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A COMPARATIVE STUDY ON GROWTH OF AMARANTHUS CULTIVARS IN LIGHT AND SHADE ENVIRONMENTS

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Abstract

The growth and phytochemical constituents of *Amaranthus cruentus* L. and *Amaranthus palmeri* S. Wats. under light and shade conditions were studied. It found that growth of plants in light result more height, number of leaves, and biomass. It also noticed that the plants grow in shade accumulate less soluble protein, sugar, phenolics, anthocyanin and malonyldialdehyde. However, more accumulation of photosynthetic pigments was found in plants grow in shade. The results shows that *Amaranthus* varieties grow in open field will have better vegetative growth, biomass productivity and phytochemical constituents. Therefore, an optimized light management practice should be adopted to ensure the successful cultivation of *Amaranthus* cultivars in vertical farming.

Key words: light, shade, pigments, lipid peroxidation, biomolecules

Introduction

Light is the major factor affecting photosynthesis and biomass productivity of crops. However, light is one of the most variable components of plant environment. Light responses of plants differ based on the lightening environment, season, genotype, and cultivation practices and many others (Bayat et al. 2012). Plants have evolved several efficient protection mechanisms that make it possible for them to survive under unfavorable light and temperature conditions (Szymanska et al. 2017). Because of the urbanization process, vast urban spaces are located between the buildings, and there is increasing demand in vertical farming which is known as future of agriculture. Vertical farming decreases water usage about 95.0% because of recycling, and it also help to avoid usage of agrochemicals such as pesticides

(Benke and Tomkins, 2017). But the usage of artificial light is common in the course of vertical farming and therefore, optimizing light conditions for the plant growth helps in efficient usage of light during farming practices.

Light fluctuations not only affects plant morphology, physiology and microstructure but also has an important impact on crop productivity. This is mainly because plant growth requires an appropriate light intensity whereas excessively high or low intensity will retard photosynthesis in the plants. Shade not only influence the amount of light received by plants, but also changes other small environmental conditions affecting the plant growth such as temperature, humidity and carbon dioxide respectively (Wan et al. 2020). Shade imposes a limitation to biological productivity in plants although the extent of the limitation varies with the shade tolerance of the species and the nitrogen supply (Wan et al. 2020). Plants exhibits several well known shade avoidance responses, including accelerated stem extension growth, retarded leaf development and strengthened apical dominance during competition for light. Shade avoidance responses may improve plant fitness by increasing capture of the light under diverse environmental conditions. Stem elongation in particular has received considerable attention as an example of adaptive plasticity.

The plant *Amaranthus* belongs to the family of Amaranthaceae, with a worldwide distribution. It consists of about 60-70 species. *Amaranthus* is used as leafy vegetable, forage and ornamentals. Amaranthus is considered as one of the most promising food plant. It provides high quality protein, high amounts of unsaturated oils, dietary fiber and essential minerals. About 90.0 % vitamin C, 73.0 % vitamin A, 28.0 % calcium and 28.0 % iron of daily nutrient requirement can be obtained from one cup of cooked, boiled and drained *Amaranthus* leaves (Achigan-Dako et al. 2014). *Amaranthus* leaves contain a unique source of antioxidant pigments compared to other leafy vegetables. The plant grows well in a variety of soil conditions from clay to sandy loam, but cannot tolerate wet or water logged soil there by making a drought tolerant vegetable. The aim of this study is to evaluate the influence of light on the growth of two different varieties of *Amaranthus* in light and shade environment that will provide insights for vertical farming. Comparison of plant growth under shade and open field conditions with regard to crop productivity and phytochemical constituents were tested.

Materials and methods

Plant material

The seeds of *Amaranthus* used for the study was collected from seed market, Erattupetta. For this study *A. palmeri* and *A. crutentus* that are the edible species in the genus *Amaranthus*. These are edible and highly nutritious. *A. palmeri* and *A. crutetus* thrives in hot weather, and responds quickly to high levels of available nutrients. It can grow up to 2.0 m in height. The high protein content and amino acid composition give amaranth medicinal benefits. Different environmental conditions such as temperature, light, and soil have an influence on *Amaranthus* seed germination and thus affect grain yield. The selected plant varieties are cultivated in fertile soil. The soil used for this experiment was black soil. Black soil is enriched with minerals. Black soil is suitable for the cultivation of vegetables, and grains. Soil colour is due to the availability of organic matter content. The black colour of soil indicates that the soil has high organic matter content.

Method of planting

The black soil collected was mixed with dried cow dung in a ratio of 2:1.Then the mixture is filled in four pots which are medium sized with a diameter of 14.0 cm. The *Amaranthus* seeds which were already sown maintained with care with regular water supply and by providing same environmental conditions are selected for the experiment. From the seedlings of two verities six seedlings from each variety are selected. From the six seedlings three of them from each verity are kept in shade (503.48 lux) and the remaining three are kept in full sun (50889.68 lux).The plants are watered regularly and observed the growth.

Measurement of growth parameters

The plant height, number of leaves, and the sun light intensity were determined in regular intervals. The plant height was measured from base to the apex using a centimeter scale. Biomass was quantified at the time of harvest using a weigh balance. These are the factors which indicate the growth of the plant.

Estimation of pigments

Chlorophyll and carotenoids quantified using leaf extract in acetone:dimethylsulphoxide (50:50). The optical density of leaf extract measured at 470.0, 646.0 and 663.0 nm and content of pigments estimated with the following formulae (Lichtenthaler and Wellburn,1983). Total chlorophyll = 20.2 (A646) + 8.02 (A663); Chlorophyll a = 12.21 (A663) - 2.81 (A646); Chlorophyll b = 20.13

(A646) - 5.03 (A663); Carotenoids = (1000 A470 - 3.27[chl a] – 104 [chl b])/227.

Estimation of phenolics

Total phenolics estimated from the methanol extract of dried leaf powder (McDonald et al. 2001). Leaf powder (1.0g) extracted with 10.0 ml methanol. To the extract, 5.0 ml of 0.1 % FolinCiocalteu reagent and 4.0 ml of 1.0 M sodium carbonate added. The reaction mixture incubated for 15.0 min. The amount of phenolics determined after measuring absorbance at 765.0 nm. Gallic acid dissolved in 50.0 % methanol used to make a standard graph, and the result represented as the equivalent of gallic acid**.**

Estimation of anthocyanin

Anthocyanin quantified from methanol/HCl/water (90:1:1) extract of leaf powder. The absorbance of the extracts read at 530 (A530) and 657(A657). Amount of anthocyanin calculated using formulae A530 - A 657 (Mancinelli, 1984). Amount of pigments expressed in cyanidin equivalents per gram fresh weight of leaf tissue.

Lipid peroxidation

Malondialdehyde (MDA) accumulates in plant cells as a result of peroxidation of lipids in membranes. Therefore, the extent of lipid peroxidation in leaves determined via estimation of MDA content (Heath and Packer,1968). Trichloroacetic acid (TCA) (4.0 ml) used to extract MDA from leaf tissues (500.0 mg).The extract mixed with 1.0 ml 2-thiobarbituric acid (0.5 %) and the mixture heated at 95.0 o C for 30min. The mixture cooled and centrifuge at 10000.0 rpm for 10 min. The supernatant subjected to the measurement of optical density at 532.0 and 600.0 nm (18). Extinction coefficient value of 155.0 mM−1 cm−1 used to calculate the MDA content in the sample, and the result expressed in nmol MDA per gram fresh weight.

Estimation of Total soluble sugar

Total carbohydrate content was measured using Phenol-Sulphuric acid method (Masuko et al. 2005). For this 100 mg of the sample weighed, and the soluble sugar extracted in double distilled water. The samples were centrifuged and then 1.0 ml aliquots were transferred to test tubes. Standards were prepared by mixing sucrose in double distilled water. The test solutions were mixed with 1.0 ml of 5.0 % phenol and 3.0 ml sulphuric acid and boiled for 20 minutes in a water bath. The absorbance of test solution read at 490.0 nm used for calculation of total soluble sugar.

Estimation of protein

Protein in the sample estimated using Bradford assay method. The plant tissues

were homogenized in 5.0 mL of 0.5 M Tris-HCl (pH 7.4) using a pestle and mortar. The crude extract was centrifuged at 8000 rpm for 10.0 min, and the supernatant was used to determine protein content by mixing with Bradford reagent and the absorbance read at 595.0 nm (Bradford,1976). Bovine serum albumin (BSA) was used as the standard.

Results

Analysis of plant growth

Growth, development, productivity and postharvest quality of any crop largely depend on the interaction between the plant and the environmental conditions under which they are grown. There was a distinct difference in sunlight intensity for the shaded plants as compared to plant grown in open field .The shade used in this experiment manipulated micro climatic properties and influenced growth and yield of *Amaranthus*. *A. palmeri* and *A. cruentus* are the two verities selected for the experiment. The growth and development of these two varieties in the open environment was particularly same throughout the study period. The average light intensity of environment plants was 50889.68 lux and for shaded plants was 503.48 lux (Table1). The plant growth parameters during the study period were given in table 1.The height of plants in shaded and open environment is observed. *A. palmeri* has the higher growth in open environment (Table 1, Figure.1A-D). While comparing with sunlight exposed light plants, the height of plants in the shade environment decreased about 83.0 % in the case of *A. palmeri* and 72.0 % in the case of *A. cruentus* respectively. There was highly significant effect of light on number of leaves. The number of leaves was more in plants grown in light. *A. palmeri* had about 68.0 % and *A. cruentus* had about 72.0 % more no. of leaves (Table. 1). Plant biomass is the stored chemical energy from the sun. Plant produces biomass through photosynthesis. Photosynthesis is a light dependent process, so the plant biomass recorded more about 97.0 % in *A. palmeri* and 94.0 % *in A. cruentus* when grown in light (Table. 1).

Photosynthetic pigments

Chlorophyll is an important photosynthetic pigment to the plant, largely determining the photosynthetic capacity and hence plant growth. High light environment may impart stress on the synthesis of photosynthetic pigments. The contents of total chlorophyll, chlorophyll a, and chlorophyll b are given in the Figure.2A-C. It found that chlorophyll increased up to 32.0 % *A. palmeri* and 65.0 % *in A. cruentus* respectively when grown shade. There was also a slight increase in chlorophyll a/b ratio (0.8 - 4.0 %) among plant grown in shade (Figure.2D).

Carotenoids are lipid - soluble pigments, which can be found in fruits and vegetables that help to avoid photo oxidative stress in plants (Ngamwonglumert et al, 2019). It found that carotenoids content increases up to 13.0 - 30.0 % when the plants grow shade (Fig. 3A).

Changes in molecules with antioxidant properties

Anthocyanins are coloured water soluble pigments belonging to the phenolics class. This pigment is responsible for the colours of red, purple and blue in fruits and vegetables. Anthocyanin content was more in *A. cruentus* compared to *A. palmeri* (Figure. 3B). Plant grown in light showed about 12.0 - 16.0 % more anthocyanin content than shaded plants. Phenolics are aromatic benzene ring compounds with one or more hydroxyl groups. These compounds mainly produced for protection against abiotic and biotic stress. Phenolics play important role in plant metabolism, particularly in the biosynthesis of liginin and pigment (Bhattacharya et. al. 2010). In the present study, phenolics content was more about 40.0 -50.0 % among plants grown in light (Figure. 3C).

Lipid peroxidation

Membrane lipid peroxidation is detected by measuring malondialdehyde (MDA). Malondialdehyde is a widely used marker of oxidative lipid injury caused by environmental stress (Kongw et al. 2016). Malondialdehyde content was more in *A. crutenus* which was grown in light (Figure. 3D). The decrease in MDA content was 50.0 - 70.0 % among plant grown in shade.

Changes in cellular macromolecules

Sugar is produced in plants as a result of photosynthesis. Therefore sugar content in plants also represents the rate of photosynthesis. Total soluble sugar was about 60.0% more in plants grown in light (Figure. 4A).Plants store protein in vegetative cells to provide carbon, nitrogen and sulphur resources for subsequent growth and development. The protein content was about 50 - 60.0 % more in plants grown light (Figure.4B).

Discussion

Shade can influence plant growth and development by changing the plant niche. The important visual effect of shade on plant growth is change in morphology such as height and number of leaves. Moderate shade found to increase stem elongation and specific leaf area in plants (Brainard et al. 2005). Also, plants responded to shade with a decrease in number of main leaves (Brainard et al. 2005).

This kind of changes were reported to be the results of action of plant hormones such as gibberllic acid and ABA (Jha et al. 2010). So the decrease in plant height and number of leaves found in plants grow in shade was the outcome of difference in hormonal activity.

Shade could greatly alter the contents of the leaf photosynthetic pigments of which total chlorophyll and chlorophyll a/b ratio were important indicators for assessing shade tolerance in plants (Zhao et al. 2012). Carotenoids are accessory pigments which help to dissipate excess light energy via nonphotochemical quenching (Rosas-Saavedra and Stange, 2016). Shade tolerant plants had high total chlorophyll contents and carotenoids (Zhao et al. 2012). In the present study, plant grown in shade had more chlorophyll, chlorophyll a/b ratio and carotenoids. However, the surface area of leaves drastically decreased among plant grows in shade. It reported that the sun plants will have more chlorophyll especially with regard to chlorophyll a and carotenoids (Atanasova et al. 2003). But the contradictory result observed in the present study was the outcome of decrease in plant growth which in turn leads to more accumulation of metabolites in unit volume.

Plant phenolics had pivotal role in abiotic stress tolerance in plants (Dai and Mumper, 2010). The biosynthesis of phenolic acids in plants occurs through the shikimate-phenylpropanoid pathway using aromatic amino acids such as L-phenylalanine and L-tyrosine, respectively (Cheynier et al. 2013). Light signal is critical for the expression of genes responsible for enzymes involved in the synthesis of phenolics (Cheynier et al. 2013). This compound mainly helps to defense against ultraviolet radiation and biotic stress respectively. Also, phenolics play an important role in determination of market value of plant produce because these compounds contribute to the bitterness and astringency of plant based products. Phenolics are rich in hydroxyl groups, and hence they act as antioxidants which scavenge reactive oxygen species. So it is concluded that plant grow in shade accumulate less phenolics because of retardation of biosynthetic pathway of phenolics which require light.

The plants grown in shade especially *A. crutenus* showed had fading of red colour. Anthocyanins impart red colour in plants (Kayesh et al. 2013). These pigments are produced via the phenyl propanoid pathway and the accumulation of anthocyanin occurs during exposure to light (Kayesh et al. 2013).This pigment is a water soluble flavanoid. The synthesis of anthocyanin is under control of cordial gene expression and environmental factors. Anthocyanin helped to overcome abiotic stress such as highlight. This molecule act as a scavenger of reactive oxygen species. However, light could regulate related anthocyanin biosynthetic enzyme

activities according to a certain light stress tolerance mechanisms (Khandaker et al. 2010). So the decrease in anthocyanin among plants grow in shade was the outcome of delay in switching of genes involved in anthocyanin biosynthetic pathways.

Malonyldialdehyde (MDA) is an indicator of abiotic stress in plants. This compound is formed as a result of lipid peroxidation in plants. The degradation of arachidonic acids and polyunsaturated fatty acid via activity of reactive oxygen species results formation of MDA in plants. An increase in antioxidant activity decrease accumulation of MDA in plant (Pietryczuk and Czerpak, 2012).But the contradictory result observed in the present study was the outcome of difference in metabolic status of the plant. The MDA accumulation in sun plants was not in toxic levels even though more MDA accumulated in these plants compared with plants rear in shade. Exposure to relatively high intensity of light triggered MDA production in Amaranthus grows in sunlight where synthesis of bioactive compounds having antioxidant capacity prevented light stress (Ping et al. 2015). This resulted efficient photosynthesis which in turn help to produce more cellular macromolceule. Due to greater penetration of sunlight in the amaranths planted in the light, they were able to perform better photosynthesis even though photosynthetic pigment content decreased as results of photoprotective mechanisms and mobilization of photosynthates for biosynthesis of cellular metabolites such as sugar and protein involved in plant development (Poorter et al. 2015, Sebastian et al. 2015). The results of present study indicate that the sunlight intensity in the light has a great effect on the growth of *Amaranthus* cultivars. The plant growth parameters such as biomass, plant height, and leaf number decreased when *A. palmeri* and *A. crutenus* were grown shade. Therefore, it is also clear that shade will negatively influence the crop productivity *Amaranthus*.

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Table. 1 Morphological changes of plants grow under different light intensity				
Parameter	Sunlight (50889.65 lux)		Shade (503.48 lux)	
	A. crutentus	*A. palmeri*	*A. crutentus*	*A. palmeri*
No of leaves	25.0 ± 1.0	22.0 ± 2.0	7.0 ± 1.0	7.0 ± 1.0
Plant height (cm)	30.0 ± 0.4	48.0 ± 0.7	8.2 ± 0.5	8.0 ± 0.9
Plant biomass (g)	11.52 ± 0.1	10.52 ± 0.2	0.62 ± 0.3	0.22 ± 0.2

Figure.1

Growth responses of *Amaranthus* (*A. crutentus* - *purplish*, *A. palmeri-green*) grown in light (A, C) and shade (B, D).

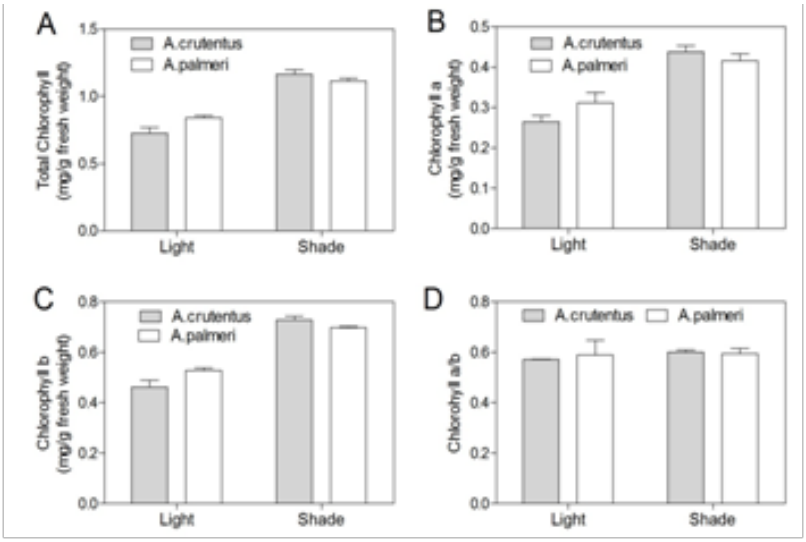

Figure. 2

Photosynthetic pigments content in *Amaranthus* (*A. crutentus, A. palmeri*) grown in light and shade environments A. Total chlorophyll B. Chlorophylla C.Chlorophyll b D. Ratio of chlorophyll a against chlorophyll b

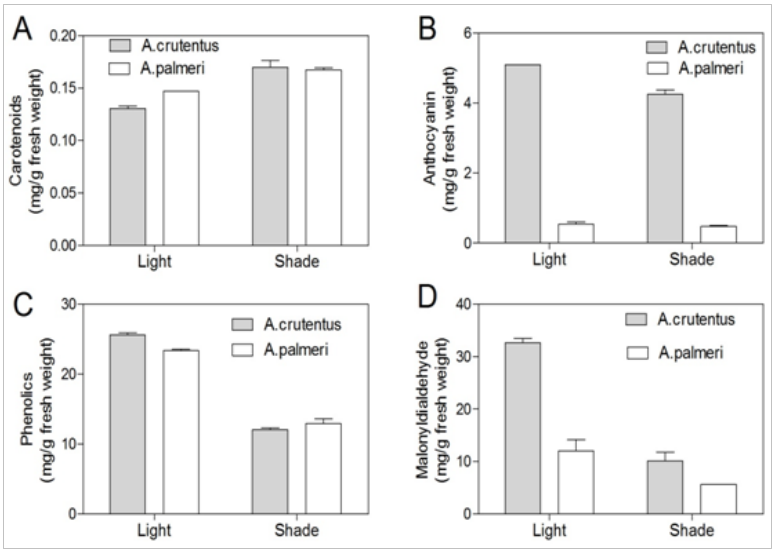

Figure. 3

Phytochemical constituents in *Amaranthus* (*A. crutentus, A. palmeri*) grown in light and shade environments A. Carotenoids B. Anthocyanin C. Phenolics D. Malonyldialdehyde

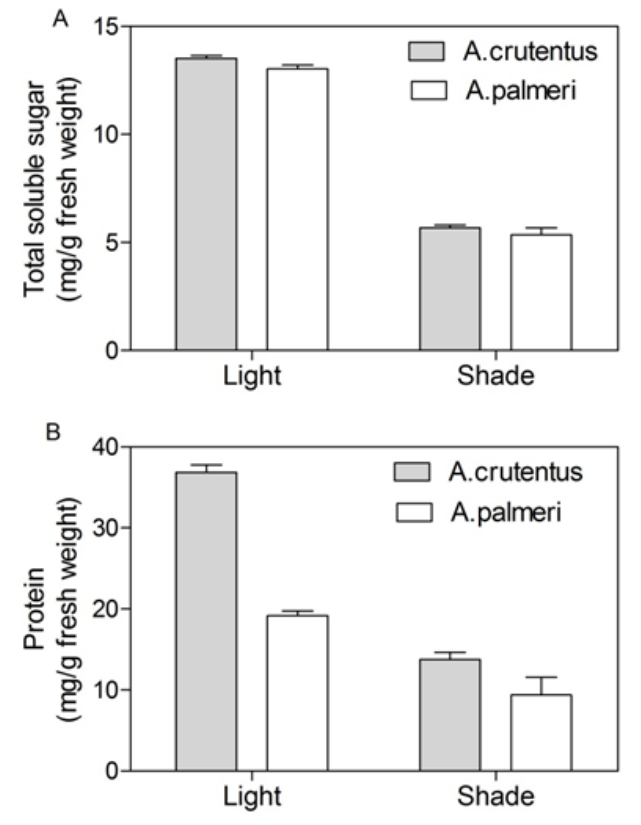

Figure. 4

Accumulation of cellular macromolecules in *Amaranthus* (*A. crutentus, A. palmeri*) grown in light and shade environments. A. Total soluble sugar B. Total soluble protein

BREWED TEA WASTE PROMOTE GROWTH OF *VIGNA UNGUICULATA* L. SEEDLINGS: SCOPE OF TEA WASTE USAGE IN GERMINATION BED INDUSTRY

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Abstract

The conversion of tea wastes in to a commercial asset ensures sustainable agriculture. In the present study, the growth of *Vigna unguiculata* L. seedlings were monitored on germination media contains black tea and milk tea wastes respectively. The addition of tea waste helped to increase soil pH whereas there was no change in conductivity of soil solution. The presence of tea waste resulted in an increase in size of vegetative parts, lateral roots and biomass respectively. Plant growth promoting effects of tea waste at molecular level was reflected as an increase of chlorophyll a content. However, there was no change in accumulation of chlorophyll b and carotenoids. Similar results noticed after treatment with vermicompost too. It predicted that more plant available nitrogen account for above changes. Thus, we concluded that tea waste can be an alternative for vermicompost to prepare germination beds.

Keywords: Tea waste, Germination bed, Seedlings vigor, Lateral roots, Photosynthetic pigments

Introduction

Healthy seedlings are prerequisite for crop productivity. Therefore, the seedlings are very often raised in germination bed. Germinating bed preparation is a bio-safe process in which soil is mixed with vermin compost, cow dung etc. Addition of organic matter in germination bed not only improves physicochemical properties of the soil but also attract plant growth promoting microbes (Sebastian and Prasad, 2013). Secondly, the usage of organic matter helps to improve nutrient status of the soil as well as humic substances in the soil. So raising plantlets in germinating beds offers a controlled rhizosphere environment that ensures development of healthy seedlings.

Germination cannot occur unless and until the seed is provided with an external supply of water. Water is absorbed by a dry seed through the micropyle and the seed coat. Water performs a number of functions during the germination of seeds (Zhang et al. 2015). It softens seed coat and makes it permeable for better gaseous exchange. Aeration of both the soil and seed is absolutely necessary for the germination because oxygen is necessary for the aerobic respiration by which the seeds get the requisite energy for the growth of the embryo (Li et al. 2019). Water also activates the protoplasm of the seed cell via converting insoluble food materials such as starch to soluble sugar. It is noteworthy that several enzymes which are essential for germination become active only in the presence of water. Seeds germinate under a wide range of temperature (Motsa et al. 2015; Zhang et al. 2015). But freshly harvested seeds of several plants germinate only within a narrow temperature range which widens only when after ripening has taken place. Similarly, plants differ as to the effect of light on their germination (Motsa et al. 2015). Seeds of many plants are non photoplastic because germination of these plants are not depend on light. Generally, photo assimilates stored in the plants support growth of tissues such as root, leaves, flower initials etc. with a negative carbon balance (Lemoine et al. 2013). The ability of a seed to germinate when provided with optimum condition is described as viability of the seeds. It depends upon type of stored food, hardness of seed coat etc. Most of the crop plants lose their viability after longer periods. However, seed dormancy is due to the internal factors such as accumulation of ABA in the seed (Ryu et al. 2014).

India occupies second position in terms of consumption, export, and production of tea (Lutgendorf, 2011). It estimated that more than 1.2 million tons of tea is produced annually in India. However, most of the industries dispose their tea wastes in open dumps or land area which results in pollution of land and water with phytochemicals (Kumar et al. 2017). Proper disposal of tea waste from industries and kitchens is necessary for maintaining healthy environment. Preparing germinating beds from the tea waste is one of the cheapest ways for the proper disposal of this waste without doing any harm to the environment. The usage of tea waste for germinating bed is a cheap and eco-friendly way to provide nutrients that boost plant growth. Tea waste also attracts beneficial creatures to seed beds. Earthworm are attracted by tea waste, and it serve many purposes in the planting such as turning organic matter in to plant food and increasing the amount of oxygen and water in the soil (Kaur et al. 2015). A growing media made up of tea waste can provide adequate anchors or support to the seedlings. It also would be a reservoir for nutrients and water. Addition of tea waste may facilitate oxygen to the roots, and

gas exchange between roots and the rhizospere. Therefore, in the present study, the utilization of tea waste for the preparation of germination bed is tested.

Materials and methods

Plant material

Vigna unguiculata L. is a herbaceous plant belong to genus Vigna. This plant is an important crop in the semiarid regions across Asia and Africa. The plant can either be short and bushy (20.0cm) or acts like a climber growing to a height of 7.0 m. The plant had taproot which can penetrate to a depth of 2.4m.The crop is mainly grow for its seeds which are high in protein (23.0 g per100.0 g). The mature plants thrive in poor dry conditions and it grows well in soils having 85.0 % sand. However, germination and the growth of seedlings of cow pea plants dependant on the availability of water and nutrient status of the soil. Vigna seeds used for the experiment in the present study were purchased from a local market at Erattupetta.

Germination media

Growing medium have following major functions such as supply roots with nutrients, air and water, allow plants for maximum root growth and physically support the plant respectively. The health of seedling is greatly affected by the growth media. In the present study germination bed is prepared by adding tea waste generated after the brewing of tea. Both black tea and milk tea waste were used for the present study. The soil for the culture was air-dried and sieved (3.0mm) for the removal of root debris and stones. The germination bed for the seedling culture is prepared by mixing 5.0 g of dry tea waste in 25.0 g of soil. A group of seedlings maintained in soil (30.0 g) and soil (25.0 g) plus vermicompost (5.0 g) as negative and positive controls respectively.

Growth conditions

The seeds were sown on the surface of the germinating media. Each type of growth media inoculated with 6 seeds to monitor the germination process. The plant culture performed at light intensity of 50.0 ± 5 μmol photons $m^{-2}s^{-1}$, photoperiod of 18 h light/6 h dark, temperature of 32 ± 2 °C, and water supply 5.0 mL/day respectively during the growth period of 21.0 days.

Measurement of soil pH

Soil pH is one of the important factors which determine the plant available nutrients present in soil. The soil pH decreases when there is an increase in the

amount of hydrogen ions in the soil. A drop in pH increases acidity and causes dissolution of cations in soil solution. In the present study, soil pH measured from soil solution using a standard calibrated pH meter where soil to water ratio was 1:2 (Sebastian and Prasad, 2014).The soil solution obtained after stirring of soil-water mixture for about 30 minutes.

Analysis of soil conductivity

Soil conductivity is a measure of the amount of salts in soil. It indicates soil health as well as nutrient availability of plants. In the present study, soil electrical conductivity measured from soil solution using a potassium chloride standard calibrated digital conductivity meter. The ratio of soil to water was 1:2 and conductivity measured after 30 minutes of stirring of soil and water mixture (Cambardella et al. 1994). The conductivity expressed in units of µ siemens.

Quantification of biomass

Analysis of biomass will show efficacy of various treatments performed in the study that will improve crop productivity. To quantify biomass, plants cleaned with water, and the fresh weight of the individual plants measured with the help of a weight balance. The biomass expressed as mg fresh weight.

Morphological analysis

Morphological characters such as length of plant parts and number of lateral roots were analyzed by direct observation of specimen at the time of harvest. Length or width of leaves, stem and roots measured using a cm scale. The lateral root number was calculated by counting number of lateral roots arise from the tap root.

Estimation of photosynthetic pigments

Plant pigments measured from acetone – DMSO (1:1) extract of leaf. Leaf discs placed in test tubes containing extraction solvent, and kept in dark for 24.0 hrs. The absorbance (A) of extract recorded and the content of pigments (µg/ml) determined using Arnon's equations for photosynthetic pigments (Lichtenthaler and Wellburn, 1983). The amount of photosynthetic pigments expressed in mg per gram fresh weight of leaves.

Results

Soil properties

Soil is a complex mixture of minerals, organic matter, water, air and microbes which degrade remains of living things. The physicochemical properties of soil will change in the course of addition of soil amendment. The soil pH and conductivity

of soil solution are the key soil properties which changes up on addition of soil amendments. In the present study, mixing of tea waste to the soil caused an increase of soil pH. It noticed that soil pH increase from 6.8 to 7.2 (0.4) units after the addition of both black and milk tea wastes. However, the increase in soil pH after the addition of vermicompost was about 0.1 units only. Soil conductivity is closely related to presence of mineral salts in the soil. But there was no change in conductivity (0.066 Siemens/m) of soil solution after the addition of both vermicompost and tea waste.

Morphological changes

Mophological analyses help to identify the threshold of plant growth responses. The changes in vegetative structures are observed for the comparison of effectiveness of various treatments on plant growth (Figure.1, Table.1). Treatment with milk tea was effective to increase length of root, stem and leaves. Secondly, black tea waste amendment found to be superior over other additives to increase length of the stem. However, the vermicompost amendment which is used as a positive control was more effective to increase the number of lateral roots.

Biomass

Biomass production depends on photosynthetic activities of leaves. In the present study, it noticed that addition of organic amendments such as vermicompost and tea waste increase biomass of Vigna seedlings up to 13.0-21.0 % (Table.2). The highest increase of biomass noticed among of plants reared in germination bed with milk tea waste. The milk tea waste treatment increased stems and leaf biomass up to 33.0 % and 18.0 % respectively. However, there was no effect on root biomass after treatment with milk tea waste. It is noteworthy that seedlings reared with black tea waste amendment had 33.0 % more root biomass compared to those grow with milk tea waste amendment.

Photosynthetic pigments

Photosynthetic pigments are involved in light harvesting process during photosynthesis. Secondly, content of pigments such chlorophyll considered as an indicator of nitrogen status of the plant. It found that total chlorophyll content increased up to 9.0 % after the growth of seedlings in germination bed contain milk tea waste (Figure.2). The increase in chlorophyll was more pronounced with regard to accumulation of chlorophyll a where there was an increase of 20.0 % during application of milk tea waste (Figure. 3). However, black tea waste amendment had no effect on the accumulation of chlorophyll in seedlings. Milk tea waste was more effective than vermicopost to increase accumulation of chlorophyll in

seedlings (Figure. 3). Also, addition of vermicompost decreased chlorophyll b content in seedlings unlike tea waste where there was an increase of chlorophyll b content up to 4.0 % (Figure. 4). There was also a decrease in carotenoids content among seedlings grow in germination bed contain tea waste and vermicompost amendments (Figure. 5).

Discussion

A germination bed is a local soil environment to raise seedlings from seeds. Seeds are embryonic phase of a plant. Germination occurs as soon as moist warm conditions available. The seed coat becomes permeable to O_2 and water during the course of imbibitions of water (Debeaujon et al. 2000). After imbibitions, the inner content of the seed coat leads the rupture of the seed coat, and it is followed by emergence of plumule and radicle (Northam and Callihan, 1994). Seeds confront changes in colour and water content during germination. Germination ends when the embryo has developed into a seedling which is able to perform photosynthesis. In the present study, addition of organic matter content in the form of vermicompost and brewed tea waste to the germination bed found to enhance vigor of seedlings. These seedlings had more biomass as well as photosynthetic efficiency in terms of pigment composition.

Organic matter in the soil helps to decrease soil compactness which in turn enhances aeration (Shah et al. 2017). Also, organic matter reported to increase plant available nutrients in the soil (Ding et al. 2020). So it assumed that addition of tea waste enhanced aeration and nutrient availability for seedlings growth. But there was no change in conductivity of soil solution after the treatment of vermicompost and brewed tea waste. The inherent factors affecting soil conductivity are soil minerals, nutrients, and soil texture (Ding et al. 2020). Above results points that increase in amount of cations such as K^+, Mg^{2+}, Ca^{2+} etc. in the soil was not significant after the addition of organic amendments chosen for the study. However, the addition of vermicompost and brewed tea waste made soil pH slightly alkaline which is ideal for uptake of chemical species of nitrogen (Bruce et al. 2013). It is also reported that organic matter enhances cation exchange capacity of the soil (Shah et al. 2017). So the addition of organic amendments increased plant available nutrients in the soil which in turn promoted seedlings growth in the present study.

Morphological analysis pointed that vegetative parts attain more size and biomass after the addition of vermicompost and brewed tea waste. It also noticed that seedlings forms more lateral roots during growth in germination bed contain organic amendments. The number of lateral roots in *Arabidopsis thaliana* increased

during organic matter treatment as a response to accumulation of nitrogen (Walch-Liu et al. 2006). It is also reported that photosynthesis efficacy as well as more nitrogen uptake result an increase in size and biomass of plants grow in soil contain organic matter (Guo et al. 2019). The results of present study corroborate with above reports, and the analysis of photosynthetic pigments support the finding that increase in plant available nutrients, especially nitrogen account for higher biomass and more lateral roots production during growth of Vigna seedlings in both vermicompost and tea waste amended soil.

Chlorophyll is an indicator of nitrogen status of the plant (Prost and Jeuffroy, 2007). The increase of chlorophyll a content during treatment with vermicompost and milk tea waste indicates that addition of these amendments in soil results more nitrogen for plant uptake. It is noteworthy that both these amendments are rich in protein as well as amino acids which are a source for nitrogen. However, black tea waste had relatively low protienaceous compounds compared to milk tea waste which account for no change in accumulation of chlorophyll content after treatment with black tea waste. Chlorophyll b and carotenoids are accessory pigments which play important role in photoprotection when the light reaction of photosynthesis is under stress (Kume et al. 2017). A decreasing trend in accumulation of these pigments found in the experimental plants with respect to control plants points that addition of organic amendments in the germination bed enhance photosynthetic efficiency of Vigna seedlings. In conclusion, the results of the present study point that addition of tea waste could be an alternative for vermicompost used in germination bed. Secondly, milk tea waste found to be superior to black tea waste for the stimulation of growth of Vigna seedlings.

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Table. 1 Morphological changes in seedlings

Treatments	Leaf length	Leaf width	Root length	Lateral roots	Stem length
S	3.0	2.6	3.0	4.0	10.0
S + C	3.7	3.0	5.0	8.0	10.4
S + BT	3.8	2.5	4.8	6.0	13.2
S + MT	3.8	2.7	5.1	6.0	10.6

*Abbreviations : S –Soil, S+V- Soil with vermicompost, S + BT- Soil with black tea waste, S + MT - Soil with milk tea waste

Table. 2 Biomass of plant parts after treatments

Treatments	Root weight	Leaf weight	Stem weight
S	0.06	0.18	0.22
S + C	0.08	0.22	0.24
S + BT	0.08	0.18	0.26
S + MT	0.06	0.24	0.26

*Abbreviations :S –Soil, S+V- Soil with vermicompost, S + BT- Soil with black tea waste, S + MT - Soil with milk tea waste

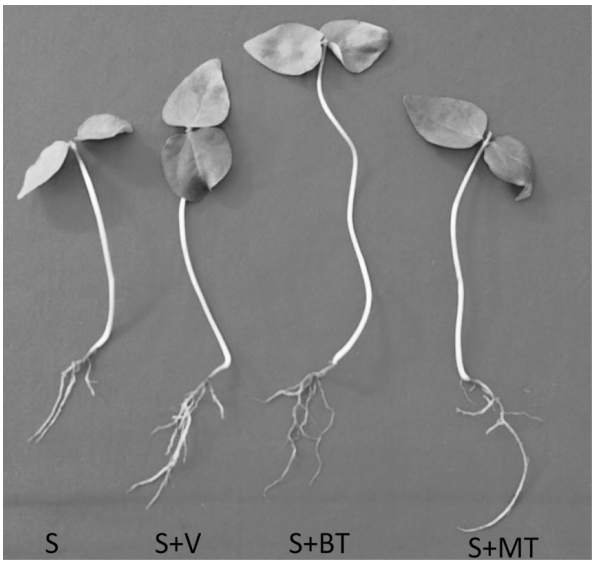

Figure. 1

Morphological appearance of plants at the time of harvest. Abbreviations: S - Soil, S+V - Soil with vermicompost, S + BT - Soil with black tea waste, S + MT - Soil with milk tea waste

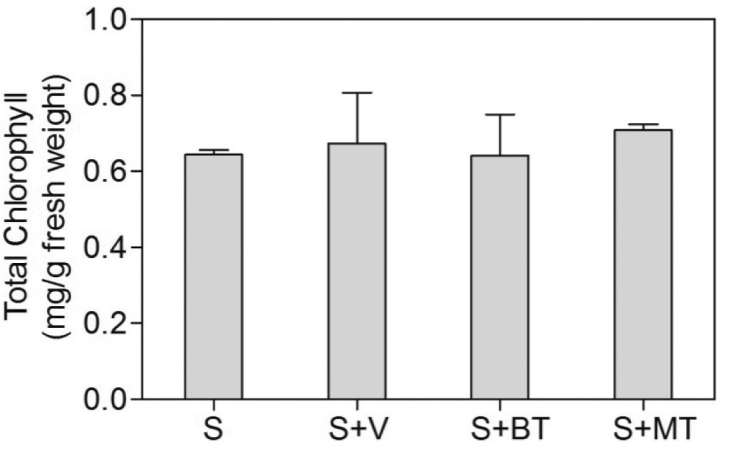

Figure. 2

Total chlorophyll contents in leaves. Abbreviations: S - Soil, S+V - Soil with vermicompost, S + BT - Soil with black tea waste, S + MT - Soil with milk tea waste.

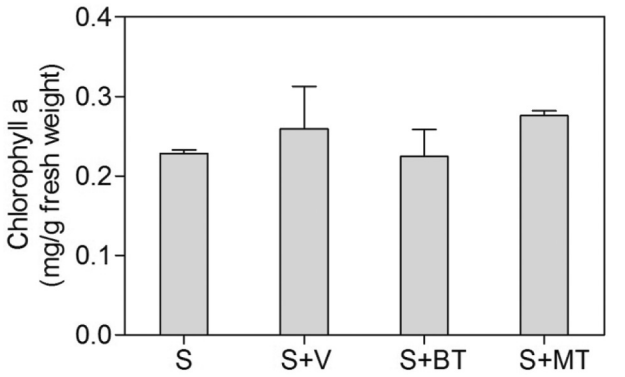

Figure. 3

Chlorophyll a content in plants. Abbreviations: S - Soil, S+V - Soil with vermicompost, S + BT- Soil with black tea waste, S + MT - Soil with milk tea waste.

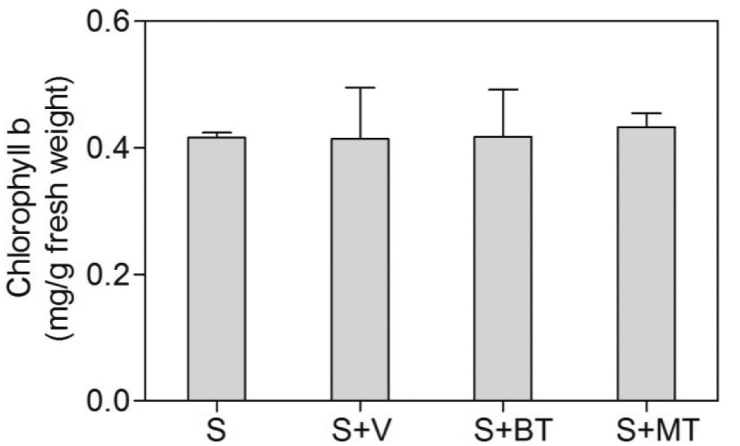

Figure. 4

Chlorophyll b content in leaves. Abbreviations: S - Soil, S+V - Soil with vermicompost, S + BT - Soil with black tea waste, S + MT - Soil with milk tea waste.

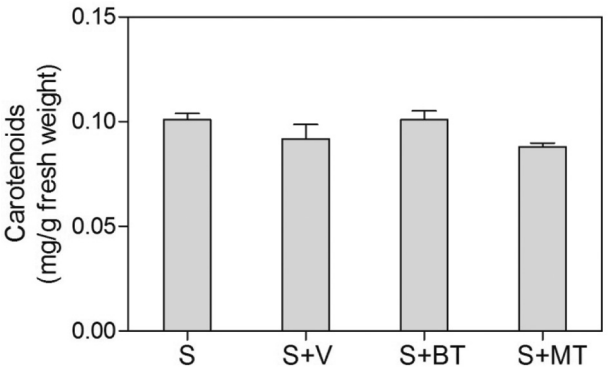

Figure. 5

Carotenoid content in plants. Abbreviations: S - Soil, S+V - Soil with vermicompost, S + BT - Soil with black tea waste, S + MT - Soil with milk tea waste.

FINDING TEXT AFTER PHENOMENOLOGICAL BRACKETING: INTERPRETIVE COMMUNITIES AS THE *EIDOS* OF TEXTUAL PRESENCE

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Abstract

One of the aims of philosophy is to comprehend the reality and communicate the same to an enlightened audience. Phenomenology has been a recent development in philosophy. Edmund Husserl speaks of an *epoché* (cessation) to refer to the suspension of judgment regarding the true nature of reality. Reader-Response theories have an inseparable relation with phenomenology. The paper is an attempt to posit the idea of Stanley Fish's Interpretive Communities in the context of comprehending reality after phenomenological bracketing. The presence of interpretive communities helps people find a common reading experience.

Key Words: Reader-Response, Phenomenological bracketing, Interpretive mmunities, *epoché*

History of philosophy describes a search for the true knowledge from what is perceived. Plato's theory of knowledge involves a distinction between a subject or "knower" and an object or thing-known. For him, knowledge is always knowledge of something. "Whilst the forms are invisible to the eye, our souls have participated in the eternal world of forms prior to being incarnate in a physical body, and retain a memory of them"("Plato's theory"). This presence of memory is sufficient, to enable our limited perceptions.

Rationalists like Descartes tried to understand the world by careful use of reason. Descartes opens the First *Meditation* asserting the need "to demolish everything completely and start again right from the foundations ... [For this] I should hold back my assent from opinions which are not completely certain and indubitable .... So, for the purpose of rejecting all my opinions, it will be enough if I find in each of them at least some reason for doubt" (Cottingham 12).Even his doubting

self gives him a proof for his existence: ***Dubito, ergo Cogito, ergo Sum*** (I doubt, therefore I think, and therefore I am).

Empiricists like Locke, Berkeley and Hume based all knowledge as acquired through perception and experience. According to Locke the mind at birth is a tabula rasa, a "white paper void of all characters, without any ideas. How comes it to be furnished? Whence comes it by that vast store which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer, in one word, from experience"(Locke 53). Physical objects exist independently of perception, but their appearance is very different from reality.

While Locke had trust in the existence of primary qualities like solidity, extension, figure, motion or rest and number, his successor, Bishop George Berkeley denied them as well. Berkeley becomes an advocate of immaterialism and proclaims that the *esse (*existence) of the unthinking things is p*ercipi (*perception*).* It is not possible for them to "have any existence out of the minds or thinking things, which perceive them" (Armstrong 62).

According to Hume's empirical criterion of meaning, a term is intelligible only if there is an idea with which it is associated. Hence, to have knowledge of external objects, we require an idea of that object. As all ideas are copies of (or derived from) preceding impressions, we require an impression of that external object. Hume notes that there can never be an impression of continued and distinct existence.

Immanuel Kant was said to have been woken up by Hume from his 'dogmatic slumber' to formulate a 'Copernican revolution' in the field of philosophy when he synthesized rationalism and empiricism intelligently. For him phenomena are the perception of the 'noumena' through the categories of the mind. One could reach synthetic a priori judgments which provide new information that is necessarily true.

Phenomenology is the study of "phenomena": appearances of things, or things as they appear in our experience. Franz Brentano had characterised intentionality as ´directedness upon an object´. He says:

> Every mental phenomenon is characterized by ... the intentional (or mental) inexistence of an object ... reference to a content, direction toward an object (which is not to be understood here as meaning a thing), or immanent objectivity. Every mental phenomenon includes something as object within itself.... In presentation, something is

> presented, in judgment something is affirmed or denied, in love loved, in hate hated, in desire desired and so on....This intentional inexistence is characteristic exclusively of mental phenomena. [They] are those phenomena which contain an object intentionally within themselves. (Brentano 68)

For Brentano all consciousness can be put into three categories of intentionality: representation, judgement and love or hate. Intentionality is the act of interpreting-and-perceiving, the act of relating to, always being consciousness of some meaning.

Husserl describes consciousness as intentional insofar as it refers to, or is directed at, an object. Intentionality is a property of directedness toward an object. Consciousness may have intentional and non-intentional phases, but intentionality is the property that gives consciousness its objective meaning.

The *cogito* ("I think") is the principle of the pure ego. The pure ego performs acts of consciousness (*cogitations*) that may be immanently or transcendently directed. Immanently directed acts of consciousness refer to objects that are within the same ego or that belong to the same stream of consciousness. Transcendently directed acts of consciousness refer to objects that are outside the ego or that belong to a different stream of consciousness. The objects of consciousness (*cogitata*) are the things that are perceived and consciously experienced.

The difference between immanent and transcendent perception reflects the difference between being as experience and being as thing. Things as they exist in themselves cannot be perceived immanently, and they can only be perceived transcendently. The difference between immanent and transcendent perception also reflects the difference in the way in which things are given and presented to consciousness. This givenness may be adequate or inadequate in terms of its clearness and distinctness, and in terms of its intuitability.

Immanently perceived objects have an absolute being insofar as their existence is logically necessary. The existence of transcendently perceived objects is not logically necessary, insofar as their existence is not proved by the being of consciousness itself.

Every actual *cogito* has an intentional object. The *cogito* itself may become a *cogitatum* if the principle that "I think" becomes an object of consciousness. Thus, in the *cogito*, the act of thinking may become an intentional object. However, in contrast to the Cartesian principle that "I think, therefore I am" (*cogito ergo sum*),

the phenomenologically reduced *cogito* is a suspension of judgment about whether "I am" ("I exist"). The phenomenologically reduced *cogito* is a suspension of judgment about the question of whether thinking implies existence. Thus, phenomenology examines the *cogito* as a pure intuition, and as an act of pure consciousness.

Husserl describes noesis and noema as two phases of intentionality. Noesis is the process of cogitation, while the noema (or cogitata) are that which is cogitated. N*oesis* and *noema* correspond respectively to experience and essence.

Phenomenological reduction is a process of defining the pure essence of a psychological phenomenon. This is accomplished by a method of "bracketing" empirical data away from consideration. In bracketing our experiences we suspend belief in the actual existence of intended objects — be they physical objects, persons, minds, propositions, or meanings. Husserl uses the term *epoché* (Greek, for "a cessation") to refer to this suspension of judgment regarding the true nature of reality. Through an intuition of how appearances of things might be varied we can then come to discover 'eidetically' their 'invariant general structures', that is, the essences (*wessen*) of things. This approach leaves pure consciousness, pure phenomena, and the pure ego as the residue of phenomenological reduction. Husserl says in *Logical Investigations,* "The essences directly grasped in essential intuition, and the connections based solely upon the essences, are brought to expression descriptively in concepts of essence and lawful statements of essence. Every such statement is an 'a priori' one in the best sense of the term·" (qtd. in Farber 198)

There are three steps in the transcendental-phenomenological reduction. First, one reflects on consciousness: whatever act is under consideration, one ceases to be concerned with its object (whether this object be an individual, an essence, a state of affairs, or some other kind of entity) and turns one's attention instead to the act in which the object is intended and to the ego as subject of this act. Second, one disregards the naturalistic aspects of consciousness through transcendental reduction of the ego and its acts: this reduction isolates the "pure" data of consciousness from their presumed naturalistic environment. Third, the data that remain over after transcendental reduction are then studied eidetically by applying to them the method of eidetic variation. Thus phenomenology is an "eidetic science" of transcendental consciousness, a study of those transcendental features of the ego and its acts that are universal and necessary. The end product of phenomenological reduction is the *"**eidos**" (*essence or, '*ideal species'*), of the phenomenon.

Although Husserl refers to universals, species and essences here, undoubtedly the ideality of meaning should be understood more generally as referring to that

which remains unitary or identical. The claim is that whatever object we experience; we always perceive it *both* from a particular perspective or vantage point (actual) and as unitary (ideal), and whatever is ideal, can never be turned into something real. Husserl thus sees ideality in the more general sense as 'unity in plurality'(Husserl 196).

For Sartre consciousness is consciousness "of something". It is non-substantial and is total emptiness. Sartre considers its existence in "its essence, and that everything exists for *consciousness* is itself in itself" (Marsh 85).

The exponents of Reader-response bracket the traditional concept of a work as a structure of meanings. They consider the meanings as the creation of individual readers. Though the responses of the actual reader is different from what is expected in the "implied reader", we could reach towards a common reading, as the readers share "interpretive strategies", "identity themes", "expectations" and "similarities of concern" even before reading a particular text.

There are different approaches within this school of critical theory. However, some look at the work from the individual reader's point of view, while others focus on how groups or communities view the text. Gadamer argues that "a literary work does not pop into the world as a finished and neatly parcelled bundle of meaning; rather meaning depends on the historical situation of the interpreter," (Selden 62)

Norman N Holland says, "a reader responds to a literary work by assimilating... to his search for successful solutions within his identity theme to the multiple demands ... on his ego" (*Five Readers* 218). There are similarities among readers. Holland argues, "When you and I apply ideas we share to the same text, then very likely we will come to the same conclusion about that text. In those respects we read alike" ("Old Criticism" 5).

David Bleich thinks that the readers of the "same text will agree that their sense motor experience of the test is the same" (220).

In the essay "Literature in the Reader", Fish defines his "informed reader" as having the following qualities: "The informed reader is someone who (1) is a competent speaker of the language out of which the text is built up; (2) is in full possession of 'the semantic knowledge that a mature . . . listener brings to his task of comprehension,' . . . ; and (3) has literary competence" (48).

This is in contrast with what William Wimsatt and Monroe Beardsley has said in *The Verbal Icon*: "The Affective Fallacy is a confusion between the poem and its *results* (what it *is* and what it *does*) . . . It begins by trying to derive the standards

of criticism from the psychological effects of the poem and ends in impressionism and relativism. The outcome . . . is that the poem itself, as an object of specifically critical judgment, tends to disappear (qtd. in Fish 23).

Fish answers this by saying that the "objectivity of the text is an illusion and, moreover, a dangerous illusion, because it is so physically convincing. . . . A line of print is so obviously there . . . that it seems to be the sole repository of whatever value and meaning we associate with it" (43). To Fish, the poem can't disappear because it was never actually there in the first place except as a reflection of the interpretive strategy used to approach it.

Fish denies the text's independence as a repository of meaning. The text does not contain meaning: despite being written upon, it is a tabula rasa, a blank slate onto which the reader, in reading, actually writes the text. Fish focuses on two major questions that his critics levelled against him. The first question that concerns him addresses the reasons behind why the same reader will interpret "different texts" (167) in different ways, and the second question that he addresses explores the reasons why different readers will interpret the same text in a similar way.

According to Fish, in both of these situations, the answers stem from the methods that the readers use in interpreting the texts, rather than from the formal elements of the texts themselves. First, the employment of a different "set of interpretive strategies" upon the same literary text would produce "another text" (168). Thus different interpreters will see different intentions because they are a creation of the reader and not the author. Second, the employment of the "same set of strategies" (169) used on Lycidas and a different text(For example, George Eliot's Adam Bede)would produce similar results. Third, another reader who employs "interpretive strategies similar to mine [on the same poem] will perform the same (or at least a similar) succession of interpretive acts" (169), for which reason we would be "tempted to say that we agree about the poem (thereby assuming that the poem exists independently of the acts either of us performs) [whereas] what we would really agree about is the way to write it" (169). Fourth, another reader of Lycidas who "puts into execution a different set of interpretive strategies will perform a different set of interpretive acts [with the result that one] could complain to the other that we could not possibly be reading the same poem . . . and he would be right: for each of us would be reading the poem **[**the person] had made"(169). Fish concludes from this that the "notions of the 'same' or 'different' texts are fictions [for] it will not be because the formal structures of the two poems (to term them such is also an interpretive decision)call forth different interpretive strategies but because my predisposition to execute different interpretative strategies will

produce different formal structures"(237).

Fish seeks to know why different readers should ever agree and why should "regular...differences in the career of a single reader ever occur" (171). This is because of the presence of

> interpretive communities ... who share interpretive strategies not for reading(in the conventional sense) but for writing texts, for constituting their properties and assigning their intentions....[These] strategies exist prior to the act of reading and therefore determine the shape of what is read rather than, as is usually assumed, the other way around....[If] it is an article of faith in a particular community that there are a variety of text, its members will boast a repertoire of strategies for making them,...[while if another community] believes in the existence of only one text, then the single strategy its members employ will be forever writing it(171).

In speaking, "what utterers do is give hearers and readers the opportunity to make meanings (and texts) by inviting them to put into execution a set of strategies" (173). He asks: if "everyone is continually executing interpretive strategies and in that act constituting texts, intentions, speakers, and authors, how can any one of us know whether one of us know whether or not he is a member of the same interpretive community?"(173).Given that any evidence proposed to "support the claim would itself be an interpretation [the only] 'proof 'of members is fellowship, the nod of recognition from someone in the same community" (173).

In response to a criticism launched by M. H. Abrams, Fish explains some of his understanding of the conventional nature of language:

> If what follows is communication or understanding, it will not be because he and I share a language, ... but because a way of thinking, a form of life, shares us, and implicates us in a world of already-in-place objects, purposes, goals, procedures, values, and so on; and it is to the features of that world that any words we utter will be heard as necessarily referring (303).

Thus the act of recognizing literature is not constrained by something in the text, nor does it issue from an independent and arbitrary will; rather, it proceeds from a collective decision as to what will count as literature, a decision that will be in force only so long as a community of readers or believers continues to abide by it.

To claim that each reader essentially participates in the making of a poem or novel is not an invitation to unchecked subjectivity and to the endless proliferation

of competing interpretations. For each reader approaches a literary work not as an isolated individual but as part of a community of readers. "Indeed," Fish writes, "it is interpretive communities, rather than either the text or reader, that produce meanings"(14).

When the method of Husserl's phenomenology and that of interpretive communities are analysed, one could find that there is a similar strive towards a common essence. It is the universality and similarity of perception that makes human life possible. The collective name 'human being' or even 'being' is given to a particular group that shows the similarity of the same sorts. It is our belief that what we perceive is similar to that of others. Absolute similarity is not possible as A. J. Ayer says, "[The other] tells me that he is in pain, but may it not be that what he understands by pain is something quite different from anything that I should call by that name"(205). But our continuation of life in this world is seen possible through the belief in a similarity of perception.

In the same way people, especially of a particular society, living together share the same milieu. Sartre states, "people of the same period and community, who have lived through the same events, who have raised or avoided the same questions, have the same taste in their mind" (*What is Literature?* 51)

The phenomenological reduction is a search for universal essence from particular experience after bracketing the external world. Reader response theories also bracket the intention of the author. The exponents of reader response exhorts that the "birth of the reader must be at the cost of the author"(*Image* 148).

For Stanley fish, it is the readers who 'write' the 'text'. In the sense there are innumerable 'texts' as reading. (Even the 'texts' created by readings of a particular reader at different times are varied insofar as their interpretive strategies differ.) The sharing of interpretive strategies by the readers by a community of readers leads to a universal reading.

Whereas in phenomenological reduction we reach a universal essence from a particular instance, in reader response, as conceived by Stanley Fish, we obtain the universal reading from several readings. There are, of course, "texts" after bracketing the author. However, in order to have a common reading, we have to open the bracket and accept the possibility of sharing certain cultural assumptions and strategies.

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COVID-19 PANDEMIC: IMPACT ON CARDAMOM PLANTATIONS IN KERALA

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Abstract

This paper analyses the circumstances of cardamom cultivators and cultivations against the backdrop of COVID-19 pandemic in Kerala. As the cultivation of cardamom is highly labour intensive, the scarcity of labour force resulted in large scale decay of unplucked cardamom cloves in various plantations. The shortage of labour force also resulted in a drastic increase in labour cost for hand picking of cardamom cloves from the plants. This study focuses on unstructured interviews and conversations with large scale and small- scale planters, labourers, cardamom traders and people employed in commercial large scale drying of cardamom. The findings suggest that many cultivators organized various strategies to overcome the issues especially migrant labour crisis of employing unskilled labourers at a high cost, bringing migrant labourers from their hometowns in private buses at the expense of cultivators. Cardamom, called the queen of spices, proved worthy of its title when it fetched a record price in the market this year and brought good tidings to Kerala farmers who are otherwise affected by the vagaries of the weather. With the price hitting Rs 6,000/ kg, cardamom growing areas saw people buying acres of farms and those who had turned to other crops returning to cultivate the green gold. Kerala's reputation as the land of spices goes back at least 3,000 years. Here, Express delves into the aromatic world of spices with a special focus on Kerala.With the outbreak of the Covid -19, the farmers and traders of cardamom started facing serious challenges in their sector. There was a tremendous change in this field. Because of the lockdown interstate trade as well as export of the spices including cardamom was at a standstill. There was serious fall in the prices of cardamom. The cost of production increased as there was shortage in labour. The auction centres were also closed.

Keywords: E-Auction , vagaries, legendary

Covid-19 : Impact on cardamom plantations in Kerala

Introduction

India is nicknamed as the home of spices. Indian spices have been a heart to Indian culture and also plays an important role in the country's civilization. Traditionally India was known as the legendary land of spices. A wide variety of spices are produced and traded in India. Among the varied spices, Cardamom plays a crucial role both in the national and international market. Cardamom is a spice that belongs to ginger family. It is considered to be one of the oldest spices. Cardamom is the world's third most expensive spice and is renowned as the Queen of spices. Cardamom is mostly used for flavouring in both food and drink and used even as a medicine. Kerala is the largest producer of small cardamom in India. The territorial spread of cultivation of small cardamom or Elettaria cardamom in Kerala is confined to Idukki, Wayanad and Palakkad districts. The cardamom hills of Idukki district produce the major share of the cardamom in markets of Kerala. It is about 90 percent of total cardamom production in India. There are two types of cardamom : Black cardamom (large) and green cardamom (small).This study attempts to highlights the impact in the cardamom hills of Idukki district against the backdrop of COVID-19 pandemic lockdown. This study is based on a descriptive research design and reviewed previous works related to cardamom cultivation in Idukki district. Also, this research paper is based on the unstructured interviews among planters, local traders, and workers of cardamom dyers to know the experiences of individuals engaged in the production process of cardamom during the pandemic crisis.

Cardamom is one of the severely affected crops due to the lockdown. The regular nature of plant protection operations and the 6-8 rounds of harvesting cycles practiced in the crop means that any prolonged period of disruption in input supply chains, including that of labour supply, would adversely affect the crop. The limitations imposed on labour use and restrictions on movement severely curtailed normal operations in the crop in the major production zone, Idukki. More than 13 per cent of the total small cardamom area and production in the country is concentrated in Idukki District. Presently, the ongoing crop operations in cardamom include irrigation and other farm operations. At present the crop loss is reported to be marginal. Though harvesting is reported to be mostly over in the cardamom plantations, reports suggest that last-stage harvesting is still pending in some cases. Harvest of cardamom in Kerala is undertaken by migrant workers from Tamil Nadu. As the Kerala-Tamil Nadu border was sealed during the lockdown, these workers were not available for harvesting. Considering that cardamom is a non-perishable crop, the

loss due to non-harvesting of small cardamom owing to shortage of manpower may be worked out at a minimum of about 10 kg per ha. Accordingly, the total estimated crop loss during the season may be about 300 MT. Further, auctions were stopped after mid-March 2020 when there was a sharp drop in prices by about Rs 1,000 per kg. More than 90 per cent of the cardamom production in the State is sold through the e-auction centres. As a result, stock has accumulated and weekly payments are not received by cardamom growers. No trading happens in cardamom now. Data on e-auctions from the Spices Board indicate that if 2,861 MT of cardamom was traded by planters and dealers in March and April of 2019, the corresponding amount for 2020 was 588 MT. The value of trade at the e auctions fell from Rs 461 crore in March and April of 2019 to Rs 239 crore in March and April of 2020 (this was partly due to a price rise from Rs 1,813 per kg in April 2019 to Rs 2,667 per kg in April 2020, and not a reflection of quantities). The farmers are holding stocks without an effective means of sale. The global demand for spices has not declined, but global supply chains are affected. Export orders for cardamom to the Gulf region for the Ramadan season beginning from April 21 have been postponed or cancelled. The closure of the upcountry markets like Delhi and Mumbai also led to fall in sales of cardamom. The crop loss is expected to reach up to 30 per cent of the normal harvest during the months of March and April. It is estimated that about 200 MT of stock per week is stuck with farmers, amounting to around 800 MT of cardamom for a month, valued at about Rs 180 crore. Losses in Kerala may amount to about Rs 126crore.

Review of literature

V Sajeev Kumar(2020), in his journal titled " Spices board mulls using e-NAM portal for cardamom sales", stated that in order to deteriorate issues in the marketing of cardamom, spices board introduced an online mechanism named e-Nam. It doesnot require the physical presence of buyers. Nationwide lockdown during the severe pandemic has affected the trading. Also he states that , the board has taken a series of measures to support the cardamom planters from the vagaries of Covid 19 crisis. Initially the mechanism was introduced on a pilot basis at spices park in Puttady in association with Kerala Agricultural department.

R R Kattel, M D Sharma et. al, (2020), in their journal on " Factors affecting adoption of improved method in large cardamom curing and drying in the eastern Himalaya", suggested that most of the institutions are giving both financial and non financial support for large cardamom in its curing and drying process.

Spices Board (2020), in their paper titled "India's Spices Board to support

cardamom growers" states that the India's Spices Board will provide financial support for replantation of cardamom in the three cardamom growing states of Kerala, Karnataka and Tamil Nadu.The replantation support will be extended in two annual instalments.

Cardamom growers owning up to four hectares in Kerala and Tamil Nadu will qualify for a financial package of Rs17,780 ($414.50) as first instalment and Rs17,036 as second instalment. Farmers owning above four hectares but up to eight hectares will receive Rs13,470 as first instalment and Rs12,950 as second instalment. For the rejuvenation of cardamom plantations, the Spices Board will disburse Rs13,300 per hectare as a single instalment to cardamom growers owning up to four hectares in the states of Kerala and Tamil Nadu. The Spices Board is also providing financial aid for setting up irrigation facilities, soil conservation and for cardamom curing as well as technical advice to cardamom growers.

Research Gap

Most of the studies have concentrated on cardamom production and marketing in a particular geographical area. No attempts have been made to study the impact of Covid 19 pandemic in the cardamom plantation in Kerala. Hence the present study.

Scope of the Paper

This study shows the " Impact of Covid 19 pandemic in the cardamom plantations in Kerala". This analysis is made through the data collected mainly from cardamom planters (small and large) and from the cardamom traders in Idukki district. Also similar data are collected from Spices board and from such other institutions.

Objectives of the study

The objectives of this study are as follows:

1 To study the impact of Covid 19 pandemic on cardamom plantations in Kerala.

2 To know the threats and challenges faced by the cardamom sector in the national and global market.

Methodology of the study

The data for this study is taken from primary source and secondary sources. Unstructured interviews were conducted among the cultivators , traders and labourers of cardamom plantations to scientifically investigate the impact of severe pandemic crisis. The sampling universe of this study includes cardamom planta-

tion cultivators, labourers, supervisors, traders, commercial cardamom dryers and local cardamom traders of Idukki District. Following the safety measures during the pandemic, conversations with respondents were recorded by note-taking. The photographs were taken in the field with the consent of participants. A descriptive analysis approach is selected for the study. Secondary data were collected from the publications of Spices Board of India, reports and magazines of the Government. Statistical tools such as averages and percentages were used in this study.

Results and Discussions

Data needed for the study are collected for the period 2014-2020.

Challenges faced by the cardamom planters and traders as a result of Covid- 19 are :

(i) Immense fall in the cardamom price

Before the lockdown in March 2020, the average price of cardamom was quoted as Rs.3300/kg. Later the average price for the same has dropped to Rs.1150/ kg. With in a week, price dropped by Rs.1000/kg. Covid19 pandemic immensely affected the auction price. Auction centres had remained closed for long period. After its reopening, average price again fell down. Many of the small scale cardamom planters were compelled to sell their cardamom at low prices incurring huge loss. In August 2019, maximum price of cardamom was at Rs.7000/kg. The lower price realisation has led to panic selling.

(ii) Hit cardamom Traders

Covid 19 immensely hit the small scale as well as large scale cardamom traders, who purchased bulk quantities of cardamom from planters and farmers, expecting hike in price. Unfortunately, the average price for the same got reduced to a great extent. They incurred huge loss. Bulk quantity of cardamom stock remained unsold at their warehouses due to shut down of auction centres, low demand and low price. Above all, the cardamom in the warehouses is getting damaged day by day. Now, traders have stopped purchasing cardamom from planters and farmers. It negatively affects the farmers and planters

(iii) Storage problems

Due to shutting down of auction centres at Puttady and at Bodynaikkannoor , tonnes of cardamom stocks remained unsold in the warehouses. Exporting of cardamom were hindered. Traders who bought cardamom in bulk quantities from planters expecting rise in price, suffered with accumulation of cardamom at warehouses. A large amount of capital got blocked as stock. They are trying to sell

their cardamom even at a price much lower than the marginal price, which bears loss. Also huge quantities of cardamom were deteriorated due to storage over long period of time. And traders are compelled to sell the old stock which belongs to last year. But a pale yellow colour in the stock downgrades its quality.

(iv) Issues with related to transportation

Another major consequence that affected cardamom sector is with regard to transportation. Since there exists lockdown and restrictions with regards to inter-state mobility, a huge number of traders and businessmen from Tamil Nadu were unable to travel to Kerala for participating in auction.

(v) Shutting down of Auction centres

Nowadays, marketing of cardamom is conducted through auction centres. Auction centres are located at Puttady and Bodynaikkannoor in Kerala. When lockdown was announced in the country, auctions were suspended. So the movement of cardamom from Idukki district has been stopped. Eventhough the traders purchased and stored huge amount of cardamom from planters, they were unable to sell the same to wholesalers through auction.

(vi) **Lack of export**

Idukki is considered to be the main producer and exporter of cardamom. It is the major source of earning foreign income. Covid 19 has severely affected the export of the same to Gulf nations. When the pandemic started spreading across the world, the Gulf countries temporarily suspended cardamom import especially from Kerala. As a result, Kerala lost many export orders .Thus inflow of foreign currency got declined.

(vii) **Increased labour cost and production cost**

Tremendous spreading of pandemic affected the availability of labour during the harvest season. Nationwide lockdown insists strict restriction on mobility of labour inputs from one place to another. Social distancing also negatively affected the availability of labour on time. There exists restrictions with regard to number of workers. Labourers started to claim increased wages, travelling expense and other benefits. Timely availability of workforce is an unavoidable factor. Along with increased labour cost, overall production cost got increased

(viii) **Labour crisis**

The cultivation of cardamom is labour intensive .Since cardamom plants are grown on the slopes of mountains, it requires everyday irrigation during summer

season (January to May). The workers water the plants with water pumped by diesel motor from streams or well by using hoses or by operating sprinklers. The workers weed the planation at least thrice a year and maintain a compost pit in the middle of every four cardamom plants. In summer, weeds plucked by workers are used to cover the bottom parts of the plants that lie above the soil to protect new buds from the summer heat. In summer months, managers allot specific areas of a plantation to each migrant worker for manual tilling of topsoil with shovels, picks and hoe. The large-scale manual tilling aerates the soil and benefits manual irrigation and manuring.

The COVID-19 pandemic outbreak in the early months of 2020, resulted in the government of India declaring nation-wide lockdown on 24th March 2020. The enforcement of COVID-19 protocol resulted in the suspension of all activities in plantations of cardamom hills. The initials months of lockdown witnessed the mass departure of migrant workers from cities like Delhi, where workers travelled for days on foot to reach their homes. In Kerala, the enforcement of lockdown was so strict that workers could not assemble on the streets because of frequent police patrols. Later, the negotiations between the government of Kerala and central government resulted in arranging railway transportation for migrant workers. The strict lockdown resulted in bewildering most of the medium and large plantations up till the onset of COVID-19 unlock protocol on 8th June 2020.

The days of strict lockdown coincided with the months of monsoon in Kerala. Therefore, the planters managed without regular irrigation as rains provided necessary water for the plants.. Since there were very few or no migrant workers to perform large scale harvest, the first harvest was delayed in most medium and large plantations.

For some years, the daily wage of migrant workers are around three hundred rupees, and permanent workers are paid five hundred rupees. But the temporary Tamil workers are paid five hundred and fifty for each person. Most of the temporary Tamil workers are unskilled, and there lacked necessary less time to train them for carefully pluck ripened cardamom cloves from the plants. The heavy rains and lack of labour force for weeding resulted in the decay of several plants in various plantations. Similarly, the difficulty in spraying pesticides resulted in cardamom cloves developing rough texture due to pest infest.

Table 1 : Area of Cultivation, and Production of small cardamom in India (in hectare)

State	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Kerala	39730	39680	39080	39080	38882	38796
Karnataka	25080	25240	25117	25135	25135	25137
Tamil Nadu	5160	5160	5160	5115	5115	5110
Total	69970	70080	69367	69330	69132	69043

Source: Spices Board of India Publications compiled data

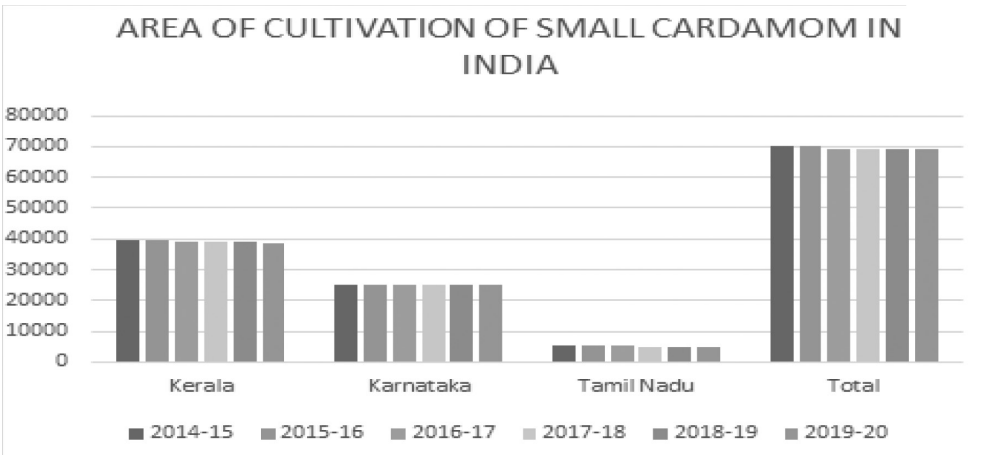


Figure 1

Area of Cultivation, and Production of small cardamom in India (in hectare)

Source : Table 1

India – the home land of spices, is the major producers of small cardamom second to Guatemala. In India Kerala, Karnataka and Tamilnadu are the major producers of green cardamom. The statewise area of cultivation of small cardamom in India is given in Table 1.Table 1 shows that, the area of cultivation of small cardamom remains static and constant throughout the years under study. A small fluctuation in the area is due to adverse climatic conditions such as flood.

Table 2 : Statewise production of small cardamom in India (in tonnes)

State	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Kerala	19500	21503	15650	18350	11535	9650
Karnataka	1500	1437	1449	1450	690	690
Tamil Nadu	1000	950	891	850	715	710
Total	2200	23840	17990	20660	12940	11050

Source: Spices Board of India Publications compiled data

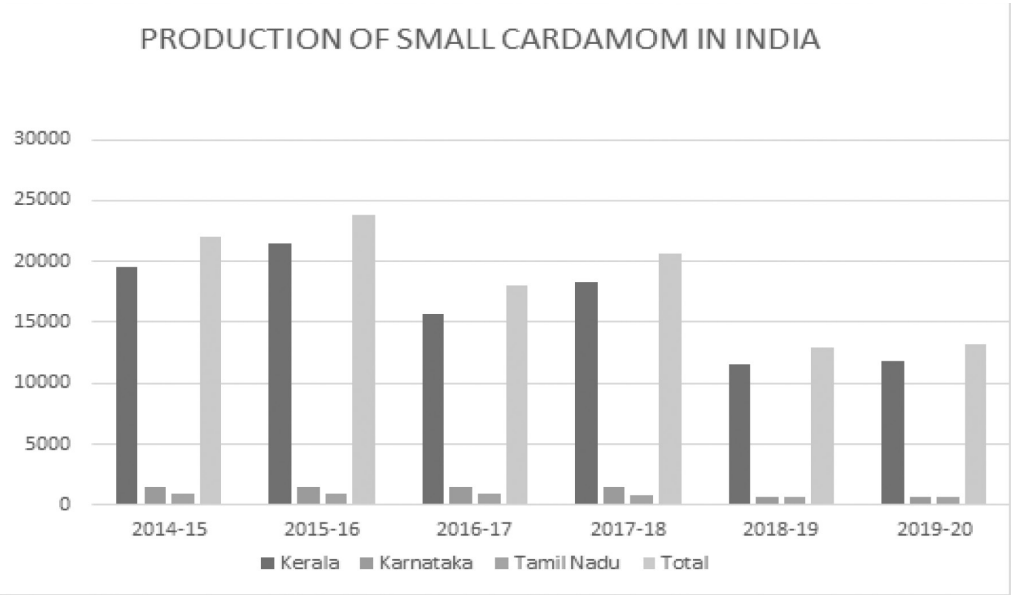


Figure 2

Production of Small Cardamom in India

Source :Table 2

Table 2 shows that statewise production of small cardamom in India. Among the three states, Kerala accounts major portion in terms of production. The production shows wide fluctuation under the period of study. The main fall in the production in Kerala is due to impact of flood and immense lockdown due to pandem-

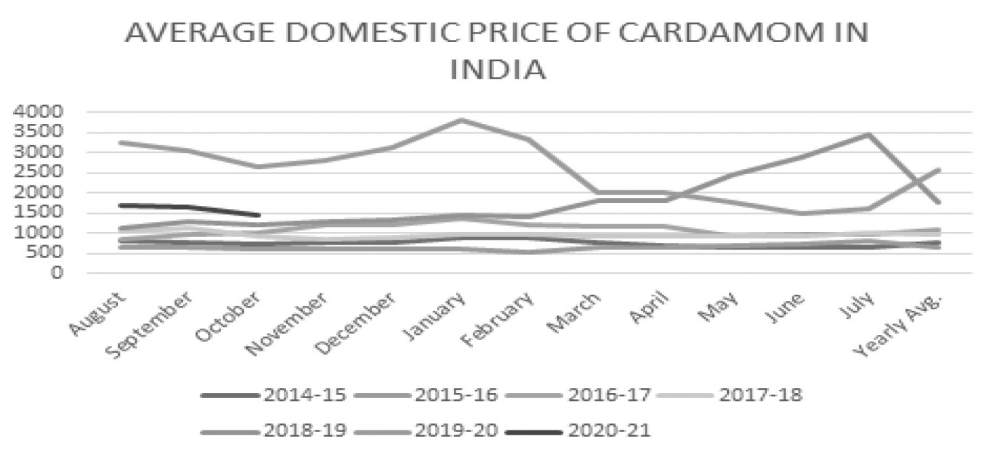
ic situation. Lack of availability of sufficient labourers from nearby states during cardamom plucking season adversely affects the cardamom production. It has serious implications on the income of cardamom planters .

Table 3: Average domestic price of small cardamom in India

Month	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
August	817	634	841	1064	1132	3251	1687
September	773	657	956	1144	1271	3040	1634
October	737	610	1011	931	1197	2652	1462
November	757	610	1221	837	1300	2803	
December	776	595	1197	908	1317	3125	
January	875	598	1351	968	1432	3802	
February	873	544	1198	952	1398	3313	
March	771	638	1154	915	1813	2000	
April	708	638	1154	915	1812	2000	
May	663	697	929	927	2442	1770	
June	663	743	957	914	2873	1477	
July	637	793	957	1022	3436	1619	
Yearly Avg.	754	647	1077	958	1785	2571	1594

Source : Spices Board of India Publications

Figure 3: Average domestic price of cardamom in India



Source : Table 3

Table 4 : Covariance

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
2014-15	1						
2015-16	-3811.30178	1					
2016-17	5444.207101	-5460.15	1				
2017-18	791.3727811	1002.349	-5506.47	1			
2018-19	-38011.8817	38645.74	-33547.7	-2539.17	1		
2019-20	46222.69231	-35005.5	44655.62	13104.46	-395839	1	
2020-21	2947.111111	1362.778	-5978.33	6924.556	-1029.33	23632.67	

Table 5 :Correlation

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
2014-15	1						
2015-16	-0.84285	1					
2016-17	0.535796	-0.60852	1				
2017-18	0.146057	0.209493	-0.51217	1			
2018-19	-0.77497	0.892229	-0.34469	-0.04893	1		
2019-20	0.912619	-0.78267	0.444333	0.244528	-0.81593	1	
2020-21	0.937982	0.739444	-0.87884	0.820705	-0.18873	0.991897	1

Table 6:Anova

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2014-15	13	9804	754.1538	5547.474		
2015-16	13	8404	646.4615	4325.936		
2016-17	13	14003	1077.154	21842.31		
2017-18	13	12455	958.0769	6210.744		
2018-19	13	23208	1785.231	508973.5		
2019-20	13	33423	2571	542700.8		

2020-21	3	4783	1594.333	13836.33		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	35905174	6	5984196	33.79642	2.57E-19	2.223826
Within Groups	13102883	74	177066			
Total	49008057	80				

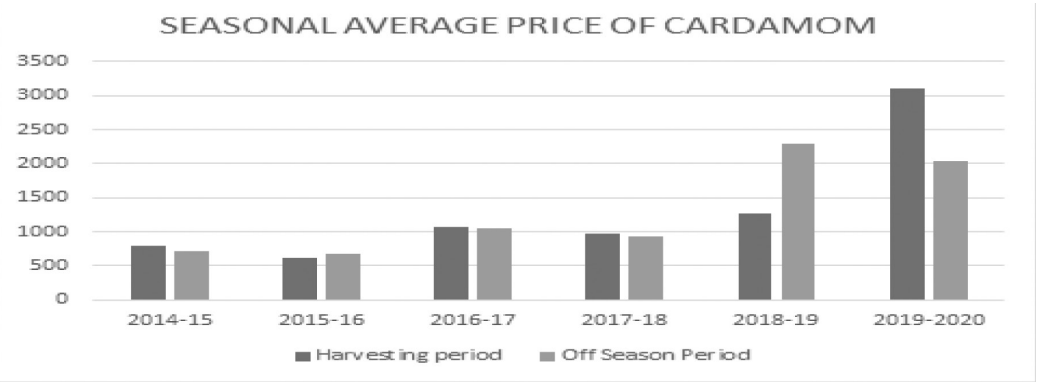
The table 6 shows the output of the ANOVA stating whether there is a statistically significant difference between the group means. There are two modes of marketing cardamom. i.e, through direct selling and through E- auction. The market price of cardamom is influenced by the auction prices which is subject to wide fluctuations. From the table 6, it is evident that the significant value is 2.57(p= 2.57), which is above 0.05 and therefore there is no statistically significant difference .

Table 4 : Seasonal Average Price of Cardamom

Year	Harvesting period	Off Season Period
2014-15	789	719
2015-16	617	675
2016-17	1069	1058
2017-18	975	940
2018-19	1274	2295
2019-2020	3112	2044

Source : Spices Board of India Publications

Figure 4 : Seasonal Average Price of Cardamom



Source : Table 4

Table 5 :Descriptive Statistics – Harvesting Period

Mean	1306
Standard Error	372.84
Median	1022
Standard Deviation	913.28
Sample Variance	834080
Kurtosis	4.77
Skewness	2.12
Range	2495
Minimum	617
Maximum	3112
Sum	7836
Count	6

Table 6 :Descriptive Statistics – Off season Period

Mean	1402.4
Standard Error	321.71
Median	1058
Standard Deviation	719.36
Sample Variance	517480.3
Kurtosis	-2.66
Skewness	0.50

Range	1620
Minimum	675
Maximum	2295
Sum	7012
Count	5

From the tables 5 and 6, there are two variables under study. Average prices of cardamom during harvesting season and off season. In both the cases, mean is greater than the standard deviation indicating good results. Also it is evident from the tables that the average price obtained for cardamom in the harvesting season and off season was not the same. The year 2019-2020 has an exception due to the impact of Covid 19 pandemic.

Table 7: Socio- Demographic profile of cardamom planters in Idukki district (sample=100) 2020 data

Age of the respondents	Below 40 40-50 Above 50	40 30 30	40% 30% 30%
Cardamom Area	Less than 5 Acres 5-10 Acres Above 10 Acres	77 19 4	77% 19% 4%
Annual Production	Less than 3000 kg 3000-6000 kg Above 6000kg	39 57 4	39% 57% 4%
Annual Yield	Less than 500 kg 500-1000 kg 1000-1500 kg	25 62 13	25% 62% 13%
Annual Cost	Lessthan 2 lakhs 2- 4 lakhs 4-6 lakhs Above 6 lakhs	2 45 41 12	2% 45% 41% 12%
Annual Profit	Less than 75000 75000-150000 Above 1,50,000	25 63 12	25% 63% 12%

Impact of Covid pandemic	(1) Volatility in the cardamom price	40	40%
	(2) Hike in the cost	15	15%
	(3)Labour crisis	15	15%
	(4)Lack of export	30	30%

Source : Primary data

Table 8 :Descriptive Statistics

Mean	30
Standard Error	4.48
Median	27.5
Mode	30
Standard Deviation	21.01
Sample Variance	441.52
Kurtosis	-0.34
Skewness	0.66
Range	75
Minimum	2
Maximum	77
Sum	660
Count	22

Findings and Suggestions

The study made among the cardamom cultivators and traders among Idukki district found that, neither the Government of India nor Government of the State of Kerala has so far offered Minimum Support Price (MSP) for cardamom crops. In most cases, the cost of production is much higher than the value of output. Increased labour costs and expenses of fertilizers and pesticides, together with the decrease in the price of cardamom, reduce the annual profit of planters. Many of the planters took loan from banks and other institutions for making investment in the sector. Despite lockdown, a kilogram of first quality cardamom in a retail shop costs around four thousand rupees; meanwhile, the average price at an auction turns out as thousand five hundred rupees per kilogram. The local buyers offer less than the average auction price for the planters.

Most of the planters avoid taking the risk of replanting with unskilled labour who emerged out of situations created by COVID-19 pandemic lockdown. Also started to leave the sector. Government organisations, NGO' s, banks, spices board, spices park, banks and other institutions can uplift the cardamom planters and traders from this severe pandemic.

Conclusion

Ultimate result of the severe pandemic situation is vanishing of green high quality cardamom. Failure to hire adequate number of workers, inadequate transportation, increased cost of production, decreased demand, decreased price, all culminated in the disappointment of planters. So it damages the fertility of the soil and decreased productivity. Quantity of cardamom available is much lower than that of before. Grade and quality thus affected.

The global hindrance in the economy due to the COVID-19 pandemic resulted in fall in the price of cardamom. Constraints forced many cardamom planters to sell their cardamom at a much lower price to the local buyers, eventhough the planters might not get back the expenditure incurred by selling at low prices in the auction. But, the small-scale farmers sell the crop to local buyers for less than the average price . Many large-scale planters decided not to sell their product as the market is non profitable. Despite drying and processing of tons of cardamom this year the planters are yet to pay for their services.

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GENDER DIFFERENCES IN MANAGEMENT OF FAMILY FIRMS-A REVIEW

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Abstract

The study on gender differences in management of family firms aims to investigate the fact that a sizable portion of these family businesses are owned and managed by women and there are many distinct differences between male and female managers with regard to business performance. Still there has been minimal study of gender issues in family business management. This article provides a comprehensive review and a critical assessment of the gender issues in family business research. From the major predominant theoretical perspectives, the study made a comprehensive review of the areas namely succession, management, conflict management, financial performance and survival and accordingly, joint approaches combining different theoretical frameworks can help to improve understanding of the family business which further contributes to extending gender theories.

Keywords: Family business, gender, succession, conflict management, financial performance

Introduction

Studies of gender differences and similarities in managerial and entrepreneurial behavior have been a small but growing component of the research literature in recent decades (Gatewood et al., 2003; Gupta et al., 2009). A sizable body of literature has developed since the 1980s with a focus on possible similarities and differences between women and men business managers (Bennett and Dann, 2000; Carter et al., 1997; Chaganti and Parasuraman, 1996; Powell and Ansic, 1997; Sonfield and Lussier, 2009; Wagner, 2007). Certainly, this area of research has been influenced and supported by the growing number of women in the management workplace, both in the entrepreneurial and corporate environments and, more specifically,

in the family business context (Baines and Wheelock, 2000; Bennett and Dann, 2000; Hughes, 2003; Jome et al., 2006; Moore and Buttner, 1997; Pyromalis et al., 2004; Weller and Bernasek, 2001). However, while comparing with a much larger body of literature which focuses on male business managers, this women-manager research is much more limited in size and in findings (Chaganti and Parasuraman, 1996; Lewis, 2006; Sonfield et al., 2001). Thus the research question is: What is the relationship between gender and the ways in which male and female owner/managers run family businesses? The primary purpose of this paper is to provide a prior research context for gender differences in various management aspects.

Gender differences in management

Earlier studies found that women who manage business were more cautious, less aggressive, less confident, easier to persuade, and had inferior leadership and problem-solving abilities than did male managers. Conversely more recent research provides mixed conclusions but tend to emphasize more gender similarities than differences. A variety of both older and recent studies confirm this trend (Carsrud et al., 1986; Chaganti and Parasuraman, 1996; Johnson and Powell, 1994; Powell and Ansic, 1997; Sonfield et al., 2001; Watson, 2002). More specifically, some researchers have found that there are no significant gender differences in management decision making styles or values (Chaganti, 1986; Powell, 1990). Some other researchers have reported that women and men entrepreneurs possess more similarities than differences in decision-related personality traits (Birley, 1989; Collins-Dodd et al., 2004; Sexton and Bowman-Upton, 1990). And other studies have concluded that under conditions of risk, females and males are equally successful in making decisions (Hudgens and Fatkin, 1985; Johnson and Powell, 1994), are equally capable of processing and reacting to information (Hyde, 1990; Stinerock et al., 1991) and are equally effective in roles of leadership (Eagly et al., 1995; Hollander, 1992).

However, many studies have showed differences between the two genders. For example, Alimo-Metcalf (2002) found that women rated higher on transformational leadership than men. Transformational leaders exhibited charisma, individualized consideration, and intellectual stimulation (Vallejo, 2009; Bass, 1985). In other studies, women showed more trust, flexibility and cooperation, and less directive behavior than men (Vera & Dean, 2005; Eagly & Johnson, 1995). Additional research regarding organizational leadership styles reported that women were less hierarchical, take more time to make decisions, and seek more information on others' opinions than do men (Jackson, Alberti, & Snipes, 2014). In the U.S., there has been agreement among researchers that the masculine leadership style, which

is productivity-driven and result oriented, was more successful (Geddes, 2011; Jackson, Alberti, & Snipes, 2014). Hasan et al, (2011) described men as direct in decision-making and autocratic and that women were less aggressive and more nurturing. Eagly and Johnson (1990) earlier proposed that female leadership was consistently democratic and male leaders more autocratic. In this research, context was also very important for leadership style. If the leader was in a role congruent with their gender, they were more likely to organize activities and accomplish relevant tasks (Eagly & Johnson, 1990). Similarly, Schieman and McMullen (2008) found that women taking on masculine attributes were not highly rated by subordinates. Bertrand and Hallock (2001) revealed that women are considerably underrepresented in leadership position. Alimo-Metcalfe (2002) showed that women are more transformational leaders than men, which means that they are persuasive, charismatic and able to intellectually stimulate others. Vera and Dean (2005) pointed out that while comparing with men, women are directive and less distrustful, and more conciliatory, attentive, flexible, supportive, collaborative, balanced and caring. They also seek more information on other's opinions, take more time to make decisions, and attend to both the well-being of the business and of the family.

On the other hand, the results of a study by Fahed-Sreih and Djoundourian (2006) report that more than two-thirds of the Lebanese firms favour female CEOs in managing the family firms. Nelton (1998) states that daughters and wives are rising to leadership positions in family firms more frequently than in the past, and that the occurrence of daughters taking over businesses in traditionally male-dominated industries is increasing rapidly. Kirkwood (2009) found that women are more likely to seek explicit support of their business endeavors, while men are likely to assume spousal support exists without seeking unambiguous statement of it. In regard to business strategies and financial decisions, Watson (2002) shows that male business managers invest more heavily than female managers, and female managers incorporate fewer resources for their new ventures. Watson provides two reasonable explanations for this phenomenon: One is that female managers have fewer resources in their businesses on average which limit their strategies; the other reason was that female managers are more risk averse than male managers. In a study of gender issues, Sonfield and Lussier (2009) investigate family businesses in six countries and the results of their study indicate that when the gender of the business manager is female, it is not an indicator of a success of the family business

Haynes et al. (2000) show that only if the business managed by a male, then the financial statement of the household is a good indicator of the performance of the

family business, but it does not indicate success if the manager is a woman. They also show that women-owned businesses are more likely to be in the transportation and retail service industries and have fewer employees than those managed by men. They also found that on average, women-owned businesses have lower levels of equity, total business assets, liabilities and income than men-owned businesses. On the contrary, Haynes et al. (2007) reports that the success of small businesses is not necessarily tied to family prosperity; however, women-owned businesses are more likely to realize ‘‘an increase in the transfer of money from the business to the household’’ (p.403, 407) when compared to businesses owned by men. Therefore the hypothesis is stated as follows:

H1: There is a difference in management of family firms between male-led and female-led family businesses.

Gender differences in conflict management

In order to function effectively at any level within organizations, conflict management skills are important. Extensive research examining individual differences in conflict management style has focused upon sex as an explanatory variable. Even though the associated literature is considerable, it is characterized by inconsistent results. A number of studies advocate that women have a more co-operative orientation to conflict management than men (Rahim, 1983a; Rubin & Brown, 1975). Others suggest that women are more competitive (Bedell & Sistrunk, 1973; Rubin & Brown, 1975). According to the gender role perspective (Bern, 1974; Bern & Lenney, 1976; Spence & Helmreich, 1978), differences in conflict management behaviour of men and women may be linked to, but not determined by, biological sex. To a certain extent, gender roles, which are considered to represent learned patterns of masculine and feminine characteristics, may determine how individuals behave in a certain situation (Cook, 1985). Some studies, based on cultural stereotypes, have supported the long-standing assumption, that women have a more co-operative orientation to conflict than men and that men are more competitive than women (Rubin & Brown, 1975). For example, several studies have shown that women report more of a preference for accommodation and compromise and less of a preference for domination and competition than do men (Ilmer, 1980; Kilmann & Thomas, 1977; Ruble & Stander, 1990; Rosenthal & Hautaluoma, 1988).

The results of some other studies, however, are not totally consistent with the above findings or with each other. Although both Chanin and Schneer (1984) and Rahim (1983b) pointed out that women reported using compromise more

than men, both studies also report that there were no gender differences in the reported use of a dominating or competitive style. Besides Rahim (1983b) found men to report being more obliging than women and women to report being more avoiding and collaborative than men. But Chanin and Schneer (1984) found men to report being more collaborative than women and that women and men did not differ on accommodation or avoidance. Other researchers have questioned whether female and male managers differ at all in their preferred conflict management style (Baxter & Shepard, 1978; Yelsma & Brown, 1985). Gender differences in conflict management style, if they exist at all; tend to disappear once gender differences on these factors such as age, education, or managerial experience are controlled (Champion, 1979; Chusmir & Mills, 1988; Korabik & Ayman, 1987). Thus, women and men managers who are similar to one another do not appear to differ in their self-report about their preferred conflict management style (Renwick, 1975, 1977; Shockley-Zalabak, 1981). So, based on the above stated arguments, this study hypothesized that:

H1: There is a difference in conflict management of family firms between male-led and female-led family businesses.

Gender differences in succession

Gender can be influenced by the process of succession because it is connected with a family enterprise's internal culture. Humphreys (2013) reports that skill and commitment override gender in the selection of successors. The results of the study conducted by Tatoglu et al. (2008) showed that the majority of family businesses in Turkey are nominated a male successor. Several previous studies also reported that this role was assigned to the eldest son (Fox et al.,1996; Wahjono, 2010). Family- owned companies in the USA and Korea also confirmed behavior strongly suggesting that males were regarded as the ideal individuals to pursue a career in business as successors with most commercial enterprises. A different situation prevails with family- owned companies in Japan where, although the role of women has traditionally been restricted, at least some women head up family businesses within the country (Kaslow, 2006; Wahjono, 2010). However, there is a strong perception that the public prefers men to women in management as senior executive positions (Prasso, 1996; Wahjono, 2010).A study by Rosenblatt (1985) revealed that the women element within the family did not receive equal encouragement, education and opportunity as its male counterpart. Such realities prevent women in occupying executive positions in family businesses. Pyromalis et al. (2008) observes the existence of an important prejudice against women within the family business succession process. The study by Overbeke's (2007) stated that only 2

per cent of family business CEOs were women who are motivated to assume the position because of their husbands' ill- health or death or by having the opportunity of starting their own business.

According to Idígoras et al. (2009), women face a number of barriers to work in the family business which included their position within the family structure, the importance of primogeniture and parents' preferences regarding gender, jointly with the influence of traditional gender roles underpinning the invisibility of women within family businesses. Pyromalis, Vozikis, Kalkanteras, Rogdaki, and Sigalas (2004) indicates that women seem to outperform men on the ''satisfaction with the succession'' dimension, while men seem to outperform women on the ''effectiveness of the succession'' dimension. For Pyromalis et al. (2004), these findings justify those who claim that women and men possess complementary competencies and skills**.** Amore, Garofalo, and Minichilli (2014) studied the change in profitability after CEO succession by comparing male-female and male-male transitions in Italian family firms and they confirm that the profitability effect of female CEO transitions is increasing in the proportion of female directors on the board. However, the positive effect of female interactions on profitability is reduced when the family firm is located in geographic areas characterized by gender prejudices and when the firm is large (Amore et al., 2014).The family business owners should not undervalue the potential of female successors in securing the survival of the family firm, and they should foster their daughters as competent successors from early on instead of taking them into account only after a critical incident forces the family to do so (Schröder et al., 2011). So, based on the above arguments, the study hypothesized that:

H1: There is a difference in succession of family firms between male-led and female-led family businesses.

Gender differences in financial performance

Comparisons made between male and female businesses on performance variables yield contradictory results. Some of the studies have found that female-owned businesses are less profitable than male- owned businesses (Fasci and Valdez 1998; Reynolds 1993; Loscocco et al. 1991; Loscocco and Robinson 1989). However, another group of studies found few performance differences in comparisons of male and female-owned businesses (Watson 2002; Shim and Eastlick 1998; Chaganti and Parasuraman 1996; Kalleberg and Leicht 1991). Adams and Ferreira (2009) report an ambiguous effect of female directorship on firm profitability, whereas Dezso and Ross (2012) found that female management can benefit performance in some contexts.

Kalleberg and Leicht (1991) found that there are no differences in growth of business earnings based on the owner's gender. Loscocco et al. (1991) found that female-owned businesses earned less income and generated both less sales volume compared to male-owned businesses. Lustgarten (1995) found that self-employed women-owned businesses had lower earnings while comparing with self- employed men. Fasci and Valdez's (1998) found that gender have the highest impact in explaining the differences in economic performance of small accounting practices. Watson (2002) explored the performance of male and female-owned small and medium- sized businesses in Australia by examining various output measures such as sales and profit while relating them to appropriate input measures such as total assets and total equity. And found that there was a significant difference in these performance measures and these differences were not significant once three control variables such as industry, age of business, and the number of days a business operated was introduced.

Also there are several studies which report that male-owned businesses outperformed female–owned businesses. Loscocco, et al. (1991) found that male-owned firms outperformed firms owned by female in terms of sales volumes and income. The study claims that female's lack of industry experience and their concentration in less profitable sectors of the economy contributed significantly to their lower sales volume and income. The study also reveals that not only firm's size generated more sales to male-controlled firms than female–controlled firms, but also females were not able to generate as much financial gain from size as males. The comparative study conducted by Fischer, et al. (1993) supports these findings and found that firms owned by male consistently outperformed those of female with respect to annual sales, income and number of employees. This study also found that businesses owned by men exhibited a higher level of productivity than those of female in terms of sales per employee. Moreover, they found that female had less relative business experience than male, which they imply indicative of the barriers that women face with respect to access to business experience (Fischer et al., 1993). It is commonly believe that female-owned businesses are less successful and fail more often than male-owned businesses (Cuba, Decenzo, & Anish, 1983).

Shim and Eestlick (1998) report that Hispanic female business owners had fewer employees, fewer years of business experience, and smaller annual sales than their male counterparts. Still, they argue that female-owned businesses were as likely to achieve higher growth stage as their male counterparts. These findings were supported by the findings of Fasci and Valdez (1998) who note significant differences between male and female-owned firms with respect to the ratio of

profit to gross revenue. They suggest that work experience and age of business contributed significantly to that difference. Alowaihan (2004) found that female had higher education levels, less business experience, and were older than their male counterparts. Besides, the results show that female-owned firms suffered from liability of newness and their financial performance was significantly lower than male-owned firms. The study by Cruz, Justo, and De Castro (2012) pointed out that employing family members improved the performance of the firm in women-led businesses, most likely because women are able to better handle the conflict between simultaneously pursuing financial and socio-emotional goals.

Johnson and Storey (1993) showed very little difference between female and male- owned business on hard performance measures whereas the results of Rosa and colleagues indicate that female-owned businesses are overall, smaller and less successful (Rosa and Hamilton 1994, Rosa et al. 1996). Other studies, notably, Kallenberg and Leicht (1991) found that women were found to have less relevant experience of industry such as restaurants, computer sales and software, and health-related business sectors in the USA and had started fewer businesses than had the men but men's and women's firms in all three industries were equally likely to survive and grow. On the contrary, the study by Cuba et al. (1983) indicates that women perform less well on quantitative financial measures.

Coleman's (2007) findings indicate that financial capital has a greater impact on the success and profitability of male-owned businesses whereas human capital variables such as experience and education are more likely to contribute to the profitability of female-owned businesses. These findings reinforce the work of Lansberg (1983), Marion (1988), and Davis (1983). (Lee, Jasper, & Fitzgerald, 2010)this study investigated the effect of gender on business success and profit growth among family businesses. The Ordinary Least Squares (OLS show that a differential response existed in profit growth over time between male and female managers in relation to health status, business size, business liabilities and whether the business was home-based or not. They conclude that there are many distinct differences between female and male managers in business performance.

The study conducted by Watson (2002) in Australia, found no significant differences between the financial performance of male- and female-controlled businesses in terms of total income to total assets, the return on assets, and the return on equity, although female-owned businesses were significantly smaller and generated less profit and income. Furthermore, he suggests that, after removal of the control variables, there was evidence to suggest that female-controlled businesses outperformed male-controlled businesses (Watson, 2002). There is an

insignificant abnormal return on the announcement of a female added to a board. Companies include female in the board as to respond to either internal or external calls for diversity (Farrell & Hersch, 2005). Arguments on owner's gender studies are inconclusive. So, based on the above arguments relating to gender differences, this study hypothesized that:

H1: There is a difference in financial performance of family firms between male-led and female-led family businesses.

Gender differences in survival prospects

Data from the Census Bureau's 1982 and 1987 on Characteristics of Business Owners (CBO) surveys indicate that, compared to female business owners, men are more likely to retain ownership of their businesses for the first 4 to 6 years after starting or acquiring them. (Boden & Nucci, 2000)we examine the relationship between owner and business characteristics and business survival. Our findings are based upon analyses of the Census Bureau's 1982 and 1987 Characteristics of Business Owners (CBO found that the mean survival rates of male-owned businesses are higher, than those of businesses owned by women. An in-depth research conducted by Kalleberg and Leicht (1991) on how survival and success among small firms headed by male and female, related to organizational structures, industry differences, and attributes of owner-operators. The study concluded that female's firms were not more likely to fail, nor less successful than those headed by male. Moreover, they suggested that processes underlying small business performance headed by male were similar to those headed by female. On the other hand, they found that firms headed by female were smaller and had lower level of gross earnings than those headed by male. Male had more experience in terms of prior self-employment than female. In spite of that, Kalleberg and Leicht (1991) argue that these factors had no bearing on survivability and success of these firms. Cuba et al. (1983) contend that there are two reasons why the survival rate of female-managed businesses is low: Firstly, majority of women are not adequately prepared before they become an owner; secondly, women managers are reluctant to delegate detailed work to other people so that they do not distribute their time efficiently. Boden and Nucci (2000) show that female business managers are more likely to have higher levels of education and less prior employment experience when compared with their male counterparts and thus improved survival rate of the businesses in their first few years. Loscocco et al. (1991) found that male managers continue in the industry for a longer period of time than female managers; as a result, they have more managerial experience than their female counterparts. Female, on the other hand are more nurturing, supportive in the work environment,

do not focus on the financial performance as an important element for firm survival, but they are more likely to focus more on the primary objectives of the firm (Butner & Moore, 1997).

Collins-Dodd et al. (2004) indicate that gender is not a significant variable in explaining the difference in financial performance between male and female-managed businesses while considering the effects of some factors such as number of employees, home-based or not, control of work situation etc. and personal characteristics such as age, number of children, education etc. in the model. The results of a study by Kalleberg and Leicht (1991) also indicate that that success levels are similar across genders and report that women-owned businesses are less likely to fail than men-owned businesses. Kepler and Shane (2007) examined the characteristics of female and male entrepreneurs when they are establishing a new business and show that females are more likely to purchase their firms instead of establishing them; firms managed by females are more likely to earn positive revenue; males spend more time searching new business opportunities; and males are more likely to take risky strategies for their new venture

The results of a study by Kalleberg and Leicht (1991) also reveal that women-owned businesses are less likely to fail than those owned by men; they also indicate that success levels are similar across genders. Other researchers indicate that women might measure business success differently than men, in part because they may be likely to focus on balancing work and family (Anna et al. 1999) preferring to adapt their businesses to manage personal, family, and professional demands (Fitzgerald and Folker 2005). Masuo et al. (2001) also point out that perceived business success varies by gender, with females perceiving higher levels of success.

Carter and Marlow (2003) point out the differences in the prior professional and occupational experience of female and male managers in waged jobs which have an impact on businesses ownership. They assert that this explains why female-managed firms are smaller and have lower performance. On the other hand, Fischer et al's (1993) findings do not support this point; they suggest that the reason for the size and performance difference is that women managers have ''less experience in working in similar firms, in managing employees, or in helping to start-up new businesses'' (p. 151). In a study of female and male managers, Loscocco and Leicht (1993) focus on the link between the family and the business. They showed that female managers are more likely to be single and spend more time on their work; they operate younger and smaller businesses than their male counterparts. The study by Philbrick and Fitzgerald (2007) further supports these results.

Hundley (2001) report that self-employed males ‘‘work the most hours per week in the market and the female self-employed work the fewest’’ (p.128), which indicates that females may sacrifice business priorities for family priorities. Regarding the division of labour by gender, Hundley also found that ‘‘women do more housework, and the amounts by which female hours on chores and childcare exceed male hours are much greater among the self-employed’’ (p.131). Other scholars also indicate that women put more effort into their family goals like spending time with family members, and put less effort into accomplishing the business goals (Hisrich and Brush 1987; Kaplan 1988; Kepler and Shane 2007); on the other hand, Fischer et al. (1993) show an opposite result. Similarly, Tuttle and Garr (2009) report limited support for the hypothesis that self-employed women have better work- family fit, concluding that the higher job satisfaction and autonomy available to the self-employed may have an indirect influence. Schieman and Young (2010) recognize greater levels of family-work conflict in association with economic hardship, especially among men.

Kalleberg and Leicht (1991) indicate that female managers place a greater emphasis on the quality of the business in competition; they assert that there is no significant innovation gap between female and male-managed businesses. Cliff (1998) reports that there is no significant difference between the desires of male and female managers to expand their businesses. However, Cliff describes female managers as being more conservative and careful, when they expand their firms, while male managers are more likely to undertake risky strategies. Cliff also notes that male managers are both more at ease and more aggressive in competitive business situations.

The results of a study by Orser and Hogarth-Scott (2002) show that the most of the female managers engage in those business strategies which improve the quality and offer better price, but limit the quantity and the variety of the products. Orser and Hogarth-Scott also point out that there is no significant difference in the processes and weights that the two different genders put into the development of the firm, but female managers are more likely to be influenced by their spouse’s perspectives and opinions when they make business decisions.

Danes et al. (2007) show differences in the gross revenue between male and female-owned family firms while controlling for innovation practices and family business management. Both female- and male-owned businesses is positively affected by the introduction of new methods of prodcution, but personnel management has a greater effect on gross revenue for females. They also point out that gender has a moderating effect on business management practices, but gender

does not moderate the effects of innovations on gross revenue. Loscocco et al. (1991) claim the average levels of sales and income of female-managed businesses is substantially lower than that of male-managed businesses. Cliff (1998) reports that female-managed businesses have significantly smaller annual sales, return on assets and employment growth. So, based on the above findings from the previous studies, the present study hypothesized that:

H1: There is a difference in survival prospects of male-led and female-led family businesses.

Conclusion

Inspired by the literature, the objective of this study was to the focus was on gender differences in management, financial performance, conflict management and succession in family businesses. The findings of this study indicate mixed opinions regarding the various aspects concerning family business with regard to gender which is important for future gender-related research, for social policy and efforts to assist family businesses, and for eventual model-building. With further research studies, a clearer understanding of the role of gender in family businesses may be reached which would allow consultants and others who assist family firms to differentiate, if and when appropriate, between those clients who do and those who do not have a significant number of women owner-managers. Furthermore, at a broader level (beyond specifically family business), such an understanding might contribute to an eventual "model" of women's entrepreneurship beyond more general models (Carter et al., 1997; Fischer et al., 1993; Hisrich et al., 1997; Statham, 2004), and also lead to more effective social policy practices and goals in supporting and fostering of women-owned businesses in general.

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A PROTOTYPE CONTENT CREATION FRAMEWORK FOR INDIAN SIGN LANGUAGE (ISL)

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(Abstract)

COVID-19 pandemic has forced many countries to shutdown educational institutions. Instructions through virtual mode are experimented in many parts of the world as an alternative. This unexpected switch proved to be difficult for both teachers and students. This is more serious for schools catering to the needs of deaf students in the developing world. The lack of availability of Sign Language based lectures and the difficulty in developing contents in sign language has badly affected the teaching learning process of the deaf. This paper proposes a web based easy to use solution for Sign Language based multimedia content creation. Initial feedback suggests that the proposed framework is helpful for the instructors to create accessible multimedia contents.

Indian Sign Language, CALL, Distance Learning

Introduction

COVID-19 pandemic induced lock-down has forced all educational institutions to move teaching online in most parts of the world. This unexpected switch proved to be a challenge for both teachers and students. This is more serious in developing countries(Gupta) since the level of technology adoption is much less as compared to the developed world. According to the census of 2011, India has 5,071,007 people who have hearing disability. The figure amounts to about 8.9% of the total differently abled population of India. Vasishta et al.(Vasishta etal.), in their study, emphasized that there is only one Indian sign language, they however acknowledged that there existed several regional variations. In developing countries, there are only very few schools for deaf students. Unemployment rate

among adults with hearing loss isvery high in developing countries. Learning sign language is not an easy task because of several reasons. Difficulty in understanding the sign language and non-availability of learning materials are some of the reasons for its slow adoption.

Though state backed attempts exist in India for reaching students on a larger scale, instructions in sign language are non existent for deaf students in these platforms. Multimedia based contents are preferred by students since sign based instructions can easily be represented using it. Lack of knowledge in technology based mediums for instructions makes it difficult for teachers to create content. Teachers are forced to release contents as their own for students. Instructors are finding their own solutions to manage the situation. Most of them use mobile phones to record the lessons and share with students using different platforms. This process normally requires additional help from someone to record the video. Textual contents corresponding to sign videos are also provided sometimes. This work presents a web based framework that can be used to create multimedia contents. The primary consideration in the design of the framework are ease of use and high availability. The instructor can create contents without any extra help using this application. Ability to place textual contents along with the video is an added advantage. Initial studies suggests this tool is helpful in educational content creation.

Related Works

Availability of easily accessible sign language based learning tools for textbook contents are very less(Vasishta et al.). Most of the existing tools are multi-modal bilingual applications and are game based ones(Adamo-Villani et al., Chuan and Guardino). We haven't come across any of them for Indian Sign Language (ISL).

RISE ebook(Collins et al.) is a bilingual bimodal joint project by Gallaudet University and Swarthmore College to promote reading. RISE ebook makes available classic children's books and is augmented with Sign Language to provide a shared reading facility for deaf children and their parents. Veliza, Espinoza et al(Véliz et al.) studied the effect of SL augmented digital books for deaf learners. They followed a participatory development model and preliminary results indicate

that augmenting SL based instructions with books improves comprehension. Visual Language and Visual Learning (VL2) project from Gallaudet University aims to develop a story book application for mobile phones and tablets. VL2 project(Malzkuhn and Herzig) augments SL contents with English text, facilitating reading and language acquisition for early and emerging readers. Unlike the above

two projects, SMARTSign AR project1 is a mobile based application that can be used along with physical copy of books. Users can click a picture of the story and SMARTSign AR mobile application automatically converts it to corresponding sign. Assistive Courseware for Hearing-Impaired (AC4HI)(Mutalib et al.) is a system for deaf learners to learn using Sign Language. It describes a system which displays text and sign videos side by side. Evaluation suggests that designing contents tailored for deaf students is favourable and they like text coupled with sign based instructions.

System Working

The proposed application is a web-based software which can easily be used by instructors to create content. Users can choose any of the modern web browser to use the application.

Application is made up of two screens, one for recording videos and adding corresponding text and another screen for previewing the added video. First screen also includes controls for video recording and adding text. Figure A shows the first screen of the application. First, the user starts the camera using the “Start Camera” option. Further, the video recording can be started using the “Start Recording” option. The “Play” option displays the recorded video in the right part of the screen.

“Crop and Play” option helps to crop the video based on the need of the instructor. Simultaneously instructor can also add text corresponding to the video. After the correct videos are cropped and text added, user can use the “Send” option to upload the video to the server. Processed video can be downloaded using the “Download” option. “Submit”option previews the video.

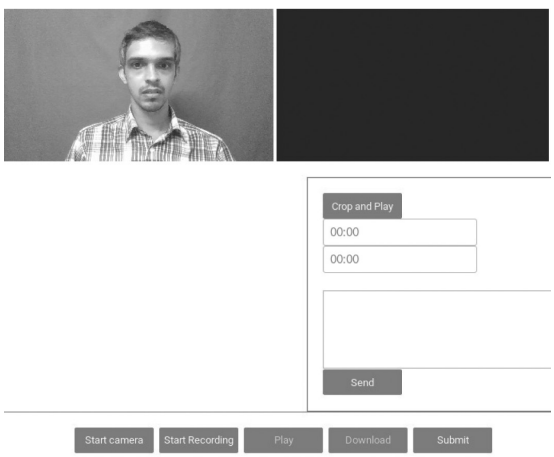

Figure A: Content Creation Screen

The proposed application is implemented using Javascript, which is a client side scripting language and hence it can run in any of the Javascript enabled browser. Content creator is presented with a HTML web page where he can record the video, preview, cut and add spoken language text.

Result and Discussions

Figure A shows the editor interface used by the instructor to create the content. Left portion of the screen is used to record video and the right side is used to store the corresponding text. Figure B shows the result of the recording. Students can use any web browser to view the lectures.

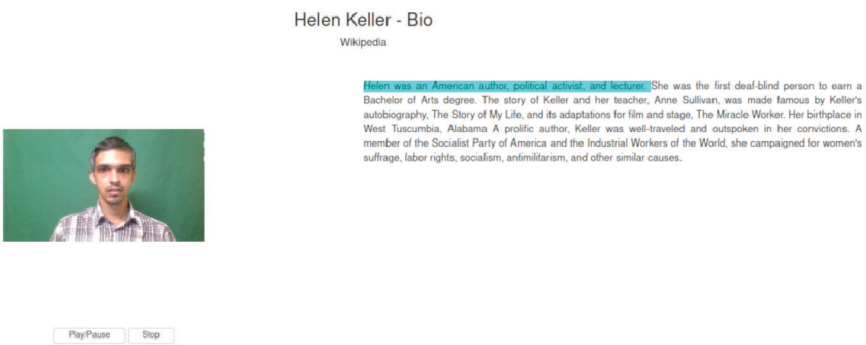

Figure B: Content Creation Screen

A preliminary evaluation was conducted with the help of three instructors. One of the instructors was from a school for Deaf. From the questionnaire response, it is observed that the web based framework is preferred by all the participants. They suggested including an accessible help page in the application as it can help users who are not accustomed to technology based tools for content authoring.

Conclusion

This paper proposes a web based content authoring framework for helping sign language instructors to create accessible contents. Both the content creation process and output are web based making it easy for users to access the contents. Initial feedback suggests that the proposed framework is helpful for the instructors.

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RELATIONSHIP BETWEEN THE GOLD AND SILVER MARKETS IN INDIA.

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Abstract

A derivative is a financial security with a value that is reliant upon or derived from an underlying asset or group of assets. The derivative itself is a contract between two or more parties based upon the asset or assets. Its price is determined by fluctuations in the underlying asset. The most common underlying assets include stocks, bonds, commodities, currencies, interest rates and market indexes. This study shows the "Performance Analysis of Indian gold and silver Commodity derivative Market" and this analysis made through the study of cointegration in gold and silver commodity market, then the long-term relationship between gold and silver market and price discovery in gold and silver commodity derivative market. The study is made using data taken from MCX website for the last five years and these spot and future prices considered here. The study suggests that There is no long-term relationship between future prices and spot prices of Gold and Silver so there is no cointegration or association between them in long run. In this case for an investor this Gold and Silver are good investment avenues in the long run. Both Gold and Silver has no relationship in the long run so by investing in these commodities the investor can diversify the risk and it's a diversified portfolio.

Key Words: MCX ,Gold and Silver , Cointegration , Granger Causality , Unit root

Introduction

A derivative is a financial security with a value that is reliant upon or derived

from an underlying asset or group of assets. The derivative itself is a contract between two or more parties based upon the asset or assets. Its price is determined by fluctuations in the underlying asset. The most common underlying assets include stocks, bonds, commodities, currencies, interest rates and market indexes.

A commodity market is a market that trades in primary economic sector rather than manufactured products. Soft commodities are agricultural products such as wheat, coffee, cocoa, fruit and sugar. Hard commodities are mined, such as gold and oil. Investors access about 50 major commodity markets worldwide with purely financial transactions increasingly outnumbering physical trades in which goods are delivered. Futures contracts are the oldest way of investing in commodities. Futures are secured by physical assets. Commodity markets can include physical trading and derivatives trading using spot prices, forwards, futures, and options on futures. Farmers have used a simple form of derivative trading in the commodity market for centuries for price risk management.

There are some studies shows long term relationship between commodity gold and silver in the commodity derivative market and some other studies shows no long term relationships between commodity gold and silver price of one commodity lead to the price of other commodity and the future market prices leads to the spot market prices and the future spot price of the commodity leads to the future price so there is efficiency in the commodity derivatives market the future spot price is predicted by the future contract price for example the future price of a commodity after 3 months is 30000 and the spot price of the commodity may become 30000 in the future if it happen there is price discovery . Here there is lot of studies in commodity market but recent period especially after 2013 the studies are less in commodity market

(Gupta, 2011) Made study on the topic efficiency in commodity features markets in India. The purpose of this paper to analyse the efficiency of agricultural commodity markets by assessing the relationships between futures prices and spot market prices of major agricultural commodities in India .The efficiency of the futures market for 12 agricultural commodities, traded at one of the largest commodity exchanges of India, i.e. National Commodity & Derivatives Exchange Ltd, has been explored by using Johansen's cointegration analysis and Granger causality tests. Results show that cointegration exists significantly in futures and spot prices for all the selected agricultural commodities except for wheat and rice. **(Ke, 2005)** Analysed the efficiency of the Chinese wheat and soybean futures markets and assess the conditions in agricultural commodity futures and cash markets in China. Formal statistical tests are conducted through Johansen's

cointegration approach using three different cash prices along with different futures forecasting horizons ranging from one week to six months. Results suggest a long-term equilibrium relationship between the futures price and cash price for soybeans, and a weak short-term efficiency of the soybean futures market. **(Easwaran, 2008)** Commodity futures and derivatives have a crucial role to play in the price risk management process, especially in agriculture. The present study is an investigation into the futures markets in agricultural commodities in India. The statistical analysis of data on price discovery in a sample of four agricultural commodities traded in futures exchanges have indicated that price discovery does not occur in agricultural commodity futures market. The econometric analysis of the relationship between price return, volume, market depth and volatility has shown that the market volume and depth are not significantly influenced by the return and volatility of futures as well as spot markets. **(Sehgal, 2012)** Made study on price discovery relationship for ten agricultural commodities has been examined. Price discovery is confirmed for all commodities except Turmeric. Price discovery results are encouraging given the nascent character of commodity market in India. However the market does not seem to be competitive. The findings have implications for policy makers, hedgers and investors and will help in deeply understanding the role of futures.

Scope of the paper

This study shows the "Performance Analysis of Indian gold and silver Commodity derivative Market" and this analysis made through the study of cointegration in gold and silver commodity market, then the long-term relationship between gold and silver market and price discovery in gold and silver commodity derivative market. The study is made using data taken from MCX website for the last five years and this spot and future price considered here.

Objectives

The objectives of this study are as follows:

1. To study the long-term relationship between spot prices of gold and silver.
2. To study the long-term relationship between future prices of gold and silver.
3. To study the efficiency of futures market in price discovery in gold and silver market

Methodology

The data for this study is taken from the MCX website for the last five years and this include the future and spot prices quoted in MCX Gold and Silver market

and this is studied here and the analysis is made using the econometric tests like Johancen's cointegration, Granger causality test and ADF test and PP unit root test. So, the tests is made using above mentioned tests.

In statistics and econometrics, an **Augmented Dickey–Fuller test (ADF)** tests the null hypothesis that a unit root is present in a time series sample. The alternative hypothesis is different depending on which version of the test is used, but is usually stationarity or trend-stationarity. It is an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models. The augmented Dickey–Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejections of the hypothesis that there is a unit root at some level of confidence.

In statistics, the **Phillips–Perron test** (named after Peter C. B. Phillips and Pierre Perron) is a unit root test. That is, it is used in time series analysis to test the null hypothesis that a time series is integrated of order 1.

In statistics, the **Johansen test**, named after Søren Johansen, is a procedure for testing cointegration of several, say k, I(1) time series. For the presence of I(2) variables see Ch. 9 of his 1995 textbook. This test permits more than one cointegrating relationship so is more generally applicable than the Engle–Granger test which is based on the Dickey–Fuller (or the augmented) test for unit roots in the residuals from a single (estimated) cointegrating relationship.

$$\lambda_{Trace}(r) = -T \sum_{i=r+1}^{g} in(1-\hat{\lambda}_i)$$

$$\lambda_{Max}(r, r+1) = -T \ln(1-\hat{\lambda}_{r+1})$$

There are two types of Johansen test, either with trace or with eigenvalue, and the inferences might be a little bit different. The null hypothesis for the trace test is that the number of cointegration vectors is $r=r^*<k$, vs. the alternative that $r=k$. Testing proceeds sequentially for $r^*=1, 2$, etc. and the first non-rejection of the null is taken as an estimate of r. The null hypothesis for the "maximum eigenvalue" test is as for the trace test but the alternative is $r=r^*+1$ and, again, testing proceeds sequentially for $r^*=1, 2$, etc., with the first non-rejection used as an estimator for r.

The **Granger causality test** is a statistical hypothesis test for determining whether one time series is useful in forecasting another, first proposed in 1969. Ordinarily, regressions reflect "mere" correlations, but Clive Granger argued that

causality in economics could be tested for by measuring the ability to predict the future values of a time series using prior values of another time series.

Long term Relationship with Spot Gold and Silver and Future Gold and Silver

The testing of the long term relationships with the spot gold and silver prices and future gold and silver prices is normally made using Johansen cointegration model and this is used here, before making Johansen cointegration need to consider lot of other factors that are the descriptive statistics to analyze the basic behavior of the data and unit root test to identify whether the data is stationary and after that we need to fix the lag length criteria to identify the lag structure after these all steps applied Johansen cointegration

Descriptive statistics is used to know the basic behavior of the data. It gives information about mean, median, standard deviation, Skewness, Kurtosis etc and it helps to know whether the data is normal or not. If the data is not normal, we want to smoothen the data. In order to smoothen the data, the data series are to be converted into Log. If the value of skewness and kurtosis are if the value of skewness and Kurtosis are 0 and 3 respectively, the observed distribution is said to be normal but if the skewness coefficient is in excess of one, it is considered as fairly extreme and the low or high kurtosis value indicates extreme platykurtic or extreme leptokurtic

Table 1

Descriptive Statistics

Commodity	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Future Gold	28478.63	28659.00	1764.493	0.100215	3.213127	4.433126
Future Silver	40511.54	39850.11	4171.672	0.817480	3.931686	183.4012
Spot Gold	28544.72	28808.00	1754.617	-0.18159	2.093345	49.40556
spot silver	40174.59	39483.00	4080.687	0.728726	3.571116	126.9072

In the case of commodity gold future price the value of skewness is near to zero and the value of kurtosis is near to 3 so it is concluded that the data of commodity gold future is near to normal distribution. The value of Jarque Bera

statistics also shows near to normal distribution. For the value of commodity future silver the value of skewness and Jarque Bera is near to normal distribution and the value kurtosis indicates leptokurtic. So it is assumed the data of commodity future silver is near to normal distribution.

In the case of commodity spot gold prices the value of skewness and Jarque Bera is near to normal distribution and the value of kurtosis indicates platykurtic. So it is assumed the data of commodity spot gold is near to normal distribution. When the commodity spot silver prices is considered the value of kurtosis and the Jarque Bera is near to normal distribution and skewness is also near to normal distribution so the commodity silver spot price is assumed to be normal.

Unit Root Test

The **unit root test** is used to ensure that the variables are stationary. The null hypothesis is generally states the presence of a unit root and alternative hypothesis there is no unit root. The unit root test is performed with the help of Augmented Dicky Fuller Test (ADF) and Philips-Perron test (PP). These two tests show the T statistics and probability value at level and first difference. Then it is decided to reject the null hypothesis when the t statistics is significant at 1%, 5% and 10% levels. Here we use ADF Test and PP test for identifying whether the data is stationary or not. This can be identified using T statistics and the probability value. The null hypothesis is set like that the data has a unit root and if the probability value is more than 0.05 in that case we accept the null hypothesis that means the data has a unit root the data is not stationary. If the probability value is less than 0.05 in that case the null hypothesis is rejected and the data has said to be there is no unit root so the data is said to be stationary normally there is acceptance of null hypothesis in level and we reject it in first difference, if it accepts in level and reject it in first difference so in that case the data is stationary. In the case of T statistics the T statistics is more than the level of significance in level and in first difference the T statistics is less than the level of significance here we reject the null hypothesis, so if all these thongs satisfied we say the data is stationary the following table shows about the normality of data.

Table 4.2

Unit Root Test

	ADF Test				PP Test			
	Level		First Difference		Level		First Difference	
	Probability value	T statistics	Probability value	T statistics	Probability value	T statistics	Probability value	T statistics
Future Gold	0.0585	-2.79979	0.0000	**-26.14****	0.0726	3.84265	0.0001	**-55.17****
Future Silver	0.0848	-2.64211	0.0000	**-29.57****	0.0699	-2.72575	0.0000	**-29.82****
Spot Gold	0.2264	-2.14697	0.0000	**-36.74****	0.1081	-2.53186	0.0000	**-36.99****
Spot Silver	0.1372	-2.41710	0.0000	**-36.94****	0.0781	-2.67817	0.0000	**-37.02****

** The null hypothesis is rejected at 1 % significance level

We can see that in the above table there is T statistics and the probability value both in the **Augmented Dickey Fuller Test (ADF)** and **Philips-Perron test (PP).**

In the case of **future gold prices** in ADF test we can see that the probability value 0.0848 and T statistics -2.79979 at level so in here at level we can see that the probability value is more that 0.05 so here we failed to reject the null hypothesis and we say that there is unit root in the data so the data is not stationary. In the case of first difference we can see that the probability value is only 0.0000 and it is below the normal so we reject the null hypothesis there is a unit root so we can say that the data is stationary. In the case of future gold prices in PP test we can see that the probability value 0.0726 and T statistics -3.84265 at level so in here at level we can see that the probability value is more that 0.05 so here we failed to reject the null hypothesis and we say that there is unit root in the data so the data is not stationary. In the case of first difference we can see that the probability value is only 0.0000 and it is below the normal so we reject the null hypothesis there is a unit root so we can say that the data is stationary. So we can conclude that both in ADF and PP test the data is show unit root or non-stationary in level but in first difference it shows no unit root so the data is stationary.

In the case of **future silver prices** in ADF test we can see that the probability value 0.0585 and T statistics -2.64211 at level so in here at level we can see that the probability value is more that 0.05 so here we failed to reject the null hypothesis and we say that there is unit root in the data so the data is not stationary. In the case of first difference we can see that the probability value is only 0.0000 and it is below the normal so we reject the null hypothesis there is a unit root so we can say that the data is stationary. In the case of future gold prices in PP test we can see that the probability value 0.0699 and T statistics -2.72745 at level so in here at level we can see that the probability value is more than 0.05 so here we failed to reject the null hypothesis and we say that there is unit root in the data so the data is not stationary. In the case of first difference we can see that the probability value is only 0.0000 and it is below the normal so we reject the null hypothesis there is a unit root so we can say that the data is stationary. So we can conclude that both in ADF and PP test the data is show unit root or non-stationary in level but in first difference it shows no unit root so the data is stationary.

In the case of **spot gold prices** in ADF test we can see that the probability value 0.2264 and T statistics -2.14697 at level so in here at level we can see that the probability value is more that 0.05 so here we failed to reject the null hypothesis and we say that there is unit root in the data so the data is not stationary. In the case of first difference we can see that the probability value is only 0.0000 and it is below the normal so we reject the null hypothesis there is a unit root so we can say that the data is stationary. In the case of future gold prices in PP test we can see that the probability value 0.1081 and T statistics -2.53186 at level so in here at level we can see that the probability value is more than 0.05 so here we failed to reject the null hypothesis and we say that there is unit root in the data so the data is not stationary. In the case of first difference we can see that the probability value is only 0.0000 and it is below the normal so we reject the null hypothesis there is a unit root so we can say that the data is stationary. So we can conclude that both in ADF and PP test the data is show unit root or non-stationary in level but in first difference it shows no unit root so the data is stationary.

In the case of **spot silver prices** in ADF test we can see that the probability value 0.1372 and T statistics -2.41790 at level so in here at level we can see that the probability value is more that 0.05 so here we failed to reject the null hypothesis and we say that there is unit root in the data so the data is not stationary. In the case of first difference we can see that the probability value is only 0.0000 and it is below the normal so we reject the null hypothesis there is a unit root so we can say that the data is stationary. In the case of future gold prices in PP test we can see that the

probability value 0.0781 and T statistics -2.67817 at level so in here at level we can see that the probability value is more than 0.05 so here we failed to reject the null hypothesis and we say that there is unit root in the data so the data is not stationary. In the case of first difference we can see that the probability value is only 0.0000 and it is below the normal so we reject the null hypothesis there is a unit root so we can say that the data is stationary. So we can conclude that both in ADF and PP test the data is show unit root or non-stationary in level but in first d**4.2.4**

Johansen Cointegration

In statistics, the Johansen test, named after Søren Johansen, is a procedure for testing cointegration of several, say k, I(1) time series. For the presence of I(2) variables see Ch. 9 of his 1995 textbook. This test permits more than one cointegrating relationship so is more generally applicable than the Engle–Granger test which is based on the Dickey–Fuller (or the augmented) test for unit roots in the residuals from a single (estimated) cointegrating relationship.

There are two types of Johansen test, either with trace or with eigenvalue, and the inferences might be a little bit different. The null hypothesis for the trace test is that the number of cointegration vectors is r=r*<k, vs. the alternative that r=k. Testing proceeds sequentially for r*=1,2,etc. and the first non-rejection of the null is taken as an estimate of r. The null hypothesis for the "maximum eigenvalue" test is as for the trace test but the alternative is r=r*+1 and, again, testing proceeds sequentially for r*=1,2,etc., with the first non-rejection used as an estimator for r

The Johansen test is a test for cointegration that allows for more than one cointegrating relationship, unlike the Engle–Granger method, but this test is subject to asymptotic properties, i.e. large samples. If the sample size is too small then the results will not be reliable and one should use Auto Regressive Distributed Lags (ARDL). And here there is two hypothesis where there is no cointegration or there is at least one cointegration, there is both Trace test and Maximum Eigenvalue both of these is considered here following data shows the cointegration test of future gold and silver prices and spot gold and silver prices

Table 3
Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statstic	Critical value	Prob.**
None**	0.007355	16.05591	15.49471	0.0411
Atmost 1*	0.005593	6.931739	3.841466	0.0085

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 4
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statstic	Critical value	Prob.**
None	0.007355	9.124172	16.26460	0.2760
Atmost 1*	0.005593	6.931739	3.841466	0.0085

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Here in trace test it shows there is cointegrating equations and there cointegration between gold and silver future prices but the Maximum Eigenvalue shows there is no cointegrating equations and there is no cointegration

Cointegration result of spot gold and silver prices

Table 5

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statstic	Critical value	Prob.**
None	0.004931	10.51259	15.49471	0.2433
Atmost 1*	0.003522	4.378539	3.841466	0.364

Trace test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 6
Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Max -Eigen	0.05	
No. of CE(s)	Eigenvalue	Statstic	Critical value	Prob.**
None	0.004931	6.134053	14.26460	0.5961
Atmost 1*	0.003522	4.378539	3.841466	0.0364

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Here both in Trace test and Maximum Eigenvalue there is two hypotheses normally set firstly there is no cointegration and secondly at most one cointegration so here we see that there is in trace test and Maximum Eigenvalue there is no cointegration so hypothesis is rejected here.

So we conclude that there is no cointegration between future gold and silver price and also there is no cointegration between spot gold and silver prices.

Efficiency of gold and silver market in price discovery

Price discovery in commodity market means the future prices are efficient enough to predict the future spot prices and here in this paper the price discovery in commodity market is analyzed using Granger Causality model. Here just use the similar steps up to testing the causality all other steps are similar and here need to test the short-term relationships also if there is short term relationship there should be price discovery

Granger causality test is used to identify the short-term relationships of the data also it is used for price discovery it is used to identify whether the future contract price is efficient enough to predict the future price or not. The causality is used to identify where the future price predicts the future spot price or not if it predicts it means there is price discovery and it is possible here.so causality is used to identify both the short-term relationship and the price discovery in gold and silver market. The following figures show causality in Gold and Silver market. The steps for causality are similar to that of cointegration test

4.3.1 Granger Causality between Spot and Future Gold prices

Table 4.9
Granger Causality between Gold future and spot prices

Null Hypothesis	Obs	F-Statistic	Prob.
			0.00000000
ZGS does not Granger Cause ZGF	1241	59.2724**	5
ZGF does not Granger Cause ZGS		15.3211**	0.0000037

** The null hypothesis is rejected at 1 % significance level

In the case of gold spot and future price there is two hypotheses where the gold spot prices does not granger causes gold future prices and gold future price does not granger causes gold spot prices and we accept the hypothesis where the probability value is more than 0.05 otherwise, we reject it and say that there is granger cause. By analyzing the above figures, we can say that the both the probability value is less

than 0.05 so we can reject the null hypothesis in both the cases and we can say that there is causality between gold spot and future market.

So in the case of commodity gold market there is causality between the spot and the future market and price discovery is possible here the future contract price is efficient enough to predict the future spot price and the market is efficient

4.3.2 Granger Causality between Spot and Future silver prices

Table 4.10

Granger Causality between Silver future and spot prices

Null Hypothesis	Obs	F-Statistic	Prob.
ZGS does not Granger Cause ZSF	1242	191.600**	0.00000000
ZGF does not Granger Cause ZSS		5.92341	0.0151

** The null hypothesis is rejected at 1 % significance level

In the case of silver spot and future price there is two hypothesis where the silver spot prices does not granger causes silver future prices and silver future price does not granger causes silver spot prices and we accept the hypothesis where the probability value is more than 0.05 otherwise we reject it and say that there is granger cause. By analyzing the above figures we can say that the both the probability value is less than 0.05 so we can reject the null hypothesis in both the cases and we can say that there is causality between silver spot and future market.

So in the case of commodity silver market there is causality between the spot and the future market and price discovery is possible here the future contract price is efficient enough to predict the future spot price and the market is efficient

Conclusion

There is some studies shows long term relationship and some studies shows no relationship between different commodities in the commodity derivative market and price of one commodity lead to the price of other commodity. In the previous studies commodity gold and silver market can see that there is price discovery and short-term relationships. The future prices of the commodity predict the future spot prices. Here the problem under the study is "Performance Analysis of Indian gold and silver Commodity Derivative Market. The results are obtained by evaluating the data taken from the MCX website and two tests are applied and after all these

made some findings. The commodity gold and silver spot and future prices are evaluated here and, Johansen cointegration and Granger causality is applied for getting the result.

After conducting the study, following findings are made:

1. There is no long term relationship between spot prices of Gold and Silver; it has no relationship in long run.

2. There is no long term relationship between future prices of Gold and Silver, can found any relationship in long run.

3. Future price of Silver is efficient enough to predict the future spot prices, Silver spot price granger causes commodity Silver future prices and vice versa so the price discovery is possible here.

4. Future price of Gold is efficient enough to predict the future spot prices, Gold spot price granger causes commodity Gold future prices and vice versa so the price discovery is possible here.

The study suggests that There is no long term relationship between future prices and spot prices of Gold and Silver so there is no cointegration or association between them in long run. In this case for an investor this Gold and Silver are good investment avenues in the long run. Both Gold and Silver has no relationship in the long run so by investing in these commodities the investor can diversify the risk and it's a diversified portfolio. The study suggests that the investment in gold and silver is good for risk averse investors.

The result of cointegration test shows that there is no long term relationships with gold and silver spot prices and also the results shows that there is no relationship with gold and silver future prices. When consider the third objective where there is efficiency in price discovery we can identify that there granger cause between spot and future prices of commodity gold and spot and future prices of commodity silver. So can conclude that there is efficiency in commodity market for predicting the future spot prices, the future price discovers the future spot prices and there are short term relationships between gold and silver spot and future prices

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BIOPHYSICAL INSIGHTS INTO THE AGGREGATION MECHANISM OF OVALBUMIN

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Abstract

This work illustrates the possible share of environmental toxins in inducing protein misfolding and hence protein aggregation. This is brought out by the interaction studies of ovalbumin (OVA) with mercuric chloride (denaturant) using time resolved, steady state, atomic force microscopy spectroscopy (AFM). The steady state quenching experiments showed a three state sigmoidal transition pattern indicates a concentration dependent quenching. More insight about the fibrillation pathway at molten globule state is brought out using AFM studies. Various oligomeric structures of OVA are encountered during the study with the addition of different concentrations of $HgCl_2$. Time dependent atomic force microscopy study exposed the formation of fibrils in the end state.

1. Introduction

Though the subject had been debated for years, studies on metal ion protein interaction has more relevance in the present scenario. The probabilities of coming across diseases caused by protein polymerization such as Alzheimer, dementia, emphysema, and liver cirrhosis have increased in the modern times (Squitti and Polimanti 2013). There can be a number of reasons which may lead to perturbation of protein structure, eventually leading to polymerization and hence loosening its functions (Gettins 2002, Hatcher, Hong et al. 2008). There are high chances either through dermal or dietary exposure, biomolecules are vulnerable to endocrine disrupting compounds, pharmaceutically active compounds, personal care products and many more toxic matrices (Ibrahim, Ibrahim et al. 2010, Mathew, Sreedhanya et al. 2014). Among this, the interaction with protein has its own relevance being the carrier of exogeneous ligands. Spectroscopic studies are the most popular tool to

study such interactions. The intrinsic fluorescence of some proteins has already been utilized to study the metal ion binding interaction. These include serum albumins and proteins of the serpin family. Some of the most toxic heavy metal ions have been a subject of this interaction studies such as Hg, Cd, Zn, Ni etc (Tamás, Sharma et al. 2014, Tamás, Fauvet et al. 2018, Lopes de Andrade, Marreilha Dos Santos et al. 2021). There have been many reported incidences due to the toxic effect of inorganic Hg that results either from direct or indirect bioaccumulation. Whatever may be the case, Hg is always a hot topic as far as the toxicity is concerned.

In this respect the study on the interaction of Hg with proteins (especially serpin group) are expected to provide vital information regarding conformational transition. These protein misfolding diseases can be initiated by a number of environmental triggers, leading to cellular toxic intermediates (β-sheet oligomers). The oligomeric forms of amyloidogenic proteins interact with cell membranes and are known to perturb structural integrity and permeation character (Bhattacharya and Dogra 2015, Dalal, Arya et al. 2015). The health crisis due to human degenerative diseases have initiated investigations to identify the cellular toxic β-sheet rich intermediates of proteins, their mechanistic pathways that lead to fibrillar formation and the subsequent interaction with cellular membranes. The findings indicate that the low molecular weight soluble oilgomers and the high molecular weight protofibrils are more toxic than the final insoluble fibrils which form the amyloid plaque. The constituents of the plaques are different in different diseases, for instance, Aβ peptide in AD, α-synuclein fibrils, Parkinson's disease (PD), and islet amyloid polypeptide (IAPP) in type II diabetes (Jacobsen, Reinhart et al. 2005, Pan, Wang et al. 2016). The final fibrillar stage and the very early conformational transitions are easier to investigate than the heterogeneous prefibrilar stage. The intermediate stages and oligomerization dynamics is more interesting from the therapeutic point of view.

Formation of toxic intermediate structures is common feature found in protein aggregation pathways. Rather than the final fibrilar stage the steps leading to the formation of intermediates and possible mechanism of their assembly is far more crucial. Herein we report the mechanism of formation of defolded state of ovalbumin, a model serpin at molten globule state (pH 2.2) on exposure to increasing concentration of mercuric chloride (denaturant). We combine different spectroscopic and microscopic techniques to study the intermediate oligomers and protofibrils.

2. EXPERIMENTAL SECTION

2.1 Materials.

Ovalbumin was purchased from Sigma-Aldrich and was used without further purification. Protein solutions (1 mg/ml) were prepared in buffer. $HgCl_2$ was prepared in water. Ultra-pure water was used for the preparation of all the solutions and buffers. Glycine-HCl (pH 2.5, 3), was used for buffer preparations. Mercuric chloride ($HgCl_2$) from Merck-India was used as received. All other chemicals were of analytical grade and were used as supplied. All other reagents were of analytical grade. The pH of the buffer was checked with digital pH meter (model 335 Systronics, Kochi).

2.2 Steady-State Measurements.

The fluorescence measurements were carried out on a LS55 (Perkin Elmer) having a 20 kW continuous powered high pressure Xe-lamp as the excitation source and an R928 photomultiplier as the photodetector. The excitation and emission slits were set at 5 nm. Ovalbumin was excited at 295 nm in order to minimize the contribution from Tyrosine (Tyr). The fluorescence emission was collected from 300 to 600 nm

2.2 Time-Resolved Fluorescence Measurements.

Time–resolved fluorescence decay measurements were carried out by time-correlated single photon counting using Horiba Jobin Yvon spectrometer. A pulsed diode (λ_{max} = 295 nm) was used as the excitation source and emission was monitored at respective emission wavelengths. The data was analyzed by using DAS6 software attached with the system.

2.3 AFM:

Structural characterization of protein aggregate is attempted by using confocal Raman microscopy coupled with an atomic force microscopy (AFM) instrument (Witec ALPHA 300RA, Germany). The AFM measurements have been carried out in the noncontact mode, with silicon tip of 75 kHz resonant frequency and 2.8 N/m force constant (radius below 8nm). Data was then collected using a multimode fiber into a high throughput lens based spectrograph (UHTS 300) with 300 mm focal length and grating 1800 g/mm, blazed at 500 nm. The microscope base is also equipped with an active vibration isolation system, active in the range 0.7−1000 Hz. The acquired spectra and AFM images are processed and analysed using the Witec Project 4 program.

3. RESULT AND DISCUSSION

3.1 AFM analysis of OVA at molten globule state

The topographical feature of self-assembled nanoscale structures of OVA was recorded using AFM. The structural feature of OVA with the addition of different concentrations of $HgCl_2$ is shown in figure 1. The detailed morphological analysis of OVA at acidic pH has been demonstrated in several reports (Bhattacharya and Mukhopadhyay 2012). In our study we have characterized the structural transformation of OVA at pH 2.2 with the addition of denaturant. Prior to the addition of denaturant "V" shaped monomers were observed (Fig. 1A). The statistical analysis revealed that these oligomers have height of 10-30 nm (Fig. 1C) and width of 178 nm (Fig. 1A). Upon the addition of 1.25 µM HgCl2 bead like oligomers are formed. The protofibrils formed have an average height of 5-20 nm. Compared with the molten globule structure we can observe a gradation in the average height of protofibrils formed. On the other hand the width remained the same. Further addition of 3 µM HgCl2 (Region II), results in the formation of long protofibrils with the height of 5-20 nm (Fig. 1 F) and width decreased to 165 nm (Fig. 1B). The careful monitoring of AFM image revealed the progressive increase in the length elongation of the protofibrils formed. In order to known about the detailed mechanism of protein aggregation, the SV (Stern-Volmer) plot and life time decay plot of OVA are utilised with the help of steady-state fluorescence experiments.

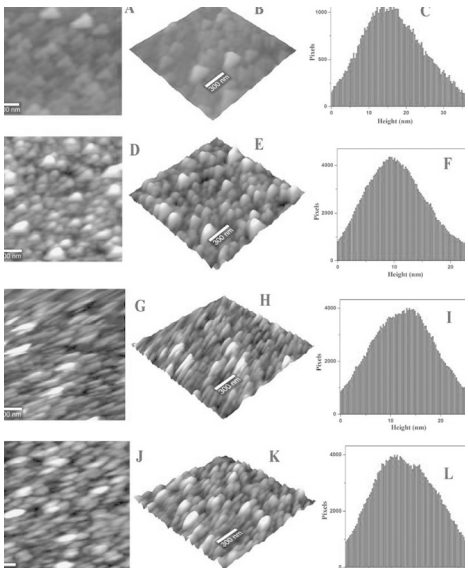

Figure 1: AFM images of (A): OVA pH 2.2 before exposure (scale bar is

300 nm throughout) showing "V" shaped monomers; (B): and (C): the corresponding 3D representation and height profile, (D): "bead like oligomers" after exposure to 1.25 μM HgCl2; (E): and (F): the corresponding 3D representation and height profile; (G): Long protofibrils with the increment of HgCl2 to 2.5 μM (H): and (I): the corresponding 3D representation and height profile (J) protofibrils formed by lateral addition with the increment of HgCl2 to 6.25 μM (K): and (L): the corresponding 3D representation and height profile.

3.2 Fluorescence spectroscopy

Fluorescence spectroscopy is a reliable tool to study the interaction of pollutants with proteins due to its great sensitivity and capability to probe different microenvironments (Albrecht 2008, Lamba, Paul et al. 2009, Anand, Jash et al. 2010). Any changes in the fluorescence intensity or shift in the emission maximum normally indicate conformational changes in the protein. The intrinsic fluorescence spectra of OVA in the presence of a series of concentrations of $HgCl_2$ are collected at an excitation wavelength of 295 nm. Figure 2A represents the variation of fluorescence intensity of OVA with the different concentration of $HgCl_2$. The figure clearly depicts that with the initial addition of quencher molecule up to 1.5 μM, the florescence intensity reduced only to a small extent. Increasing the concentration of $HgCl_2$ to 2.5 μM results in the further reduction in fluorescence intensity of OVA to a significant level. Further addition of $HgCl_2$ has no influence on the fluorescence intensity of OVA. In order to know the mechanism of quenching of OVA, the binding constant (K_b), number of binding site (n) were calculated using the modified version of Stern-Volmer equation.

$$\log\left[\frac{(F_0 - F)}{F}\right] = \log K_b + n \log[Q] \qquad (1)$$

Where F_0 and F are the steady-state fluorescence intensities in the absence and in the presence of quencher, respectively, K_{sv} is the Stern-Volmer quenching constant and [Q] is the concentration of quencher (BPS). τ_0 is the average lifetime of the protein without the quencher. K_b reflects the degree of interaction of OVA with $HgCl_2$.

The thermodynamics of binding can be estimated by measuring the free energy of binding (ΔG^0) given by

$$\Delta G^0 = -2.0303\ RT \log K_b \qquad (2)$$

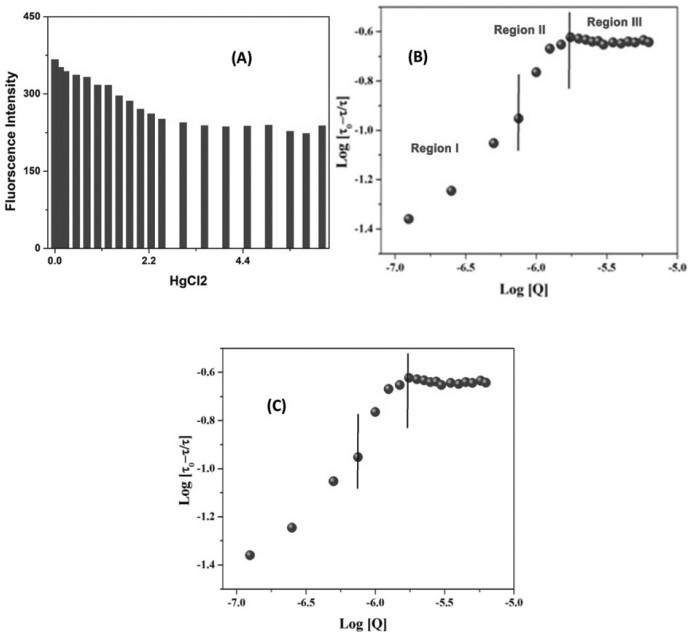

Figure 2. (A) Variation in the fluorescence intensity of OVA against the varying concentrations of HgCl2. (B) Plot of log [(F0-F)/F] vs log [ligand] for OVA-$HgCl_2$ at pH 2.2. The regions (I-III) represent the various binding stages of HgCl2 to OVA. (C) Plot of log $[(\tau_0-\tau)/\tau]$ against log $[HgCl_2]$ for OVA-ligand at pH 2.2.

A plot of log $[F_0-F/F]$ against log $[HgCl_2]$ is shown in figure 2B. From the figure, it is evident that the stepwise addition of $HgCl_2$ and sequential unfolding of ovalbumin involves a three state transition with the increasing concentration of $HgCl_2$. Classical linear polymerisation of protein usually has a typical sigmoid presentation. The sigmoidal curve presents a three stage process involving misfolding (lag phase), nucleation (growth phase), and fibril elongation (end phase). Lag phase is the slow process in the polymerization reaction where the 'nuclei' formation is initiated. In the second phase (growth phase) the nuclei (monomers) formed joins together to form rapidly join to form oligomers (protofibrils). This phase is thermodynamically highly favourable and is a fast process. In the saturation phase final fibril is formed (Bhak, Choe et al. 2009, Arosio, Knowles et al. 2015). To elucidate the detailed mechanism of protein aggregation the magnitudes of K_b, n, and ΔG binding have been estimated for the first two regions (I-II of figure 2 up to which binding of $HgCl_2$ to OVA takes place) using eqn. 1 and 2, and are summarized in table 1.

Table 1. Quenching constants and binding parameters of OVA-$HgCl_2$ systems at 298 K.

pH	Kq_1 ($M^{-1}s^{-1}$)	Kq_2 ($M^{-1}s^{-1}$)	n_1	n_2	K_{b1} (M^{-1})	K_{b2} (M^{-1})	ΔG_1 (kJ mol^{-1})	ΔG_2 kJ mol^{-1}
2.2	1.19×10^{13}	2.26×10^{13}	0.62	1.35	46.03	3.49×10^{4}	-9.48	-25.92

From the life time data also we obtained a three state transition state as shown in figure 2C. This further confirms the steady-state fluorescence experiments. A short lag phase was observed for the system. The molten globule state of OVA has stable secondary structural features and is devoid of tertiary structure. The thermodynamic analysis of region I of pH 2.2 shows low 'n' value indicating partial binding of $HgCl_2$ to the protein. The K_b value of this region is also very low. This indicates the formation of nuclei, which is a slow process and thermodynamically unfavourable. The ΔG_0 value for this region only -9.48 kJ mol^{-1}, indicating weaker binding. Region II shows large 'n' and ΔG_0 value indicative of stronger binding. Region II demonstrates the 'growth' phase in the protein aggregation. These points out the possibility of linear polymerisation have short or lag time having all the characteristic features of nucleation dependent polymerization. There will be sequential build-up of intermediates occurs up on fibrillation pathway. The addition of 6.25 µM $HgCl_2$ (saturation phase) the width of the protofibrils intensely increased to 265 nm with no effect in the height (Fig. 3D). Increases width of the protofibrils points out the possibility of lateral addition for the fibril growth mechanisms the saturation phase.

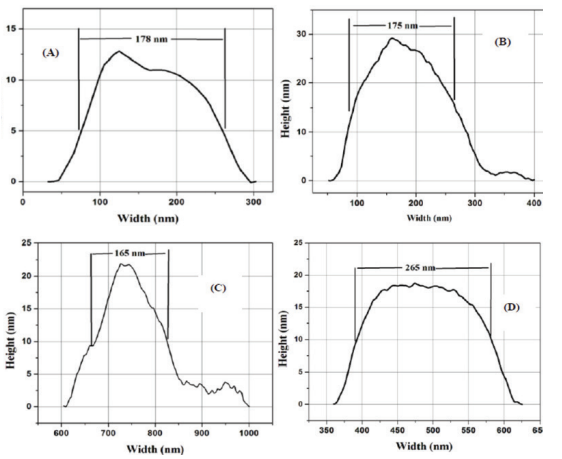

Figure 3. Width profile of oligomers/protofibrils (A): OVA pH 2.2 before exposure (B): after exposure to 1.25 µM $HgCl_2$; (C): with the increment of $HgCl_2$ to 2.5 µM; (D) with the increment of $HgCl_2$ to 6.25 µM

3.3 Time Dependent AFM Analysis

The AFM results show the formation of various oligomeric structures during the characterization. Not all protein aggregates in CNS diseases are of the amyloid fibrillar type. It is generally accepted that amyloid fibrils are just detoxification products while oligomeric intermediates are the toxic species. So in order to know whether the different protofibrils formed by the addition of $HgCl_2$ leads to fibril formation prolonged incubation of each phase (region) for 25 days were carried out and its AFM image were recorded. From the figure 4A, it is clear that with the incubation time the oligomers in the Region I joined to form long fibrils with a height of 10-30 nm (Fig. 4C) with a width of 300 nm (Fig. 4D). In region II, we can observe thicker fibrils (Fig. 4E) in which the protofibrils were combined side wise to form a thicker fiber of almost 700 nm wide (Fig. 4H). The height of the particle tremendously increased to 50- 125 nm (Fig. 4G). During the region III, thicker and longer fibers (Fig. 4I) were formed with ~ 1 µm (Fig. 4L) width suggesting that the protofibrils are self-assembled laterally during the prolonged incubation. The height is found to be in between 25-200 nm (Fig. 4K). Such micrometer-sized thicker fibrils obtained for peptide mixtures were reported by Justin R. Barone et al.

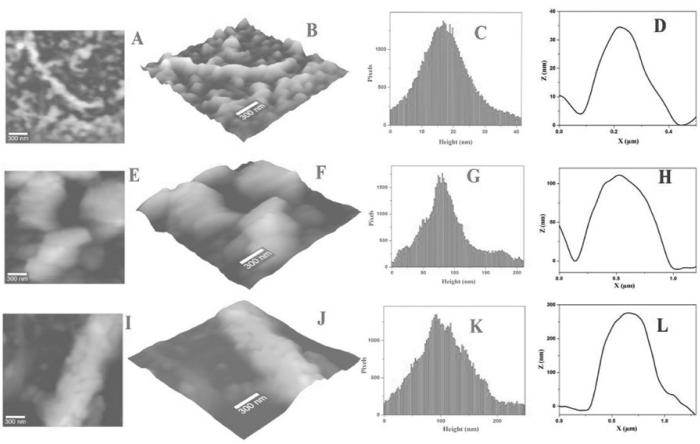

Figure 4: (A):Long fibrils and protofibril formation of OVA with the addition of 1.375 µM HgCl2 after the incubation of 25 days (B): (C): and (D): the corresponding 3D representation, height and width profile; (E): Thick micrometer sized fibril formation of OVA with the addition of 2.5 µM HgCl2 after the incubation of 25 days; (F): (G): and (H): the corresponding 3D representation, height and width profile; Thick long straight fibril formation of OVA with the addition of 6.25 µM HgCl2 after the incubation of 25 days; (F): (G): and (H): the corresponding 3D representation, height and width profile.

4. Conclusion

Herein, we report the mechanism of formation of defolded state of ovalbumin, a model serpin at acidic pH on exposure to increasing concentration of mercuric chloride. We combine different spectroscopic and microscopic techniques to study the possible share of environmental toxins in inducing protein misfolding and hence protein aggregation. The fluorescence interaction study of mercuric chloride, a heavy metal toxin, with OVA brings about more insight, without doubt, into the mechanistic aspects; but to a large extent the perturbation it can cause to the protein conformation. Critical role of the oligomeric species isolated in the middle of fibrillation process should be acknowledged to evaluate the mechanism of amyloid fibril formation by acting as the seeds or the growing unit for the fibrillar assembly, in addition to their suggested pathological activity of causing cytotoxicity.

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INFLUENCE OF GENDER SPECIFIC LIQUIDITY PERCEPTION REGARDING E BANKING ON SAVING BEHAVIOR

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Abstract

This paper examines whether gender influence liquidity perception of e-banking users. The study also analyse the significance of liquidity perception regarding e banking in determining the saving. The study analysed data collected from 305 respondents to make interpretations regarding gender specific financial perception and e-banking based financial behaviour. The study finds that gender of an e banking user and his perseption regarding liquidity of money in e-banking enabled bank account is not associated. Further the study reveals that monthly savings and perception regarding liquidity of money in e banking enabled bank account are associated. The study hence manifests the significance of behavioural factors in financial decision making in e banking environment.

Keywords: liquidity, e-banking, saving,

Introduction

Banking transactions done through electronic devices and platforms is known as e-banking. It can can be defined as the deployment of banking services and products over electronic and communication networks directly to customers. Electronic banking is changing the banking industry and is having the major effects on banking relationships. With the introduction and upgradation of technology in banking there is a revolutionary change in the pattern of doing banking transactions. Technology also brings about changes in- mobility, connectivity,dropping costs and helps in inclusive banking.The finsancial perception and evaluation of the e banking users differ across the banking platforms because the features like speed ,convenience, easiness etc offered by e banking channels and traditional banking channels differs. E-banking have multidimensional implications in personal finance and society.The use of e-banking have resulted in changes in financial behaviour and perceptions of e banking users with respect to saving habit, spending habit, investing

habit and psychology governing financial decision .Soci- economic features like age ,gender ,occupation etc of an e banking user also have a role in determining the e banking usage behaviour . Liquidity and vividness of money transacted in e banking channels is also different from cash transactions and these changes are capable of influencing the financial behaviour of e banking users. Cash transactions leave a vivid memory and the pain of payment is severely felt every time when a cash transaction is done. Changing contexts can also have a powerful effect on financial behavior . Money in bank account are now easily accessible through e banking channels and hence the liquidity perception of money in e banking enabled bank account of e banking users also have undergone changes. It is obvious that liquidity of money determines the saving and spending of a person. When money is liquidly available the temptation for spending increases and on the other hand when money is not liquidly available the scope for spending decreases and money will be saved by default. Human behavior is guided not only by rationality but it is guided by a sociable and emotional brain that some times makes irrational decisions. The most effective and sustainable changes in behavior may sometimes come from the integration of cultural, regulatory and individual change. Gender plays different roles in the relationship with e-banking dimensions .

There are many prior studies that reports changes in financial behaviour with respect to payment channel and gender. (Prelec and Loewenstein 1998) proposed an important concept related to changes in financial behaviour with respect to the e banking usage is the "pain of payment".

In cash transactions, parting money is vividly felt, which induces a high pain of paying (Prelec and Simester 2001; Soman 2003; Thaler 1999). As a result, consumers spend less when paying with cash than when using other means of payment (Feinberg 1986; Prelec and Loewenstein 1998; Runnemark et al. 2015). Savings decisions might equally be affected by cash transactions as the money saved is not physically present anymore

Soman (2001) explored the spending effects of different payment mechanisms by attributing them to memory processes .Hirschman (1979) reported a significant difference in the spending amounts when the preferred mode of payment changes. (Hansen,Kutzner, Wanke, 2013) has shown that priming concept of money can generally lead people to think more abstractly than they otherwise would .Ananthapadhmanabha Achar (2012) found that age, gender, marital status, and lifestyle determined the savings and investment behaviour.

The present study tries to analyse whether there is any relation between the gender, liquidity perception and saving behaviour of the e banking user who makes financial decisions through e banking channels .In this study a customer centric evaluation of differences in e banking based financial perseption across different

genders is attempted. The study also analyse the impact of e banking based financial perception on the saving behaviour

Objectives

1. To evaluate the association of liquidity perception of e banking users with respect to their gender.
2. To analyse the significance of liquidity perception of e banking users in determining their saving behaviour.

Analysis and Discussions

Objective 1 - To evaluate the association of liquidity perception of e banking users with respect to their gender.

Table 1. Analysis of liquidity perception of e banking users with respect to their gender.

			Opinion on the liquidity of money in e banking enabled bank account.			Total
			less liquid than cash in hand	more liquid than cash in hand	same as cash in hand	
gender	male	Count	9	69	66	144
		Expected Count	8.5	74.1	61.4	144.0
		% within gender	6.3%	47.9%	45.8%	100.0%
		% within opinion on the liquidity of money in e banking enabled bank account.	50.0%	43.9%	50.8%	47.2%
		% of Total	3.0%	22.6%	21.6%	47.2%
	female	Count	9	88	64	161
		Expected Count	9.5	82.9	68.6	161.0
		% within .gender	5.6%	54.7%	39.8%	100.0%
		% within opinion on the liquidity of money in e banking enabled bank account.	50.0%	56.1%	49.2%	52.8%
		% of Total	3.0%	28.9%	21.0%	52.8%
Total		Count	18	157	130	305
		Expected Count	18.0	157.0	130.0	305.0
		% within .gender	5.9%	51.5%	42.6%	100.0%
		% within opinion on the liqui dity of money in e banking enabled bank account.	100.0%	100.0%	100.0%	100.0%
		% of Total	5.9%	51.5%	42.6%	100.0%

Source: Field Survey

The gender wise analysis of responses of e banking users on the liquidity of money in e banking enabled bank account is shown in Table.1 .

From the analysis it is clear that out of 305 respondents 144 (47.2 per cent) are male and 161 (52.8 per cent) are female.

There are 18 respondents who are of the opinion that money in e banking enabled bank account is less liquid than cash in hand. Out of these 18 respondents 9(50 per cent) are male and 9(50 per cent) are female.

There are 157 respondents who are of the opinion that money in e banking enabled bank account is more liquid than cash in hand. Out of these 157 respondents 69(43.9 per cent) are male and 88 (56.1 per cent) are female.

There are 130 respondents who are of the opinion that money in e banking enabled bank account is same as cash in hand. Out of these 130 respondents 66(50.8 per cent) are male and 64 (49.2 per cent) are female.

The table shows that out of 305 respondents 18(5.9 per cent) are of the opinion that money in e banking enabled bank account is less liquid than cash in hand , 157(51.5 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand, and 130 (42.6 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand.

There are 144 respondents who are male . Out of these 144 respondents 9 (6.3 per cent) are of the opinion that money in e banking enabled bank account is less liquid than cash in hand, 69 (47.9 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand and 66 (45.8 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand .

There are 161 respondents who are female . Out of these 161 respondents 9 (5.6 per cent) are of the opinion that money in e banking enabled bank account is less liquid than cash in hand, 88 (54.7 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand and 64 (39.8 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand .

Chi-Square Tests

Table		Value	df	Asymp. Sig. (2-sided)	Conclusion
1	Pearson Chi-Square	1.387[a]	2	.500	Not significant
	Likelihood Ratio	1.388	2	.500	
	Linear-by-Linear Association	.636	1	.425	
	N of Valid Cases	305			
	a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.50				

Chi-square test was conducted to know whether gender and opinion on the liquidity of money in e-banking enabled bank account are associated or not, and the result is found to be not significant at 5 percent level of significance. $\chi 2$ (2, n=305) = 1.387, $p > 0.05$. This implies that gender and opinion on the liquidity of money in e-banking enabled bank account are not associated.

Objective 2- To analyse the significance of liquidity perception of e banking users in determining their saving behaviour.

Table 2 Analysis of opinion of e banking users on the liquidity of money in e banking enabled bank account to monthly saving in e banking enabled bank account.

			opinion on the liquidity of money in e banking enabled bank account			Total
			less liquid than cash in hand	more liquid than cash in hand	same as cash in hand	
	up to 2500	Count	2	51	41	94
		Expected Count	5.5	48.4	40.1	94.0
		% within the amount of money you save in your e banking enabled bank accounts during a month.	2.1%	54.3%	43.6%	100.0%
		% within opinion on the liquidity of money in e banking enabled bank account.	11.1%	32.5%	31.5%	30.8%
		% of Total	0.7%	16.7%	13.4%	30.8%

saving in e banking enabled bank accounts during a month.	2501-5000	Count	10	49	32	91
		Expected Count	5.4	46.8	38.8	91.0
		% within the amount of money you save in your e banking enabled bank accounts during a month	11.0%	53.8%	35.2%	100.0%
		% within opinion on the liquidity of money in e banking enabled bank account.	55.6%	31.2%	24.6%	29.8%
		% of Total	3.3%	16.1%	10.5%	29.8%
	5001-7501	Count	0	14	24	38
		Expected Count	2.2	19.6	16.2	38.0
		% within amount of money you save in your e banking enabled bank accounts during a month.	0.0%	36.8%	63.2%	100.0%
		% within opinion on the liquidity of money in e banking enabled bank account.	0.0%	8.9%	18.5%	12.5%
		% of Total	0.0%	4.6%	79%	12.5%
	7501-10000	Count	3	23	13	39
		Expected Count	2.3	20.1	16.6	39.0
		% within amount of money you save in your e banking enabled bank accounts during a month.	7.7%	59.0%	33.3%	100.0%
		% within opinion on the liquidity of money in e banking enabled bank account.	16.7%	14.6%	10.0%	12.8%
		% of Total	1.0%	7.5%	4.3%	12.8%
	above 10000	Count	3	20	20	43
		Expected Count	2.5	22.1	18.3	43.0
		% within amount of money you save in your e banking enabled bank accounts during a month	7.0%	46.5%	46.5%	100.0%
		% within opinion on the liquidity of money in e banking enabled bank account.	16.7%	12.7%	15.4%	14.1%
		% of Total	1.0%	6.6%	6.6%	14.1%

Total	Count	18	157	130	305
	Expected Count	18.0	157.0	130.0	305.0
	% within the amount of money you save in your e banking enabled bank accounts during a month.	5.9%	51.5%	42.6%	100.0%
	% within opinion on the liquidity of money in e banking enabled bank account.	100.0%	100.0%	100.0%	100.0%
	% of Total	5.9%	51.5%	42.6%	100.0%

Source: Field Survey

The analysis of opinion on the liquidity of money in e banking enabled bank account of e banking users with respect to their monthly saving in e banking enabled bank account is depicted in Table.2.

From the table it is clear that out of 305 respondents 18(5.9 per cent) are of the opinion that money in e banking enabled bank account is less liquid than cash in hand , 157(51.5 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand and 130 (42.6 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand.

There are 94 respondents who have monthly saving upto ₹2500 in e banking enabled bank account.Out of these 94 respondents 2(2.1 per cent) are of the opinion that money in e banking enabled bank account is less liquid than cash in hand , 51 (54.3 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand and 41 (43.6 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand.

There are 91 respondents who have monthly saving of ₹2501 to ₹5000 in e banking enabled bank account. Out of these 91 respondents 10(11 per cent) are of the opinion that money in e banking enabled bank account is less liquid than cash in hand , 49 (53.8 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand and 32 (35.2 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand.

There are 38 respondents who have monthly saving of ₹5001 to ₹7500 in e banking enabled bank account. Out of these 38 respondents none of the respondents are of the opinion that money in e banking enabled bank account is less liquid than cash in hand , 14 (36.8 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand and 24 (63.2 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand.

There are 39 respondents who have monthly saving of ₹7501 to ₹10000 in e banking enabled bank account. Out of these 39 respondents 3(7.7 per cent) are of the opinion that money in e banking enabled bank account is less liquid than cash in hand , 23(59 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand and 13(33.3 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand.

There are 43 respondents who have monthly saving above ₹10000 in e banking enabled bank account. Out of these 43 respondents 3(7 per cent) are of the opinion that money in e banking enabled bank account is less liquid than cash in hand , 20(46.5 per cent) are of the opinion that money in e banking enabled bank account is more liquid than cash in hand and 20(46.5 per cent) are of the opinion that money in e banking enabled bank account is same as cash in hand.

From the table it is further clear that out of 305 respondents 94 (30.8 per cent) have monthly saving up to ₹2500, 91(29.8 per cent) have monthly saving of ₹2501 to ₹5000 , 38(12.5 per cent) have monthly saving of ₹5001 to ₹7500, 39(12.8 per cent) have monthly saving of ₹7501 to ₹10000 and 43(14.1 per cent) have monthly saving above ₹10000 in e banking enabled bank account.

There are 18 respondents who are of the opinion that money in e banking enabled bank account is less liquid than cash in hand. Out of these 18 respondents 2(11.1 per cent) have monthly saving up to ₹2500 , 10(55.6 per cent) have monthly saving of ₹2501 to ₹5000, none of the respondents have monthly saving of ₹5001 to ₹7500, 3 (16.7 per cent) have monthly saving of ₹7501 to ₹10000 and 3 (16.7 per cent) have monthly saving above ₹10000 in e banking enabled bank account.

There are 157 respondents who are of the opinion that money in e banking enabled bank account is more liquid than cash in hand. Out of these 157 respondents 51(32.5 per cent) have monthly saving up to ₹2500 , 49(31.2per cent) have monthly saving of ₹2501 to ₹5000, 14(8.9 per cent)of the respondents have monthly saving of ₹5001 to ₹7500, 23 (14.6 per cent) have monthly saving of ₹7501 to ₹10000 and 20 (12.7 per cent) have monthly saving above ₹10000 in e banking enabled bank account.

There are 130 respondents who are of the opinion that money in e banking enabled bank account is same as cash in hand. Out of these 130 respondents 41(31.5 per cent) have monthly saving up to ₹2500 , 32(24.6 per cent) have monthly saving of ₹2501 to ₹5000, 24(18.5 per cent)of the respondents have monthly saving of ₹5001 to ₹7500, 13 (10 per cent) have monthly saving of ₹7501 to ₹10000 and 20 (15.4 per cent) have monthly saving above ₹10000 in e banking enabled bank account.

Chi-Square Tests

Table		Value	df	Asymp. Sig. (2-sided)	Conclusion
2	Pearson Chi-Square	17.162	8	.028	Significant
	Likelihood Ratio	19.116	8	.014	
	Linear-by-Linear Association	.001	1	.970	
	N of Valid Cases	305			
	a. 3 cells (20.0%) have expected count less than 5. The minimum expected count is 2.24.				

Chi-square test was conducted to know whether monthly savings and opinion on the liquidity of money in e banking enabled bank account are associated or not, and the result is found to be significant at 5 percent level of significance. $\chi 2$ (8, n=305) =17.162, $p < 0.05$. This implies that monthly savings and opinion on the liquidity of money in e banking enabled bank account are associated.

Symmetric Measures

Table			Value	Approx. Sig.
2	Nominal by Nominal	Phi	.237	.028
		Cramer's V	.168	.028
		Contingency Coefficient	.231	.028
	N of Valid Cases		305	

The strength or depth of the relationship between monthly savings and opinion on the liquidity of money in e banking enabled bank account is measured by symmetric measures. Phi, Cramer's V and Contingency Coefficient are the symmetric measures for nominal data. For all symmetric measures if P there exists relationship between the variables. Higher the value of symmetric measures higher the strength of relationship between saving and spending through e banking. Similarly lower the value of symmetric measures lower the strength of relation between saving and spending through e banking. Value of Phi, Cramer's V and Contingency Coefficient range between 0 and 1. Here the values of Phi, Cramer's V and Contingency Coefficient are 0.237,0.168 and 0.231 respectively and therefore we can interpret that the strength of the relationship between monthly savings and opinion on the liquidity of money in e banking enabled bank account is low.

Conclusion

Socio economic factors are crucial in determining the financial behaviour , but financial decisions in e banking

environment are not always influenced by socio economic factors .Financial decisions and preseptions in virtual banking arena is governed by many complex psychological and behavioural impulses rather than socio economic factors. The present study confirms that gender and opinion on the liquidity of money in e-banking enabled bank account are not associated. The study also reveals that there is low degree of association between monthly savings in e banking enabled bank account of e banking users and their opinion on the liquidity of money in e banking enabled bank account .

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ON A RHIZOMATIC PLANE: DELEUZO-GUATTARIAN ANALYSIS OF FLUID HOMES AND IDENTITIES IN AMITAV GHOSH'S THE GLASS PALACE

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Abstract:

Home or homeland has long been considered a prerequisite for developing a sense of identity and belonging and enjoying ontological security. Though dependent on the mere accident of birth, this home has been imagined as a spatially rooted, homogeneous entity. But, this turns problematic when migration becomes the inevitable norm for survival. The paper views Amitav Ghosh's novel *The Glass Palace* which is peopled with characters who share the inexorable experience of displacement, in the light of Deleuzo- Guattarian concept of rhizome . It argues for the reconceptualisation of existence as rhizomatic in order to grapple with the intricacies of dislocations and relocations which dominate the game of survival.

Key words: Displacement, Home, Identity, Rhizome

Full Paper

Home or homeland has long been considered a prerequisite for developing a sense of identity and belonging and for enjoying ontological security. The narratives on migration and displacement have, till recently, spun around the feelings of rootlessness and nostalgia experienced by the migrants since home or homeland is thought to be linked to a person's sense of identity and belonging. The conception of home as a spatially rooted entity and the consequent building up of identity turn problematic when dislocation becomes inevitable for survival. The paper assays the rhizomatic potential of existence as evinced in Amitav Ghosh's novel *The Glass Palace* which is peopled with characters who share the inexorable experience of displacement.

Amitav Ghosh is one of the prominent literary figures of the Indian diaspora, whose works penetrate and obliterate boundaries of the self and nationhood. His *The Glass Palace* (2000) is a yarn of many families told within the background of momentous historical events. The seven parts of the novel cover the time span of more than one century from 1885 to 1996. The major events of the novel are scattered over Malaya, Burma and India. It is a family saga of three generations which begins with the arrival of Rajkumar, an Indian orphan in Mandalay, Burma. Rajkumar works in a tea stall of a matronly lady Ma Cho. The British conquest of Mandalay brings about a change in the serene life of the place. The Burmese King Thebaw and the royal family are transported to India. With the loyal help of his friends Doh Say, Saya John and others, Rajkumar gradually succeeds in becoming a rich teak trader and a powerful member of the Indian community in Burma. Thereafter, he goes in search of Dolly, the devoted maid servant of queen Supayalat, with whom he had fallen in love at first sight as a boy during the British occupation of Mandalay. Dolly lives in the distant Indian city of Ratnagiri with the exiled king Thebaw, queen Supayalat and the princesses. There Dolly befriends Uma, the wife of an Indian District Commissioner assigned to look after the King and his family. Through Uma's contact, Rajkumar finally marries Dolly. The rest of the novel accounts the interaction between three families: of Dolly and Rajkumar in Burma, of Uma and her brother in India and of Saya John - Rajkumar's mentor and his son Matthew in Malaysia. Interspersed in the story is the harrowing experience of war between Japan and Britain with its implications. The major characters are King Thebaw, Rajkumar, Saya John, Bipin Dey, Arjun, Neel, Dinu and Matthew; the Queen Supayalat, Dolly, Uma, Alison, Manju, Jaya and the Princesses. The form of the novel is deliberately episodic to cover massive social, historical and geographic landscapes. Besides, the major stories of the four families, there are many little narratives in this novel, for instance, the stories of Ilongo Alagappan, Doh Say, Mohan Sawant, Co Buckland, Ma Cho, Jaya, etc.

The multiple dislocations and constant reshaping of identity of the characters in the novel lend themselves to a perusal in the light of the rhizomatic model expounded by the French philosophers Gilles Deleuze and Felix Guattari. A concept from biology, rhizome implies a modified subterranean stem of a plant that sends out roots and shoots from its nodes. Deleuze places "the rhizome in opposition to the tree, a rhizome-thought instead of an arborescent thought" (xvii). As a model for culture, the rhizome resists the organisational structure of the root-tree system which charts causality along chronological lines and looks for the source of things and looks towards the pinnacle or conclusion of those things:

> A rhizome has no beginning or end: it is always in the middle, between things, interbeing, *intermezzo*. The tree is filiation, but the rhizome is alliance, uniquely alliance. The tree imposes the verb "to be", but the fabric of rhizome is the conjunction, "and ...and...and" . This conjunction carries enough the force to shake and uproot the verb "to be". Where are you going? Where are you coming from? Where are you heading for? These are all totally useless questions. (Deleuze and Guattari 25)

The principles of rhizome elaborated by Deleuze and Guattari in *A Thousand Plateaus* are also worth considering in the discussion of migrant identity. These include: (i) and (ii) connection and heterogeneity - As opposed to the fixed nature of a tree, rhizome establishes any number of connections from any point to another. The connections established by rhizomes do not confine to any particular sphere, but extend to diverse domains; (iii) multiplicity - In the case of rhizome, multiplicity implies different dimensions which change in nature and refuse to be defined by an overarching unity; (iv) asignifying rupture - Breaking does not mean the end of rhizome. The shattered rhizome emerges again from an old spot or new spot; (v) and (vi) cartography and decalcomania - The structure of a rhizome cannot be traced. Instead, a rhizome can only be mapped since it is subject to continual modification.

In *The Glass Palace*, characters are not spatially rooted like arbors or trees, instead they are on the horizontal plane of existence like a rhizome. Commenting on Rajkumar's arrival in Mandalay, the novel says: "It was chance alone that was responsible for Rajkumar's presence in Mandalay that November morning."(Ghosh 4). Saya John, Rajkumar's mentor is introduced thus: "His clothes were those of a European and he seemed to know Hindustani – and yet the cast of his face was neither that of a white man nor an Indian. He looked, in fact, to be Chinese." (8). At Singapore where Saya John worked as an orderly in a military hospital, soldiers used to tell him: "... you are a dhobi ka kutta – a washerman's dog – na ghar ka nag hat ka- you don't belong anywhere, either by the water or on land, and I'd say, yes, that is exactly what I am" (10). Rajkumar is also a person who belongs to nowhere and is at a loss to understand the grief of the Burmese people at the deposition of their king by the British because "beyond the ties of blood, friendship and immediate reciprocity, Rajkumar recognised no loyalties, no obligations and no limits on the compass of his right to provide for himself" (47). The lives of these characters proceeds on swirls of connection, disconnection and reconnection: "This constant alteration means that it is a mistake to want to hold on to everything. Individuals must find ways of connecting well but the only way of doing this is by forgetting" (Williams 5).

The reality of dislocation is not confined to the commoners alone. The British occupation of Burma leads to the dethronement of the Burmese king Thebaw. The King, the Queen, the Princesses and servants are exiled to Madras, then finally to Ratnagiri. On the way to the exiled places the King wonders: "What vast, what an comprehensible power, to move people in such large numbers from one place to another- emperors, kings, farmers, dock workers, soldiers, coolies, policemen why? Why this furious movement - people taken from one place to another, to pull rickshaws, to sit blind in exile?" (Ghosh 50). In Ratnagiri the king and his entourage were accommodated in Outram House, a remote, neglected residence on a hilltop. When King Thebaw and his family are exiled to Ratnagiri, initially the family could retain Burmese culture. But because of long stay, their home and identity change:

> In their early years in India the Princesses usually dressed in Burmese clothes- aingyis and htameins. But as the years passed, their garments changed. One day, they appeared in saris- not expensive or sumptuous saris but the simple green and red cottons of the district. They began to wear their hair braided and oiled like Ratnagiri school girls; they learned to speak Marathi and Hindustani as fluently as any of the townsfolk (76-77).

While they were in Burma the royal family members rarely came out and mixed with common people but in Ratnagiri the princesses play, eat and sleep in servants' huts.

Displacement causes many challenges all that human beings can do is try to adjust, compromise, live and above everything else form connections. When Uma discusses with Dolly about the marriage of the princesses, Dolly told that in the entire Burma there were only sixteen eligible grooms. Only a man descending of Konbaung blood in both lines is eligible to marry them. Further Dolly told Uma that "the queen would not allow her daughters to defile their blood by marrying beneath themselves" (Ghosh 115). But the dislocation brings unexpected changes in their life. Both the first Princess and the second princess who were born in Burma remain in India. In the course of twenty years of exile the First Princess marries Mohan Sawant, a coachman and the Second Princess elopes with a Burmese commoner. The shocked King dies of heart attack and his burial is unbelievably plain. The colonial rule did not transport the King's body to Burma because of the fear that the body might become a rallying point in Burma. The First Princess in a letter written to Dolly writes that "no one could believe that this was the funeral of Burma's last King!" (205). After the death of the King, the Queen returns to Rangoon and stay there till her death six years. Thus the colonial occupation dislocates the royal

family from home and they were forced to accept new homes and identities. The formation of new bonds and the mixing of races continue and there is no point in turning averse to these processes. The king and queen are not ready to accept new homes and their life turns miserable. But the princesses adapt to the change of their homes and identities, hence their survival is easier.

Dolly herself is a fine embodiment of the notion of rhizomatic existence. She is born in Burma, but she moves to India with the royal family. She tells Uma about Ratnagiri: "I've lived here nearly twenty years, and this is home to me now" (Ghosh 112). But again she moves to Burma after marrying Rajkumar. Later when circumstances turn unfavourable, she persuades Rajkumar to shift the place. In the end she joins a Buddhist nunnery, thus symbolically rejecting all homes.

In a world where morrow is unpredictable, one has to look for routes, not roots. Mobility becomes the norm for survival, rather than settlement. When Rajkumar begins to feel that he is almost settled, the circumstances change. When the Indians in Burma became powerful and prosperous, the Burmese feel displaced. Riots break out all over Burma and Dolly and her sons become the targets of attack because she has married an Indian. Rajkumar's failure to be on the move leads to personal tragedy. His wife, Dolly suggests him to go to India. But he says, "It is hard to think of leaving: Burma has given me everything I have "(Ghosh 309). This sense of belonging proves detrimental. In a Japanese air-raid on Rangoon, the elephants in Rajkumar's timber yard panic, causing the logs to topple down killing Neel, Rajkumar's elder son. Rajkumar leaves for Calcutta. On the way Neel's wife, Manju commits suicide by jumping into the river. They travel along jungle with thousands of people and reach India. Rajkumar's younger son Dinu who had gone to sell off Morningside Rubber Estate in Malaysia does not go to India. He stays in Rangoon with his Burmese wife. Jaya, daughter of Manju and Neel, is brought up by grandparents in Calcutta. Saya John spends his days with his granddaughter Alison in the Morningside Estate in Malaysia after his son Matthew's death in an accident. Because of Japanese advancement into Malaya they plan to leave for Singapore, but Saya John is caught by the Japanese soldiers. Alison shoots herself before she is caught by the soldiers. After the death of her husband, Uma also moves along places in Europe and America. Arjun, Uma's nephew enlists in the army and is always on the move. The characters emerge as "rhizomes", rather than the traditional "arbors", longing for roots. For them, life is open, borderless, and is created out of proliferating connections, rather than fixed roots. As the Somali writer Nuruddin Farah puts it: "One of the pleasures of living away from home is that you become the master of your destiny, you avoid the constraints and limitations of your past and if need be create an alternative life for yourself" (65)

The novel reiterates the rhizomatic nature of existence which necessitates continuous remoulding of homes and identities. On the one hand, there are commoners like the central character Rajkumar and his mentor, Saya John, who appropriate colonial strategies and transit national frontiers and their prospects depend on the ability to rediscover homes and adapt to the ongoing process of migration. On the other hand, there are Thebaw, the deposed King of Burma and his Queen Supayalat who cannot be at ease anywhere except in the palace. And, there are a horde of other characters from varied milieus, whose lives spill over boundaries. Stuart Hall observes: "Diaspora identities are those which are constantly producing and reproducing themselves anew through transformation and difference" (235).

In *The Glass Palace*, the king, the queen, the princesses and common men and women, add their own shades to the theme of dislocation. These characters drift across the globe, realise the necessity of continual transformation in the ethic of survival, reconstruct their lives and resist all fixed notions of belonging. Horizontal movement of the rhizome is the reality of existence for them, not the vertical rooting of a tree. They are on the move and their homes and identities are created and recreated, from time to time, at some unstable points where the personal, political, historical, economic and numerous other forces intersect and interact.

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UPROOTED OR HOMELESS SELVES: SHIFTING AND FRACTURED IDENTITIES IN MICHAEL ONDAATJE'S *ANIL'S GHOST*

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The concept of diaspora is associated with dispersal and migration. Wherever there is displacement and whoever undergoes a displacement, he/ she is a diaspora. With the advent of postmodernism, the concepts like centre, root, home/homeland, origin are at stake and rather than stability, instability and hybridity have been celebrated. The term diaspora, in common parlance, signifies any people "living outside their homeland" (Anand 212). In contemporary media, diaspora is used as "a substitute for any notion of expansion and scattering away from the centre" (Tololyan 10). Very recent social issues have again broadened the shades of its meaning and now the term encompasses serious questions such as political refugees, alien residents, guest workers, immigrants, expellees, ethnic and racial minorities, overseas communities who find themselves living outside of the territory to which they are "historically rooted" (Carter 55). In the present global scenario, the very concepts like "root" and "home" are transient in nature, given the incessant movement of people from one region, country or continent to another . The diaspora in the process is psychologically dispersed to the 'in-between' zone called the "third space" as Homi K. Bhabha calls it (53). In the process of journey through trauma, nostalgia, memory, recollection, dislocation, desire for relocation and adjustment through torture and humiliation, the diasporic individual is reborn in the third space and the diaspora achieves a transnational, multicultural hybrid identity. There will be a shift in the identity and the resultant identity crisis brings out a fragmented existence. The continual exodus of people raise questions regarding to essential factors like nation, border, boundaries, location etc. Taisha Abraham clearly defines the significance of politics of location in her "Introduction" chapter of *Introducing*

Postcolonial Theories: Issues and Debates as the politics of location in postcolonial theories goes beyond the geographic terrain of the nation-state to include the international frame of the diaspora and migration as well....Questions of identity, politics, race, gender, journeys, memory, problems of deterritorialization and re-territorialisation in relation to exile and migrancy, the relationship between centre and periphery and notions of home and abroad, therefore, gain significance (7).

Philip Michel Ondaatje is a Sri Lankan born Canadian writer who has explored the various nuances of diasporic experiences through many of his characters. His migration to England and then to Canada explains his own experiences of geographical displacement. His sense of loss for Sri Lanka necessitates the need for relocation. He is also a product of this hybridity and a split- consciousness is very much reflected in his characters. As a diaspora, he has straddled multiple cultures- of Sri Lanka, of England and of Canada. His attempt of re-locating is signified by his revisits to the homeland in 1978 and 1980 before writing his fictional memoir *Running in the Family*. Culturally he feels torn between Sri Lanka and Canada due to the transculturation and in an interview he says, "...being Sri Lankan born and growing up there, I feel it's half my life... Sri Lanka was my culture... Canada was the culture I adopted... so these two things are important to me" (quoted in Tansley 183). The protagonists in Ondaatje's fiction too have undergone this same sense of dislocation and relocation as a part of their transcultured existence and shifting identities. Theories of diaspora bring out the hybrid and fluid nature of identity and for Ondaatje, identity is both a construct and a process. For him, identity is in constant flux and it always undergoes a process of becoming.

Ondaatje's novel *Anil's Ghost* (2000) exemplifies the problem of identity in a severe way. Along with the crisis faced by the protagonist Anil Tissera, the novel also addresses complex ethnic and national identities that prevailed across Sri Lanka. The novel portrays identity as its core issue and its individual and national level dimensions are woven here in an unparalleled way. Anil Tissera, a Sri Lankan born and western educated woman comes back to her homeland after fifteen years of expatriation. She is a UN forensic scientist who has come back all the way from USA to investigate extrajudicial executions that has happened in Sri Lanka. The novel is set in the backdrop of a gruesome civil war during the 1980s in Sri Lanka. Ondaatje writes:

> From the mid-1980s to the early 1990s, Sri Lanka was in a crisis that involved three essential groups: the government, the antigovernment insurgents in the south and the separatist guerrillas in the north. Both the insurgents and the separatists had declared war on the government.

> Eventually, in response, legal and illegal government squads were known to have been sent out to hunt down the separatists and the insurgents. Anil's Ghost is a fictional work set during this political time and historical moment (Author's note).

This sets the ambivalence of the country's identity and this political unrest of Sri Lanka could be read in parallel with the dislocation of Anil. The untold sufferings of the civilians and the rootlessness that they face due to the civil war are also heard in the novel.

Anil leaves the country for her studies at the age of eighteen and when she comes back to the homeland, the only link between Anil and Sri Lanka is Lalitha who was her ayah. She is a fractured self and tries to complete herself with the patches in Sri Lanka. Lalitha is the sole Tamil character in the novel and the meeting between the two was really a digging of the past and the fact is that she speaks a little Sinhala. Anil's last conversation in Sinhala was "the distressed chat she'd with Lalitha.... that ended with her crying about missing egg ruling and curd with jiggery... [and Lalitha] weeping , it felt, at the far ends of the world (141). This last, tear-soaked talk in her mother tongue is a costly one. The issue of language again problematizes Anil's identity, questioning her sense of belongingness to Sri Lanka. What makes identity problematic in the novel is that she occupies a stage of "in-betweenness" throughout the novel. She cannot forget her Sri Lankan origin, she always shares an urge to relocate herself in the island to which she cannot fully belong. She articulates her sense of belongingness when she says to Sarath, "This isn't just 'another' job! I decided to come back. I wanted to come back" (196). She positions herself with the island when she tries to make her case to the government on the discovery of the sailor. She says, "I think you murdered hundreds of us" (269). The oneness she feels with the Sri Lankans negotiates her desire to belong to the homeland. Sarath's observation at this can be seen as sarcastic : "Hundreds of us. Fifteen years and she is finally with us" (269). The desire "to come back" to the roots is a recurrent motif in Ondaatje's writings. Again the split-consciousness of Anil can be seen when she shares the feeling that she wouldn't be staying there much longer as there was no wish in her to be in Sri Lanka anymore (280). There is an unresolved question that whether she is an insider or outsider in the island. Before leaving the island she articulates this identity of hers while appreciating Sarath's and Gamini's determination to stay in the island: "No westerner could understand the love they had the island" (282) and again the fragmented self of Anil is seen.

Crossing the borders or boundaries of a nation also has a significant role in moulding the identity of diasporas. Ondaatje's *Anil's Ghost* provides an examination of identity reflective of cultural clashes that are inevitable consequences of such an interweaving of nationalities, histories and border divisions. Sophia A. McClennen suggests that "transnationalism renders the borders of a nation insignificant" (30). Also, Robert Gross considers there to be a need for "transnational thinking" (384). In several ways, Anil is a dislocated person who was born in Sri Lanka, went to the USA and became a member of UN Forensic department and as a forensic anthropologist, she is constantly on the move. Thus she transgress the boundaries of nation and state, also crosses the conventional notions regarding gender and position. Hers is a transnational and postmodern perspective: that she crosses and re-crosses many ideological boundaries, but it does not mean that she is devoid of any national identity at all. She is a blend of many identities and her multiculturalism demonstrates the fact that identity is a construct and at the same time, it is in constant flux. In other words, "Anil's transnational nature as being a continually changing mixture of a variety of cultures, which incorporates, encompasses and contains different fragments in one unified whole" (Cook 3). In a single entity, there are diverse factors to assert its identity.

The process of naming in *Anil's Ghost* accentuates the crisis of identity faced by the characters. Clearly, names and namelessness are central to Ondaatje's problematizing of identity. He points out in the acknowledgments of his semi-autobiographical work *Running in the Family*, that the use of names "may give an air of authenticity" (206). To be named, therefore, is to be located and thus to assert the identity. Ondaatje confronts this 'denied identities' through the representation of the 'murdered and the disappeared ones' during the civil war in *Anil's Ghost*. Anil feels that by establishing the identity of the lately discovered skeleton "Sailor" and finding out the family to whom he belongs, she will be locating all those who sailor represents: "who was this skeleton?...this representative of all those lost voices. To give him a name would name the rest" (56). The 'lost voices' are found out and named in the novel and 'called back' into existence. Naming as positioning the self is more reflected in the case of Anil when she chooses her brother's name for herself. It was stated in the novel that she was a good swimmer and she adopted the name of her brother deliberately and thus questioned and resisted the conventional notions on gender and names. For Ondaatje, names and identities are not fixed entities, but cultural and ideological constructions. Through choosing a new name for herself, Anil takes on a new identity making her first name oblivious. In other sense, it was a shedding of the past and assertion of a new one, emphasizing the shift in identity and a fracture (break up).

Ondaatje's construction of identity parallels Stuart Hall's notion of identity: "... identity is a process, identity is split. Identity is not a fixed point but is an ambivalent point...we cannot speak for very long about one experience, one identity without acknowledging the other side- its ruptures and discontinuities" (13). Ondaatje also presents the problematics of situating a homeland. *Anil's Ghost* represents the instability of personal and national identities.

As Anil has multiple identities, the title of the novel can have multiple connotations. What does the ghost refer to is a question that turns up with different possible answers. The ghost may refer to Anil's past- her bygone days in the island and the memories associated with it, which always follow her. The ghost may also refer to 'Sailor' and other unnamed victims of civil war, the murderer of sailor, the driving force for Anil to investigate "the extrajudicial executions and to Sarath Diyasena, the local archaeologist. As Ondaatje writes: "He (Ananda) and the woman Anil would always carry the ghost of Sarath Diyasena (301).

However, *Anil's Ghost* clearly paints the picture of the civilians' life during the civil war in Sri Lanka. So many people have been murdered and they have been silenced. *Anil's Ghos*t renders a space for these 'voiceless' and thus they are located as Anil turns out to be the spokesperson for these marginalised ones. Obviously, *Anil's Ghost* exemplifies the terror behind terrorism and the trauma of the common people. The country too shares a fractured identity as Anil Tissera. *Anil's Ghost* is set amidst in Sri Lanka's civil conflict, focused on a period in the mid 1980s and early 1990s when the government was combating both Tamil separatists and Sinhalese insurgents. The chaotic political scenario in Sri Lanka and civil war indicated that national identity within its geographical boundaries was in danger and could be challenged as it was divided in "North" and "South" where one can experience the transnationality within Sri Lanka. People like 'Sailor' are deprived of their identity, nationality and culture and were imposed to go unnamed and unidentifiable. In the opening, *Anil's Ghost* appears to encourage the idea of a united Sri Lankan Buddhist belief. It in initiated in "the minor's folk song, Sri Lanka" referring to the "life wheel"

In search of a job I came to Bogala
I went down the pits seventy-two fathoms deep
Invisible as a fly, not seen from the pit head
Only when I return to surface
Is my life safe...
Blessed be the scaffolding deep down in the shaft

Blessed be the life wheel on the time's pithead

Blessed be the chain attached to the life wheel (01)

The concept of life wheel echoes the concepts of roots or origin. The intense desire to relocate oneself in the homeland is evident in these lines and it resonates the pain of fractured identity in the diasporas. In true sense, Anil is a dislocated person- with regard to her name, to her family and to the nation. The dislocation of Anil reverberates the fragmentation of the nation due to the civil war and it also addresses the unheard voices of the murdered ones. Though *Anil's Ghost*, Ondaatje problematizes notions of individual or national identity as being fixed an immutable, adopting instead a perspective that considers such boundaries as both flexible and permeable.

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“A STUDY ON DECELERATION OF THE INDIAN ECONOMY”

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Abstract:

The Indian economy will grow at 9.7% in 2021, which will be faster than all of the world's major economies according to a London-based data and analytics firm Global Data, however, it will be 11.5% in 2021as per the statistics of IMF. Indus valley civilization, which flourished between 2800 BC and 1800 BC, had an advanced and flourishing economic system. The Global Financial Crisis, India’s long-term growth has slowed as the two engines propelling rapid growth-investment and exports-sputtered. Today, the other engine-consumption-has also stalled. As a result, growth has plummeted precipitously over the past few quarters. Key words: Deceleration, Indian Economy, GDP, Middle-income traps.

Introduction

India is one of the world's fastest-growing major economies. The Indian economy will grow at 9.7% in 2021, which will be faster than all of the world's major economies according to a London-based data and analytics firm Global Data, however, it will be 11.5% in 2021as per the statistics of IMF. Indus valley civilization, which flourished between 2800 BC and 1800 BC, had an advanced and flourishing economic system. The Indus valley people practiced agriculture, domesticated animals, made tools and weapons from copper, bronze and tin and even traded with some Middle East countries.

The recent growth fell to its lowest case investment has weakened unemployment has risen. So, what is causing the slowdown, how can it be reversed? Since the turn of the century, India's economy has grown at a rapid rate helping transform the country between 2006 and 2020 rising incomes lifted 271 million people out of poverty. Meaning the proportion of Indians still living in poverty has fallen dramatically from around 55 per cent to 28 per cent access to electricity as also approved in 2007 just seventy per cent of the population had access to power by 2021 that grew to nearly 93 per cent more recently the Indian government constructed around

a hundred and ten million toilets a huge step towards better sanitation designed to prevent the practice of open defecation. It's a signature program of Prime Minister Narendra Modi known as Swachh Bharat. In India, all this development has been supported by a booming economy. But as of late that expansion has begun to run out of steam in the third quarter of 2020. India's economic output grew by four and a half per cent making it the first time the country's growth dip below 5% since 2013 the context four and a half per cent growth is still much higher than that of developed economies like the US but with 12 million Indians entering the workforce every year economists. The country needs annual growth rates to stay above 9% to ensure there are enough jobs.

SCOPE OF THE STUDY:

An economic slowdown occurs when the rate of economic growth slows in an economy. Countries usually measure economic growth in terms of gross domestic product (GDP), which is the total value of goods and services produced in an economy during a specific period. This study examines the influence of the world economic crisis in Indian Economy.

OBJECTIVES OF THE STUDY:

1. To study the current state of the Indian economy.
2. To find the impact of the slow down on the growth of the country.
3. To evaluate the reforms that will help the Indian economy grow.

COLLECTION OF DATA:

The secondary data are collected from various books, journals, newspapers, periodicals, websites, etc.

METHODOLOGY:

With a view to assume the objective of the present study the secondary source of information has been used.The history, growth and performance of the Indian economy have been examined based on secondary data like periodical textbooks, journals reports and different websites containing information of India economy. The work is heavily banked on the secondary source of information. Simple statistical tools like Graphs and charts were used in this study.

INDIAN ECONOMY:

India has emerged as the fastest-growing major economy in the world and is expected to be one of the top three economic powers of the world over the next 10-15 years, backed by its strong democracy and partnerships. India's nominal GDP

growth rate is estimated at 15.4 per cent in 2021-22. It was contracted by 8% in 2020-21. During Q2 of 2020-21, GDP (at constant 2011-12 prices), GDP stood at Rs. 33.16 lakh crore (US$ 474.46 billion) showing a growth rate of 4.3 per cent over the corresponding quarter of the previous year.

SECTORS OF INDIAN ECONOMY:

1. Primary Sector: When the economic activity depends mainly on the exploitation of natural resources then that activity comes under the primary sector. Agriculture and agriculture-related activities are the primary sectors of the economy.
2. Secondary Sector: When the main activity involves manufacturing then it is the secondary sector. All industrial production where physical goods are produced come under the secondary sector.
3. Tertiary Sector: When the activity involves providing intangible goods like services then this is part of the tertiary sector. Financial services, management consultancy, telephony and IT are examples of the service sector.

OTHER CLASSIFICATIONS OF ECONOMY:

In the Indian economy introduction, the sectors of the economy based on other basis are also required to get a clear picture of the strengths of Indian Economy.

1. Organized Sector: The sector which carries out all activity through a system and follows the law of the land is called an organized sector. Moreover, labour rights are given due respect and wages are as per the norms of the country and those of the industry. Labour working organized sectors get the benefit of the social security net as framed by the Government. Certain benefits like provident fund, leave entitlement, medical benefits and insurance are provided to workers in the organized sector. These security provisions are necessary to provide a source of sustenance in case of disability or death of the main breadwinner of the family without which the dependents will face a bleak future.

2. Unorganized Sector: The sectors which evade most of the laws and don't follow the system come under the unorganized sector. Small shopkeepers, some small-scale manufacturing units keep all their attention on profit-making and ignore their worker's basic rights. Workers don't get adequate salary and other benefits like leave; health benefits and insurance are beyond the imagination of people working in unorganized sectors.

3. Public Sector: Companies which are run and financed by the Government comprises the public sector. After independence, India was a very poor country. India needed a huge amount of money to set up manufacturing plants for basic items like iron and steel, aluminum, fertilizers and cement. Additional infrastructure like roads, railways, ports and airports also require a huge investment. In those days Indian entrepreneurs were not cash-rich so the government had to start creating big public sector enterprises like SAIL (Steel Authority of India Limited), ONGC (Oil & Natural Gas Commission).

4. Private Sector: Companies which are run and financed by private people comprise the private sector. Companies like Hero Honda, Tata are from the private sector.

MARKET SIZE:

India's nominal GDP growth rate is estimated at 12 per cent in 2020-21. The estimate for 2018-19 was 11.5 per cent. During Q2 of 2020-21, GDP (at constant 2011-12 prices), GDP stood at Rs 33.16 lakh crore (US$ 474.46 billion) showing a growth rate of 4.3 per cent over the corresponding quarter of the previous year.

` India has retained its position as the third-largest startup base in the world with over 8,900-9,300 startups, with about 1,300 new start-ups being founded in 2020, according to a report by NASSCOM. India also witnessed the addition of 7 unicorns in 2020 till August, taking the total tally up to 24.

India's labour force is expected to touch 160-170 million by 2020, based on the rate of population growth, increased labour force participation, and higher education enrolment, among other factors, according to a study by ASSOCHAM and Thought Arbitrage Research Institute.

India's foreign exchange reserves were US$ 448.59 billion in the week up to November 22, 2020, according to data from the RBI.

RECENT DEVELOPMENTS:

With the improvement in the economic scenario, there have been various investments in various sectors of the economy. The M&A activity in India increased 53.3 per cent to US$

77.6 billion in 2020 while private equity (PE) deals reached US$ 24.4 billion. Some of the important recent developments in the Indian economy are as follows:

- Exports from India increased by 1.60 per cent year-on-year to US$ 386.96 billion in April-November 2020.

- Nikkei India Manufacturing Purchasing Managers' Index (PMI) stood at 52.7 in December 2020, showing expansion in the sector.
- Mergers and Acquisitions (M&A) activity in the country has reached US$ 48 billion during Jan-Sept 2020.
- The gross tax revenue stood at Rs 11.74 lakh crore (US$ 168 billion) out of which Income tax collection contributed Rs 2.67 lakh crore (US$ 38.34 billion) between April-November 2020.
- Companies in India have raised around US$ 114.1 billion through 768 Initial Public Offers (IPO) first nine months of 2020.
- India's Foreign Direct Investment (FDI) equity inflows reached US$ 436.47 billion between April 2000 and June 2020, with maximum contribution from services, computer software and hardware, telecommunications, construction, trading and automobiles.
- India's cumulative growth of Index of Industrial Production (IIP) with base 2011-12 for the period April-September 2020 stands at 1.3 per cent, with September 2020 stands at 123.3.
- Consumer Price Index (CPI) – Combined inflation 3.3 per cent in April-September 2020.
- In 2020-21, the highest number of 11.6 lakh net jobs was created during the month of November, while the least number of 4.73 lakh jobs was created in May, as per the EPFO data.
- India improved its ranking in the World Bank's Doing Business Report by 14 spots over last year and is ranked 63rd among 190 countries in the 2020 edition of the report.
- India is expected to have 100,000 startups by 2025, which will create employment for 3.25 million people and US$ 500 billion in value, as per Mr T V Mohan Das Pai, Chairman, Manipal Global Education.
- The World Bank has stated that private investments in India are expected to grow by 12.1 per cent in FY 2020-21 to overtake private consumption growth of 10.1 per cent, and thereby drive the growth in India's gross domestic product (GDP) in FY 2020-21.
- India is expected to retain its position as the world's leading recipient of remittances in 2020, with total remittances touching US$ 150 billion, according to the World Bank's Migration and Development Brief.

GOVERNMENT INITIATIVES:

Union Finance Minister Nirmala Sitharaman on 25 February 2021 said this year's Budget has negated the notion that welfare state is a socialist prerogative, and added that it has given a directional change to the Indian economy, wherein the government trusts wealth creators and citizens.

She lauded the reform of faceless assessment for direct and indirect taxes, saying that tax terrorism will be a thing of the past, but also warned that "technology terrorism" will now gain ground.

"This is a budget for the new decade. This budget clearly says- private sector we trust you and you are welcome to participate in the development of the country. It's a budget in which we are recognising what a government can do or how far it can do...So it's a budget that gives directional change to the Indian economy,"

"We inherited a system from the USSR, where glories of socialism were spoken about...That only socialism can take care of the welfare of the entire population. They say the welfare state is a socialist prerogative," she said. The total expenditure in 2020-21 is targeted at Rs 1,44,265 crore. This is 14.8% higher than the revised estimates of 2020-21. This expenditure is proposed to be met through receipts (other than borrowings) of Rs 1,14,970 crore and borrowings of Rs 29,242 crore.

Numerous foreign companies are setting up their facilities in India on account of various government initiatives like Make in India and Digital India. Mr. Narendra Modi, Prime Minister of India, has launched the Make in India initiative intending to boost the manufacturing sector of Indian economy, to increase the purchasing power of an average Indian consumer, which would further boost demand, and hence spur development, in addition to benefiting investors. The Government of India, under the Make in India initiative, is trying to give a boost to the contribution made by the manufacturing sector and aims to take it up to 25 per cent of the GDP from the current 17 per cent. Besides, the Government has also come up with the Digital India initiative, which focuses on three core components: the creation of digital infrastructure, delivering services digitally and to increase digital literacy. Some of the recent initiatives and developments undertaken by the government are listed below:

- India is expected to attract investment of around US$ 100 billion in developing the oil and gas infrastructure over the next five years.
- With the help of the new agriculture export policy, the Agri exports from India is likely to reach the export target of US$ 60 billion by the year 2022.

- In India, Atal Innovation Mission (AIM), a flagship initiative of NITI Aayog, launched the Atal Community Innovation Centre (ACIC) program in NITI Aayog which aims at spurring community Innovation in underserved and unserved areas of the country.
- National Institute for Transforming India (NITI) Aayog released a strategic document titled 'Strategy for New India @75' to help India become a US$ 4 trillion economy by FY23.
- The Government of India is going to increase public health spending to 2.5 percent of GDP by 2025.
- For the implementation of Agriculture Export Policy, the government has approved an outlay Rs. 206.8 crore (US$ 29.59 million) for 2020, aimed at doubling farmers income by 2022.
- Government is planning to launch Bharat Craft portal, an e-commerce marketing platform to market and sell the products.
- Under the Pradhan Mantri Awas Yojana (Urban), the government has sanctioned more than 96.50 Lakh houses under PMAY(U) and approved 606 proposals for the construction of 3,31,075 houses with an overall investment of Rs 15,125 crore (US$ 2.16 billion).
- The Cabinet Committee on Economic Affairs has approved to increase the authorized capital of Food Corporation of India (FCI) from existing Rs 3,500 crore (US$ 500.79 million) to Rs 10,000 crore (US$ 1.43 billion).
- India has registered a 26.9 per cent reduction in Maternal Mortality Ratio (MMR) since 2013: Sample Registration System Bulletin-2020.
- Around 26.02 million households have been electrified as on 31st March 2020 under the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA).
- Prime Minister's Employment Generation Programme (PMEGP) will be continued with an outlay of Rs 5,500 crore (US$ 755.36 million) for three years from 2018-19 to 2020-21, according to the Cabinet Committee on Economic Affairs (CCEA).
- As per the Union Budget 2020-21, public sector banks (PSBs) will be provided with a capital infusion of Rs 70,000 crores (US$ 10.02 billion), allowing NBFCs to raise foreign debt.
- The mid-term review of India's Foreign Trade Policy (FTP) 2020-21 has been released by the Ministry of Commerce & Industry, Government of India, un-

der which annual incentives for labour-intensive MSME sectors have been increased by 2 per cent.

- Under the scheme Pradhan Mantri Gram Sadak Yojana (PMGSY-III), the government plans to spend Rs 50,250 crores (US$ 7.19 billion) to build roads to boost rural connectivity.

FUTURE OF THE ECONOMY:

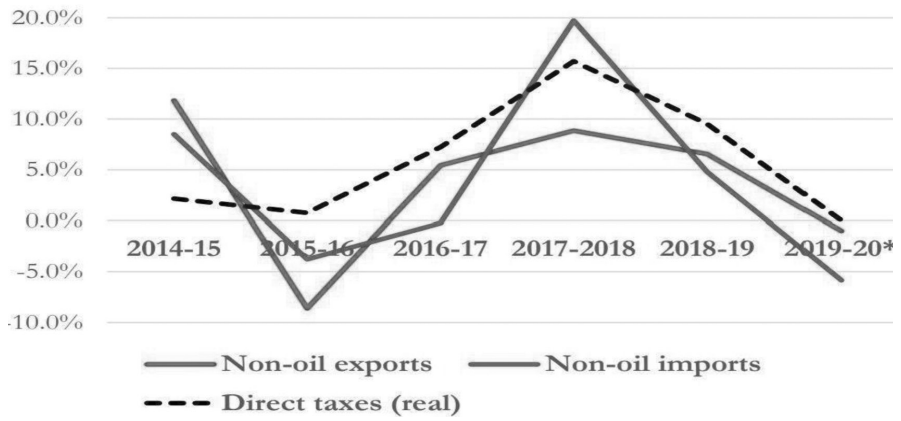
India's gross domestic product (GDP) is expected to reach US$ 5 trillion by FY25 and achieve upper-middle income status on the back of digitization, globalization, favourable demographics, and reforms.

India is also focusing on renewable sources to generate energy. It is planning to achieve 40 per cent of its energy from non-fossil sources by 2030 which is currently 30 per cent and has plans to increase its renewable energy capacity from to 175 GW by 2022.

India is expected to be the third-largest consumer economy as its consumption may triple to US$ 4 trillion by 2025, owing to shift in consumer behaviour and expenditure pattern, according to a Boston Consulting Group (BCG) report; and is estimated to surpass US to become the second-largest economy in terms of purchasing power parity (PPP) by the year 2040, according to a report by Pricewaterhouse Coopers.

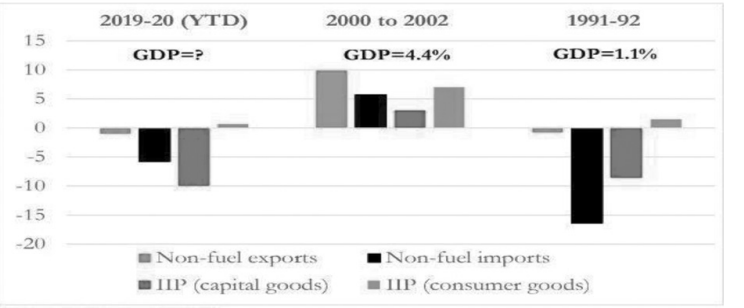
Figure 1.1. Trade and Taxes

(Growth in percent; trade-in current $; taxes in real Rupees)



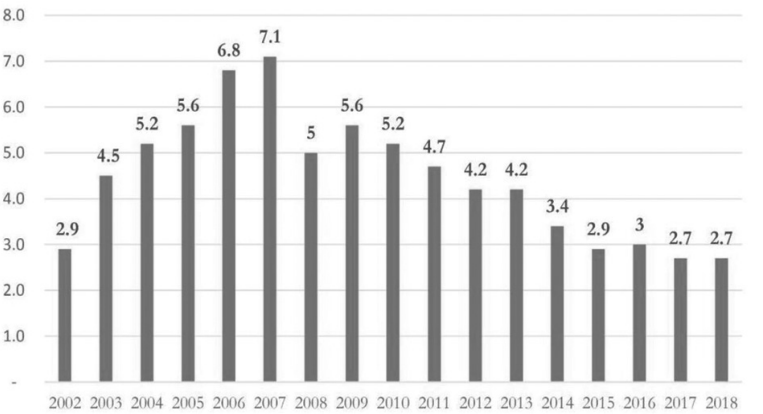
Source: *RBI for exports, ministry of Commerce for imports, and Ministry of finance for taxes.*

Figure 1.2. Present and Slowdowns



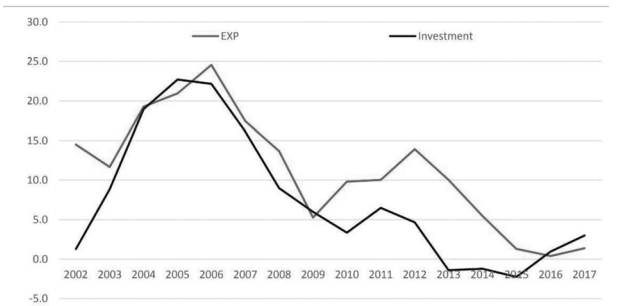
Source: *WDI and MOSPI*

Figure 1.3. Corporate Profits (share of GDP; %)



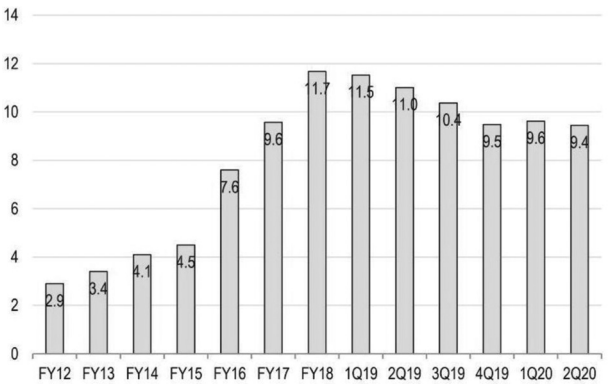
Source: *CMIE PROWESS*

Figure 1.4. Growth of Real Exports and Investment (%)



Source: *WDI*

Figure 1.5. Gross Non-Performing Asets (in per cent of bank assets)



Source: *Credit Suisse*

Findings, Suggestions and Conclusions

Since the Global Financial Crisis, India's long-term growth has slowed as the two engines propelling rapid growth—investment and exports—sputtered. Today, the other engine—consumption—has also stalled. As a result, growth has plummeted precipitously over the past few quarters.

Indeed, the economy seems locked in a downward spiral. Best capturing this stark reality is the astonishingly high interest-growth differential. The corporate cost of borrowing now exceeds the GDP growth rate by more than 4 percentage points, meaning that interest on the debt is accumulating far faster than the revenues that companies are generating. Already, this has caused a resurgence in the amount of stressed debt, a second wave of the Balance Sheet Crisis. If this process is left unchecked, the economy will continue to spiral downward, as stress reduces growth, which then intensifies the stress.

Action must be taken to stabilize the economy and get it back on the path of rapid growth. But in the current circumstances, the standard macroeconomic tools are not very useful. There are actions that the government cannot do (further significant fiscal stimulus); must not do (reducing personal income tax rates or raising GST rates); can do with only limited effectiveness (easing monetary policy). What, then, is to be done?

First, can anything be done quickly? A major first action-- almost a precondition for righting the economy—could be a Data Big Bang; both instill confidence and produce a reliable basis for policy making. This must comprise the publication

of unreleased reports together with a strategy for improving official statistics in at least three areas: the real sector (GDP, consumption and employment), fiscal accounts, and stressed assets in the banking system.

Next, we propose several strategies to halt the current vicious economic spiral, the most critical one being to address the Four Balance Sheet challenge – the stress in banks and NBFCs on the financial side, and infrastructure companies and real estate on the corporate side.
Policies need to act on the 5Rs:

- Conducting a new Asset Quality Review to cover banks and NBFCs (Recognition)
- Making changes to the IBC to ensure that participants have incentives to solve the problem (Resolution)
- Create two executive-led public sector asset restructuring companies ("bad banks"), one each for the real estate and power sectors (Resolution)
- Strengthening oversight, especially of NBFCs (Regulation)
- Linking recapitalization to resolution (Recapitalization)
- Shrinking public sector banking (Reform)

There is, of course, a reason why these policies have not been implemented before. They are politically difficult and other, easier alternatives have seemed more attractive. But the government currently has a tremendous amount of political capital. And by now all the alternatives have been tried and found wanting. So, finally, after a long and difficult decade, the government has both the opportunity and the clear need to resolve the Four Balance Sheet (FBS) problem.

But we must be clear. Realism demands recognition that resolving the FBS problem, as well as the difficulties in agriculture, will inevitably take time. A slow-bleed over many years led to the current predicament. The way out will also be laborious. India's weak state capacity and the entrenched stigmatized capitalism have stymied private initiative and honest public officials for a very long time. There are no quick solutions.

A corollary is that sustained effort will be needed. Complacency remains an abiding danger. The economy was buoyed by a series of cyclical factors in the 2010s; another fortuitous factor may well arrive in 2020, at which point there could be euphoria, lulling us back into policy inertia. Such a reaction would be dangerous, for the FBS challenge is deep and intractable, defying easy or quick corrections.

Any signs of an incipient upturn must therefore not be interpreted as harbingers of durable improvement. They must be seen for what they are: sirens that must be resisted.

Another reason to be realistic and even moderate India's medium-term growth expectations are the external environment. The Economic Survey of 2018 spoke of headwinds facing "late convergers" such as India, countries that have not even attained proper upper-middle-income status. These headwinds include the declining trading opportunities that sustained the East Asian and Chinese growth miracles, labor-saving technologies, and climate change.

But being realistic is not an invitation to succumb to pessimism. It is important to realize that India has agency. Even "middle-income traps" can be sprung. After all, some of the problems have been domestic and self-inflicted. If we got into India's Great Slowdown in part because of what we did in the past, surely, we can also emerge out of it by what we do next.

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INTEGRABILITY OF HAMILTONIAN SYSTEM WITH HOMOGENEOUS POLYNOMIAL POTENTIAL OF DEGREE FOUR

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Abstract

The analysis of non-linear dynamical problems is important in both mathematical and physical point of view. The non-linear systems are not explicitly solvable and they are chaotic depending upon the value of the control parameters. From physical point of view, the existence of integrable nonlinear dynamical systems often means the existence of very regular motion. From mathematical point of view, they imply the existence of beautiful analytic and geometric structures. The concept of integrability is itself in a sense not well defined and seems to be no unique definition. The integrability nature of dynamical systems can be methodologically investigated using the following two broad notions (1) Integrability in the complex time plane: Painleve Property (2) Complete Integrability and Liouville Integrability. In this paper the Painleve method is used to check the integrability of Hamiltonian system. The main objective of this work is to analyses the integrability of Hamiltonian system with a homogeneous polynomial potential of degree four using Painleve test.

Key words : Painleve, Integrability, Hamiltonian

Introduction

Integrating the non-linear differential equations completely or obtaining their analytic solutions or finding integrals of motion systematically or invariants seem to be rare. What does one mean by integrability of a non-linear differential equation and when does it occur for a given system is the two fundamental questions which arise in this regard. The answer to the former question is somewhat vague as the concept of integrability of differential equation is itself in a sense not well defined and there seems to be no unique definition to it as yet. For the later, it is even more difficult to answer as no well-defined criteria seem to exist to identify integrable cases. From a qualitative point of view, integrability can be considered

as a mathematical property that can be successfully used to obtain more predictive power and quantitative information to understand the dynamics of the system locally as well as globally. Investigations [1,2] which are in a sense revival of the efforts of the mathematicians and physicists of the past century show that the integrability nature of dynamical systems can be methodologically investigated using at least the following two broad notions. The first one uses essentially the literal meaning: Integrable-Integrated with sufficient number of integration constants and Non-Integrable-Proven not to be integrable. Thus loose definition of integrability can be related to the existence of single-valued, meromorphic solutions, a concept originally advocated by Fuchs [3] Kovalesvskaya [4,5] Painleve [6] and others for differential equations. Such a definition then leads to the notion of integrability in the complex time plane, which is generally called the Painleve Property. The second notion, particularly applicable to Hamiltonian systems, is to look for sufficient number of single-valued, analytic, involutive integrals of motion: N integrals for a Hamiltonian system with N-degrees of freedom, so that the associated Hamiltonians' equations of motion can be integrated by quadratures in the sense of Liouville.

Hamiltonian systems describe the movements of an object whose energy is conserved. Hamilton's equations of some Hamiltonian systems can be integrated by "quadratures", these are the completely integrable Hamiltonian systems. Example of such system is the motion of a top. The motion of a free particle on a surface of revolution or an ellipsoid are other simple examples of completely integrable Hamiltonian systems. In the special setting of Hamiltonian systems, we have the notion of integrability in the Liouville sense. For many mechanical systems, the Hamiltonian takes the form

$$H(q,p)=T(q,p)+V(q)$$

where $T(q,p)$ is the kinetic energy, and $V(q)$ is the potential energy of the system. Such systems are called the natural Hamiltonian systems.

A dynamical system is integrable when it can be solved in some way. One restrictive way in which this can happen is if the flow of the vector field can be constructed analytically. However, since this can almost never be done and this is not an especially useful class of systems. However, there is a class of Hamiltonian system action-angle systems, whose solutions can be obtained analytically, and there is a well-accepted definition of integrability for Hamiltonian dynamics due to Liouville.

Singularity Point Analysis for Ordinary Differential Equations

For an ordinary differential equation to be of P-type, it is necessary that it has no movable branch points, either algebraic or logarithmic. We do not consider in our following analysis the presence of essential singularities,whose treatment appears to be much more complicated and the theory is probably not complete to locate them. In the following, we describe the ARS [7] which provides a systematic way to investigate the presence of movable critical points of branch point type and to determine whether the given ordinary differential equation is of P-type or not.

To be specific, we consider an n^{th} order ordinary differential equation

$$\frac{d^n w}{dz^n} = F\left(z; w, \frac{dw}{dz}, \dots \dots \dots \frac{d^{n-1} w}{dz^{n-1}}\right) \text{ ---------- (1)}$$

Here F is analytic in z aand rational in their other arguments.We look for a solution of equation(1) as a Laurent series in the neighbourhood of a movable singular point $z_{0.}$ Then the ARS algorithm essentially consists of the following three steps.

1. Determination of leading -order behaviours of the Laurent series in the neighbourhood of the movable singular point $z_{0.}$
2. Determination of resonances, that is, the powers at which arbitrary constants of the solution of equation (1) can enter into the Laurent series expansion.
3. Verifying that sufficient number of arbitrary constants exist without the introduction of movable critical points.

At the end of the above three steps one will be in a position to check the necessary conditions for the existence of P-type solution and integrability of equation (1).

Painleve Analysis and Integrability of Hamiltonian System with Homogeneous Polynomial Potential of Degree Four

The Hamiltonian reads

$$H = \frac{1}{2}(p_x^2 + p_y^2) + \frac{1}{2}ax^2(x^2 - y^2 + 2xyi) + \frac{1}{4}(x^4 + y^4 + 2x^2y^2)\text{-----}$$

(2) where is a constant.

It is well-known that the above Hamiltonian system is widely used as a models in lattice dynamics, condensed matter theory, field theory, astrophysics etc.

Now the Hamiltons' equations read,

$$\frac{d^2x}{d^2t} = -4x^3\alpha - 2\beta xy^2 - 3\gamma x^2y - x^3 + xy^2 \text{----------(3)}$$

$$\frac{d^2y}{dt^2} = -2\beta x^2y - \gamma x^3 - y^3 + x^2y \text{----------(4)}$$

where $\alpha = \frac{a}{2},\ \beta = \frac{-a}{2}, \gamma = ai$

Leading - order Behaviour

Let us consider the equations 3 and 4, we assume that the leading order behaviour of x(t) and y(t) in a sufficiently small neighbourhood of the movable singularity t_0 is

$$x(t) \approx a_0\,\tau^p \text{ and } y(t) \approx b_0\tau^q\tau = (t - t_{0)} \to 0 \text{---------(5)}$$

Substituting equation (5) in equation (3) and (4), we get

$$a_0p(p-1)\tau^{p-2} + 4\alpha a_0^3\tau^{3p} + 2\beta a_0b_0^2\tau^{p+2q} + 3\gamma a_0^2b_0\tau^{2p+q} + a_0^3\tau^{3p} + a_0b_0^2\tau^{p+2q} = 0 \quad \text{--- (6)}$$

$$b_0\text{q(q-1)}\tau^{q-2} + 2\beta a_0^2b_0\tau^{2p+q} + \gamma a_0^3\tau^{3p} + b_0^3\tau^{3q} + a_0^2b_0\tau^{2p+q} = 0 - - - -(7)$$

From the above equations it is clear that each term is a leading-order term and so we obtain,

p = -1 and q = -1 and

Resonances

For finding the resonances, we substitute

$$2a_0 + 4\alpha a_0^3 + 2\beta a_0b_0^2 + 3\gamma a_0^2b_0 + a_0^3 + a_0b_0^2 = 0 \text{---------(8)}$$

$$2b_0 + 2\beta a_0^2b_0 + \gamma a_0^3 + b_0^3 + a_0^2b_0 = 0 \text{----------(9)}$$

Into terms of equations (3) and (4)

Retaining only the leading-order terms, we obtain a system of 2-coupled linear algebraic equations, in matrix form it can be written as

$M_2(r)\Omega = 0, \Omega = (\Omega_1, \Omega_2)^7$

where is a 2 matrix is given by

$$\begin{pmatrix} r^2 - 3r + 8\alpha a_0^2 + 3\gamma a_0 b_0 + 2a_0^2 & 4\beta a_0 b_0 + 3\gamma a_0^2 + 2a_0 b_0 \\ 4\beta a_0 b_0 + 3\gamma a_0^2 + 2a_0 b_0 & r^2 - 3r + 2 + 2\beta a_0^2 + 3b_0^2 + a_0^2 \end{pmatrix}$$

For non-trivial set of solutions (we demand

(Ω_1, Ω_2) we demand *det* M_2 $(r)^2$

$(r^3 - 3r + 8\alpha a_0^2 + 3\gamma a_0 b_0 + 2a_0^2)(r^2 - 3r + 2 + 2\beta a_0^2 + 3b_0^2 + a_0^2) - (4\beta a_0 b_0 + 3\gamma a_0^2 +$

$2a_0 b_0)^2 = 0.$

The ARS algorithm demands the above quartic polynomial admits a root equal to -1. This is possible only if $\alpha = 0$, $\beta = 0$, $\gamma = 0$ which implies $\alpha = 0$

Case 1: a = 0

The associated equations of motion are

$$\frac{d^2x}{d^2t} + x^3 + xy^2 = 0 \text{---------} 11$$

$$\frac{d^2y}{dt^2} + y^3 + x^2y = 0 \text{---------} 12$$

Leading-Order Behaviour

Consider the equations (11) and (12), we assume that the leading-order behaviour of $x(t)$ and $y(t)$ $b_0\,\tau^q$ in a sufficiently small neighbourhood of the movable singularity t_0 is

$x(t) \approx a_0\,\tau^p$ and $y(t) \approx b_0\tau^q$, $\tau = (t - t_{0)} \to 0$--------13

To determine p, q, we use equation (13) in equation (11) and (12) and obtain a pair of leading - order equations,

$a_0 p(p-1)\tau^{p-2} + a_0^3\tau^{3p} + a_0 b_0^2\tau^{p+2q} = 0$----------14

$b_0 q(q-1)\tau^{q-2} + b_0^3\tau^{3q} + a_0^2 b_0\tau^{2p+q} = 0$----------15

Equating the powers we get

p = -1 and q = -1, substitute this values we get,

$$a_0^2 + b_0^2 = -2$$

So we cannot take as arbitrary. Here all the terms are leading-order terms.

Resonances

For finding the resonances, we substitute into equations (11) and (12)

$x(t) \approx a_0 \tau^p + \Omega_1 \tau^{p+r}$ and $y(t) \approx b_0 \tau^q + \Omega_2 \tau^{q+r}$-----(16)

Retaining only the leading-order terms,we obtain a system of linear algebraic equations

$M_2(r)\Omega = 0,\ \Omega = (\Omega_1, \Omega_2)^T$

where$M_2(r)$ is a 2 × 2 matrix dependent on r, the form of $M_2(r)$ is,

$$\begin{pmatrix} r^2 - 3r + 2a_0^2 & 2a_0 b_0 \\ 2a_0 b_0 & r^3 - 3r + 2b_0^2 \end{pmatrix}$$

For non-trivial set of solutions (Ω_1, Ω_2 we demand *det* $M_2(r)$ is, On solving we will get r = -1,0,3,4

Excluding -1 and possibly 0, all the remaining roots are positive real integers,then there are no algebraic branch points.So the given ordinary differential equation is of P-type.

Conclusion

From this analysis we can conclude that Hamiltonian System with Homogeneous Polynomial Potential of Degree Four is of P-type with the parametric restriction a=0, which leads to the notion of integrability in the complex plane.

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A STUDY ON STRUCTURE GRACEFUL INDEX

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ABSTRACT

In this presentation I introduce an upper bound for structure graceful index of Kn.

Today, graph theory is one of the most flourishing branches of Mathematics and has applications to a wide variety of subjects. .Also, graceful labelling plays a vital role. But the complete graph Knis not graceful for n>4. This paper is a brief study on graceful labelling of graph and structure graceful index of graph. This paper investigates about the graceful labelling of graphs and trees. It is clearly demonstrated that all wheels are graceful for all $n \geq 3$. Also it is illustrated that Petersen graph, hypercubes and caterpillars are all graceful.AGn graph which is graceful for n>4 has V(Gn)={v1,v2,……,vn} and E(G)={v1 vi/ i>1}U {v2 vi /i>3}U {vjvn/5≤i≤n},for n>4.

Keywords: Graceful labelling, Graph structure, Structure graceful index, k-Structure graceful.

1. INTRODUCTION

In many real life situations, we are using complete graphs. Also, graceful labelling plays a vital role. Let G be an undirected graph without loops or double connections between vertices. In labelling (valuation or numbering) of a graph G, we associate distinct nonnegative integers to the vertices of G as vertex labels (vertex values or vertex numbers) in such a way that each edge receives a distinct positive integer as an edge label (edge value or edge number) depending on the vertex labels of vertices which are incident with this edge. Graph labelling gave birth to families of graphs with attractive names such as graceful, felicitous and elegant. The name "graceful labelling" is due to Solomon W. Golomb; this class of labelling was originally given the name β-labelling by Alexander Rosa in a 1967

paper on graph labelling. But the complete graph K n is not graceful for n > 4. In the course of the proof, we found a graph Gn , which is graceful for n>4. A Gn graph has V(G n) ={v 1 ,v 2 ,…,v n } and E(Gn)={v 1 v i / i>1} U {v2 v i /i>2} U {v3 v i / i>3} U {vjvn/5≤i<n}, for n>4. Using this G n graph, we find the upper bound for the structure graceful index of Kn ,n>10.

Although numerous families of graceful graphs are known, a general necessary or sufficient condition for gracefulness has not yet been found. Also it is not known if all tree graphs are graceful. Another important labelling is an α -labelling or α -valuation which was also introduced by Rosa . An α-valuation of a graph G is a graceful valuation of G which also satisfies the following condition: there exists a number γ (0 ≤ γ < E(G)) such that, for any edge e∈ E(G) with the end vertices u, v ∈ V(G), min { vertex label (v), vertex label (u) } ≤ γ < max { vertex label (v), vertex label (u) }

It is clear that if there exists an α-valuation of graph G, then G is a bipartite graph. During the past thirty years, over 200 papers on this topics have been appeared in journals. Although the conjecture that all trees are graceful has been the focus of many of these papers, this conjecture is still unproved. Unfortunately there are few general results in graph labelling. Indeed even for problems as narrowly focused as the ones involving the special classes of graphs, the labelling have been hard-won and involve a large number of cases.

2. STRUCTURE GRACEFUL LABELLING

2.1GRACEFUL LABELLINGS

A graceful labelling of a graph G with m edges is a function f: V(G)→{0, 1, 2,……...m} such that distinct vertices receive distinctnumbers and {|f (u) – f(v) | : uv ε E(G)}={1, 2, ……m}.

A graph is graceful if it has a graceful labelling. In order for a graphto be graceful, it must be without loops or multiple edges.

Examples 1

Thomsen Graph

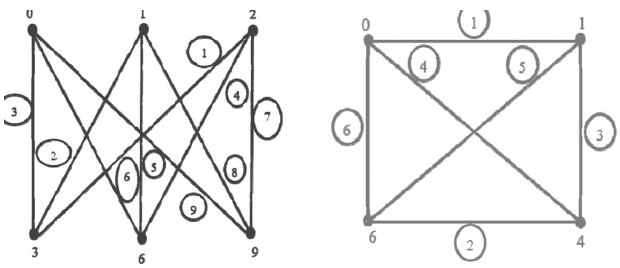


Figure 1 In all the figures, vertices are labeled as numbers and graceful labels of edges are marked inside small circles.

2.2 STRUCTURE GRACEFUL INDEX

The structure graceful index of a graph G is defined as the minimum k for which G is k-structure graceful. Let us denote it by SGI(G).

2.3 k-STRUCTURE GRACEFUL

A graph G = (V,E) is said to be k-structure graceful if E can be partitioned into k disjoint subsets E 1 ,E 2 ,…,E k such that the graph structure (V(G), E 1 , E 2 , …, E k) is graceful.

THEOREM 2.1:

The wheel Wn is graceful for all n≥3.

Proof:

Construct a numbering f of a wheel Wn = Cn +K1 , as follows: f assigns the vertex of K1, the number 0 and f assigns the vertices of the cycle Cn consecutively the numbers

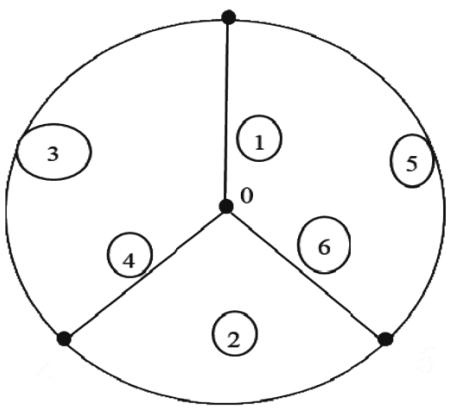
(i) 2_n, 1, $_{2n-3}$, 3, 2_{n-5}, 5 …n+2, n-2, 2_n-2, 2_n if n is a odd.

(ii) 2_n, 1, 2_{n-3}, 3, 2_{n-5}, 5,……n-3, n+1, 2, 2n if n is even.

In order to show that numbering f is graceful, it suffices to verify that for every number i ε {1, 2,…….2_n} there is exactly one edge numbered i. All the verifications are trivial.

Case 1: When n is odd

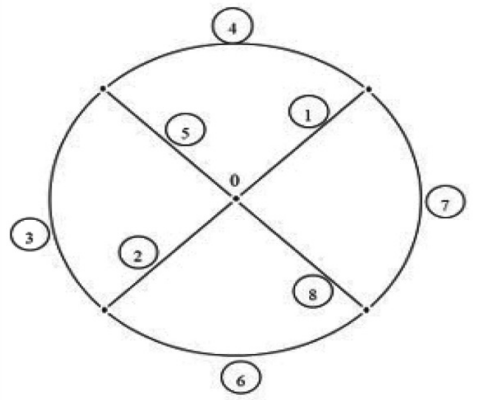
Figure 2



iε {1, 2, 3, 4, 5, 6}

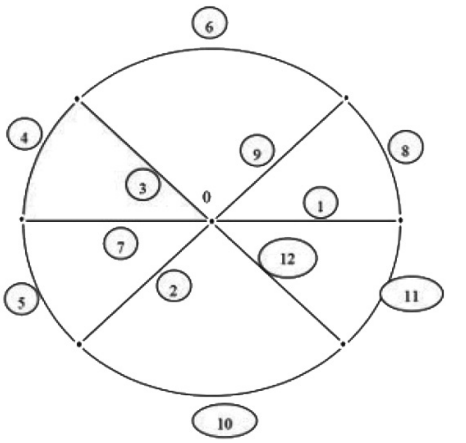
W_3 (n=3)

Case 2: when n is even



{1, 2, 3, 4, 5, 6, 7, 8,}

W_6 (n=6)



iεiε {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12}

W_4 (n = 4)

Figure 3

MORE EXAMPLES OF GRACEFUL GRAPHS

- PETERSEN GRAPH
- HYPERCUBES
- CATERPILLARS

CATERPILLARS ARE GRACEFUL

A caterpillar is a tree having a path that contains at least one vertex of every edge. (It can be taken to be a path of maximum length) Every caterpillar has a graceful labeling. The illustration below shows a caterpillar with a graceful labeling.

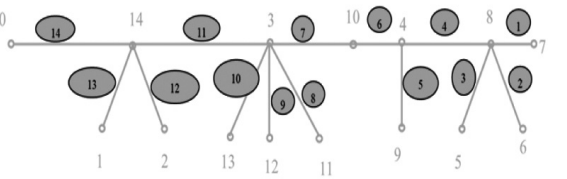


Figure 4

THEOREM 2.2:

$$SGI(K_n) \leq \begin{cases} \left[\frac{n-5}{4}\right]+1, & \text{when } n \equiv 1 \pmod 4 \\ \left[\frac{n-6}{4}\right]+1, & \text{when } n \equiv 2 \pmod 4 \\ \left[\frac{n-7}{4}\right]+2, & \text{when } n \equiv 3 \pmod 4 \\ \left[\frac{n-8}{4}\right]+2, & \text{when } n \equiv 0 \pmod 4 \end{cases}$$

where n > 10.

To prove this theorem we need the following lemma.

Lemma: One point union of Km and K1,n is graceful for

2 < m < 7.

Case (i): When m = 3

Define

$$f(v_i) = \begin{cases} 0, & i = 1 \\ i, & i > 1 \end{cases}$$

Case (ii): When m = 4

$$\text{Define } f(Vi) = \begin{cases} 0, & i=1 \\ 6, & i=2 \\ 5, & i=3 \\ 2, & i = 4 \\ i + 2, & 5 \le i \le 4+n \end{cases}$$

Case (iii): When m = 5

$$\text{Define } f(vi) = \begin{cases} 0, & i = 1 \\ 11, & i = 2 \\ 10, & i = 3 \\ 2, & i = 4 \\ 7, & i = 5 \\ 6, & i = 6 \\ i + 5, & 7 \le i \le 5+n \end{cases}$$

case (iv): When m = 6

$$\text{Define } f(vi) = \begin{cases} 0, & i = 1 \\ 17, & i = 2 \\ 16, & i = 3 \\ 2, & i = 4 \\ 13, & i = 5 \\ 7, & i = 6 \\ 8, & i = 7 \\ 12, & i = 8 \\ i + 9, & 9 \le i \le 6+n \end{cases}$$

Proof for the theorem: Partition the edges of K_n ie) $E(K_n)$ into two sets namely, $E(G_n)$ and $E(K_n \setminus G_n)$, then $E(K_n \setminus G_n)$ into $E(G_n - 4)$ and $E(\setminus G_n - 4)$, then $E(\setminus G_n - 4)$ into $E(G_n - 8)$ and $(E(\setminus G_n - 8)$, then $(E(\setminus G_n - 8)$ into $E(G_n - 12)$ and and so on.

From this partition, in the last step we arrive the following cases:

(i) $E(G_9)$ and edges in one point union of K_5 and $\underline{K_{1,\left\lfloor \frac{n}{4} \right\rfloor - 1}}$, when $n \equiv 1 \pmod 4$

(ii) $E(G_{10})$ and edges in one point union of K_6 and $\underline{K_{1,\left\lfloor \frac{n}{4} \right\rfloor - 1}}$, when $n \equiv 2 \pmod 4$

(iii) $E(G_7)$ and edges in one point union of K_3 and $\underline{K_{1,\left\lfloor \frac{n}{4} \right\rfloor - 1}}$, when $n \equiv 3 \pmod 4$

(iv) $E(G_8)$ and edges in one point union of K_4 and $\underline{K_{1,\left\lfloor \frac{n}{4} \right\rfloor - 1}}$, when $n \equiv 0 \pmod 4$

When $n \equiv 1 \pmod 4$:

We have subgraphs which contain the edges of G_n, G_{n-4}, G_{n-8}, …, G_9 and one point union of K_5 and $\underline{K_{1,\left\lfloor \frac{n}{4} \right\rfloor - 1}}$. Totally we have $m + 1 =$ +1 graceful subgraphs.

$\therefore$ SGI(K_n) $\leq$ + 1.

When $n \equiv 2 \pmod 4$:

We have sub graphs which contain the edges of G_n, G_{n-4}, G_{n-8}, …, G_{10} and one point union of K_6 and $\underline{K_{1,\left\lfloor \frac{n}{4} \right\rfloor - 1}}$.

We have $m + 1 =$ +1 graceful subgraphs.

$\therefore$ SGI(K_n) $\leq \left\lceil \frac{n-5}{4} \right\rceil + 1$.

When $n \equiv 2 \pmod 4$:

We have sub graphs which contain the edges of G_n, G_{n-4}, G_{n-8}, …, G_{10} and one point union of K_6 and $\underline{K_{1,\left\lfloor \frac{n}{4} \right\rfloor - 1}}$.

We have $m + 1 =$ +1 graceful subgraphs.

$\therefore$ SGI(K_n) $\leq \left\lceil \frac{n-6}{4} \right\rceil + 1$.

When n 3(mod 4):

We have sub graphs which contain the edges of G_n, G_{n-4}, G_{n-8}, …, G_7 and one point union of K_3 and $K_{1,\left\lceil \frac{n}{4} \right\rceil - 1}$ ∴.

We have m + 2 = $\left[\frac{n-6}{4}\right]$ +2 graceful subgraphs.

∴ SGI(K_n) ≤ $\left[\frac{n-7}{4}\right] + 2$

When n ≡ 0 (mod 4):

In this form we have subgraphs which contain the edges of G_n, G_{n-4}, G_{n-8}, …, G_8 and one point union of K_4 and .We have m + 2 = $\left[\frac{n-6}{4}\right]$ +2 graceful subgraphs.

∴ SGI(K_n) ≤ $\left[\frac{n-8}{4}\right] + 2$.

Hence the proof.

Illustration: The 3–structure graceful labeling of K_{13} is shown below:

Here we have 13 ≡ 1(mod 4). Hence by the above result, SGI (K_{13}) = $\left[\frac{n-5}{4}\right]$ + 1 = 2 + 1 = 3. For, partition the edges of K_{13} into E(G13) and E($K_{13} \setminus G_{13}$). We have

G_{13} $K_n \setminus G_n = K_{13} \setminus G_{13}$

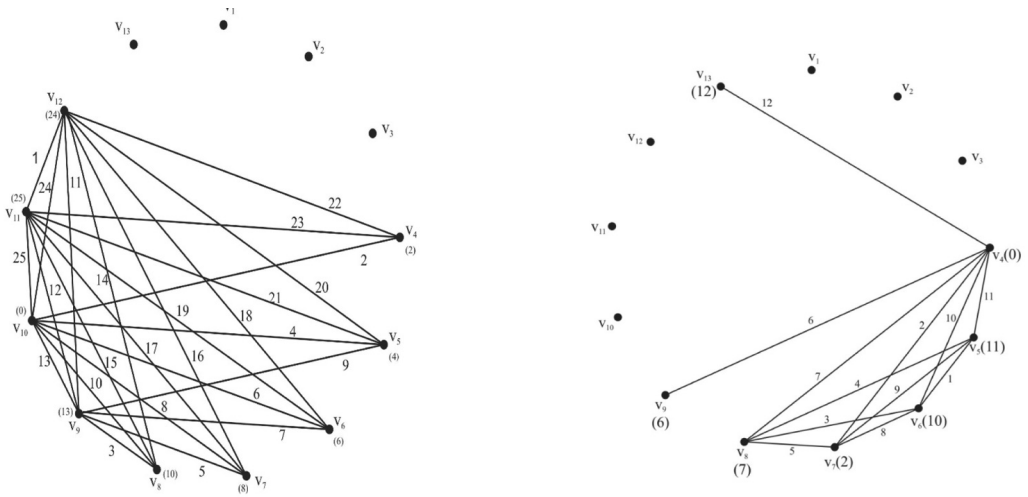


Figure 5

Partition the edges of K13 \ G13 into E(Gn–4 = G9) and E(\ G9)

G9 \ G9 = One point union of K5 and K1,2

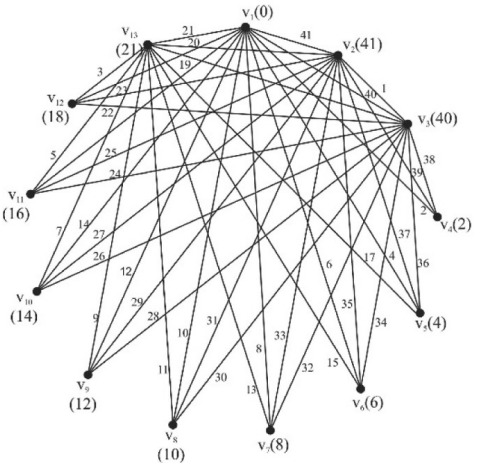


Figure 6

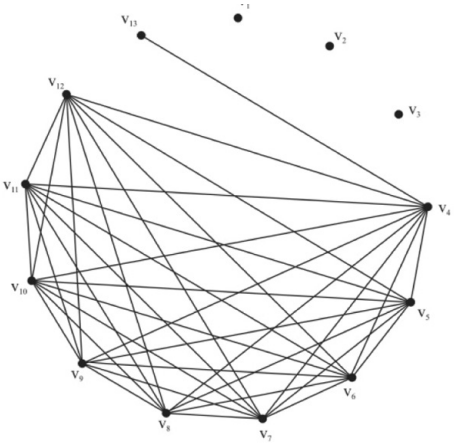


Figure 7

Hence SGI (K_{13}) = 3.

3–structure graceful labelling of K13

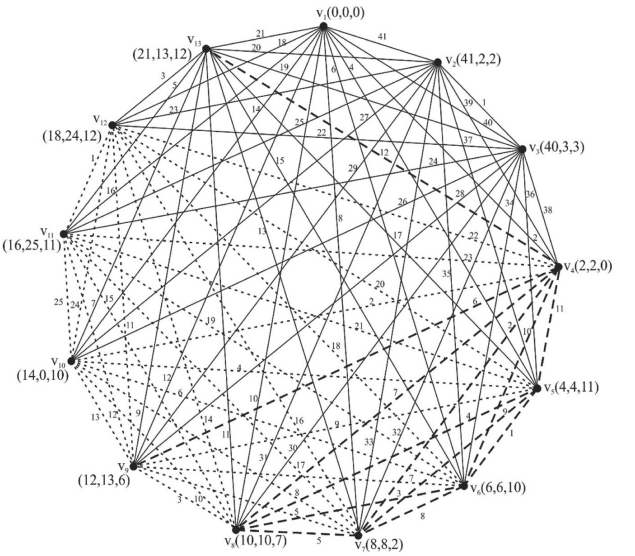


Fig.8

3. Acknowledgement

The authors are highly thankful to the anonymous referees for their critical comments and kind suggestions on the first draft of this paper

4.Conclusion

Graceful labelling is a useful branch of labelling as it has manyimportant applications in the modern world like Optical MPLS (MultiProtocol Label Switching) networks, coding in computerprogrammes and so on. Graceful graphs are related to manymathematical topics including Golomb rulers, permutations and other graph labelling problems. They have practical applications such as radioastronomy,crystallographyetc. So we conclude with the note that the study on graceful labelling remains relevant for the times. Decomposition of complete graph Kn into graceful subgraphs has been got for $n > 10$. This work may contribute much on application side. The sharpness of upper bounds for SGI(Kn) is yet to be tested. The extension of this sort of work to other important families of graphs such as Petersen graphs, etc. is our next target.

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BIMAGIC LABELLINGIN GRAPH

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ABSTRACT

Now a days most of the researchers are doing lots of work in BimagicLabelling of graphs. The purpose of this paper is to introduce new labelling called edge magic labelling and is to obtain the existence of this labelling for certain graphs. An edge magic total labelling of a graph G(V,E) with p vertices and q edges is a bijection f: V (G) U E(G)→ {1, 2,.., p+q} such that f(u)+f(v)+ f(uv) is a constant k for any edge uv∈E(G). If there exists two constants k1 and k2 such that f(u)+f(v) + f(uv) is either k1 or k2, it is said to be an edge bimagic total labelling. A total edge magic (bimagic) graph is called a super edge magic (bimagic) if f(V (G)) = {1, 2,.., p} and it is called super edge magic(bimagic) if f(E(G)) = {1, 2,.., q}. In this paper, we investigate and exhibit super edge magic and bimagiclabelling for some interesting families of graphs.

Keywords: Graph labelling, edge magic labelling

1.INTRODUCTION

A labelling of a graph G is an assignment f of labels to either the vertices or the edges or both subject to certain conditions.Labeled graphs are becoming an increasingly useful family of mathematical models from a broad range of applications. Graphlabelling was first introduced in the late 1960's.A useful survey on graph labelling by J.A Gallian (2010)can be found in[1].All graphs considered are finite , simple and undirected.We follow the notation and terminology of [2]. In most applications labels are +ve integers, though in general real numbers could be used.A (p, q)-graph with p vertices and q edges is called total edge magic if there is a bijection f:VUE→ {1,2,……,p+q} such that there exists a constant k for any edge uv in E with f(u)+f(v)+f(uv)=k. The original concept of total edge-magic

graph is due to Kotzig and Rosa [3]. They called it magic graph. A total edge-magic graph is called a super edge-magic if f(V(G))={1,2,……,p}. Wallis [4] called super edge-magic as strongly edge- magic. An Edge antimagic total labelling of a graph with p vertices and q edges is a bijection from the set of edges to 1, 2,……,p+q such that the sums of the label of the edge and incident vertices are pairwise distinct. It becomes interesting when we arrive with magic type labelling summing to exactly two distinct constants say k1 or k2. Edge bimagic totally labelling was introduced by J. Baskar Babujee [5] and studied in [6] as (1,1) edgebimagiclabelling. A graph G(p,q) with p vertices and q edges is called total edge bimagic if there exists a bi-jection f:VUE→ {1,2,…….p+q} such that for any edge uv∈E we have two constants k1 and k2.

2. SUPER EDGE-MAGIC LABELLING

Definition 2.1.

A graph G with p vertices and q edges is called total edge magic if there is a bijection f : V ∪ E → {1, 2, .., p+q} such that there exists a constant k for any edge uv in E, f(u) + f(uv) + f(v) = k. A total edge magic graph is called super edge magic if f(V) = {1,2,…,p}.

Example 1:

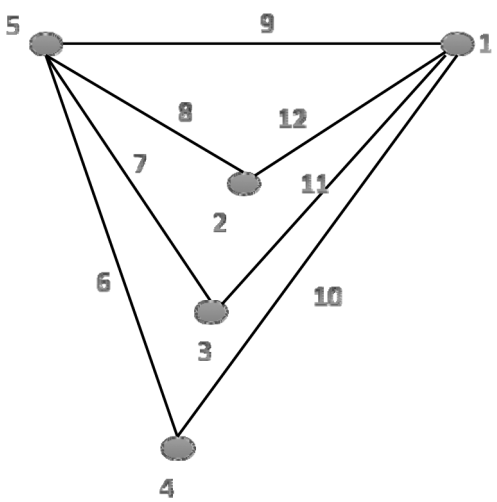

Figure 1: *Super edge magic graph for* $P_2 + 3K_1$ *and magic constant k = 15*

Definition 2.2.

A graph G with p vertices and q edges is called total edge bimagic if there exists a bijective function f: VUE →{1,2,…,p+q} such that for any edge uv∈E, we have two constants k_1 and k_2 with f(u)+f(v)+f(uv) = k_1 or k_2. A total edge-bimagic

graph is called super edge-bimagic if f(V) = {1,2,…,p} .

Definition 2.3.

A vertex switching Gv of a graph G is obtained by taking a vertex v of G, removing all the edges incident to v and adding edges joining v to every other vertex which are not adjacent to v in G.

3. Main Results on Super Edge BimagicLabelling

Theorem 3.1

Switching a pendant vertex in path graph P_n(n ≥ 6) admits super edge bimagiclabelling.

Proof.

Let v_1, v_2, $v3$, …, v_n be the vertices of P_n and G_v be the graph obtained by switching a pendant vertex v of G = P_n . We denote that the pendant vertex v_1 is swiched in G. Then the vertex set

V={v_i ;1≤ i ≤ n} and edge set E = E_1 ∪ E_2 where E_1=

{$v_{i\,vi+1}$;2 ≤i ≤ n−1}and E_2= {v_1 v_i ; 3 ≤ i ≤n} . We note that |V(G)| = n and |E(G)| = 2n-4. We define a bijective function f : V∪ E →{1, 2, ..., 3n-4} is given below.

(i) If n is even

For i = 3 to n-1 :$i \equiv 1(mod\ 2)$, $f(v_i) = \frac{n}{2} + \frac{i+1}{2} - 1.$

For i = 2 to n :$i \equiv 0(mod\ 2)$, $f(v_i) = \frac{i}{2}.$

For i = 3 to n-1 :$i \equiv 1(mod\ 2)$, $f(v_1v_i) = n + \frac{n}{2} - \frac{i+1}{2} + 1.$

For i = 4 to n :$i \equiv 0(mod\ 2)$, $f(v_1v_i) = 2n - \frac{i}{2}.$

$f(v_1) = n$, For i = 2 to n-1 :$f(v_iv_{i+1}) = 3n - 2 - i.$

In the following cases, it is justified that the above assignment results in the required labelling.

case(i) : For any edge $v_i\, v_{i+1} \in E_1$

subcase(i) : $i \equiv 1(mod\ 2)$

$$f(v_i) + f(v_{i+1}) + f(v_iv_{i+1}) = \frac{n}{2} + \frac{i+1}{2} - 1 + \frac{i+1}{2} + 3n - 2 - i = \frac{7n-4}{2} = k_1 .$$

subcase(ii): $i \equiv 0(mod\ 2)$

$$f(v_i) + f(v_{i+1}) + f(v_iv_{i+1}) = \frac{i}{2} + \frac{n}{2} - 1 + \frac{i+2}{2} - 1 + 3n - 2 - i = \frac{7n-4}{2} = k_1.$$

case(ii) : For any edge $v_1 v_i \in E_2$

subcase(i) : i $\equiv 1(mod\ 2)$

$f(v_1) + f(v_i) + f(v_1v_i) = n + \frac{n}{2} + \frac{i+1}{2} - 1 + 1 + n + \frac{n}{2} - \frac{i+1}{2} + 1 = 3n = k_2$.

subcase(ii): i $\equiv 0(mod\ 2)$

$f(v_1) + f(v_i) + f(v_1v_i) = n + \frac{i}{2} + 2n - \frac{i}{2} = 3n = k_2$.

(ii) If n is odd

For i = 3 to n :$i \equiv 1(mod\ 2)$, $f(v_i) = \frac{n+1}{2} + \frac{i+1}{2} - 2.$

For i = 2 to n-1 :$i \equiv 0(mod\ 2)$, $f(v_i) = \frac{i}{2}.$

For i = 3 to n :$i \equiv 1(mod\ 2)$, $f(v_1v_i) = n + \frac{n+1}{2} - \frac{i+1}{2} + 1.$

For i = 4 to n-1 :$i\ 0(mod\ 2)$, $f(v_1v_i) = 2n - \frac{i}{2}.$

For i = 2 to n-1 :$f(v_iv_{i+1}) = 3n - 2 - i. f(v_1) = n.$

In the following cases, it is justified that the above assignment results in the required labelling.

case(i) : For any edge $v_i\ v(i+1) \in E_1$

subcase(i) : $i \equiv 1(mod\ 2)$

$f(v_i) + f(v_{i+1}) + f(v_iv_{i+1}) = \frac{n+1}{2} - 2 + \frac{i+1}{2} + \frac{i+1}{2} + 3n - 2 - i = \frac{7n-5}{2} = k_1.$

subcase(ii) : $i \equiv 0\ (mod\ 2)$

$f(v_i) + f(v_{i+1}) + f(v_iv_{i+1}) = \frac{i}{2} + \frac{n+1}{2} - 2 + \frac{i+1}{2} + 3n - 2 - i = \frac{7n-5}{2} = k_1.$

case(ii) : For any edge $v_1 v_i \in E_2$

subcase(i) : $i \equiv 1(mod\ 2)$

$f(v_1) + f(v_i) + f(v_1v_i) = n + \frac{n+1}{2} - 2 + \frac{i+1}{2} + n + \frac{n+1}{2} + 1 - \frac{i+1}{2} = 3n = k_2$.

subcase(ii): $i \equiv 0(mod\ 2)$

$f(v_1) + f(v_i) + f(v_1v_i) = n + \frac{i}{2} + 2n - \frac{i}{2} = 3n = k_2$.

From the above cases we have two constants. When n is odd then the constants are $k_1 = \frac{7n-5}{2}$ and $k_2 = 3n$.

When n is even then the constants are $k_1 = \frac{7n-4}{2}$ and $k_2 = 3n$. Hence the graph obtained by switching a pendant vertex in path P_n

admits super edge bimagic labelling.

Example 2.

Taking the graph by switch a pendant vertex in path P_6

admits super edge bimagiclabelling with two constant k_1 and k_2

are given in Figure 2.

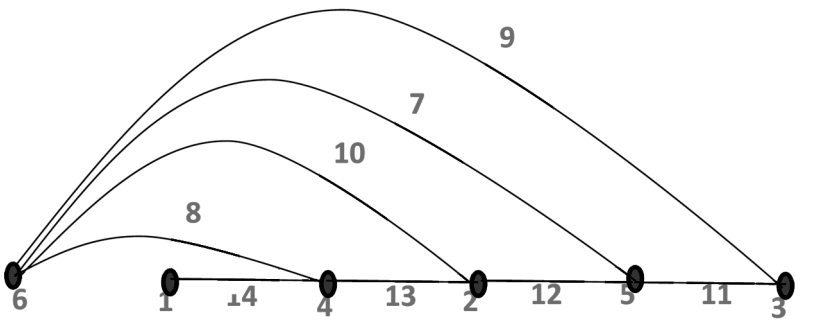

Figure 2: k_1 =18, k_2 = 19

Remark 1. Switching a pendant vertex in pathP_n (n = 3, 4 or 5) admits super edge magic labelling.

Theorem 3.2.

Switching a vertex in cycle graph C_n (n ≥6) admits super edge bimagiclabelling.

Remark 2. Switching a vertex in cycle graph C_n (n =4 or 5) admits super edge magic labelling .

Theorem 3.3.

Switching a pendant vertex in star graph $K_{1, n}$ (n ≥ 3) admits super edge bimagiclabelling.

Theorem 3.4. Switching a pendant vertex in crown graph $C_n \odot K_1$

(n≥ 3) admits super edge bimagiclabelling.

Example 3.

switching a pendant vertex in crown graph $C_1 \odot K_1$ is given in fig. 3. It is super edge bimagic labelling with two common counts k_1 = 7n+1, k_2 = 4n+3. It is also indicated in the same figure.

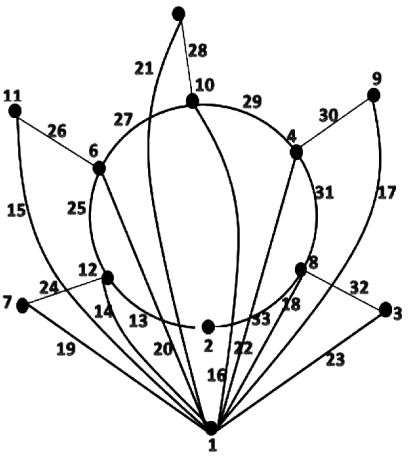

Figure 3: k_1**=43,** k_2 **= 27**

Theorem 3.5.

If n is odd then switching the apex vertex in helm graph H_n (n ≥ 3) admits super edge bimagiclabelling.

Proof:

Letv_1, v_2, …, v_{2n+1} be the vertices of H_n and G_v be the graph obtained by switching the apex vertex v of $G = H_n$.

We denote that the apex vertex w is switched in G. Then the vertex set V = $\{v_i ; 1 \le i \le n\} \cup \{w, u_i; 1 \le i \le n\}$ and edge set $E = E_1 \cup E_2 \cup E_3$ where $E_1 = \{u_1 u_n, u_i u_{i+1}; 1 \le i \le n-1\}$, $E_2 = \{u_i vi ; 2 \le i \le n\}$, $E_3 = \{wvi ; 1 \le i \le n\}$. We note that |V(G)| = 2n+1 and |E(G)| = 3n. We define a bijective function f : V ∪ E →{1, 2, ..., 5n+1} is given below.

For i = 1 to n ; i ≡ 1(mod 2), $f(u_i) = 2n - \frac{(i+1)}{2}$

For i = 2 to n-1 ; i ≡ 0(*mod* 2), $f(u_i) = 2n + 2 - ½$.

For i = 1 to n-1 ; $f(u_i u_{i+1}) = 2n + 1 + i$.

For i = 1 to n ; i ≡ 1(mod 2), $f(u_i v_i) = 4n+2 - \frac{(i+1)}{2}$

For i = 2 to n-1 ; ; i ≡ 0(mod 2), $f(u_i v_i) = 4n - \frac{(n+1)}{2} + 2 - \frac{i}{2}$

For i = 1 to n ; $f(wv_i) = 5n+2-i$.

For i = 1 to n-1 ; $f(v_i) = i+1$. $f(u_1 u_n) = 3n+1$.

In the following cases, it is justified that the above assignment results in the required labelling.

case(i): For any edge $u_i\, u_{i+1} \in E_1$

subcase(i): i ≡ 1(mod 2)

$$f(u_i) + f(u_{i+1}) + f(u_i u_{i+1}) = 2n + 3 - \frac{n+1}{2} - \frac{i+1}{2} + 2n + 2 - \frac{i+1}{2} + 2n + 1 + i$$

$$= \frac{11n+9}{2} = k_1.$$

subcase(ii): i ≡ 0(mod 2)

$$f(u_i) + f(u_{i+1}) + f(u_i u_{i+1}) = 2n + 2 - \frac{i}{2} + 2n + 3 - \frac{n+1}{2} - \frac{i+1}{2} + 2n + 1 + i = \frac{11n+9}{2}$$

$$= k_1.$$

subcase(iii): For edge $u_1 u_n \in E_1$

$$f(u_1) + f(u_n) + f(u_1 u_n) = 2n - \frac{n+1}{2} + 2 + n + 2 + 3n + 1 \frac{11n+9}{2} = k_1.$$

case(ii): For any edge $u_i\, v_i \in E_2$

subcase(i): i ≡ 1(mod 2)

$$f(u_i) + f(v_i) + f(u_i v_i) = 2n + 3 - \frac{n+1}{2} - \frac{i+1}{2} + i + 1 + 4n + 2 - \frac{i+1}{2} = \frac{11n+9}{2} = k_1.$$

Subcase(ii): i ≡ 0(mod 2)

$$f(u_i) + f(v_i) + f(u_i v_i) = 2n + 2 - \frac{i+1}{2} + i + 1 + 4n - \frac{n+1}{2} + 2 - \frac{i}{2} = \frac{11n+9}{2} = k_1.$$

case(iii): For edge $wv_i \in E_3$

$f(w)+f(v_i)+f(wv_i) = 1+i+!+5n+2-i = 5n + 4 = k_2.$

Therefore, We have two constants from above cases there are

$k_1 = \underline{(11n+9)}$ and $k_2 = 5n+4$.
2

Hence the graph obtained by switching the helm graph H_n admits super edge bimagiclabelling.

Example 4.

Switching the apex vertex in helm graph H_7 is given in fig. 4. It is super edge bimagiclabelling with two common counts $k_1 = \frac{11n+9}{2}$ and $k_2 = 5n+4$ are also indicated in the same figure.

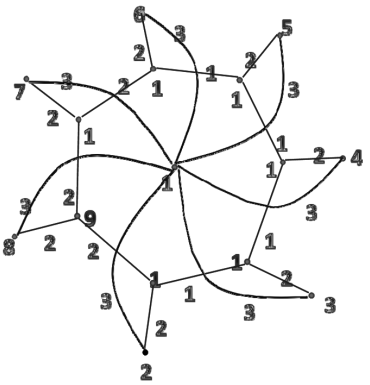

Figure 4: $k_1 = 43,\ k_2 = 39$

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MILIEU OF CRM – A PORTRAYAL ON REGAIN MANAGEMENT

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Abstract:

As now, the focus is shifted from transaction based economy to relationship oriented economy; there arise the need to win back lost customers. Apart from customer relationship management, regain management is focused on winning back customers who have either given notice to terminate the relationship or whose relationship has already ended. This paper throws light to the strategies for profitable acquisition of their lost customer segments. Maintaining good relations with customers and retaining them for long run became the need of the hour. Based on this theoretical foundation, it is an attempt to specify processes of customer regain management and exemplify measures supporting them.

Keywords:- Relationship, Regain management, Customer Relationship management

Introduction

The domain of Customer Relationship Management extends into many areas of marketing and strategic decisions. The recent business schema identifies well the vitality of sustaining satisfied customers. Its recent prominence is facilitated by the convergence of several paradigms of marketing. Delighting the customer became the key element of each business. The rapid advancements in the field of science and technology have a great impact in managing customer relationships.

Customer Relationship Management is a process or strategy or technology by which a company can manage its interaction with present and prospective customers. It is an approach which allows a company to manage all type of its customers. It uses information about customers' past profile for the company to

improve their business relationship, specifically focusing on customer retention and increasing sales. It helps organization to maintain good and healthy relationship with customers for long term. It also helps to increase sales, customer service and profitability of business. Customer Relationship Management is a strategy to maintain relations with customers simultaneously by reducing cost and increasing profitability in business. The survival of business always depends upon satisfying customer needs. The primary aim of CRM is to have a positive balance between sales, marketing and customer support.

Retrospection to Concept

Relationship marketing becomes a solution to address the switching problem of customers. This concept must be a mutually rewarding connection between the provider and customer. Also the parties have some sort of commitment to the relationship over time, and they must be willing to make adaptations in the routines with which the exchange situations deal.

(Berry (2002) reports that relationship marketing can be practiced on multiple levels, depending on the type of bond used to enhance customer loyalty. He suggests that the solution to the customer's problem is designed into the service delivery system rather than being dependent upon the relationship building skills of service providers.

Falgani and Manish (2009) have identified that banks are laying stress on retaining customers and increasing market share. This pressure of competition and dynamism has contributed to the growth of CRM. The structured approach to CRM provides various benefits to the bank such as, distinctive and consistent customer experience, clear identification of the organizational, technological and process-related capabilities and prioritization of these capabilities.

(Das, 2012) Customers are the focal point in the development of successful marketing strategy. Marketing strategies both influence and are influenced by consumers' affect and cognition, behaviour and environment.

(Krishnamohan, 2017) Customer retention assumes significance in revenue analysis of various organizations. But because of various reasons and apprehensions like financial burdens, risk of failure, marketing inertia etc., many firms are still following the traditional ways of marketing and only few of them are making attempts to adapt CRM.

Customer Regain Management

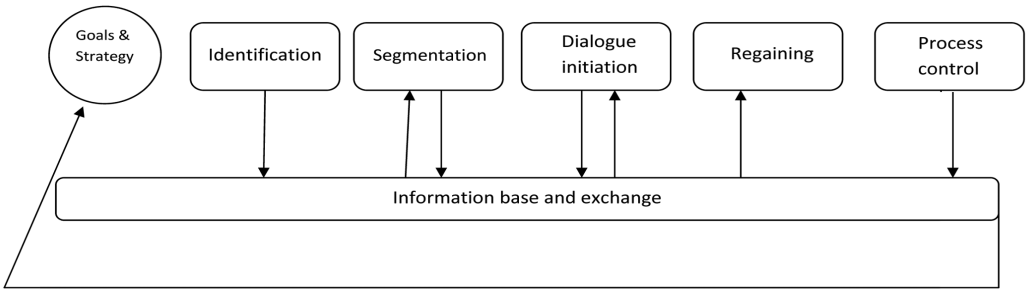
Customer relationships vary from time to time because it is evolved under

distinguished stages from where the relationship with customers can evolve:-

- **Exploration-** Exploration is the process when customer investigates or tests the supplier's capabilities and performance or cross verifies the product's or brand's usefulness
- **Awareness-** Awareness is the process when the customer understands the motivational values of supplier or the products he sells.
- **Expansion-** Expansion is the process when the supplier wins customer's faith and customer falls under huge interdependence of the supplier.
- **Commitment-** Commitment is a powerful stage when suppliers learn to adapting business rules and goal to excel.
- **Dissolution-** Dissolution is a stage when customer requirement suddenly changes and he looks for better perspectives. This sudden change is the end of relationship.

Goal of customer regain management is to reinitiate valuable customer relationships, which have been already terminated. Regain management has to detect such 'lost' customers, select valuable relationships and attempt to regain them in an effective and efficient way, for which a systematic process is necessary. Customer regain management extends and reactivates terminated customer relations and pursuit in most cases a profitability goal. In addition, other objectives for customer regain management are possible like for example communication and information goals. Communication goals aim to avoid negative image spread by lost customers, while information goals pursue the enrichment of the information basis by collecting termination reasons and patterns. This information can be used to develop early warning systems and improve customer regain management.

Regain management is focused at winning back the dissatisfied customers. It offers the firms a profitable customer market by applying a special management process comprising of analysis, actions and evaluation. With regain management strategy, marketing can rely on a proprietary data base for segmentation and communication. As a nutshell, regain management addresses the issues and strategies that a firm should entail in order to attract its lost customers.



(Sub processes of customer regain management (According to Michalski 2002)

Identification

In the first stage, terminated relationships have to be identified. Terminated relationships may be internal or external. In order to regain lost customers, mechanism for detecting the termination has to be implemented. External termination by customers may be easy to detect, as it is evident from contractual relationships.

Segmentation

On the basis of attractiveness, customers can be segmented according to their profitability potential or in terms of their regaining probability. Customers with either a low regaining probability or a low lifetime value can be – depending on the firm's strategies – considered as not "worth to regain". In case of a high regaining probability and a high lifetime value, individualized regaining procedures will be engaged.

Dialogue initiation

According to the regaining strategy used and regaining measures applied, customers have to be contacted and dialogue has to be initiated. On the basis of targeted customer segment and type of information needed, the mode of dialogue can be implemented. Depending on the termination reasons, more offers and privileges can be offered to customers.

Regaining

At this phase, on account of fixing regaining offers, the actual customer regaining takes place and reinitiating the relationship. Former faults that were made in the relationship must be avoided and it must be signalized, that the customers' expectations on the future relationship can be satisfied by the cooperation partner

Process control

Efficiency measures the relation between input and output, whereas effectiveness measures the regaining success. Effectiveness for example could be measured by the ratio between the number of re-activated relationships and the targeted or contacted customers. Efficiency could be calculated as the ratio of regaining costs (costs of identification, segmenting, dialogue initiation, progress control and regaining offers) and the actual regaining benefits (actual customer value, quantified communication and information benefits).

Conclusion

Customer regain management is a part of CRM. But this area is not much explored in this field. Higher business revenue can be achieved by increasing the "customer life time" and the profitability of existing relationships. As a consequence of this paradigm, the emphasis shifted from the orientation of share in the market to share of customer. As a result of these consequences, CRM and regain management are crucial for profitable and successful business solutions. To succeed in market, firms have to address not only prospective and existing customers, but also lost customers as a distinct target group. Firms have to adopt innovative measures to solve the problems of present customers, acquire new customers and at the same time, initiate steps to win back lost customers.

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CONTOURING EMPOWERMENT OF RURAL WOMEN –MGNREGA MODEL IN KUTTANADU TALUK

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Abstract

Gender is the inevitable factor for growth and development of nation like India. Economic empowerment for women is the only way by which it can be possible to give equal status to women in a male dominated society. To be empowered, women should come forward and realize that they are not second grade citizen of the society and at the same time also equally capable with men in all aspects of livelihood. A major initiative taken by the Government of India to raise the level of socio-economic status of the rural people under the Ministry of Rural Development is the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) on the empowerment of women in Kuttanad Taluk of Alapuzha district in Kerala. It also focuses on the prospects and problems of women empowerment through MGNREGA and will try to provide some recommendations to overcome the shortcomings.

Keywords: MGNREGA, Women Empowerment

Introduction

It is observed that women are often experienced the situation of extreme poverty which are further aggravated by household and social discrimination. In spite of the given provisions in our constitution, the harsh reality of deprivation and degradation continues. The changes have taken place in a significant portion of urban women, but their counter parts living in rural areas are only marginally affected by these changes. The achievement of inclusive growth and overall development is highly dependent on the gender quality and prosperity of women in the rural society. A major initiative taken by the Government of India in the Eleventh Five Year Plan

to raise the level of socio economic status of the rural people under the Ministry of Rural Development is the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). The implementation of MGNREGA has been positively affecting the rural life as well as empowering the women of India in various aspects.

MGNREGA - A Positive Initiative

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is a landmark legislation passed by the parliament of India after a successful struggle for employment guarantee legislation. MGNREGA as a flagship programme of Government of India was notified on September 7, 2005 in 200 rural districts in its first phase of implementation which took an effect from February 2, 2006. In 2007 – 2008, it was extended to an additional 130 rural districts. The remaining districts were notified under MGNREGA with effect from April 1, 2008. Since then MGNREGA has covered the entire country with the exception of districts that have a hundred percent urban population. The main objective of the Act is to enhance livelihood security of the rural household by providing at least 100 days of guaranteed wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work. i t was essentially a programme to provide basic income and employment opportunities to poor households in rural areas where opportunities of work did not exist or was very limited.

Review of Literature

Ramesh and Kumar (2009) in their study found that MGNREGA holds the powerful prospect of bringing major changes in the lives of women. MGNREGA is playing a substantial role in empowering women economically and laying the basis for greater independence and self esteem.

Babita Pandey and Tanveer Ahmedwani (2014) focused study on women participation in MGNREGA in Kashmir. The study shows that role of women in MGNREGA is a distant dream of achieving for it was meant and finds that Kashmir has the lowest percentage of women participation.

Lavanya and Mahatma (2013) determined the scope of women empowerment through MGNREGA in Palakkad. The results of the study showed that MGNREGA had made women beneficiaries economically independent and it was also concluded that the programme had laid a foundation for self esteem and independence for women beneficiaries.

Hazarika (2009) examined the impact of MGNREGA on gender empowerment in Morigaon and Bongaigon district of Assam. This study showed that almost 70

– 80 percent of sample workers had meaningful income other than unpaid family work during the pre – NREGA. Majority of the worker felt that they are now in better position to fulfill their own requirement without looking at others.

K. Borah and R. Bordoloi (2014) in their research paper, MGNREGA and its wages on Daily Waged Workers: A case study of Sonitpur District of Assam has discussed about the impact of MGNREGA on empowerment and identified the obstacles in the path of implementation of the scheme. The paper revealed that female workers have significant benefits from MGNREGA and also identified some limitations in the implementation of the Act.

Significance of the Study

. MGNREGA is the first programme in India that has promised to provide the legal right to work. Though the main aim of the Act is to generate employment in rural areas, but apart from this, there are several secondary benefits lies in the Act in the form of women empowerment. Women cannot take decision on their own without consulting their husbands or fathers neither do they have control over household productive activity such as farming. But these women usually contribute to farming activities such as harvesting and storage of farm products which are controlled by the male members of the house. Therefore it is necessary to know their opinion regarding the programme to get a clear picture about the success of MGNREGA. Though many studies have been conducted on women empowerment through MGNREGA, Alapuzha District remains under-researched in this aspect. Hence the present study aims to fill this gap.

Objectives of the study

1. To examine the impact of MGNREGA on socio economic empowerment of women beneficiaries of five Gramapanchayats of Kuttanad Block.
2. To find out the problems in the implementation of MGNREGA.
3. To suggest measures for more effective implementation of MGNREGA based on the findings of the field study.

Methodology

There are twelve Development Blocks in Alapuzha district. Only five Gramapanchayats of Kuttanad development block has been selected for the purpose of the study. The total sample size is 50 and 10 samples from each grama panchayats have been selected randomly from Kuttanad block. The targeted groups for the study were the women beneficiaries of MGNREGA.

Table No.1

Benefit of women beneficiaries under MGNREGA and control of their own earning

Benefits of women in MGNREGA And control over own earnings	Number of respondents	Percentage
Yes	28	56
To some extend	15	30
No	14	14
Total	50	100

Table: 2

Participation of women beneficiaries in family decision making under MGNREGA

Participation in family decisions	Number of respondents	Percentage
Yes	31	62
To some extend	12	24
No	4	8
Could not reply	3	6
Total	50	100

Suggestions

- Lack of awareness regarding the scheme has reduced its success rate. To create awareness among the women regarding MGNREGA, apart from Brochures, newspaper, television, radio etc, proper campaigning through street drama, loudspeaker , writing on the wall about MGNREGA can be an effective measures to increase awareness.
- To increase awareness, women need to be educated .More initiation and awareness should be given to the rural poor women about MGNREGA that they should know the benefits of the scheme which will increase the women participation rate.

- Transparency and accountability ensure efficient utilization of resources under the scheme. Therefore provision for regular social audit must be carried out by Gram Sabha which enable in bringing transparency and accountability.
- Government should give more importance to productive works based on local need which will cover more women under the umbrella of MGNREGA.
- The study reveals that market wage rate is much higher than MGNREGA wage. It discourages the women to work under the scheme .Therefore in order to maintain consistency with the minimum market wage rate, MGNREGA wage rates should be revised at a regular intervals
- The government must take immediate steps to curb corruptions in implementation of MGNREGA and be vigilant so that without delay wages reach to the women workers for whom it is meant for.
- As Kuttanad Taluk of Alapuzha district is agriculture based society, government should provide more agricultural related works .
- More literacy driven programmes should be arranged by the government for the rural women, which will help them to involve themselves in such kind of scheme for their empowerment.

Conclusion

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is the largest poverty alleviation and well thought legislation in Indian history of social security programme since independence. By providing guaranteed wage employment to its registered workers, the Act has brought about a silent revolution in rural areas of the country. Though the official statistics reflects that MGNREGA has been quite successful and well implemented scheme operating in Alapuzha district, but in reality, there has been no significant dent on the problems of unemployment of rural women in the district. From the above analysis it can be concluded that the performance of MGNREGA is not full satisfactory. The scheme could not ensure the 100 days job guarantee to the majority of the women job card holders. The problem lies not in the Act, but in its defective implementation and lack of transparency etc, need to be strictly controlled. The prospects of the MGNREGA for rural development and woman empowerment are quite bright provided it is properly executed.

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TRIMMING OF RURAL FINANCE FOR RURAL DEVELOPMENT

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Abstract

Indian economy is an agricultural economy and real India lies in villages. The importance of the rural banking in the economic development of a country cannot be overlooked. Without an inclusive financial system, poor and vulnerable section of the community and small and petty enterprises would not be in a position to take advantages of growth opportunities. Traditionally, formal financial institutions have avoided or failed to offer sustainable services in rural areas. Thus, informal or semi-formal financial institutions as well as alternative providers like traders or input suppliers have become major providers of financial services. This article throws light on strengths and weaknesses of various financial institutions and role of NABARD for rural development.

Key Words: - Rural development, NABARD, Rural finance, Agricultural credit

Introduction

Rural finance is a dynamic term which focuses on areas for the entire development of the village economy. Although the share of agriculture sector's contribution to GDP has declined, the population dependent on this sector has not shown much fall. Major reason for the decline in the growth rate of agriculture sector has been the demises in the public investment after the reforms.

The critical importance of agriculture and rural development was well recognized in the successive Five Year Plans, since growth in this sector helped to improve food security, nutritional standards and the supply of wage goods at reasonable prices. Around the turn of the 1980s, an urgent need was felt for broad-based agricultural and rural development that gave an impetus to allied activities in rural areas, both to generate employment and to alleviate poverty. This prompted the establishment of a specialized apex institution for agriculture and rural

development, namely, the National Bank for Agriculture and Rural Development (NABARD) in 1982.

Review of Literature

Narasimham working party (1975) introduced replacement set of banks, as institutions which "combine the local feel and therefore the familiarity with rural problems which the cooperatives possess and the degree of business organization, ability to mobilize deposits, access to central money market sand modernized outlook which the commercial banks have"

All India Rural Credit Survey (1951) of the RBI suggested that the co-operatives were complete failure in giving rural credit, and also have an importance in agriculture credit.

Rahman and Khandker (1994) suggested that Grameen Bank and BRAC are expanding various opportunities of self-employment for their members. Microfinance is basically providing loan to their members and it improves the standard of people.

Murdo chand Haley, 2002) suggested that informal credit system became a most powerful weapon for poverty alleviation among people who are economically and financially backward people.

Banerjee (2004) provides evidence that informal interest rates in India are high and exhibit variation. A latest study reveled that significant output of users of micro credit is higher than the non-users.

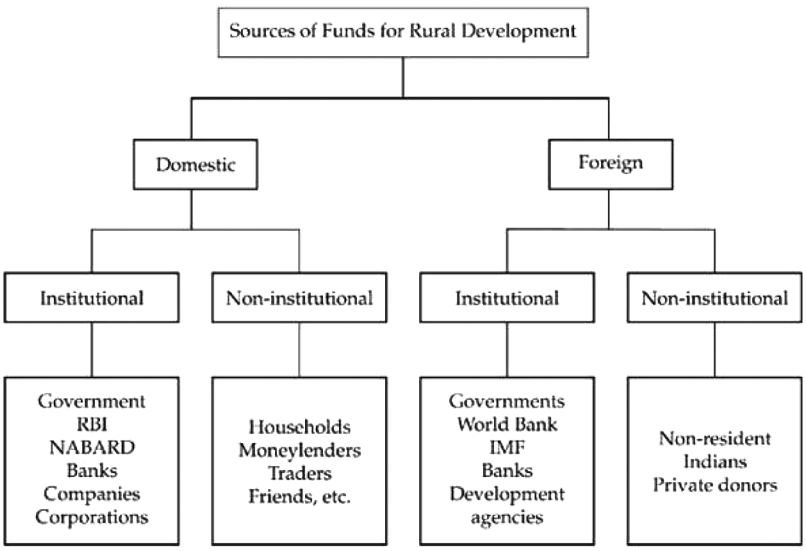
Significance of the study

The study begins with various institutions mainly created to provide credit facilities to agricultural activities, National Bank for Agriculture and Rural Development (NABARD), Regional Rural Banks, Commercial Banks and Co-operative Societies are analyzed. The human resource development needs literacy, education and skills for the development of rural areas. Development of productive resources is not efficiently utilized. Infrastructure development like irrigation, credit and marketing pro facilities, electricity, facilities for agriculture research etc. are poor conditions. Poverty alleviation measures bring about important improvement in the living style of the population. There is a need to emphasize access to productive employment opportunities.

Objectives of the study

- *To identify the relationship between rural finance and rural development.*
- *Understand the need for rural finance especially for the development of rural areas.*

Raising of Rural Finance



Contribution of Co-Operative Credit Societies

Efforts are being made to form co-operative societies more efficient due to its motive of welfare and betterment of cultivators. Their contributions have been consistently rising. This sector has one disadvantage ie, as loan is often taken for any purpose the emergency and purpose of loans are ignored. Hence, they have not been able to prove themselves to be good and viable substitutes of moneylenders. There are two wings of the co-operative credit system, one fulfilling the short-term needs and therefore the other managing long-term needs.

• Primary Agricultural Credit Society: It operates at the village level and focus on direct contact with the people to fulfill their needs. For its own requirements of finance, it is linked to a Central Co operative Bank which operates at the district level.

• Land Development Banks. These come under the category of long-term loan needs. Their other names are Land Mortgage Banks and Agricultural Development

Banks.. These banks have diversified lending for other equally important productive purposes; one among this can be subsidy to agriculture.

A large part of these societies is managed by large farmers and hence, small and medium farmers are bereft of benefits. There are serious regional imbalances observed in their growth. They depend more on external sources of finance which is not a good and healthy sign for their development in future. The other Id related with recovery of loans and advances. The overdue are large and growing. They suffer from inadequate organization and lack of managerial efficiency. In the case of Primary Agricultural Credit Societies they have small area of operation and less membership. Due to less business, their income is extremely low and that they cannot keep proper staff.

Bestowal of Commercial Banks

These provide loans for all agricultural purposes. These may broadly be divided into

- Direct Advances. It may be short, medium or long term. Short term may take the form of crop loans or production loans. These loans have to be repaid within a period of one month or two months, after the harvest of crops. Medium and long-term loans are granted for development programs which are capital intensive Maximum repayment period is 15 years.
- Indirect Advances. These include, Credit granted to dealers of fertilizers to meet their working capital requirements. Advances made to co-operative milk societies, which in turn extended credit assistance to their members for purchase of milk, cattle, sheep, etc.

Banks are quite selective in their village adoption approach. More backward villages have not been adopted. The manager lends to the rural poor very carefully because manager's performance will lead to this promotion or demotion. As a result he is very cautious while lending. Proper feedback system is no is absent. There are no linkages between bank credit and use of it in has raising productivity. The rural branches of commercial banks have not been able to mobile the savings of the rural population.

Alms of Regional Rural Banks

These are come upon under the Regional Rural Banks Act 1976. 'The areas of their operation have been very carefully selected as the area where banking facilities and co-operatives are absent. Normal region is a cluster of districts. The

central Government through NABARD participates in its 50% capital. They cater exclusively to the requirements of weaker section. These banks are successful because of loans at lower rate of interest and better rate of interest on deposits. The pay of the staff was in tune thereupon of other banks.

Regional Rural Banks have disparities in growth rate. The growth of RRBs in all parts of the country was not proportionate. Sometimes, they were wrongly located which created the problem of coordination. Problem of growing over dues is the reason. Pre-sanction inspections are not conducted properly. Sometimes documents executed by the borrowers were incomplete.

National Bank for Agriculture and Rural Development (NABARD)

In 1979, RBI appointed a committee to go into the whole structure of rural credit and make recommendations for reorganizing it. The committee gave its report in March, 1981 and recommended the fixing of NABARD it had been found out in July, 1982. The national form agricultural credit fund has been transferred from RBI to NABARD to a part of its National Rural Credit Fund. It is permitted to raise resources from market.

Operational areas of NABARD

- To provide short, medium and Banks and other financial long term credits to State Co-operative Banks, RRBs, Land Development institutions, approved by the RBI.
- To give loans to the approved institutions to invest in securities or to contribute to share capital institutions of engaged in agricultural and rural development.
- To promote research in agriculture and rural development.
- NABARD can help tenant farmers and small farmers to consolidate their landholdings.
- To coordinate institutions entrusted the activities in of the Central and the State Government and other all India and state level the development of small-scale industries, village industries and rural crafts.
- To grant long-term loans to the State Government for subscribing to the share capital of co-operative societies.

Suggestions to the problems of Agricultural Credit in India

- An effective mechanism for the recovery of the agricultural loans should be evolved at the earliest.

- Credit facilities should be extended to farmers by commercial banks on easy terms and conditions.
- Cooperative credit societies in rural areas should be strengthened and their working should be transparent and efficient.
- More regional rural banks should be found out to satisfy the credit needs of the rural and backward areas.

Conclusion

The real growth of Indian economy lies on the emancipation of rural masses from poverty, unemployment and other socio – economic backwardness. This article helps to know the agricultural development institutions and functions, need and role of NABARD. However, as per the current environment the rural credit systems need more changes for creating the agricultural sector aware. It also advised to provide more initiatives especially farm production, processing, marketing, trade, and distribution. We should connect farmers to economy for rural finance and rural development.

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DESPERATE TIMES, SUSTAINABLE CREED: THE POST-PANDEMIC SPIRITUAL PARADIGM IN MADDADDAM TRILOGY BY MARGARET ATWOOD

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The cornerstone of environmental thought is the impulse to defend the existential interests of living forms, under conditions of unprecedented threat engendered mainly by the applications of science and rationality. This hostility towards science and rationality often leads to a search for a new cosmological, spiritual or religious basis for human life and inter-species relationships. Within the green movement there is considerable interest in the promise proffered by eastern religious traditions for the refurbishment of the human-in-the world relationship. Buddhism,Taoism, Hinduism and Islam are recognized as religious systems with the capacity to underwrite a new environmental enlightenment. The impact of eastern religious and neo-pagan traditions within the green movement highlights the perceived failure of mainstream Christianity to provide a relevant basis for an ecologically benign society.

In his seminal essay "The Historical Roots of Our Ecologic Crisis," published in *Science* magazine in 1967, historian Lynn Townsend White, Jr. argues that those Biblical precepts made Christianity, "especially in its Western form," the "most anthropocentric religion the world has seen." In stark contrast to pagan animism, Christianity posited "a dualism of man and nature" and "insisted that it is God's will that man exploit nature for his proper ends." The hierarchical, anthropocentric and patriarchal understandings of creation lead to the alienation of human beings from each other and from nature. Men and women were created in the image of God, given a privileged place among creatures, and commanded to exercise stewardship over the earth (Gen. 1:26—28; Ps. 8:5). Fundamental to a properly Christian environmental ethic, then, are the Creator/creature distinction and the doctrine of humankind's creation in the image of God.

Both by endowing them with his image and by placing them in authority over the earth, God gave men and women superiority and priority over all other earthly creatures. This implies that proper environmental stewardship, while it seeks to harmonize the fulfillment of the needs of all creatures, nonetheless puts human needs above non-human needs when the two are in conflict. Man's dominion over earth suggested in *Genesis* can thus be interpreted to mean that God planned all creation exclusively for man's benefit and rule. Some environmentalists reject this vision as "anthropocentric" or "speciesist," and instead promote a "biocentric" alternative. White believed that science and technology could not solve the ecological problems they had created; our anthropocentric Christian heritage is too deeply ingrained. "Despite Copernicus, all the cosmos rotates around our little globe. Despite Darwin, we are not, in our hearts, part of the natural process. We are superior to nature, contemptuous of it, willing to use it for our slightest whim"(1204).Thus western Christianity's cosmology taught Europeans to view themselves as separate from nature, which they could dominate with indifference in pursuit of their salvific destiny. The environmental task was therefore clear: recover an ecological worldview centered on nature's value rather than human transcendence.

So he suggests as a model Saint Francis, "the greatest spiritual revolutionary in Western history." Francis should have been burned as a heretic, White writes, for trying "to substitute the idea of the equality of all creatures, including man, for the idea of man's limitless rule of creation." White argued that something similar to that vision is necessary to save the world in our time. Alternative environmental cults can aid us in ushering an ecologically sustainable and tranquil future.

The present study attempts to offer a re-negotiation of nature-human bond in the context of the alternative environmental religious sect the God's Gardeners conceptualized by Margaret Atwood in the second installment of her *MaddAddam Trilogy*, *The Year of the Flood.* Although *The Year of the Flood* returns to the dystopian world of *Oryx and Crake*, reliving the same nightmare (albeit from a different perspective), this time the emphasis is on the hope of human survival and redemption rather than the prevailing despair of Jimmy/Snowman's "Last Man" narrative. *The Year of the Flood,* acquaints the reader with Toby's story of loss and survival set against the violent Pleebland slums from where an eco-religious group called the God's Gardeners rescues her. The group captain is the grandiloquent Adam One and his brother Zeb and an assortment of other 'Adams' and 'Eves' live together on a lush green rooftop elevated above the slums. Gradually Toby merges with the group and she is relegated to play a key role in the Gardener's secret network, which performs acts of terrorism to undermine the hegemony of corporate

power. As a disguised agent of the gardeners, she reaches the the AnooYoo Spa where she ends up fenced in, as the pandemic erupts. Flood closes on Toby breaking her isolation to save a couple of younger women, Amanda and Ren, from the hands of a band of evil men, the Painballers.

In "Compassion, Imagination, and Reverence for All Living Things:Margaret Atwood's Spiritual Vision in *The Year of the Flood*," Carol Osborne states: "Atwood is using her novel, and the promotional events connected with it, to 'preach' the key principles of the fictional God's Gardeners: environmental stewardship, sustainable living practices, and reverence for the interconnectedness of all living things" (Osborne32).The Gardeners' theology is a combination of Christian imagery and scientific knowledge and their religion fuses reverence for life with biotechnological knowledge. Quite remarkable is their shift from the fundamental assumption of patriarchal discourse that Man should "be masters of the fish of the sea, the birds of heaven, the cattle, the wild animals and all the other creatures that creep along the ground" (*English Parallel Bible*, Gen1:26).On the other hand the Gardeners proclaim their biological connection to the world around and the other non-human life:

God could have made Man out of pure Word, but He did not use this method. . . He made us "a little lower than the Angels," but in other ways – and Science bears this out – we are closely related to our fellow Primates, a fact that the haughty ones of this world do not find pleasant to their self-esteem. Our appetites, our desires, our more uncontrollable emotions – all are Primate!(TYF 52)

The novel is underscored with similar sermons that manifest certain aspects of Gardener theology and reiterate the necessity of peaceful human/non- human co-existence. The crux of their theology is the conception of nature-human reciprocity, that all living things, and not just humans, are indispensible to the created world. Atwood explains that the universe is made from something, and various terms can be attributed to this something, but many people label it as "God." In this case, every form of matter is therefore a "different expression of 'God,'" so when species become extinct, God is essentially being diminished. If the entire world contains God in it, then, any alterations or destruction to the Earth erases iterations of God. The Gardeners have the clear conviction that that their "sacred task of stewardship" lies in preserving the inherent value of each created being, down to the smallest bug. Adam One the most senior member of the Gardener community, preaches that the Gardeners and all humans should not "consider… themselves as exceptional... that they are set above all other Life," and asks, "Why do we think that everything on Earth belongs to us, while in reality we belong to Everything?" (TYF 63). The

Gardeners dismiss the dissociation of God from nature that traditional Christian faith maintains through the inference that humans are the only beings that can encounter God.

Atwood intersperses fourteen hymns throughout the novel, emphasizing their importance to the Gardeners' religious message. In the hymn, "Oh Let Me Not Be Proud,"6 the Gardeners sing about nature-human interconnectedness. The first stanza is an earnest plea: "Oh let me not be proud, dear Lord,/Nor rank myself above/The other Primates, through whose genes/We grew into your Love" (TYF 54). The third stanza furthers the commentary on human evolution through monkeys and gorillas: "We cannot always trace Your path/Through Monkey and Gorilla,/Yet all are sheltered underneath/Your Heavenly Umbrella" (TYF 54). Their point is that just because humans have a higher capability of understanding God than their primate ancestors, it doesn't mean that primates deserve less than humans or mean less to God.

The Gardeners who value every creation of God deems it their responsibility to restore Life when it is threatened and to resist the subordination of nature. Adam One, expounds the Gardener theology with the authority of a biblical patriarch. According to him the Fall of Man was multidimensional. The ancestral primates fell out of the trees; then they fell from vegetarianism into meat-eating. Then they fell from instinct into reason, and thus into technology; from simple signals into complex grammar, and thus into humanity; from firelessness into fire, and thence into weaponry; and from seasonal mating into an incessant sexual twitching. Then they fell from a joyous life in the moment into the anxious contemplation of the vanished past and the distant future (TYF224)

The Gardeners are set against a complicated, pre-apocalyptic world that casts a shadow over environmental concerns and challenges life. According to them, the society outside is the "Exfernal World," a rotten and filthy landscape steeped in pervasive consumerism and environmental desecration. They inhabit a world controlled by bio-technological corporations and where people are categorized into two- the elite, gated Compounds where scientists and businessmen live and work and "Pleeblands," the cities of the lower classes. Gardeners operate within this less privileged space. They become a self-reliant group, living in tune with the rhythms of nature, shielded by the Edencliff Rooftop Garden. The garden is virtually a haven for them and Adam One, the group's leader, preaches his sermons in the Garden, surrounded by the innumerable flora and fauna. Their life is centred round the Garden which is a microcosm marking their regard for the entire planet. Its Creation Day marks the beginning of time for the Gardeners. The Garden epitomizes

their "small part in the redemption of God's creation from decay" (TYF 11). As they anticipate an apocalypse, the Waterless Flood, they consider themselves as "a plural Noah" having been "forewarned" of a coming disaster and "called" to "restore Life" after the destruction strikes (TYF 24).

They are "strict vegetarians" that reject eating all meat, and particularly protest the Exfernal World's meat creations like Secret Burgers, containing mysterious ground-up animal protein, and the genetically-modified ChickieNobs. Because of their garden, the Gardeners never lack in food. They learn how to forage, grow, and know which plants and edible weeds to eat, judging what is safe by whether or not "a mouse has eaten it" (TYF 125). These skills prepare the Gardeners for survival in an apocalyptic world. The Gardeners' green eschatology includes a noticeable dose of pragmatic advice, ranging from such banalities as the use of sunhats, "butter substitute," or recyclable materials for festivals to concrete survivalist technique

Of the various courses the Gardener children had, "Predator-Prey Relationship" classes are really remarkable. Despite their "Vegivows", the children were trained to hunt down animals, in situations of emergency when their bodies need animal protein. They have to begin with the lower level of the food chain. Eggs of various birds should be their first choice, the unavailability of which sanctions them to hunt down small animals and consume them, and most preferably, those animals should preferably not among the "endangered species". They are supposed to chant the standard Gardener apology when they hunt and consume these animals.

The Garden as a space of perfect harmony and symbiosis offers itself as a contrast to the Paradice Inc in *Oryx and Crake*. Atwood offers a unique synthesis of environmental activism, aspects of fundamental Christianity and other similar religions, and scientific thought in her creation of the Gardener religion. The Gardeners further integrate features of common, well -ordered religions alongside their own sermons and hymns, with distinct rituals, marriage and burial ceremonies, Festivals, Feast Days, a specific diet, and dress code. Their holidays, or Saints' Days, commemorate different environmentalists, martyrs, and theologians, from Rachel Carson, Mahatma Gandhi to Julian of Norwich. Since the environmental is inseparably associated with the spiritual, Lauren Maxwell, who comments on environmental activism within the Gardeners' religion, depicts the Gardeners as "a movement that grounds environmental stewardship in spiritual devotion" (Maxwell4).

It may seem strange that most of the myths in the ecologically aligned trilogy are biblical, since the Bible is often blamed as one of the texts justifying human

dominion and the current destruction of biodiversity on the planet. The Biblical myths are ecologically rewritten. Adam One, though comically, often reinterprets biblical myths in ecological terms with the humour being lost on them and they take it quite seriously. Biblical myths are ecologised; ecological scientists are sanctified. Despite the pessimism of some of the God's Gardeners' beliefs, their inconsistency and comical aspects prevent them from becoming Word or dogma,

Adam One's revising of the myth of the fall is an anti-type to the biblical myth of the fall, and although it may seem comical, it also contains profound truths. It at once reaffirms and radically reinterprets the biblical myth of the fall in terms of modern science. The God's Gardeners interpret the virus that destroys most of humanity as the Waterless Flood, thus treating it as an anti-type to the original Flood myth.

Located in an abandoned urban space as opposed to a prosperous countryside, the Gardeners interweave an Evangelical environmentalism with a New Age eco-consciousness and contemporary ecological evolution. The creed of God's Gardeners seems to be Atwood's alternative way of survival. Atwood's new age, thus, affirms a deeply ecological vision, a radical anti-type to the Bible's anti-ecological vision of the New Age.

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