags. Supporting only biodegradable and bioplastics. Helping in segregation, collection and recycling of plastics by separating plastic and other solid waste, may form some of the better solutions. Only by the better coordination between public, private and people could solve the problem of plastic wastes.

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Chapter - 8
Effect of Socio-Economic and Demographic Variables on Women Empowerment through Microfinance in Rural Assam

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Chapter - 8

Effect of Socio-Economic and Demographic Variables on Women Empowerment through Microfinance in Rural Assam

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Abstract

Rural finance is very much essential to fight against poverty and make people living in villages self-dependent and empowered. However socio-economic and demographic variations among human beings benefitting from microfinance have different impacts on empowerment levels. The chapter analyzes how socio-economic and demographic variables have an impact on women empowerment through microfinance in rural Assam. The four indicators taken to assess the overall empowerment of women members of self-help group's under Assam Gramin Vikas Bank are- economic empowerment, educational empowerment, social empowerment and political empowerment. It is found that there exists a significant difference between various socio economic and demographic groups with regards to economic, educational, social and political empowerment through Self Help Group.

Keywords: microfinance, self-help group, SHG bank linkage programme, economic empowerment, educational empowerment, social empowerment, political empowerment

Introduction

Financial assistance is very much essential to fight against poverty. People living in villages inherit skills and desire to be a part of the nation's workforce so that they can be self-dependent. But due to unavailability of finance they fail to come out of the pit-hole of poverty. Moneylender exploits their immediate monetary requirements against causalities with exorbitant interest against informal loan which eventually lead to loss of property and assets when they fail to repay. The need for finance of rural poor are small, but no formal financial institutions are ready to provide finances as they fail to provide any collateral against their loan. This financial bottleneck in developing countries has helped in making the

concept of microfinance successful and this concept got a blooming ground in India too. Two prominent microfinance programmes are working in favour of the poor in India viz. SHG Bank Linkage Programme (SBLP) and Micro- Finance Institution (MFI) Programme. Though MFI model gained immediate popularity in southern region of India due to high quality infrastructure and strong base of Non-Government Organisations (NGO), but MFI model had to face a strong blow with high default rate at the beginning of the century due to its unregulated operating style [1]. Whereas SBLP model gained good reputation over time, due to low interest rate against loan amount and transparency from the bank's side at the time of deposit and credit linking [2].

Microfinance help people to become economically empowered and economic empowerment leads to other forms of empowerment in the long run [3]. SHG obtaining microcredit have many positive impacts on various aspects like income, assets, occupation, savings and access to loans, bank connectivity, knowledge, self-worthiness and decision-making level of the participants that eventually empower rural poor [4]. Thamilpavai and Vasanthapriya [5] supported on group members obtaining both economic and social empowerment post joining SHG. Along with economic and social empowerment, microfinance has helped its beneficiaries to get empowered in other fronts too, such as educational as well as political. But most studies in Indian context have connected microfinance to one or two forms of empowerment [6]. Moreover as far as researchers knowledge goes no such study has been conducted in Assam to analyse the impact of various demographic and socio-economic variables on the empowerment variables. Hence with the help of the current study an attempt is being made to analyse the impact of various demographic and socio-economic variables on the empowerment.

Among the three banking agencies that have been promoting SBLP in India, Regional Rural Banks's (RRB's) performance in Assam is better than the other two agencies. Assam Gramin Vikas Bank (AGVB) has been considered for this study as among two RRB's operating in Assam, AGVB has covered 30 districts baring only 3 hill districts of Assam.

The chapter has been divided into five sections. The second section discusses the related literature. Third section deals with the methodology used for the study. Results and discussion have been presented in the fourth section and finally, the fifth section concludes the chapter with recommendation drawn during the course of study.

Related Literature

Microfinance has a major role in empowering rural poor and low-income group. Most Indian studies have connected microfinance to one or two forms of empowerment. Aruna and Jyothirmayi [4] attempted to explore the role of microfinance as a financial intermediary in Hyderabad for enhancing women empowerment considering only the economic aspect. The study shows availability of microfinance loan and its productive utilization had an intense role and impact on women. On a similar note, Mahendra and Naidu [6] tried to construct the Women Empowerment Index (WEI) in terms of only economic empowerment to determine the level empowerment of women SHG among three districts of Andhra Pradesh. It was found that male members have significantly higher economic empowerment as compared to females. On the other hand Sivachithappa [7] focuses on the role of microfinance and its impact on socio-economic development of beneficiaries from SHG in Mandya district. It was found that Women Empowerment Programmes (WEP) made an outstanding impact on the women beneficiaries of Mandya District to undertake economic activities. Lakshmi and Vadivalagan [8] also found out that SHGs had a greater impact on both economic and social aspects of the women beneficiaries in Dharmapuri district of Tamil Nadu. On a similar note Thamilpavai and Vasanthapriya [5] also advocated about group members obtaining both economic and social empowerment post joining SHG in the same district of Tamil Nadu. Contradictorily, Mudaliar and Mathur [9] found that microfinance has not always empowered all women but some women do experience some degree of empowerment as a result of microfinance. A significant number of rural women of Assam have become empowered after getting microfinance services from formal and semi-formal financial institutions. Gogoi and Sharma [10] assessed the performance of SHG in terms of employment generation and poverty alleviation and found that employment opportunities have increased due to SHG formation also the performance of all women SHG is better than all men SHG in almost all programmes. On a similar note, Das and Boruah [11] studied the role of microfinance and SHG for the socio-economic development of poor people in Lakhimpur and Dhemaji districts of Assam. They found that after joining SHGs the poor people, particularly women have increased their income and also improved their standard of living through various income-generating activities. Borah [12] evaluated the performance of selected women SHGs in Barhampur Development Block of Nagaon district. It was found that rural credit helps members of women SHGs to start a new business. Microfinance through SHGs helped the women members of Rani Block of Kamrup district

to improve the economic conditions of the women and has also brought mental satisfaction to their family members [13]. Sarania [14] also revealed that majority of the respondent's income, employment days and amount of savings increased after joining the SHGs in Baksa district of Assam. However, Barman and Bhattacharjya [15] observed that even after the increase in income, self-confidence and mobility, still women have social restrictions and they require permission to go outside villages.

Methodology

Study Area: The study area for the present chapter covers lower Brahmaputra Valley of Assam as it has highest number of SHG's linked under AGVB among the six agro climatic regions of Assam. The samples for the study are collected from villages of five districts namely Barpeta, Baksa, Nalbari, Kamrup (R) and Kamrup (M) of the Lower Brahmaputra Valley of Assam. These five districts among all the eight districts of this zone comprise 85% of SHG Linked under SBLP by AGVB.

Data Source and Time Frame: The study is based on primary data. A structured questionnaire is used for collecting responses and for drawing conclusions for the study. A total of 340 samples are collected from 340 households under 170 SHG. The year selected for the data collection is 2017 and more than 5 years old SHG's were considered for the study.

Methods

To measure whether the empowerment variables differ significantly with various demographic and socio-economic variables Bivariate analysis viz. Independent sample t-test and ANOVA has been used to analyze the effect of socio-economic and demographic variables on the empowerment factors. The socio-economic and demographic variables used for the study are Age, Religion, Caste, Marital Status, Educational Qualification, Occupation, Family Income and Family Expenditure. The empowerment is analysed in four dimensions, namely Economic Empowerment, Educational Empowerment, Social Empowerment and Political Empowerment. 10 sub-factors are obtained from the exploratory factor analysis. Demographic and socio-economic variables are considered as independent variables and factors obtained from the factor analysis are considered as a dependent variable.

Before using the bivariate analysis, Levene's Test of Homogeneity of Variances has been checked which is used for testing that the variances are significantly not different for the empowerment variables with regards to the different demographic and socioeconomic variables used in the study. If

Levene's test is significant (i.e. the value of *Sig.* is less than .05) then it can be concluded that the variances are significantly different. This would mean that one of the assumptions of ANOVA has been violated which needs rectification. Of all the available methods the present study uses Welch's *F* as a measure of rectification. To check further and analyze which groups differ, the present study uses Games- Howell procedure as a post-hoc analysis.

Results and Discussions

Empowerment can be of various types depending on the needs of the society. For the present study, the basic indicators of empowerment namely economic empowerment, educational empowerment, social empowerment and political empowerment are analysed. The factor analysis for the indicators of empowerment resulted in 10 sub-components for the empowerment indicator viz. Thrift and Credit, Non-financial Assets and Access to Financial Security under Economic Empowerment, Banking Education and Literacy Skill under Educational Empowerment, Active Participation in Household Decision, Gender Equality, Market Participation under Social Empowerment and Women's Right and Power, Participation in Politics under Political Empowerment. An analysis of these four dimensions of empowerment can give a picture of the status of women empowerment in rural India particularly in the context of the lower Brahmaputra Valley of Assam. As such the results for the same are presented in the sections that follow.

Results of Independent Sample t-Test for Age Group, Family Income and Family Expenditure

To check whether the empowerment variables differ significantly with age, family income and family expenditure, the following hypothesis are tested

H_{01}: Empowerment through SHG does not differ significantly with respect to age.

H_{02}: Empowerment through SHG does not differ significantly with respect to monthly income.

H_{03}: Empowerment through SHG does not differ significantly with respect to monthly expenditure.

For the age group, the mean age was calculated for a sample size of 340 and was found to be 34.17 years. Therefore age above the mean age is considered to be one group and that below the mean age is considered as the second group for comparison.

For income group, the mean income is calculated for a sample size of 340 and it is found that the mean income is *8332 INR per month.* Therefore income above the mean income is considered to be one group and that below the mean income is considered as the second group for comparison.

For monthly expenditure, the mean expenditure was calculated for a sample size of 340 and it is found that the mean expenditure is *4810 INR per month.* Therefore expenditure above the mean expenditure is considered to be one group and that below the mean expenditure is considered as the second group for comparison.

Levene's test for homogeneity of variance is checked and it is found that the calculated value is greater than .05 for the empowerment variables with respect to age group, income group and expenditure group. So it can be concluded that the variances are similar.

Table 1: Results for Independent Sample t-Test Analysis

Empowerment Variables	T Value for Age	T Value for Family Income	T Value for Family Expenditure
Economic Empowerment	1.284	-11.494**	-3.826**
Educational Empowerment	2.569**	-6.688**	-4.726**
Social Empowerment	1.202	-8.734**	-3.697**
Political Empowerment	1.048	-5.174**	-3.904**

Source: Calculated by the authors from Primary data

**Significant at the 0.05 level

Note: Values lying below the mean value is considered as 1st group and the values lying above the mean value is considered as second group for drawing inferences.

Mean Values: Age-34.17 Years

Monthly Income-8332 INR

Monthly Expenditure- 4810 INR (Poverty Estimate, 2011-12)

The Figure has been inflated to 2016 Rate with the help of Inflation Rate

The results of t-test show that there is a significant difference between the two age groups i.e. below 34.17 and above 34.17 years with regards to educational empowerment (.015<.05). This may be because women above the mean age group have lost their habit of reading and writing over time. As such their capacity for learning any new concept is a little difficult than those who have finished their education recently. The other reason may be that the elderly respondents are less educated than the younger generation.

The results t-test for income, shows that there is a significant difference between the two income groups with regards to economic empowerment (.000 <.01), educational empowerment (.000<.01), social empowerment (.000<.01), political empowerment (.000<.01). Based on observations it was found that respondents who attained a higher level of income post joining SHG eventually obtained a higher level of economic empowerment which led to other forms of empowerment.

The results of t-test for monthly expenditure, shows that there is a significant difference between the two expenditure groups with regards to economic empowerment (.000 <.01), educational empowerment (.000<.01), social empowerment (.000<.01), political empowerment (.000<.01). Spending money on productive ventures and education will lead to economic and educational empowerment respectively. Social and political empowerments are also directly related to a higher level of expenditure. That makes significant differences in two expenditure groups with respect to empowerment.

Results of ANOVA for Religion, Caste, Marital Status, Education and Occupation

To check whether the empowerment variables identified through factor analysis differ significantly with religion, caste, marital status, educational qualification and occupation. The following hypotheses are tested.

H_{04}: Empowerment through SHG does not differ significantly with respect to religion.

H_{05}: Empowerment through SHG does not differ significantly with respect to Caste.

H_{06}: Empowerment through SHG does not differ significantly with respect to marital status.

H_{07}: Empowerment through SHG does not differ significantly with respect to educational qualification.

H_{08}: Empowerment through SHG does not differ significantly with respect to occupation.

Table 2 represents the result of ANOVA for religion, caste, marital status, educational qualification, occupation and empowerment variables. The Levene's test for religion and caste was performed and it is found that for religious groups, except for economic empowerment, for all the other empowerment variables the test is significant (i.e. the value of *Sig.* is less than .05). Therefore, it can be concluded that variance of the educational,

social and political empowerment variables are not the same and therefore ANOVA cannot be used to check if empowerment differs significantly with respect to religion. As such the results of Welch F are presented for these three empowerment variables while the result of ANOVA is present for economic empowerment. On the other hand, for different caste groups it was found that for all the empowerment variables except social empowerment, the test was significant (i.e. the value of *Sig.* is less than .05). Therefore ANOVA cannot be used to check if empowerment differs significantly with respect to caste. As such the results of ANOVA for social empowerment and that of Welch F for the other three forms of empowerment are presented.

The Levene's test is performed for marital status, educational qualification and occupational groups as well and it is found that for all the empowerment variables the test is significant (i.e. the value of *Sig.* is less than .05). Therefore, it can be concluded that the variance of the empowerment variables are not the same and therefore ANOVA cannot be used to check if empowerment differs significantly with respect to caste. As such the results of Welch F are presented.

Table 2: Results for ANOVA and Welch's F

Empowerment Variables	Religion		Caste	Marital status		Educational Qualification	Occupation
	ANOVA	Welch's F	Welch's F	ANOVA	Welch's F	Welch's F	Welch's F
Economic Empowerment	35.966**		10.209**		16.748**	55.867**	4.125**
Educational Empowerment		50.643**	.532		13.963**	50.621**	2.522**
Social Empowerment		5.826**	9.353**	8.005**		22.064**	1.098**
Political Empowerment		737.327**	17.361**		12.881**	16.831**	4.391**

**indicates 0.05 level of significance

Source: Calculated by the authors from Primary Data

In table 2 in the columns representing ANOVA and Welch-F for religion against all empowerment variables, the significance value is less than .05, which means that there exist significant differences between various religions with regards to empowerment through SHG. So, to check which groups differ significantly, Games- Howell procedure as a post hoc test was used for analysis. For all the forms of empowerment there exists a difference between the people belonging to Hindu religion with that belonging to Muslim and Christian. The difference also exists between the Muslims and Christians. These mean differences are significant at a 0.05

level of significance. This may be due to the fact that only 2% respondents in sample household belong to the Christian community who works as a daily labourer in tea gardens. That resulted in less contribution of that group in overall empowerment scenario which further leads to significant differences between the groups. Among Hindu and Muslim community, significant differences are observed in all forms of empowerment which may be due to the differences in their religious beliefs with regards to types of occupation, participation in family decision making, going outside for marketing of their produce and participation in politics.

In table 2 in the column representing Welch-F for caste it is seen that for all the empowerment variables the significance value is less than .05, which means that there exist significant differences between various castes with regards to empowerment through SHG. So, to check which groups differ significantly, Games- Howell procedure as a post hoc test was used for analysis. For economic empowerment there exists a difference between the people belonging Schedule Tribes (ST) and the General Category and the OBC/MOBC and the General category. This is due to the fact that General Category people are better off than ST and OBC/MOBC people in the study area even before joining SHG on the basis of family income and occupation. Again for the social empowerment there exists a significant difference between the ST and the OBC/MOBC and also with the General Category. ST respondents are even actively participating in family decision making pre-joining SHG. Also, no single incident of domestic violence against General Category people has been reported. All these made significant difference between the caste categories in terms of social empowerment. Finally, for political empowerment, there exists a difference between the ST and the General Category. All the mean difference is significant at a 0.05 level of significance. From field survey, it is evident that there are very few incidences of women participation in the political arena. But those few people who have the lowest rate of participation are ST women. That may have resulted in differences in political empowerment between the two groups. However, the post hoc analysis showed indeterminate results regarding which caste actually differ with respect to educational empowerment.

In table 2 in the columns representing ANOVA and Welch- F for marital status, it is seen that for all the empowerment variables the significance value is less than .05, which means that there exist significant differences between various marital statuses with regards to empowerment through SHG. So, to check which groups differ significantly, Games- Howell procedure as a post hoc test is used for analysis. It is seen that for economic

empowerment there exists a difference between those who are married and those not married. For educational empowerment there exists a difference between those who are married and those not married and also those who are not married and the widow. Again for the social empowerment there exists a significant difference between those who are married and the widow and the unmarried and the widow. Finally for political empowerment there exists a difference between those who are married and those not married and the unmarried and the widow. All the mean difference is significant at a 0.05 level of significance.

That may be because married women are more dependent on their spouses in all aspects of life than those who are unmarried and widow. Another reason is, only 18% of women respondents are married, the rest are either unmarried or widow. That resulted in less contribution of the married group in overall empowerment scenario also resulted in significant differences between the groups.

In table 2 in the column representing Welch- F result for educational qualifications, it is seen that for all the empowerment variables the significance value is less than .05, which means that there exist significant differences between various educational qualifications with regards to empowerment through SHG. So, to check which groups differ significantly, Games- Howell procedure as a post hoc test was used for analysis. It is seen that for economic empowerment there exists a difference between the illiterates with HSLC, HS and Degree and above. Again a difference is observed between those with primary education with HSLC, HS and Degree and above. Further, the difference is observed with those passing HSLC with those Passing HS and Degree and above. For educational empowerment there exists a difference between the illiterates with those with HS and Degree and above. Again a difference is observed between those with primary education and those with HSLC, HS and Degree and above. Further, the difference is observed with those passing HSLC with those Passing HS and Degree and above. And last, there also exists a difference between those passing HS with those having Degree and above category.

Again for the social empowerment there exists a significant difference between the illiterates with those with HSLC, HS and Degree and above.

Finally, for political empowerment, there exists a difference between the illiterates with those with HSLC, HS and Degree and above. Again a difference is observed between those with primary education and those with HSLC, HS and Degree and above.

This may be because of the fact that different level of educational attainment comes with a different level of income-generating opportunities, educational empowerment, involvement with decision-making process and political participation. Moreover, there are only 2% sample respondents who are uneducated and 3% population with a degree and above. So their contribution in the overall empowerment scenario is minuscule.

In table 2 in the column representing Welch- F test for occupation, it is seen that for all the empowerment variables the significance value is less than .05, which means that there exist significant differences between various occupations with regards to empowerment through SHG. So, to check which groups differ significantly, Games- Howell procedure as a post hoc test was used for analysis. It is seen that for economic empowerment there exists a difference between Unemployed with all the forms of occupation. The difference also exists between those Engaged under government scheme with all the forms of occupation. For the Self Employed except for service plus livestock and poultry farming there exist a difference between all the other forms of occupation. There also exists a significant difference between Agricultural Farmer with all the forms of occupation. The difference is also observed between those Employed in unorganized sector with all the forms of occupation.

For educational empowerment, there exists a difference between Unemployed with all the forms of occupation. The difference also exists between those Engaged under government scheme with petty business owner and service plus livestock and poultry farming. For the Self Employed there exist a difference between agricultural farmer, employed in the unorganized sector and daily labourer. There also exists a significant difference between Agricultural Farmer with all the forms of occupation except people engaged under government schemes. The difference is also observed between those Employed in unorganised sector with service plus livestock and poultry farming and daily labourers. Finally, difference is observed between those engaged in service plus livestock and poultry farming with the Daily labourer.

Again for the social empowerment there exists a significant difference between Unemployed with the Agricultural farmer, employed in the unorganized sector and daily labourer. The difference also exists between those Engaged under government scheme with the agricultural farmer, employed in the unorganized sector and daily labourer. For the petty business owner there exist difference between all forms of occupation except unemployment and engaged under a government scheme. There also exists a

significant difference between Agricultural Farmer with all the forms of occupation. The difference is also observed between those Employed in unorganized sector with all the forms of occupation. Finally, difference is observed between those engaged in service plus livestock and poultry farming with all the forms of occupation except unemployed and those engaged under government scheme and self-employed.

Finally for political empowerment there exists a difference between Unemployed with all the forms of occupation except agricultural farmer and those engaged in the unorganised sector. The difference also exists between those engaged under government scheme with Unemployed with all the forms of occupation. For the Self Employed there exists a difference between unemployed, agricultural farmer and those who are employed in the unorganised sector. There also exists a significant difference between Agricultural Farmer with all the forms of occupation except unemployed. The difference is also observed between those employed in unorganised sector with all the forms of occupation except the unemployed. All the mean differences are significant at a 0.05 level of significance.

Based on observations it has been found that respondents with diverse types of occupation will have differences in attaining empowerment. Respondents engaged in various types of work will utilise their loan amount differently which will bring different amounts of return/profit. Moreover dissimilar types of occupation require different educational knowledge. For example, those who got engaged in petty business post joining SHG will need to have a fair knowledge of money calculation, bank transaction etc. than those who are an unemployed or daily labourer. This results in a significant difference in attaining educational empowerment. Moreover, Daily labourer and those who work in agricultural fields or government schemes need to go out of their house for a living whereas respondents who own livestock and poultry and those who are unemployed basically stays at home. Similarly to some extent participation in political arena get influenced by types of occupation.

Conclusion and Recommendation

The results t-test shows that there is a significant difference between the two age groups, with regards to educational empowerment. The results t-test further shows that there is a significant difference between the two income and expenditure groups with regards to economic empowerment, educational empowerment, social empowerment and political empowerment. Further the result of ANOVA and Welch F shows there exist significant differences

between religious groups, marital status, educational qualification and occupation with regards to various forms of empowerment through SHG. The result of Welch F shows there exist significant differences between various castes with regards to economic, social and political empowerment through SHG. However the differences can be reduced when people from all socio-economic and demographic background will obtain higher level of empowerment in the long run.

SHG's from a particular area come together to form a federation. SHG federations should encourage women to actively participate in social and political activities. They should encourage the group members to participate in family decision making and also encourage them to have a say in village level political groups with their active participation. This will ensure that they obtain educational, social and political empowerment along with economic empowerment of SHG members.

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Chapter - 9
सौन्दर्यलहर्यां तान्त्रिकतत्वानां समालोचना

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Chapter - 9

सौन्दर्यलहर्यां तान्त्रिकतत्वानां समालोचना

सन्ध्या. के. सि

आमुखम्

वैदिकपारम्पर्यस्य इव आगमिकपारम्पर्यस्यापि भारतीयसंस्कृतौ महत् प्राधान्यमस्ति। तत्रापि शक्तितन्त्रस्य इतरापेक्षया प्राधान्यं अस्ति इति सुविदितमेव। इयं च तन्त्रविद्या मुख्यतया कौळमतं समयमतं चेति द्विधा भवति। तत्र कौळमते बाह्यपूजारतेः प्राधान्यं, समयमते आन्तरपूजारतेः प्राधान्यं इति सामान्येन वक्तुं शक्यते। शङ्कराचार्यविरचितं शतश्लोकात्मकं सौन्दर्यलहरीस्तोत्रं समयागमरहस्यगर्भितं भवति। तेषु श्लोकेषु प्रतिपादितानां शक्तितन्त्रतत्वानां निर्धारणं प्रबन्धस्यास्य विषयः।

श्रीशङ्करस्य कालः देशश्च

परशुरामक्षेत्र इति नाम्ना प्रसिद्धोयं केरलदेशः अनेकेषां महापुरुषाणां जन्मना सुतरां अनुगृहीतः वर्तते। तेषां मध्ये सर्वथा प्रथमगणनीयः भवति अद्वैतवेदान्तस्य प्रतिष्ठापकः श्रीशङ्कराचार्यः। दिगन्तविश्रान्तकीर्तिः अयं क्रिस्तोः परं अष्टमशतकस्योत्तरार्धे (788-820) केरलेषु कालटिग्रामे लब्धजन्माभूत् इति ऐतिह्यानुसारं मतं। कृतोपनयनसंस्कारः सः मातुराज्ञया बाल्ये एव सन्यासं स्वीचकार । ततः गोविन्दाचार्यात् अधिगतसर्वशास्त्रार्थः सः प्रस्थानत्रयभाष्यं विरच्य औपनिषदं अद्वैतसिद्धान्तं प्रतिष्ठापयामास ।

एतत् विषये अस्ति श्लोकोयं-

“अष्टवर्षे चतुर्वेदान्द्वादशे सर्वशास्त्रकृत् ।

षोटशे कृतवान् भाष्यं द्वात्रिंशे मुनिरभ्यगात्” ।। [1]

[1] श्रीशङ्कराचार्यर्- chapter- 4-p.33

पुनः आसेतुहिमाचलं भारते पर्यटन् सकलान् पण्डितान् वादे विजित्य काश्मीरेषु सर्वज्ञपीठमारुरोह। त्रयस्त्रिंशे वयसि त्रिशिवपुरे विष्णुक्षेत्रस्य पुरतः विष्णुपादीदिकेशस्तवेन भगवन्तं आराधयन् अयं महात्मा ब्रह्मभूयं गत इति ऐतिह्यम्।

बहवः कवयः पण्डिताश्च तस्य समकालीनाः आसन् इति कथाः तत्र तत्र परामृष्टाः दृश्यन्ते। दक्षिणकेरलेषु कुन्नत्तूर् देशे कोटुमण् ग्रामे लब्धजनिः शक्तिभद्रः शङ्कर भगवद्पादानां समकालिकः आसीदिति विश्वासः वर्तते। अयं च कविः आश्चर्यचूडामणिर्नामकं अद्भुतरसप्रधानंउत्तम् नाटकं विरचयामास। कविरयं भगवद्पादानां पुरतःनाटकमिदं अश्रावयत्, मौनव्रतनिष्ठः आचार्यः न किमप्यभाणीत्,तेन नाटकमिदमवद्यं मन्वानः शक्तिभद्रः तदग्निसाद्करोत्। अन्ते च भगवदैव स्वस्मरणात् आकलितमिदं नाटकं, कविश्च भगवताचार्येण 'भुवनभूतिः [2] इति नाम्ना पुरस्कृत इति श्रूयते।बहुषु शङ्करविजयकाव्येषु प्रतिपाद्यमानेषु एतादृशैतिह्येभ्यः परं आचार्यस्य कालविषये सुदृढं प्रमाणं किञ्चित् नास्ति।

आचार्येण विरचिताः ग्रन्थाः

शताधिकानि ग्रन्थरत्नानि भगवद्पादैःआरचितानि अद्य समुपलभ्यन्ते। प्रौढगम्भीराः शास्त्रग्रन्थाः सरलमनोहराः स्तोत्रग्रन्थाः च अस्मिन् समुच्चये सन्ति। यद्यपि एतेषां कर्तृत्वं पारम्पर्यमतानुसारं आचार्यपादेषु निक्षिप्तं तथापि विषयेस्मिन् पण्डितानां विवादः वर्तन्ते।

शास्त्रग्रन्थाः

आचार्यविरचिताः शास्त्रकृतयः, भाष्यग्रन्थाः, प्रकरणग्रन्थाः इति द्विधा विभक्तुं शक्यन्ते। प्रस्थानत्रयं इति नाम्ना प्रसिद्धस्य ब्रह्मसूत्रस्य, भगवद्गीतायाः तथा दश उपनिषदां च भाष्याणि प्रथमविभागे परं प्रथितीनि भवन्ति। एते उत्तरमीमांसा दर्शनस्य आधिकारिकग्रन्थाः एव। तत्र बादरायणविरचितस्य ब्रह्मसूत्रस्य भाष्यं भवति ब्रह्मसूत्रभाष्यं। अस्य

[2] Ibid – chapter- 3-p.19

शारीरिकमीमांसाभाष्यंइति अपरा अभिधा अपि अस्ति। अद्वैतवेदान्ततत्वानुसारं भगवद्गीतायाःव्याख्यानमपि आचार्येण कृतम्। बृहदारण्यकोपनिषद्, छान्दोक्योपनिषद्, ईशोपनिषद्, केनोपनिषद्, कठोपनिषद्, माणडूक्योपनिषद्, मुण्डकोपनिषद्, प्रश्नोपनिषद्, तैत्तिरीयोपनिषद्, ऐतरेयोपनिषद् इत्येते उपनिषदः अपि आचार्येण व्याख्याताः। एतेषां त्रयाणामपि भाष्यग्रन्थानां शङ्करकर्तृत्वं प्रायेण सर्वैः निर्विवादतयाअङ्गीकृतम्। विष्णुसहस्रनामस्तोत्रम्, नृसिंहतापनीयोपनिषद्, श्वेताश्वरोपनिषद्, सुनत्सुजातीयम् इत्येतेषां ग्रन्थानामपि भाष्याणि आचार्येण रचितानि इति केचन अभिप्रयन्ति। [3]

प्रकरणग्रन्थाः

वेदान्ततत्वनिरूपणपराः अन्ये बहवः प्रकरणग्रन्थाःअपि आचार्येण रचिताः। तत्र उपदेशसाहस्री, विवेकचूडामणि, दशश्लोकी इत्येते ग्रन्थाः आचार्यविरचिताः इति प्रायेण कल्पयन्ति। तत्र उपदेशसाहस्रीवर्जानां ग्रन्थानां कर्तृत्वे अपि विवादाः वर्तन्ते।

स्तोत्रग्रन्थाः

भक्तिप्रस्थाने लब्धप्रचाराः द्विषष्टिसंख्यकाः स्तोत्रग्रन्थाः शङ्कराचार्यैः विरचिताः इति विश्वासः वर्तन्ते। प्रौढगम्भीराः सौन्दर्यलहरीप्रभृतयः इव सरलमधुराः विष्णुभुजङ्गं, सुब्रह्मण्यभुजङ्गं इत्येवमादयोपि आचार्यस्य प्रतिभादः निर्गलितीः इति यत् तत् परं विस्मयस्थानमेव। अधिकारिभेदं मनसि धृत्वा एव केषाञ्चन रचनायां प्रौढा शैली अन्येषां सरला शैली च स्वीकृता इति वक्तुं शक्यते।

भारतस्य दार्शनिकमण्डले तथा सांस्कृतिकमण्डले च भगवत्पादस्य योगदानम् अतिमहत् भवति। दिग्विजयं तथा अद्वैतमतस्थापनं च दार्शनिकमण्डले तथा बौद्धिकमण्डले च अत्यन्तं श्रद्धेयः भवति। स्वमतस्थापनार्थं तत्काले प्रचलितानां बौद्धसांख्यादिदर्शनतत्वानां प्रौढया रीत्या

[3] Ibid – chapter-15-p.109

युक्तियुक्तं खण्डनं भगवत्पादैः कृतं। एतच्च दार्शनिकतत्वचिन्तामण्डलस्य अतिमात्रं पोषणाय उपकारकं अभवत्। एवमेव अद्वैतमतप्रचरणार्थं भारतस्य चतुर्षु दिक्षु एकैकं मठं स्थापयामास। उत्तरे बदर्यां, पूर्वे पुरीनगरे, दक्षिणे श्रृङ्गेर्यां पश्चिमे द्वारकायां च। एतानि च मठानि अद्यापि अद्वैतवेदान्तस्य विचिन्तने प्रचारणे च बद्धश्रद्धानि भवन्ति। एतच्च भारतीयसांस्कृतिकमण्डले तथा बौद्धिकमण्डले च आचार्यपादस्य योगदानस्य फलमेव।

अद्वैतमतस्थापनमिव षण्मतस्थापनमपि भारतीयसांस्कृतिकमण्डले आचार्यपादस्य महत् योगदानं भवति।तस्य काले विविधाः आराधनासम्प्रदायाः प्रचलिताः आसन् [4]। तत्र शैवं वैष्णवं कौमारं गाणपत्यं सौरं शाक्तेयं इत्येते षट् प्रधानाः। तत्तदाराधनासम्प्रदायं अनुवर्तमानाः जनाश्च परस्परं स्पर्धां अकुर्वन् च। एतादृशे कालिकसन्दर्भे आचार्येण विविधानां षण्णां पूर्वोक्तानां आराधनाक्रमाणां समन्वयः सम्पादितं। अत एव षण्मतस्थापनं सांस्कृतिकमण्डले महान् आरम्भः इति वक्तुं शक्यते।

त्रयस्त्रिंशत् वर्षपरिमितेनैव जीवनकालेन एक्न आयुष्कालेन यद्यत् सम्पादयितुं शक्यं तत्सर्वं आचार्यपादैः अनुष्ठितमिति यदि उच्यते तन्न अतिशयोक्तिः। बौद्धिकरङ्गे तथा सांस्कृतिकदार्शनिकरङ्गे आचार्येण द्वादशसतकेभ्यः पूर्वं यद्यत् सम्पादितं तेषां अद्यापि प्रसक्तिः वर्तते एव।

तन्त्रदर्शनस्य विकासः

तन्त्रं वेदश्च भारतीयसंस्कृतेःमुख्यौ द्वौ आराधनाक्रमौ भवतः। तन्त्रं आगम इति नाम्ना वेदस्तु निगम इति नाम्ना च प्रसिद्धौ भवतः। तन्त्रविद्या परम्परासिद्धा वेदस्तु ऋषिप्रोक्तः इति अत्र आशयः। प्रायेण सर्वेषां दर्शनानां आदिमस्रोतः वेदः इति वक्तुं शक्यते। सांख्ययोगादिदर्शनानां वेदप्रभवत्वं यथा अङ्गीक्रियते तद्वत् तन्त्रदर्शनस्यापि वेदमूलकत्वं केचित् अङ्गीकुर्वन्ति। वेदसंहितासु प्रतिपाद्यमाना शक्तिपूजा तन्त्रविद्यायाः बीजभूता कल्पना इति तेषां अभिप्रायः। वस्तुतस्तु वेदकालात् पूर्वमपि अत्र प्रचारं लब्धः अतिप्राचीनः आराधनासम्प्रदायः अनुष्ठानक्रमश्च भवति तन्त्रविद्या इति

[4] Ancient Indian Social History Some Interpretations, Romila Thapar, Orient Longman-1996.P.160

आधुनिकगवेषकानां चरित्रकाराणां च मतम्।

ब्रह्मसाक्षात्कारः अथवा मोक्षप्राप्तिः ज्ञानद्वारा एव भवति इति वैदिकमार्गस्य तथा आस्तिकदर्शनानां च सिद्धान्तः। किन्तु तत्भिन्नया कर्मपद्धत्या अपि मोक्षप्राप्तिः साद्ध्या इति वैदिकेतरसिद्धान्तः तन्त्रविद्याः मूलभूतः आशयः भवति। भोगतिरस्कारं विना एव विविधाभिः साधनाभिः तथा बहुभिः अनुष्ठानक्रमैःच मुक्तिः साध्या इति तान्त्रिकाः कल्पयन्ति [5]।

तन्त्रदर्शनम् अथर्ववेदश्च

शान्तिकमरणादिक्रियाप्रतिपादकः भवति अथर्ववेदः। तादृशस्य अथर्ववेदस्य योगाभ्यासमन्त्रध्यानजपादि अनुष्ठानप्रधानस्य तान्त्रिकविद्यायाश्च परं सादृश्यमस्ति इत्यतः अस्य अथर्ववेदप्रभवत्वं पण्डितैः अङ्गीकुर्वन्ति। शत्रुनिग्रहादिकं उद्दिश्य मान्त्रिकलोहखण्डं-यन्त्रं-सूत्रे बद्ध्वा धारणं अथर्ववेदकाले प्रचलितमासीदिति तत्र तत्र सूचना वर्तते। एतादृश तान्त्रिकचक्राणां पूजनं धारणं च तन्त्रविद्यायांमअपि प्रधानं भवति। इयं च विद्या वेदस्य कर्मकाण्डं आश्रित्यैव विकासं प्राप इति 'वुड्रोफ्' महोदयस्य अभिप्रायः [6]।

आराध्यदेवता, आराधनासम्प्रदायः, अनुष्ठानक्रमः इत्येतान् आश्रित्य तन्त्रदर्शनस्य विभिन्नाः पद्धतयः सन्ति। शैवतन्त्रं, शाक्तेयतन्त्रम्, वैष्णवतन्त्रम्, गणपतितन्त्रम् इति बहुविधतन्त्रमार्गाः एवं विकासं प्राप्ताः।

प्रधानभूतानि तत्वानि

मोक्षविषये अथवा सायूज्यविषये तान्त्रिकानां आशयः आस्तिकदर्शनेभ्यः परं भिन्नः भवति। किन्तु लोकायतदर्शनसमाना परिदृश्यते। ब्रह्माण्डस्य मानवशरीरस्य च समष्टिव्यष्टिरूपतया सम्बन्धः तैः सिद्धान्ततः। इयमेव तन्त्रविद्यायाः प्राथमिका कल्पना। क्रमीकृतैः अनुष्ठानैः व्यष्टिरूपे शरीरे अन्तर्गतस्य शक्तिविशेषस्य समष्टिरूपब्रह्माण्डगतशक्तिविशेषतुलनासम्पादनं अत्र परमो लक्ष्यः। स एव सायूज्यः अथवा मोक्षः इति तेषां कल्पना।

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[5] Ibid .p.16.

[6] Introduction of *Mahanirvana Tantra* of Sir.Jhone Woodrof -Quated by *Lalitopakhyanavum Tantradarsanavum*-p.27.

शिवशक्तितत्वम्-

तन्त्रदर्शने परमप्रधानं भवति शिवपार्वतीतत्वं अथवा शिवशक्तितत्वम् [7]। अत्र शिवः शक्तिश्च न द्वे तत्वे अपि तु एकमेव। अग्निः तस्य दाहकशक्तिश्च यथा सम्बद्धः भवति तथैव शिवस्य शक्तेः च सम्बद्धः अपि अवियोज्यः भवति। दाहकशक्तेः वियोगे अग्नेः नाममात्रत्वं एव भवति। तथैव शिवः अपि शक्तिवियुक्तः यदि भवति तदा अशक्तः एव भविष्यति।

प्रपञ्चः शक्तेः परिणामः

शक्तेः परिणामः भवति प्रपञ्चः इति तन्त्रदर्शनं व्यवस्थापयति। अनेन परिणामेन प्रथमं तावत् पञ्चविंशति तत्वानि आविर्भन्ति। तेभ्यः विश्वस्य सृष्टिः संभवति। एतानि च पञ्चविंशति तत्वानि प्रायशः सांख्यमतप्रतिपादितानि एव। शब्दस्पर्शरूपरसगन्ध इति पञ्चतन्मात्राः, पृथ्व्यप्तेजोवायुराकाश इति पञ्चभूतानि, श्रोत्रत्वक्चक्षुजिह्वानासिकाभेदेन पञ्चज्ञानेन्द्रियाणि, वाक्पाणिपादपायूपस्थाख्यानि पञ्चकर्मेन्द्रियाणि पुनः मनस्, माया, शुद्धविद्या, महेश्वरः, सदाशिवः इति पञ्च सांख्यस्थानि मनस्, प्रकृति, महत्, अहंकारः, पुरुषः इत्येतानि तत्वानि एवं भवन्ति।

शैवागमानुसारम् शिवः, शक्ति, सदाशिवः, ईश्वरः, शुद्धविद्या, माया, कालः, कला, विद्या, नियतिः, रागः, पुरुषः, प्रकृतिः, बुद्धिः, अहंकारः, मनः, श्रोत्रं, स्पर्शं, चक्षुः, जिह्वा, नासिका, वाक्, पाणि, पादं, पायू, उपस्थं, शब्दं, स्पर्शं, रूपं, रसं, गन्धं, आकाशं, वायुः, तेजः, जलं, पृथ्वी इत्येतानि षट्त्रिंशत् तत्वानि सन्ति। अत्र प्रथमतः आरभ्य पञ्चपर्यन्तं शुद्धतत्वानि इति,अन्यानि एकोनविंशति संख्यकानि अशुद्धतत्वानि इति च तैः कल्प्यन्ते। शिवशक्तितत्वमिव अन्ये अपि बहवः विशिष्टाः कल्पनाः तन्त्रविद्यायां सन्ति। कुण्डलिनीशक्तिः षडाधारकल्पनाः श्रीचक्रकल्पना इत्येताः तत्र प्रसिद्धाः भवन्ति।

कुण्डलिनीशक्तिः

विश्वस्य सृष्टौ तथा परिपालने च समर्थायाः पराशक्तेः प्रतिरूपेण

[7] Lalitopakhyanavum Tantradarsanavum-p.36.

मनुष्यशरीरे भासमानः चैतन्यविशेषः कुण्डलिनीशक्तिः इति तन्त्रशास्त्रे व्यवह्रियते। मूलाधारे कुण्डलिनीरूपेण सुषुप्त्यवस्थां प्राप्तां पराशक्तिं प्रबोधयन् शिरोभागस्थेन सहस्रारस्थितेन शिवेन समायोजनं यया प्रक्रियया क्रियते सा कुण्डलिनीयोगः इति तन्त्रशास्त्रे प्रसिद्धं भवति।

षडाधारकल्पनाः

मानवशरीरे मेरुदणडे ईडा, पिंगला, सुषुम्ना इति नाडीत्रयस्य अवस्थितिः अस्ति। तत्र मध्ये सुषुम्ना वामे ईडा, दक्षिणे पिंगला च वर्तन्ते। सुषुम्ना तावत् कुण्डलिन्याः ऊर्ध्वगतिमार्गः योगानुष्टानेन प्रबुध्यमाना कुण्डलिनी षट्स्थानान् अतीत्य सहस्रारं प्राप्नोति। तानि च स्थानानि षडाधाराः अथवा षट्चक्राः इति वदन्ति। तानि च सुषुम्नायां उपर्युपरिरूपेण तेषां अवस्थितिः। मूलाधारां, स्वाधिष्टानाम्, मणिपूरं, अनाहतं, विशुद्धिः, आज्ञा इत्येभिः नामभिः तानि स्थानानि प्रसिद्धानि भवन्ति।

सुषुम्नायाः परं अधोभागे विद्यमानं चक्रं भवति मूलाधार चक्रं। इदं पृथ्वीतत्वात्मकं, चतुर्दलकमलरूपात्मकम्, त्रिकोणाकृतियुक्तं च भवति। तस्योपरि वर्तमानं स्वाधिष्टानचक्रं अग्नितत्वात्मकं, षट्दलकमलरूपात्मकम् च भवति। ततोप्युपरि नाभिप्रदेशे दशदलकमलरूपात्मकम् जलतत्वात्मकं मणिपूरचक्रं। एतदुपरि हृदयप्रदेशे वायुतत्वात्मकं द्वादशदलकमलरूपात्मकम् अनाहतचक्रं। तस्यापि उपरि कण्ठस्थाने अकाशतत्वात्मकं षोटशदलकमलरूपात्मकम् विशुद्धिचक्रं। सर्वेषां उपरि भ्रूमध्ये द्विदलविशिष्टस्य मनस्तत्वात्मकस्य आज्ञानचक्रस्य स्थितिः।

श्रीचक्रतत्वं

तान्त्रिकोपासकाः मन्त्रस्य तथा यन्त्रस्य च अत्यन्तं प्राधान्यं कल्पयन्ति। तैः स्वीकृतेषु बहुविधेषु यन्त्रेषु मध्ये पवित्रतरं पूजनीयं च भवति श्रीचक्रं।इदं शिवशक्त्यात्मकं इति तान्त्रिकसङ्कल्पनम्। तदुक्तं "शिवशक्त्यात्मकं ज्ञेयं श्रीचक्रं शिवयोर्वपुः" [8] इति। चक्रराजः मातृकाचक्रं नवयोनिचक्रं इत्यादिभिः पदैः अपि इदं श्रीचक्रं प्रसिद्धं भवति। शिवशक्त्योः परिणामरूपप्रपञ्चस्य

[8] *Saundarya Lahari* of Subrahmanya Sastrikal-p.2

प्रतीकात्मकतया तान्त्रिकैः श्रीचक्रं संपद्यते।

सांख्यसिद्धान्तम्, योगदर्शनम्, वैदिकधारणाः विभिन्नाः आराधनाक्रमाश्च संयोज्य श्रीचक्रस्य आलेखनं पूजनं च क्रमीकृतं मन्त्रदर्शने। बिन्दुः, त्रिकोणः, अष्टकोणः, अन्तर्दशारं, अष्टदलं, षोटशदलं, वृत्तत्रयं, भूपुरत्रयं इत्येतैः साङ्केतिकसंज्ञाभिः व्यवदिष्टैः बहुभिः रेखाचित्रैः समन्वितं भवति इदं चित्रं।तत्र अधोमुखाः पञ्चत्रिकोणाः शक्तितत्वस्य प्रतीकाः भवन्ति। एवं ऊर्ध्वाग्राः तु शिवस्य प्रतीकाः भवन्ति। पञ्चस्तु शाक्तिकत्रिकोणेषु पञ्चभूतानि पञ्चज्ञानेन्द्रियाणि पञ्चकर्मेन्द्रियाणि इत्येतेषां मूलप्रकृति विकाराणां स्थानानि कल्प्यन्ते। शैवकोणाः तु माया शुद्धविद्या, महेश्वरः, सदाशिवं इत्येतैः नामभिः व्यवह्रियन्ते। ते च क्रमेण इच्छा ज्ञानं क्रिया शम इति चतुर्णा प्रतीकाःभवन्ति। प्राथमिकत्रिकोणान्तर्गताः बिन्दुः कामस्य प्रतीकः भवति। एवं च श्रीचक्रं जगन्मातृरूपायाः शक्तेः प्रतिरूपत्वेन तान्त्रिकैः पूज्यते।

श्रीचक्ररचनायां द्वौ सम्प्रदायौ स्तः। समयमतानुवर्तिनां सृष्टिचक्रं, कौलमतानुवर्तिनां संहारचक्रं च। सृष्टिचक्रे शैवत्रिकोणानां अग्रानां अधोमुखत्वं दृश्यते।बिन्दू च अन्तर्भागस्थितस्य त्रिकोणस्य अधोभागे वर्तते। कौलानां संहारचक्रे तु शैवत्रिकोणाः ऊर्ध्वाग्राः भवन्ति। बिन्दूश्च मध्यगतस्य त्रिकोणस्य मध्यभागे भवति। श्रीचक्रोपासनायाः श्रीविद्या चन्द्रकलाविद्या इत्यभिधानमपि अस्ति।

समयमतं कौलमतं च।

शक्तितन्त्रं तावत् समयमतं कौलमतं चेति द्विधा भवति। शिवस्य शक्तेश्च समप्राधान्यं अङ्गीकुर्वन्ति समयाचारिणः, कौलस्तु शक्तेः शिवापेक्षया प्राधान्यं अङ्गीकुर्वन्ति इति तयोः प्राथमिकं वैशिष्ट्यं। आराधनाक्रमे अपि तेषां व्यत्ययः वर्तते। समयाचारिणः आन्तरपूजायाः प्राधान्यं, कौलाचारिणः बाह्यपूजायां। तदुक्तं लक्ष्मीधरव्याख्याने समयाचारो नाम आन्तरपूजारतिः कुलाचारो नाम बाह्यपूजारतिः इति रहस्यं [9]।

[9] *Saundarya Lahari* of Subrahmanya Sastrikal-p.11.

कौलाचारः वामाचारमिति अपरनाम्ना अपि प्रसिद्धः भवति। तत्रापि पूर्वकौलं उत्तरकौलं इति विभागद्वयं अस्ति। कुलपरम्परया आगत इत्यर्थे कौलमिति संज्ञां इति केचन वदन्ति। लक्ष्मीधरस्तु यः शक्तिं कुलपथे उपासते सः कौलः इति निरुक्तिं स्वीकरोति।

एवं वैदिकपारम्पर्यात् दार्शनिकदृष्ट्या अनुष्ठानपद्धत्या च परं भिन्ना भवति तन्त्रविद्या। व्यष्टिरूपे मनुष्यशरीरे स्थितस्य चैतन्यस्य कृच्छ्रसाध्यैः अनुष्ठानक्रमैः समष्टिरूपप्रपञ्चचैतन्यपर्यन्तं विकासः ऐक्यप्राप्तिः च अस्याः विद्यायाः परमो लक्ष्यः। अयमेव तान्त्रिकमते मुक्तिः अथवा मोक्षः इत्युच्यते।

सौन्दर्यलहर्यां तान्त्रिकतत्वयोजना

आननन्दलहररी इत्यपरनम्ना अपि प्रसिद्धं सौन्दर्यलहरी स्तोत्रं शतश्लोकात्मकम् समयागमरहस्यगर्भितं च भवति। साम्प्रदायिकरीत्या अस्य कर्तृत्वं शङ्कराचार्ये निक्षिप्तम्। तथापि विषयेस्मिन् प्राचीनाः, तथा अद्यतनाः च पण्डिताः विवदन्दे। डिण्डिमं इति प्रसिद्धे सौन्दर्यलहरी व्याख्याने एते मतभेदाः एवं प्रतिपादिताः दृश्यन्ते।

"स्तोत्रमेतद्वदन्त्येके शिवेन परिभाषितं
तस्यैवांशावतारेण शङ्करेणेति केचन।
केचिद्वदन्त्याद्यशक्तेर्ललितया महौजसः
दर्शनेभ्यस्समुद्धृदतमिति नानाविधश्रुतिः"।। [10]

इति। सुधाविद्योतिनी टीकायां तु क्षत्रियवंशालंकारभूतस्य द्रविडदेशाधिपतेः 'द्रमिडः' [11] इति कस्यचन राज्ञः पुत्रः प्रवरसेनः अस्य कर्ता इति अभिप्रायः अपि दृश्यते। तथापि समयागमतत्वप्रधानस्य स्तोत्रस्य भगवत्पादसंबन्धित्वं सामान्येनाद्य अङ्कीकृतम्। तत्रापि आदितः आरभ्य एकचत्वारिंशत् श्लोकाः एव आचार्यपादैः रचिताः इत्यैतिह्यमपि अस्ति। एवं कर्तृत्वविषये मतभेदे विद्यमाने अपि प्रौढगम्भीरस्य अस्य स्तोत्रग्रन्थस्य कर्तुः

[10] Introduction of *Saundarya Lahari* of Subrahmanya Sastrikal-p.6
[11] Introduction of *Saundarya Lahari* of Kandiyoor Mahadeva Sastrikal.

तान्त्रिकदर्शननिष्णातत्वं सर्वैः निर्विवादतया अङ्कीकृतम्।

ग्रन्थेस्मिन् आद्येषु एकचत्वारिंशत्सु श्लोकेषु तान्त्रिकमततत्वानां स्पष्टतया प्रतिपादनं अस्ति। अनन्तरोक्ताः श्लोकाः शक्तिस्वरूपिण्याः भगवत्याः केशादिपादवर्णनपराः भवन्ति। अतः अध्यायेस्मिन् तान्त्रिकदर्शनप्रतिपादनपराः एकचत्वारिंशत् श्लोकाः पठनविषयत्वेन स्वीकृताः।

तन्त्रदर्शनस्य आधारभूतेषु तन्त्रेषु परमप्रधानं भवति शिवशक्तितत्वम्।

"शिवः शक्त्या युक्तो यदि भवति शक्तः प्रभवितुम्।
न चेदेवं देवो न खलु कुशलः स्पन्दितुमपि।
अतस्त्वामाराध्यां हरिहरविरिञ्चादिभिरपि
प्रणन्तुं स्तोतुं वा कथमकृतपुण्यः प्रभवति"।।

इति प्रथमश्लोके अस्य तत्वस्य विशदीकरणं दृश्यते।

हरिहरब्रह्माद्याराध्याः प्रपञ्चजनन्याः महात्रिपुरसुन्दर्याः, नवयोन्यात्मकस्य श्रीचक्रस्य, षोटशाक्षरीमन्त्रस्य च सूचना अत्र अस्तीति तान्त्रिकैः व्याख्यायते। शिवात्मकं चतुष्कोणं, शक्त्यात्मकं पञ्चकोणं च मिलित्वा श्रीचक्रं सम्पद्यते इति तन्त्रदर्शनस्य आशयः अत्र सूचितः। पुनः प्रथमार्थे प्रयुक्तानि षोटशपदानि षोटशाक्षरीमन्त्रं व्यञ्चयति इत्यपि केषांचन अभिप्रायः।

"क्वणात्काञ्चीदामा करिकलभकुम्भस्तननता
परिक्षीणा मध्ये परिणतशरत्चन्द्रवदना।
धनुर्बाणान् पाशं सृणिमपि दधाना करतलैः
पुरस्तादास्तां नः पुरमथितुराहोपुरुषिका" ।।

इति सप्तमे श्लोके देव्याः अहोपुरुषिका स्वरूपं संस्तौति। करतलैः धनुःबाणात् पाशं अङ्कुशं इत्येतानि दधाना सा परिणतशरत्चन्द्रवदना भवति। देव्याः एतादृशं अहोपुरुषिका स्वरूपं समयमतानुवर्तिनां साधकानां मणिपूरचक्रे भासितं भवति इचति तान्त्रिकैः कल्प्यते।

"सुधासिन्धोर्मध्ये सुरविटपिवाटीपरिवृते

मणिद्वीपे नीपोपवनमिति चिन्तामणिगृहे ।

शिवाकारे मञ्चे परमशिवपर्यङ्कनिलयां

भजन्ति त्वां धन्याः कतिचन चिदानन्दलहरीम्"।।

इति अष्टमे श्लोके कौलाचारमतानुसारम् देव्याः बाह्यपूजनाक्रमं वर्णयति। श्रीचक्रस्य वियत्चक्रमिति नामान्तरमस्ति। वियत्चक्रत्वं तु वियत्पूज्यत्वात्। वियत्पूज्यत्वं द्विविधं दहराकाशजं, बाह्याकाशजं चेति। बाह्याकाशजं नाम बाह्याकाशवकाशे भूर्ज्जपत्रशुद्धहेमरजतादिपट्टतले श्रीचक्रं लिखित्वा पीठादौ विन्यस्य समाराधनम्। एतदेव कौलपूजेति आहुः। अयं च कौलपूजाप्रकारः अत्र उपनिबद्धः।

अष्टमे श्लोकः समयाचारसम्बन्धी भवति। समयाचारो नाम आन्तरपूजारतिः। तत्र साधनाशक्त्या कुण्डलिन्याः प्रबोधनं पुनः क्रमेण षट्चक्रान् अतीत्य सहस्रारपर्यन्तम् तस्याः आरोहणं च आराधनाक्रमः।

अयं च क्रमः-

"महीं मूलाधारे कमपि मणिपूरे हुतवहं

स्थितं स्वाधिष्ठाने हृदि मरुतमाकाशमुपरि।

मनोपि भ्रूमध्ये सकलमपि भित्वा कुलपथं

सहस्रारे पद्मे सह रहसि पत्या विहरसे" ।।

इत्यत्र प्रतिपादितम् ।

समाध्यनन्तरं कुण्डलिन्याः मूलाधारं प्रति निवर्तनं-

"सुधाधारासारैश्चरणयुगलान्तर्विगलितैः

प्रपञ्चं सिञ्चन्ती पुनरपि रसाम्नायमहसः।

अवाप्य स्वां भूमिं भुजगनिभमध्युष्टवलयं

स्वमात्मानं कृत्वा स्वपिषि कुलकुण्डे कुहरिणी" ।।

इति दशमश्लोके वर्णितं। सहस्रारं प्रविष्टा सा कुण्डलिनीशक्तिः अमृतधाराप्रवाहैः साधकस्य सकलं शरीरं सम्प्लाव्य पुनः भुजङ्गरूपेण आधारकुण्डं प्रविश्य सुषुम्नां अवष्टभ्य स्वपिति इति तान्त्रिककल्पना अत्र

सूचिता।

"चतुर्भिः श्रीकण्डैश्शिवयुवतिभिः पञ्चभिरपि
प्रभिन्नाभिश्शम्भोर्नवभिरपि मूलप्रकृतिभिः।
चतुश्चत्वारिंशद्वसुतलकलाश्रत्रिवलय
त्रिरेखाभिस्सार्धं तव शरणकोणाः परिणताः"।।

इति एकादशश्लोकः श्रीचक्रस्वरूपवर्णनपरं भवति। जगन्मातृस्वरूपायाः भगवत्याः आवासमन्दिरभूतं श्रीचक्रं, बिन्दु, त्रिकोणं, अष्टकोणं, अन्तर्दशारं, बहिर्दशारं, चतुर्दशारं, अष्टदलं, षोटशदलं, वृत्तत्रयं, भूपुरत्रयं, इत्येतैः संयुक्तं भवति। तत्र त्रिकोणं, अष्टकोणं, अन्तर्दशारं, बहिर्दशारं, चतुर्दशारं एतानि पञ्च शक्तिचक्राणि अष्टदलं, षोटशदलं, वृत्तत्रयं, भूपुरत्रयं इत्येतानि चत्वारि शिवचक्राणि। एवं तान्त्रिकमतानुसारं श्रीचक्रस्वरूपप्रकारः अत्र प्रतिपादिता।

"चतुष्षष्ट्या तन्त्रैः सकलमतिसन्धाय भुवनं
स्थितस्तत्तत्सिद्धिप्रसवपरतन्त्रैः पशुपतिः।
पुनस्त्वन्निर्बन्धादखिलपुरुषार्थैकखटना-
स्वतन्त्रं ते तन्त्रं क्षितितलमवातीतरदिदं" ।।

इति एकत्रिंशे श्लोके इतरतन्त्रापेक्षया शक्तितन्त्रस्य वैशिष्ट्यं भगवत्पादैः भङ्ग्यन्तरेण सूचितम्। त्रिपुरसुन्दरीरूपशक्तिसम्बन्धिनी इदं तन्त्रं अखिलपुरुषार्थैकघटनास्वतन्त्रं भवति इति अत्र निर्देशः।

द्वात्रिंशे श्लोके-

"शिवः शक्तिः कामः क्षितिरथ रविः शीतकिरणः
स्मरो हंसः शक्रस्तदनु च परामारहरयः।
अमी ह्रल्लेखाभिस्तिसृभिखसानेषु खण्डिताः
भजन्ते वर्णास्ते तव जननि नामावयताम्"।।

इत्यनेन शाक्ततन्त्रे प्रसिद्धस्य षोटशाक्षरीमन्त्रस्य सामान्यसूचना भगवत्पादैः दत्ता। अनन्तरोक्तैः त्रिभिः श्लोकैः क्रमेण कौलमतानुगुणं

आचारानुष्ठानक्रमं कौलमतोपास्य देवतायाः स्वरूपं पुनः तन्मतानुसारं परिणामतत्वं च प्रतिपादयति।

गुरूपदेशेन कुण्डलिनीप्रबोधने सामर्थ्यं लब्धवतः साधकस्य मूलाधारादि षट्चक्रेषु कुण्डलिनीप्रवेशसमये सम्पद्यमानः महाज्ञानप्रकाशः तवाज्ञाचक्रस्थं.... इत्यारभ्य षट्सु श्लोकेषु अवरोहणक्रमेण वर्णितः। आज्ञाचक्रपर्यन्तं कुण्डलिनीप्रवेशं कर्तुं यः साधकःशक्तः भवति तस्य शिवशक्तितादात्म्यं लभ्यते। तदुक्तं-

"तवाज्ञाचक्रस्थं तपनशशिकोटिद्युतिधरं
परं शम्भुं वन्दे परिमिलितपार्श्वं परचिता ।
यमाराध्यन् भक्त्या रविशशिशुचीनामविषये
निरालोके लोके निवसति हि भालेकभुवने" ।।

विशुद्धिचक्रे कुण्डलिन्याः आरोहणे हृद्गतान्धकारनिवृत्तिः आनन्दोद्रेकश्च सम्भवति। एतद्विवृणोति-

"विशुद्धौ ते शुद्धस्फटिकविशदं व्योमजनकं
शिवं सेवे देवीमपि शिवसमानव्यवसितां ।
ययोः कान्त्या यान्त्याः शशिकिरणसारूप्यसरणेः
विधूतान्तर्ध्वान्ता विलसति चकोरीव जगती"।।

अनाहतचक्रे कुण्डलिन्याः आरोहणे सकलकलावल्लभता गुणैकनिलयता च सिद्ध्यति इति श्लोकेस्मिन् प्रतिपादयति।

"समुन्मीलत्संवित्कमलमकरन्दैकरसिकं
भजे हंसद्वन्द्वं किमपि महतां मानसचरं ।
यदालापादष्टादशगुणितविद्यापरिणतिः
यदादत्ते दोषाद् गुणमखिलमद्भ्यः पय इव"।।

तदनन्तरं स्वाधिष्ठानचक्रे कुण्डलिन्याःसमवेशे शक्तिस्वरूपिण्याः दयार्दा दृष्टिः शिशिरं उपचारं रचयति।

"तव स्वाधिष्ठाने हुतवहमधिष्ठाय निरतं
तमीडे संवर्त्तं जननि महतीं तां च समयां ।
यदालोके लोकान् दहति महति क्रोधकलिते
दयार्द्रा या दृष्टिः शिशिरमुपचारं रचयति"।।

अनाहतचक्रस्योपरि स्थितानि सूर्यकिरणानि स्वाधिष्ठानाग्निना मिलित्वा जलतत्वं प्राप्य मणिपूरचक्रं प्रविश्य स्वाधिष्ठानाग्नौ दग्धं जगत् आप्लावयति इति तन्त्रागमरहस्यं-

"तटिवन्तं शक्त्या तिमिरपरिपन्थिस्फुरणया
स्फुरन्नानारत्नाभरणपरिणद्धेन्द्रधनुषम्।
तव श्यामं मेघं कमपि मणिपूरैकशरणं
निषेवे वर्षन्तंहरमिहिरतप्तम् त्रिभुवनम्"।।

इत्यस्मिन् श्लोके विशदीकृतम्।
"तवाधारे मूले सह समयया लास्यपरया
नवात्मानं मन्ये नवरसमहाताण्डवनटम्।
उभाभ्यामेताभ्यामुदयविधिमुद्दिश्य दयया
सनाथाभ्यां जज्ञे जनकजननीमज्जगदिदं"।।

इति एकचत्वारिंशति श्लोके कुण्डलिनीशक्तिः षट्स्थानानि अतीत्य मूलाधारे एव विलयं प्राप्नोति इति वर्णयति।

उपसंहारः

एवं एभिः एकचत्वारिंशद्भिः श्लोकैः त्रिपुरसुन्दरी, श्रीचक्रं, श्रीविद्या इति शक्तिस्वरूपिण्याः देव्याः त्रिरूपात्मकं तत्वं मुख्यतया उपवर्णितम्। तद्वारा शक्तितन्त्रे वर्तमानाः उपासनाभेदाः कौलसमयादि मतभेदाश्च सूचिताः। प्रथमश्लोके तथा द्वितीये शक्तिस्वरूपिणी इयं त्रिपुरसुन्दरी सर्वदेवतावन्ध्या, पुण्यजनोपास्या, श्रीचक्रश्रीविद्यास्वरूपिणी च भवति इति उपन्यस्तम्। 3, 4, 5, 6, 7, 8, 22, 30 इत्येतैः श्लोकैः देव्याः स्थूलरूपोपासनासम्प्रदायः वर्णितः। 27 तमे श्लोके निर्गुणोपासना, 11 तमे श्लोके श्रीचक्रोपासना 31,

32, 33 इत्येतेषु श्लोकेषु मन्त्रोपासना च वर्णिता। 9, 10, 14, 21 तमे श्लोकेषु कुण्डलिनीध्यानरूपा आन्तरोपासना प्रतिपादिता। 34, 35 श्लोकयोः कौलसिद्धान्तानुसारं शक्तिस्वरूपं प्रपञ्चपरिणामं च प्रतिपादितम्। अन्तिमैः षट्भिः श्लोकैः षटाधारपूजारूपः समयाचारक्रमः विस्तरेण उपवर्णितः। एवं प्रौढगम्भीरोयं स्तोत्रग्रन्थः सर्वथा समयागमरहस्यगर्भितं भवति।

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