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Editorial.....

It is heartening to note that our journal is able to sustain the enthusiasm and covering various facets of knowledge. It is our hope that IJMER would continue to live up to its fullest expectations savoring the thoughts of the intellectuals associated with its functioning .Our progress is steady and we are in a position now to receive evaluate and publish as many articles as we can. The response from the academicians and scholars is excellent and we are proud to acknowledge this stimulating aspect.

The writers with their rich research experience in the academic fields are contributing excellently and making IJMER march to progress as envisaged. The interdisciplinary topics bring in a spirit of immense participation enabling us to understand the relations in the growing competitive world. Our endeavour will be to keep IJMER as a perfect tool in making all its participants to work to unity with their thoughts and action.

The Editor thanks one and all for their input towards the growth of the **Knowledge Based Society**. All of us together are making continues efforts to make our predictions true in making IJMER, a Journal of Repute

Dr.K.Victor Babu
Editor-in-Chief

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REVIEW OF VARIOUS OPTICAL COMMUNICATION CHANNELS

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Abstract

The recent era is an age of network communication. Therefore the whole communication whether it is textual or digital takes place over the internet and travels through various means of communication such as wired, wireless, optical, radio waves, etc. Optical communication is one of the widely used means of communication which transmits the data by using light beams and data is carried by different communication channels. There are various communication channels that can be used for transmitting the data in optical communication. This work provides an overview to the different communication channels used such as Single Mode Fiber (SMF), Optical Wireless Communication (OWC) and Free Space Optics (FSO). These communication channels gets effected by various climatic or atmospheric variations like changes in weather, heavy rain that can lead to an obstruction in optical signals. This study focuses on FSO communication link and various atmospheric effects on FSO along with its limitations, merits and applications.

Keywords:Optical Communication, Communication Link, Free Space Optics , Optical Wireless Communication, Single mode fiber, Atmospheric Variations.

I. INTRODUCTION

In optical communication, the data travels through air by following a particular communication channel. Some of the mostly used communication channels are as follows:



1.2.1 Single Mode Fiber (SMF)

SMF stands for single mode fiber communication channel. It has the capability to propagate the optical signals which have the single mode and poses the core diameter of less than $50\mu\text{m}$ and the value of diameter corresponding to cladding is $70\mu\text{m}$ [1]. SMF is used channel for signal transmission but it is a communication channel which also suffers from high cost issues, therefore this problem makes its use less frequently [2]. This supports large spectral bandwidth of the carrier signals i.e. it can transfer large quantity of information in the single mode [3] carrier whereas the bandwidth of multi mode fiber is lesser as compare to SMFs. It has the following features:

- In SMF, the voltage level is low.
- It is used for long haul communications.
- The cost of manufacturing SMF is higher as compare to other mediums [4].
- Signals can be transferred by using single path.
- The width of central core is small.
- Supports higher bandwidth (1000MHz).

1.2.2 Optical Wireless Communication (OWC)

OWC uses near infrared frequency light for communication [5]. The OWC system still contains three central communication fragments such as the transmitter, the propagation channel and the receiver [6]. OWC systems are not significantly diverse from free space optics and fiber optic communication but the variance depends on the propagation medium [7]. The OWC channel is reflected to be a vacuum, which is estimated to be free of atmospheric attenuation factors [8]. Because of the moderate bandwidth [9], it provides high security, low price, less power consumption, and high rate. A wireless optical channel element, which is also a free-space optical element, can be applied for huge distances where atmospheric reduction is not the main penalty source but directivity angle. For example, satellite communication[10].

1.2.3 Free Space Optics (FSO)

Transmitting a visible or infrared beam signal which is modulated by means of the ambiance to comprehend optical communication is called Free Space Optics communication. Free space Optics i.e. FSO has more advantages over radio frequency and widely accepted due to advancements in air communication. The properties such as wider bandwidth, license free processing and security make it more robust technology [11]. FSO has various advantages over optical fiber communication as it is more cost effective, more simple and suitable to deploy and employ in the network. Thus, to achieve the effective communication it is mandatory that the speed of the data transmission should be effective. To achieve the speed in data transmission, the Wavelength Division

Multiplexing (WDM) is applied and is in demand because it can hold more than one independent autonomous communication channels and it also handles the data in bulk i.e. Terabytes per second. The performance of the applications which are related to the network or internet depends upon the bandwidth of the network. To make the system more effective and efficient the availability and consumption of bandwidth is very important factor [12]. To increase the bandwidth of the network, various solutions are provided by the researchers. Wavelength Division Multiplexed (WDM) is one of the existing solutions.

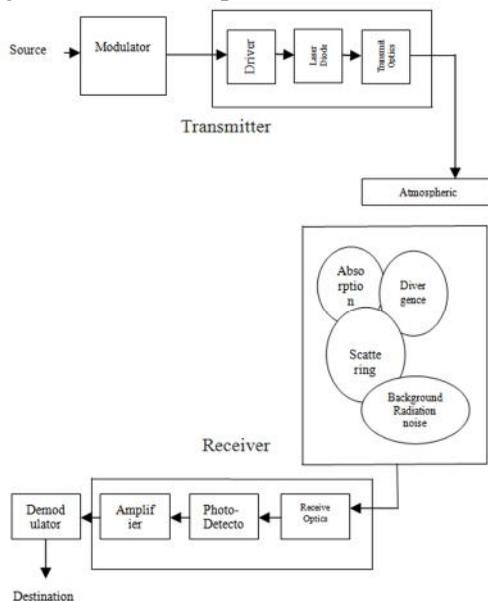


Figure 1 Working scenario of FSO

The WDM network supports massive bandwidth range and also provides the better data transmission range. In WDM network, the data is multiplexed to the transmission lines. It provides the facility to transfer the multiple wavelength at a given period of time or simultaneously. The WDM uses the concept of Fiber optic network which supports the massive bandwidth and data transmission range [13].

Hence, there is need to fulfill the requirement regarding the better data transmission rate and vast bandwidth. To fulfill this need the concept of WDM along with fiber optic network is designed. The key feature of optical fiber network is that it provides large range of data transmission and gigantic bandwidth for data transferring. Due to its features the use of

WDM along with optic fiber is increases day by day. Hence there is lot of work to do in order to increase the performance of the optic fiber network. This creates a requirement to find out the parameters or factor that affects the quality of the fiber optic network. Loss and dispersion are the factors that leave an impact on the performance of optic fiber network by degrading its performance. The FSO can also integrate with WDM as it has a major concern with the transmission of data specifically. The diameter of antenna on the both side (transmitter and receiver) determines the quality and range of the reception side [14].

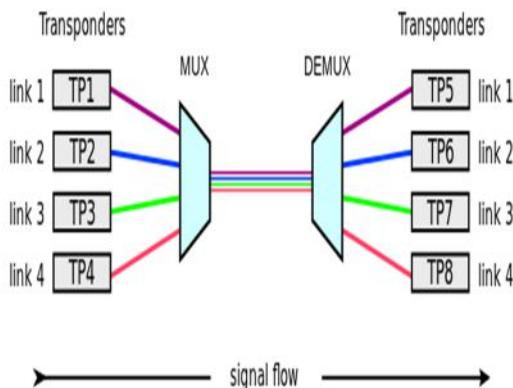


Figure 2 WDM (Wavelength Division Multiplexing)

There are various factors that affect the performance of the system. Such factors are like beam divergence, atmospheric turbulences and is still need to be solved. In order to resolve this issue various authors have provided the concept of spectrum slicing to boost up the weak signals with amplifiers and beam divergence vibrant noise compensation. Even though the available techniques were quite efficient but still it lacks somewhere in terms of data rate, complexity,etc [15].

Applications:

FSO is widely used in various services for establishing a reliable communication link. Some of the application domains are as follows:

1. Outdoor Wireless Access: FSO is mostly used by wireless service providers for communication since it did not require any licensed services whereas for microwave bands license it is must.
2. Storage Area Network: FSO is also applied for creating a Storage Area Network (SAN). SAN is a kind of network which is popular to facilitate the blocks of storage to the users.



3. **Last-mile Access:** It is very costly and inconvenient for the service providers to lay down the cable of users at the last mile. Because the spading of fiber could cost high. Therefore, fiber is replaced with FSO as it is easy to install FSO at last miles along with network. FSO is also referred as a high speed communication link.
4. **Enterprise Connectivity:** FSOs are easy to install and thus it is preferred for interconnecting LAN segments with an objective to establish a link between two different buildings.
5. **Fiber Backup:** It is also used for taking backup in case of failure of communication link in case of fiber transmission.
6. **Metro Network extension:** It is also applicable for enhancing the fiber rings of the network in metropolitan area. It can also used for establishing a complete SONET rings.
7. **Backhaul:** FSO is an aid to handle the data traffic over mobile networks from antennas to back to the PSTN at a higher data rate along with faster speed. Hence, it leads to enhancement in transmission speed.
8. **Service Acceleration:** It facilitates the users by providing them the instant services in case of deployment of fiber infra in last moment.
9. **Bridging WAN Access:** FSO is beneficial for WAN users also when it supports the high speed data services for mobile users and also enacts as backup support for high speed trunking.

EFFECT OF ATMOSPHERE ON FSO

In various tropical countries (the places located near equator), rain governs the overall attenuation coefficient. The occurrence of attenuation due to heavy rainfall at tropical region is known as non selective scattering. Hence the changes in atmosphere such as heavy rain, snowfall, smog and dust can degrade the performance of the communication system. Geometrical loses and environmental attenuation is one of the major reasons for degradation in system performance but some of the other factors such as scintillation, turbulence and multipath fading also have a negative impact on the performance of the communication network. Fog and heavy snowfall are major weather stipulations which mostly occur in temperate areas and similarly rainfall in tropical regions [16]. In FSO, the data is travelled in the form of light rays and these light rays are easily affected by rain thus the FSO is highly affected by rainfalls because the drops of the rain speckled the optical beam and this process is known as scattering. Lots of studies and researches are going on various weathers in order to design such a model which relies upon the effectiveness of the system. Most of the studies are conducted by focusing the atmospheric conditions like fog, rain, snow etc.



II. RELATED WORK

Florence Rashidi et al. (2017), [1] proposed a new approach named as SS-WDM i.e. Spectrum Sliced Wavelength Division Multiplexed for FSO communication. This technique was proposed to communicate in the downpour of Changsha, China. This study investigated the communication over 3Km on 4 different channels with the data rate of 1.56 GB/s on the wavelength of 1550nm. A WDM Demux was treated as a slicing system. Experimental analysis have shown that using SS-WDM technique with 1.56 Gb/s data rate over a range of 2.5 km acquired 9.816×10^{-11} bit error rate and 0dbm power. Whereas the transmission over FSO channel using WDM without any spectrum sensing, the performance was attained with the distance of 2.5 Km with the 10^{-3} on 10 dbm power supply. Therefore, the proposed system enhances the FSO communication system in comparison with WDMFSO scheme. Moreover, it acquired high scalable network with high bandwidth and wide coverage area in case of heavy rain without any power penalty.

K.Prabu et al. (2017), [4] investigated the communication links of 1.56 Gb/s data rate with the wavelength of 1550 nm. The proposed technique has been inspected on different channels such as 4, 8 and 16 in order to increase the performance of the communication under different weather conditions. The system proposed in this paper was susceptible to degradation because of turbulences such as wind velocity, height of buildings and refractive index. A case study on how the height of buildings around VIT has been studied. The results acquired from this study showed that how spectrum slicing WDM performed well in different climatic conditions that enhanced the system's performance. Furthermore, performance parameters are taken into consideration to highlight the characteristic feature of SS-WDM.

Aditi Malik et al. (2015), [5] surveyed about FSO communication system. In this communication system, free space acts as a medium between the transmitter and receiver. Moreover, for successful transmission of optical signal they should be in LOS. In between the transceivers there is a medium which can be outer space, air or vacuum. For the purpose of communication, this system can be used in hours as well as in lesser economy. There are several advantages of FSO communication system such as no spectrum license and high bandwidth. The transmission which takes place in communication system is totally depend upon the medium. Some of the factors which are involved in the medium are presence of foreign elements such as haze, fog, rain, scattering, obstruction as well as atmospheric turbulence. This paper also focused on different studies which have been performed on weather conditions as well as techniques used to diminish the effect on the communication.



Hilal A. Fadhil et al. (2013), [7] evaluated the quality of data transmission using WDM i.e. Wavelength Division Multiplexing. The paper also highlighted several factors which can affect the quality of the data transmission. The main idea behind the analyses of this paper was to develop a system with high quality for a high data transmission. The analysis has taken place that result into FSO with wavelength of 1550 nm which produced less effect in atmospheric attenuation. The less range between the transmitter and receiver provide an optimize FSO system transmission components or parameters. From the analysis taken, it has been concluded that an FSO communication system of 2.5 gbps with wavelength of 1550 nm and range between them should be at 150 Km at clear weather condition of 10^{-9} BER.

NishuSahu et al. (2015), [3] proposed a hybrid 16 channel 2.5 Gb/s WDM multi-beam FSO communication system that have 16 wavelengths with 100 GHz channel spacing. Comparisons have performed between the traditional and proposed system such as WDM FSO system and WDM multi-beam FSO system respectively. From the results acquired, it has shown that there was an improvement in the received Q-factor as well as optical power under different weather or rain conditions. It is concluded that an FSO communication system with a link distance of 2540 m at 10^{-9} of BER can be operated successfully that have -30.022dbm received optical power for heavy rain and for medium rain. An FSO communication system with the link distance of 3030 m at 10^{-9} of BER has received optical power of -29.806 dbm. From this analysis, it has concluded that multi beam FSO is quite sensitive and sensitive to very low optical power.

Ranjeet Singh et al. (2016), [8] focused on reducing the atmospheric turbulence effect to make far communication using Opti system simulator. The experiments have performed using 2.5 GHz signaling rate with 10 to 30 db transmitting power. The encoding technique used for the communication was NRZ on FSO transmitter channel. Additionally, an avalanche photodiode along with Bessel filter has taken for reception. This paper presented an effect of receiving aperture on the signal and showed more than 180 Km communication link in clear weather, in haze its 54.5 km with data rate of 2.5 GHz.

III. CONCLUSION

The changes in the climate leave an impact on each and every kind of communication medium whether it is wired or wireless. Thus, this study is organized to analyze the effects of fog, smog, heavy rain on free space optic communication link. A review to the existing work done by various authors is also organized in this work and it is concluded that there is a requirement to develop such a communication system which can reduce the error rate in the data transmission due to climatic variations.



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संस्कृत ग्रन्थों में निहित धर्म की अवधारणा

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संस्कृत-विभाग
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धर्म भारतीय संस्कृति का प्राण है। भारतीय संस्कृति का प्रतिनिधित्व करने वाले वेदों के सम्पूर्ण वर्ण्य विषयों को धर्म का मूल माना गया है - वेदोऽखिलो धर्ममूलम्। धर्म शब्द का व्युत्पत्तिमूलक अर्थ है - धारण करने वाला। वामन शिवराम आप्टे के अनुसार - ध्रियते लोकोऽनेन, धरति लोकं वा। अर्थात् धर्म ही ऐसा तत्त्व है, जो व्यक्ति को देशकालानुसार आचरण की प्रेरणा देकर समाज में रहने के योग्य बनाता है। धारयते लोकम् इति धर्मः इति यह व्युत्पत्ति सूचित करती है कि धर्म ही परिवार, समाज और राष्ट्र को एकसूत्र में पिरोने का कार्य करता है।

धर्म एक जीवनशैली है, जीवन व्यवहार का आधार है। भारत के मार्गदर्शक ऋषियों द्वारा बताया गया सात्विक जीवन-निर्वाह का मार्ग है, सामाजिक जीवन को पवित्र एवं क्षोभरहित बनाए रखने की युक्ति है, उचित-अनुचित के निर्णयन का एक पैमाना है, और लोकहित के मार्ग पर चलने का प्रभावी मार्गदर्शक है।

धर्म शब्द का अर्थ हम सम्प्रदाय भी ले लेते हैं। वस्तुतः पुरुषार्थ-चतुष्टय का समुचित रूप से सेवन तथा वर्णाश्रम धर्म का पालन ही धर्म है और यही मानव धर्म है। परमात्मा के अस्तित्व को मानना ही धर्म है और संसार से मुक्त होकर परमात्मा में विलीन हो जाना धर्म का लक्ष्य है। इस लक्ष्य को प्राप्त करने के लिए समय समय पर हमारे धार्मिक चिन्तकों ने जो मार्ग बताए, वे ही सम्प्रदाय हैं। ईश्वर एक है, किन्तु वैदिक काल से उसके उपासकों ने अपनी रूचि के अनुरूप उसके विभिन्न रूप मान कर उसकी उपासना की। धर्म के लक्ष्य मोक्ष एवं परमात्म स्वरूप का दर्शन पाने के लिए - भिन्नरुचिर्हि लोकः सिद्धान्त के अनुसार चुने गए मार्गों में भिन्नता आ गई। यही कारण है कि धर्म का समावेश होने के कारण ये सम्प्रदाय आभ्यन्तर रूप से अभिन्न हैं, इसीलिए सम्प्रदाय को धर्म भी कहा जाता है। किन्तु बाह्य आचरण में भिन्नता के कारण इनमें भिन्नता दृष्टिगोचर होती है। अतएव धर्म और सम्प्रदाय पर्यायवाची शब्द नहीं है। सम्प्रदाय धर्म के लक्ष्य को पाने का विशिष्ट मार्ग है। सम्प्रदाय को धर्म न कहकर धार्मिक मार्ग, धार्मिक सम्प्रदाय, तथा धार्मिक अवधारणा कहना चाहिये। धार्मिक सम्प्रदायवाद या धर्म की विभिन्न धाराओं का स्रोत हमारा वैदिक वाङ्मय है। जिसमें ऋषि द्वारा जिस देवता की भी स्तुति की गई है, उसे ही सर्वशक्तिमान् ईश्वर माना गया, मानवों को जीवन यापन की सुविधाएँ प्रदान करने, उनकी सुरक्षा करने तथा असुरों का विनाश करने के कारण नको देवता माना गया, क्योंकि ये मानव जीवन को दुःख के अन्धकार से दूर करके सुख सुविधा के प्रकाश से युक्त कर देते हैं। वेदों में इन्द्र, वरुण, यम, विष्णु, वाक् हिरण्यगर्भ, अग्नि, मरुत, पूषा, सूर्य, उषा, आदि सूक्त परामात्मा के विभिन्न रूपों का ही गान करते हैं। ऋग्वेद में भी यही बात मानी गई है कि एकं सद्भिः प्राः बहुधा वदन्ति। महाभारत में इसी तथ्य को इसी प्रकार प्रस्तुत किया गया है -

तर्कोऽप्रतिष्ठः श्रुतयो विभिन्नाः नैको मुनिर्यस्य मतं प्रमाणम्।
धर्मस्य तत्त्वं निहितं गुहायां महाजनो येन गतः सा पन्थाः॥



अर्थात् तर्क अप्रतिष्ठित है, श्रुतियाँ परस्पर भिन्न अर्थ वाली हैं, किसी एक ऋषि का अर्थ भी प्रामाणिक नहीं माना जा सकता है, वास्तव में धर्म का तत्त्व अत्यन्त रहस्यमय एवं गुप्त है। अतः महापुरुष जिस मार्ग पर चले आये हैं वही धर्म का मार्ग समझना चाहिये। इस प्रकार भिन्न ग्रन्थों में धर्म का वर्णन भिन्न रूप से किया गया है, जो कि निम्नलिखित में संक्षेप में किया जा रहा है।

1. महाभारत में वर्णित धर्म –

आज प्रायः लोगों को यह कहते सुना जाता है कि आज की सामाजिक शक्ति को विघटन करने का कार्य धर्म का है अर्थात् धर्म ने ही लोगों के प्रेम को ग्रहण लगाकर छोटे-छोटे समुदायों में विभक्त कर दिया है। धर्म ही निरन्तर धार्मिक सम्प्रदायों में वैमनस्य का बीजारोपण करके परस्पर लड़ाई-झगड़ों के लिए प्रेरित करता है। जबकि वास्तविकता यह है कि धर्म वह धारक तत्व है जिसे प्रत्येक समाज के लिए धारण करना आवश्यक है। मनुष्य भली और बुरी दोनों प्रकार की प्रवृत्तियों का मिश्रण है। भली प्रवृत्तियाँ उसे उदारता और पर-दुख-कातरता की ओर ले जाती हैं, जबकि बुरी प्रवृत्तियों से वह स्वार्थी, ओछा, लोलुप तथा वासनामय होता जाता है। धर्म भली प्रवृत्तियों को उभारता है, पनपाता है और बुरी प्रवृत्तियों का दमन करता है। संसार का कोई भी धर्म मनुष्य को आपस में लड़ने के लिए नहीं कहता, बल्कि धर्म तो सबको एकता की डोर में बाँध देना चाहता है। धर्म की परिभाषा देते हुए भीष्म पितामह महाभारत में कहते हैं—

धारणात् धर्म इत्याहुर्धर्मो धारयते प्रजाः

यत् स्याद्धारण संयुक्तं स धर्मः इति निश्चयः ॥'

अर्थात्—'जो धारण करता है, एकत्र करता है, अलगाव को दूर करता है, उसे "धर्म" कहते हैं। ऐसा धर्म प्रजा को धारण करता है। जिसमें प्रजा को एकसूत्रता में बाँध देने की ताकत है, वह निश्चय ही धर्म है।'

2. मनुस्मृति में वर्णित धर्म -

धर्म की व्याख्या करते हुए महर्षि मनु ने मानव के आचरण में जिन महत्त्वपूर्ण तथ्यों का समावेश होना चाहिए उनको दृष्टि में रख कर धर्म के लक्षणों का विवेचन इस प्रकार किया है –

धृति क्षमा दमोस्तेयं, शौचं इन्द्रियनिग्रहः।

धीर्विद्या सत्यमक्रोधो, दशकं धर्मलक्षणम्॥ⁱⁱ

अर्थात् - धृति (धैर्य), क्षमा (अपना अपकार करने वाले का भी उपकार करना), दम (हमेशा संयम से धर्म में लगे रहना), अस्तेय (चोरी न करना), शौच (भीतर और बाहर की पवित्रता), इन्द्रियनिग्रह (इन्द्रियों को हमेशा धर्माचरण में लगाना), धी (सत्कर्मों से बुद्धि को बढ़ाना), विद्या (यथार्थ ज्ञान लेना), सत्यम (हमेशा सत्य का आचरण करना) और अक्रोध (क्रोध को छोड़कर हमेशा शांत रहना)। इस प्रकार महर्षि मनु के अनुसार विचारवान मनुष्य दृढ़ संकल्प करके धर्म के सभी तत्त्वों को जीवन में उतारते हुए नैतिक आचरण से युक्त होकर जीवन यापन करना चाहिए।

धर्म एव हतो हन्ति धर्मो रक्षति रक्षितः।

तस्माद्धर्मो न हन्तव्यो मा नो धर्मो हतोऽवधीत् ॥ⁱⁱⁱ



मरा हुआ धर्म मारने वाले का नाश, और रक्षित धर्म रक्षक की रक्षा करता है। इसलिए धर्म का हनन कभी न करना चाहिये, इस डर से कि मारा हुआ धर्म कभी हमको न मार डाले। दूसरे शब्दों में, जो पुरुष धर्म का नाश करता है, उसी का नाश धर्म कर देता है। और जो धर्म की रक्षा करता है, उसकी धर्म भी रक्षा करता है। इसलिए मारा हुआ धर्म कभी हमको न मार डाले, इस भय से धर्म का हनन अर्थात् त्याग कभी न करना चाहिए। जिस समय 'धर्म' हमारे देश का अभिन्न अंग था उस समय हमारा देश 'विश्व गुरु' जैसी गौरवमयी पदवी से विभूषित था। उस समय संविधान के आदि प्रणेता भगवान मनु ने हिमालय की सर्वोच्च शिखर से घोषणा की थी-

एतद्देश प्रसूतस्य सकाशादग्रजन्मनः।

स्वं स्वं चरित्रं शिखरं पृथिव्यां सर्वमानवाः॥

3. वैशेषिक सूत्र में धर्म -

महर्षि कणाद ने धर्माचरण के परिणाम को दृष्टि में रखकर कहा है कि -

यतोऽभ्युदय निःश्रेयस सिद्धिः सः धर्मः।

अर्थात् - जिससे लौकिक अभ्युदय तथा पारलौकिक उन्नति की सिद्धि होती है, वह धर्म है। अतः भारतीय संस्कृति में भौतिक उन्नति और आध्यात्मिक उन्नति को समान रूप से महत्त्व दिया गया है। जो धर्म आध्यात्मिकता की ओर ध्यान न देकर केवल भौतिक उन्नति पर ही अपना ध्यान केन्द्रित करता है, वह एकाङ्गी है। क्योंकि भौतिक उन्नति के चक्र में प्रायः व्यक्ति सदाचारोन्मुख नहीं हो पाता। इसी प्रकार जो धर्म आध्यात्मिकता की ओर ही व्यक्ति को अग्रसर करता है, भौतिकता का त्याग करने की प्रेरणा देता है, वह भी एकाङ्गी है। अतः जिसमें भौतिक उन्नति और आध्यात्मिक उन्नति का समन्वित रूप हो, वही धर्म है।

4. शुक्रनीति में धर्म -

धर्म की आवश्यकता अभ्युत्थान के लिये है और अभ्युदय से सुख मिलता है। अधर्म से अवनति होती है, फलस्वरूप दुःख मिलता है। अतः सुखार्थी मनुष्य को भी धर्म पुरुषार्थ की सिद्धि में तत्पर रहना चाहिये -

सुखार्थाः सर्वभूतानां मताः सर्वाः प्रवृत्तयः।

सुखं च न विना धर्मात् तस्माद् धर्मपरो भवेत्॥iv

और भारतीय मनीषियों ने तो धर्म पर ही परलोक की निर्भरता को मानते हुए अपना अभिमत प्रकट किया है कि परलोक में बन्धु बान्धव और मित्र अथवा परिवार जन साथ नहीं देते, वहाँ भी व्यक्ति के साथ उसका धर्म रहता है। आचार्य शुक्र ने धर्मसंस्थापना से ही राष्ट्ररक्षा को सम्भव बताते हुए राजाओं को समुपदेश दिया है कि उन्हें देशधर्म, जातिधर्म, कुलधर्म, सनातनधर्म, प्राचीनधर्म और नवीनधर्म का पालन करना चाहिये -

देश-धर्माः जाति-धर्माः कुल-धर्माः सनातनाः।

मुनिप्रोक्ताश्च ये धर्माः प्राचीनाः नूतनाश्च।

ते राष्ट्रगुप्त्यै संधार्या ज्ञात्वा यत्नेन सन्नृपैः।

धर्म-संस्थापनाद् राजा श्रियं कीर्तिं च विन्दति॥v



5. तत्त्वार्थसूत्र के अनुसार धर्म –

तत्त्वार्थसूत्र, जैन आचार्य उमास्वामी द्वारा रचित एक जैन ग्रन्थ है। इसे 'तत्त्वार्थ-अधिगम-सूत्र' तथा 'मोक्ष-शास्त्र' भी कहते हैं। संस्कृत भाषा में लिखा गया यह प्रथम जैन ग्रंथ माना जाता है। इसमें दस अध्याय तथा ३५० सूत्र हैं। उमास्वामी सभी जैन मतावलम्बियों द्वारा मान्य हैं। उनका जीवनकाल द्वितीय शताब्दी है। आचार्य पूज्यपाद द्वारा विरचित सर्वार्थसिद्धि तत्त्वार्थसूत्र पर लिखी गयी एक प्रमुख टीका है। आचार्य उमास्वामी के मतानुसार 10 धर्म माने गये हैं। उनके अनुसार 10 धर्म इस प्रकार से हैं - उत्तम क्षमा, उत्तम मार्दव, उत्तम आर्जव, उत्तम शौच, उत्तम सत्य, उत्तम संयम, उत्तम तप, उत्तम त्याग, उत्तम आकिंचन्य, और उत्तम ब्रह्मचर्य। इनका मानना है कि इन 10 धर्मों से मनुष्य अपना सुखपूर्वक जीवन यापन करते हुए अन्तिम लक्ष्य तक पहुँच सकता है।

6. याज्ञवल्क्यस्मृति में धर्म का वर्णन –

याज्ञवल्क्यस्मृति में महर्षि याज्ञवल्क्य ने धर्म का वर्णन करते हुए कहा है कि मानव व्यवहार के लिये उचित तत्त्व ही धर्म है। याज्ञवल्क्य ने वेद, स्मृति, सदाचार एवं मन की प्रसन्नता को धर्म का मूल माना है।

श्रुतिः स्मृतिः सदाचारः स्वस्य च प्रियमात्मनः।

सम्यक् संकल्पजः कामो धर्ममूलमिदं स्मृतम्।^{vi}

महर्षि याज्ञवल्क्य सम्यक् संकल्प से उत्पन्न काम को भी धर्म मानते हैं। स्पष्ट है कि वेद धर्म के स्रोत हैं। सज्जनों का आचरण एवं मनस्तुष्टि भी धर्म का स्रोत है। अतः वेद शास्त्रोक्त नियमों के अनुसार सदाचारियों का अनुसरण करते हुए ऐसे कार्य करना धर्म है, जिनसे नैतिक उन्नति होने के साथ-साथ आत्म सन्तुष्टि भी मिले। इसी विषय को आगे बढ़ाते हुए महर्षि याज्ञवल्क्य का कथन है कि - अहिंसा, सत्य, अस्तेय, शौच, इन्द्रियनिग्रह, दान, दम, दया और शान्ति इन सभी का मूल ही धर्म है। अर्थात् धर्म ही इन सभी का साधन है।

अहिंसा सत्यमस्तेयं शौचमिन्द्रियनिग्रहः।

दानं दमो दया शान्तिः सर्वेषां धर्मसाधनम्।^{vii}

7. नीतिशतक में वर्णित धर्म –

भारतीय संस्कृति में चारों पुरुषार्थों में धर्म का सर्वाधिक महत्त्व है। धर्म ही वह तत्त्व है, जो मनुष्य को पशुओं से अलग करता है। अन्यथा तो मौलिक आवश्यकताएँ मनुष्य और पशु की प्रायः एक समान ही हैं। इस प्रसंग में नीतिशतककार भर्तृहरि ने कहा है कि –

आहारनिद्रा भयमैथुनञ्च सामान्यमेतत् पशुभिर्नराणाम्।

धर्मो हि तेषामधिको विशेषो धर्मेण हीनाः पशुभिर्समानाः।।

इसी क्रम में आगे वर्णन प्राप्त होता है कि -

येषां न विद्या न तपो न दानं ज्ञानं न शीलं न गुणो न धर्मः।

ते मर्त्यलोके भुविभारभूता मनुष्य रूपेण मृगाः चरन्ति।^{viii}



अर्थात् - जिन लोगों ने न तो विद्या-अर्जन किया है, न ही तपस्या में लीन रहे हैं, न ही दान के कार्यों में लगे हैं न ही ज्ञान अर्जित किया है, न ही अच्छा आचरण करते हैं, न ही गुणों को अर्जित किया है और न ही धार्मिक अनुष्ठान किये हैं, वैसे लोग इस मृत्युलोक में मनुष्य के रूप में मृगों की तरह भटकते रहते हैं और ऐसे लोग इस धरती पर भार की तरह। इस प्रकार नीतिशतक में भी धर्म के महत्त्व का वर्णन उपलब्ध होता है।

8. श्रीमद्भागवत् में वर्णित धर्म -

धर्म अपने आप में एक परिपूर्ण शब्द है। "परमाणु से परमात्मा तक का सम्पूर्ण ब्रम्हाण्ड शिक्षा से तत्त्वज्ञान तक का सम्पूर्ण ज्ञान और सम्पूर्ण प्रयोग-उपलब्धि समाहित रहता है जिसमें वह विधान ही 'धर्म' है।" भगवान श्री कृष्ण जी महाराज के अनुसार-- "जिस माध्यम से अनन्य भगवद् भक्ति-भाव होता रहता हो वही 'धर्म' है; जिस माध्यम से अद्वैतत्व बोध—भगवत्त्व बोध रूप एकत्व बोध होता हो, वही तत्त्वज्ञान है; जिस माध्यम से सम्पूर्ण संसार के प्रति त्याग-भाव (विषयों से असंग) और भगवान के प्रति समर्पण-शरणागत भाव हो, वही वैराग्य है और अणिमा-गणिमा आदि सिद्धियाँ जिसमें हों, वही ऐश्वर्य है।" श्रीमद्भागवत् महापुराण के अधोलिखित श्लोक से जान-देख सकते हैं

धर्मो मद्भक्तिकृत् प्रोक्तो ज्ञानं चैकात्म्यदर्शनम्।

गुणेष्वसंगो वैराग्यमैश्वर्यं चाणिमादयः ॥४५॥

धर्म के लक्षण को बताने के पश्चाद् भागवदकार का कहना है कि – धर्माचरण के लिये यह भी आवश्यक है कि विधर्म, पराधर्म, आभास, उपधर्म तथा छल आदि इन पाँच धर्माभासों से बचे।

विधर्मः परधर्मश्च आभास उपमा ह्यलः।

अधर्मशाखा पञ्चमा धर्मज्ञोऽधर्मवत्यजेत्।*

अर्थात् – अस्वस्थ अवस्था में गंगास्नान विधर्म है। क्षत्रिय द्वारा ब्राह्मण धर्म का पालन अथवा संन्यासी द्वारा गृहस्थ का धर्म पालन करना है विधर्म है। वर्णाश्रमधर्म के विपरीत स्वेच्छा से किया गया धर्म धर्माभास है। लोगों को ठगने अथवा प्रदर्शन के लिये संन्यासी का वेश धारण करना उपमा, उपधर्म अथवा दम्भ है, तथा शब्दमात्र को ग्रहण करना, यथा दान देना चाहिये, इस उपदेश वाक्य के अनुसार व्यर्थ का अनुपयोगी सामान देना छल है। अतएव व्यक्ति को चाहिये कि पाप अथवा अधर्म के समान ही इन पाँच धर्माभासों से बचकर वर्णाश्रम व्यवस्था के अनुरूप आचरण करके आत्मोत्थान करे।

उपसंहार - इसलिए अपने धर्म का पालन करना चाहिये, चाहे अपना धर्म गुणहीन ही क्यों न हो तथा दूसरे के धर्म में कितने ही गुण क्यों न हो, फिर भी उसके समक्ष अपने धर्म को छोड़ना नहीं चाहिये। श्रीकृष्ण ने अर्जुन को कर्तव्य पालन की प्रेरणा देते हुए कहा है कि अपने धर्म का पालन करते हुए मृत्यु हो जाना भी कल्याणप्रद है –

श्रेयान् स्वधर्मो विगुणः परधर्मात्स्वनुष्ठितात्।

स्वधर्मे निधनं श्रेयः परधर्मो भयावहः ॥४६॥

अतः महाभारतकार ने कहा है कि काम, भय, लोभ के भय से और यहाँ तक कि जीवन के भी डर से धर्म का परित्याग नहीं करना चाहिये। धर्म नित्य है और सुख दुःख अनित्य है तथा जीव नित्य है और जीवन अनित्य है। अतः धर्म महत्त्वपूर्ण और पालनीय है –



न जातु कामान्न भयान्न लोभाद् धर्मं त्यजेज्जीवितस्यापि हेतोः।

धर्मो नित्यः सुखदुःखे त्वनित्ये जीवो नित्यो हेतुरस्य त्वनित्यः।^{xii}

धर्म से ही व्यक्तियों में सद्गुणों का प्रादुर्भाव होता है, सत्त्वगुण की प्राप्ति होती है, भगवत्प्राप्ति होती है, और धर्म से ही विजय-प्राप्ति होती है। अतः जो मनुष्य कर्त्तव्य पालन रूप आचरण करता है, वही सच्चे अर्थ में मनुष्य है। धर्म ही धर्माचारी मनुष्य को सुख समृद्धि युक्त सफलता देने वाला है। इसी सत्य की अनुभूति करने वाले वेदव्यास ने कहा है कि -

यतो धर्मः ततः कृष्णः यतः कृष्णः ततो जयः।^{xiii}

उपर्युक्त तथ्यों से यह अतीव आवश्यक हो जाता है कि प्रत्येक मनुष्य को धर्म का पालन अवश्य ही करना चाहिये। चाणक्य के शब्दों में यह कहा जा सकता है कि -

कथञ्चिदपि धर्मं निषेवेत।^{xiv}

i महाभारत, कर्णपर्व, 69-59

ii मनुस्मृति 6-92

iii मनुस्मृति - 8-15

iv शुक्रनीति - 3-1

v वही - 4.9-10

vi याज्ञवल्क्यस्मृति, आचार अध्याय, 7.

vii याज्ञवल्क्य स्मृति १.१२२

viii नीतिशतक - 12

ix भागवत -11-19-27

x भागवत - 7-15-12

xi गीता - 3.35

xii महाभारत, स्वर्गारोहणपर्व 5.32

xiii महाभारत, शान्तिपर्व, 62 - 32

xiv चाणक्यसूत्राणि - 6-46



హరికుడి నెతలకు ఆధారం - హనుమారెడ్డి కవిత్యం

డా॥ గొల్లవల్లి అమృత

ఒప్పంద తెలుగు అధ్యాపకురాలు

నేదనంస్కృత కళాశాల

నెల్లూరు.

భారతదేశం పల్లెల్లానే ఉంటుందని, భారతీయతకు చిరునామా పల్లెటూళ్ళలోనే దాగి ఉంటుందని నానుడి. **ది రియల్ కల్చర్ ఈజ్ ఫౌండ్ ఇన్ అగ్రికల్చర్** - అని దేశ సంస్కృతి వ్యవసాయ రంగంలోనే దాగి ఉందని ఆంగ్లేక్షి. ఇన్ని విధాలుగా ప్రాముఖ్యతనిచ్చిన వ్యవసాయాన్ని, వ్యవసాయాన్ని నమ్ముకున్న రైతును నేడు అన్నిరకాలుగా అష్టకష్టాలకు గురిచేస్తున్నారు. ఒకనాడు దేశవెన్నెముకగా ప్రసిద్ధి పొందిన రైతన్నను ఇప్పుడు కనీసం శారీరక శ్రమకు మారుపేరుగా కూడా ప్రస్తావించటం లేదు. కారణం ప్రపంచీకరణ. పారిశ్రామికంగా వృద్ధిచెందితేనే దేశాభివృద్ధి జరుగుతుందని నమ్మబలికే నేటి అధికారులు యంత్రాలకు బానిసలుగా మారిపోయారు. దీని ఫలితంగా రైతన్నకు కనీస ఫలితం కూడా దక్కకపోవడం తరువాత సంగతి, అన్నమోరామచంద్ర అంటూ ఆర్తనాదాలు పెడుతున్నారు. గతంలో నిండుగా ఉండి నేడు చితికిపోతున్న రైతుల జీవితాలను స్పష్టంగా తెలుసుకోవాలంటే రైతు కుటుంబం నుండి వచ్చి కవిగా ప్రసిద్ధి పొందిన హనుమారెడ్డి దీర్ఘకవితలు(పల్లెకు దండం పెడతా, మా ఊరు మొలకెత్తింది)ద్వారా తెలుసుకోవచ్చు. ఇందులో మాయవౌతున్న పల్లెలోని పూర్వవైభవాలను, నేలతల్లిని నమ్ముతున్న కృషివలుల వ్యవసాయపు జీవన విధానాన్ని, పట్టుపు పద్ధతులపై మోజుతో పల్లెను వీడుతున్న ప్రజల జీవితాలను, ప్రపంచీకరణ, పడమటికరణ ప్రభావాన్ని తట్టుకోలేక మూగగా రోధిస్తున్న పల్లెను, అసమర్థపు పాలనలో మగ్గుతున్న దేశపరిస్థితులను గురించి వివరించారు.

రైతు జీవితానికి, దేశీయమైన పల్లెసంస్కృతికి, వీటికి విరుద్ధమైన కృత్రిమ విషయాలకి మధ్య పెరుగుతున్న ఆవేదన హనుమారెడ్డి దీర్ఘకవితలలో ప్రధానమైన అంశం. రైతు జీవితాన్ని కొల్లగొడుతున్న ప్రతి అంశమూ ఇందులో ఉంది. పల్లెల గురించి చెబుతూ జ్ఞాపకాలుగా మిగిలిపోయిన గత వైభవాలను, రైతుజీవన విధానాన్ని గుర్తు చేసుకుంటూ నేడు దుర్భర స్థితికి చేరుకున్న పల్లెను, అక్కడి ప్రజల గురించి వివరించారు కవి. వీరి రచనలలోని ఇతివృత్తమంతా వచనంలో ఉంటూ సామాన్యుడికి సైతం అర్థమయ్యేవిధంగా సౌకర్యంగా ఉంటుంది. పల్లెకు దండం పెడతా లో నాయకునిగా (రామయ్య) తననే (కవి) ఊహించుకుంటూ విషయాన్ని వివరంగా చెప్పారు. ఎన్ని కష్టాలు ఎదురైనా మట్టిమీద ఆస్పాయతతో భవిష్యత్తు మీద ఆశతో వ్యవసాయం చేస్తున్న రైతును...

నముద్రుడు ఒళ్ళువరిచి కొన్నాళ్ళు

మేఘుడు కళ్ళు మూసి కొన్నాళ్ళు

నింహాననాలు తలక్రిందులై కొన్నాళ్ళు

ఖండాంతర వైరుధ్యాలు కొన్నాళ్ళు

ఐ.టి తెరపై చీమల పెత్తనం కొన్నాళ్ళు

ప్రభుత్వాల నిర్లక్ష్యం కొన్నాళ్ళు...అంటున్న



పై పంక్తుల ద్వారా రైతును పట్టిపీడిస్తున్న కష్టాల గురించి, రాళ్ళదారిగా మారిన జీవితం గురించి తెలుసుకోవచ్చు. అతివృష్టి, అనావృష్టి ఏది వచ్చినా తట్టుకోలేనంతగా ప్రభావానికి గురైన వారిలో రైతు ప్రథముడు. అంతేకాక నాయకులు ఏదైనా మాటిచ్చి దానిని నెరవేర్చేలోగా ప్రభుత్వాలు మారిపోతున్నాయి. ఇది ఒక కారణమైతే, రైతు మేలుకోసం, వ్యవసాయాభివృద్ధి కోసం పరిశోధనలు చేస్తున్నామంటూ మాటలు చెప్పే ఐ.టి విభాగం చేతల్లో ఎటువంటి ఫలితం అందించటంలేదు. అంతేకాక అప్పుచేసినా వ్యవసాయం చేసి బాధల నుండి విముక్తి పొందాలనుకుంటే...

నిరుటి అప్పు వడిగల గుర్రమైంది

అప్పిచ్చినవారు బాజాలు, భజంత్రీలతో వచ్చారు

రేపో మాపో ఇల్లు వేలం తప్పదు

అడిగిమరీ అప్పిచ్చిన బ్యాంకులు కష్టకాలంలో ఉన్నరైతు నుండి ఎలాగైనా డబ్బు రాబట్టుకోవాలని ఇల్లు, చెంబు, తపేలాలను వేలం వేయడానికైనా వెనుకాడని పరిస్థితిని తెలుసుకోవచ్చు. వృధాప్రయాస అని అనుకోకుండా, మరొకసారి ప్రయత్నం చేసిన రైతుకు నిరాశే మిగిలిందట...

పంట కోతలు, కుప్పలు వచ్చాయి

గుండె కోతలు, కుప్పలు వచ్చాయి

కల్లలో పంట తూర్పార వట్టాడు

కల్లోల పడ్డాడు గట్టిగింజలేక

బతుకంతా తూర్పార వట్టాడు తల్లడిల్లాడు తాలుగింజలేనని

నేటి కత్తివిత్రనాలను, మందులను వాడి మోసపోయిన రైతుకు గింజలేని వరిపొట్టు(తాలుగింజలు) మిగిలిందట. కనీసపు ప్రోత్సాహం, సౌకర్యం కల్పించలేని నేటి ప్రభుత్వం ఆఖరికి విద్యుత్, నీటి వసతులను కూడా ఏర్పాటు చేయలేకుంది. రైతుల కోసమేనంటూ గుండెలు అవిసేలా మాట్లాడే నేటి పాలకులు రైతుకు ఉపయోగపడేలా నిర్మించాలనుకుంటున్న ప్రాజెక్టులను, డ్యాలను మాత్రం నిరుపయోగంగా పాడుబడే స్థితికి చేరుకున్నా పట్టించుకోవడంలేదు.

కీళ్లు సడలిన శ్రీశైలం ప్రాజెక్టు గేట్లూ?

వగిలిన ప్రకాశం బ్యారేజీ?

వెలుగు చూడని వెలుగొందా?

నీటిని కడలికి మోసుకెళుతున్న గోదావరా?

క్రిష్ణా ప్రవాహాన్ని పీల్చుకుంటున్న నముద్రమా?

అనమర్దప్రభుత్వాన్ని మోస్తున్న దరిద్రమా?



అవకాశం ఉన్నా ఉపయోగించుకోలేని నదీజలాలను నిరుపయోగంగా సముద్రంలోకి వదిలేస్తున్న తీరును, వీటన్నింటికీ కారణమైన ప్రభుత్వాన్ని దోషిగా నిరూపించవచ్చు. పైవన్నీ ఒక ఎత్తైతే ప్రపంచీకరణ, పడమటికరణ అనేవి రైతును పాతాళానికి తోసేందుకు ముందుకు వచ్చాయి. దీనివల్ల పుడమితల్లిని నమ్ముకున్న రైతు, రైతుకు ఆధారమైన భూమి నిరుపయోగవౌతున్నాయి. అభివృద్ధి పేరుతో దేశ సంస్కృతి, సంప్రదాయాల మూలాలను మరచిపోతున్న నేటి ప్రపంచానికి అన్నదాత గొప్పతనం తెలియటంలేదు.

వలుగు పార పట్టి కూలీవైనా బాగుండును

కలోగంజో తాగి, రేపటి చీకూచింతా లేకుండా

చెట్టు నీడలో ఆదమరచి నిద్రపోయేవాడిని

తోపుదారి పట్టి వలసపోయినా బాగుండును

నావల్లె నాగుండెల్లో చిరంజీవి అయ్యెడి

వ్యవసాయాన్ని కమ్ముకుని అప్పులపాలై పస్తులుండేకన్నా, కనీసం కూలిపనికి పోయినా ఏపూటకాపూట గంజితాగైనా కడుపు నింపుకోవచ్చని, దీనికోసం పట్టణాలకు వలసపోతున్న రైతుల బాటలో తానూ ప్రయాణిస్తే కొంతవర్కైనా మిగిలి ఉన్న పల్లెభాయలు తనమదిలోనే నిలిచిపోతాయని భావించాడు రైతు. దీనిద్వారా భూమిపుత్రులు వలసపక్షులై కూలీలుగా బ్రతికే భారమైన జీవితం అర్థవౌతుంది.

పగిలిన పుడమితల్లి గుండెల్ని

హైటెక్ అతికించలేదు

కన్నీటి కాల్యల్ని డబ్బుటిబి అవలేదు

ప్రపంచ బ్యాంకు విన్యాసాల కోసం

ప్రణాళికలు స్వాగతం బోర్డులు పెట్టాయి

భారతీయుడు బందీ, అతనికి స్వేచ్ఛలేదు

రామయ్య చేనుకు పారే నీరుకు స్వేచ్ఛలేదు



రామయ్యలో ప్రతి రైతును చూడవచ్చు. రైతుకు కలిగే ఇబ్బందులను, తనకు ప్రభుత్వం ఏర్పరిచిన నియమాలను పై పంక్తుల ద్వారా తెలుసుకోవచ్చు. పట్నం నుండి ఆజలను, ఆంక్షలను జారీచేసే ప్రభుత్వానికి పట్నమే ప్రపంచమనుకుంటున్న ప్రజలకు ముఖ్య గమనిక...

పల్లె పాదుల్లోంచి పట్నం ప్రభవించింది

రైతుబిడ్డ వునాదిపై పట్నం ఇకిలిస్తున్నది

పట్నంలో ప్రతిమనిషికి తల్లివేరు పల్లెలోనే ఉన్నది.

అని మనవి చేశాడు కవి. పల్లె సౌభాగ్యాలను, ప్రాముఖ్యతను, అన్నదాత కడగండ్లను తెలిపి మన సంస్కృతిని కాపాడుకోవాలంటూ పల్లెకు దండం పెట్టాడు.

కళలు, సంస్కృతి

కన్నీటి వరదలకు, వాయుగుండాలకు

సముద్రాన్ని ఈదలేక మునిగిపోయాయి

ఆచారాలు, సంప్రదాయాలు

కరువుకాటకాల నుడిగాలుల్ని తప్పించుకోలేక

రెక్కలు విరిగి కూలిపోయాయి

వృత్తి నైపుణ్యం

వ్యవస్థతో పాటే పాలిమేరలుదాటింది

తమ వృత్తులనే జీవనాధారంగా కొనసాగిస్తూ పల్లెపాదుల్లో చల్లగా బ్రతికే శ్రమజీవులు నేటి వ్యవస్థలోని అకృత్యాలకు బలైపోతున్నారనేది అందరూ ఎరిగిన సత్యం. వీరితోపాటు మన సంస్కృతి, సంప్రదాయాలు కూడా కనుమరుగౌతున్నాయని, వీటన్నింటితో నిండిన పల్లె తన రూపాన్ని కోల్పోతోందని పై పంక్తుల ద్వారా తెలుస్తోంది.

హనుమారెడ్డి రైతుబిడ్డ. అందుకే రైతుల వెతలను కళ్ళకు కట్టినట్లురచన చేశారు. కవిగా పల్లెలోని ప్రతి అంశాన్ని వర్ణిస్తూ పాఠకుడిని ఊహలోకాలకు తీసుకెళ్ళారు. రైతు సమస్యలకు పరిష్కారం చూపి బాధ్యతగల వ్యక్తిగా నిలబడ్డారు. దేశ సౌభాగ్యాన్ని కాపాడుకోవాలనేది కవి అభిలాష. కొంతకాలం తరువాత, పూర్వం మన దేశంలో రైతు ఉండేవాడని చెప్పుకోవాల్సిన దుర్భర పరిస్థితి రాకూడదనేది కవి ఆవేదన. రైతును, శ్రమకు నిలయమైన మన దేశ సంప్రదాయాన్ని కాపాడుకుందాం! మనమూ మన పల్లెలకు దండం పెట్టి మళ్ళీ మొలకెత్తింపచేద్దాం!

ఆధార గ్రంథాలు

పల్లెకు దండం పెడతా - బి.హనుమారెడ్డి

మా ఊరు మొలకెత్తింది - బి.హనుమారెడ్డి



REVIEW ARTICLE ON WATER POLLUTION EFFECT ON HUMAN HEALTH

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Abstract

Water is most critical for living life form. This audit shows individuals impact by water contamination who influenced by human exercises, for example, expanding request of water system, human and modern utilization, the accessible water assets are getting exhausted and water quality has fall apart. Indian waterways are dirtied because of release of untreated sewage and modern effluents. As the time go with increment in human populace and human exercises the nature is at its inconvenient stage and on the off chance that not, mindful today people may face even the most exceedingly awful conditions then today. In any case, this contamination make impact on human wellbeing like a Typhoid, Diarrhea, Dengue, Cholera, Malaria, Born ailment and respiratory impact as well.

Introduction:

The water pollution may be defined as “the deterioration in chemical, physical and biological properties of water brought about mainly by human activities”. In other words, substances, bacteria or viruses present in such concentration or number as to impair the quality of water rendering it less suitable or unsuitable for its intended use and presenting a hazard to man or to its environment makes the water polluted. The water pollution may be caused by any one or more of the following factors. Atmospheric dissolved gases. Decomposition of animal and vegetable materials. Industrial effluents. Sewage disposal. Weathering of soil and rock materials. Disposal of radioactive substances. Huge amount of nutrients, Nitrate and phosphate, sewage, pesticide and fertilizers stimulate the growth of micro-organisms which often increase the biological oxygen demand (BOD) of the water and reduce the amount of dissolved oxygen (DO) available in aquatic life. The sewage wastes falling into streams, rivers, lakes and coastal water create various kinds of problems. This waste may contain pathogenic bacterial and viruses which are threat to the human health. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decrease oxygen levels, which can kill fish and alter food chain composition, reduce species biodiversity, and foster invasion by new thermophilic species.(1,2)parasitic worms including the Schistosoma (3,4). The water borne diseases such as typhoid, bacillary dysentery, amoebic dysentery and hepatitis all represent potential health hazards in sewage contaminated waters (5). Water is basic for sustaining human life. There is saying in Sanskrit “Jal hi Jeewan Hai”. It is used in domestic, agriculture and industries and transportation and many other forms also. The fresh water reserve for drinking, bathing and other human purpose, is limited. Only 0. 9% of the fresh water is found in rivers, lakes, ponds and underground (6). In industries and mining activities, the used water is discharged in the form of effluents mixed with various toxic and non-toxic pollutants along with oil and grease which are harmful and pollute the other sources of water, such



as rivers, tanks, reservoirs etc. It adversely affects the aquatic system. Deterioration in the quality of water, inefficient network hydraulics, old and dilapidated networks are some of the other major problems related to water supply in the city. The proportion of water in India in different sectors is estimated as agriculture 96 percent, domestic 3 percent and industrial 1.0 percent. In case of Indian cities and towns, the average daily consumption of water varies from 50 litres/capita/day in small towns to 450 litres/capita/day for large and industrial cities (7). A more serious aspect of water pollution is that caused by human activity, urbanization and industrialization.

The sources of water pollution resulting from these are Sewage, which contains decomposable organic matter and pathogenic agents. Industrial and trade wastes, which contain toxic agents ranging from metal salts to complex synthetic organic chemicals. Agriculture pollutants, which comprise fertilizers and pesticides. Physical pollutants, e.g. heat (thermal pollution) and radioactive substances. The indicators of pollution include the amount of total suspended solids, biochemical oxygen demand (BOD) at 20deg. C, concentration of chlorides, nitrogen and phosphorus and absence of dissolved oxygen.[9] Even if the source of water supply and its treatment are of a high standard, water pollution may still occur as often happens, due to corrosion of pipe lines, leaky joints and cross connections between water supply pipes and sewage drainage pipes.[10] Water borne diseases are infectious diseases spread primarily through contaminated water. Most of the intestinal infectious are transmitted through faecal waste. Pathogens which include virus, bacteria, protozoa and parasitic worms are disease producing agents found in the faeces of infected persons. These diseases are more prevalent in areas with poor sanitary conditions. These pathogens travel through water sources and interfaces directly through. Water is critical for the survival of all living organisms including human, food production, and economic development. Today there are many cities worldwide facing an acute shortage of water and nearly 40 percent of the world's food supply is grown under irrigation and a wide variety of industrial processes depends on water. The environment, economic growth, and developments are highly influenced by water-its regional and seasonal availability, and the quality of surface and ground water. The quality of water is affected by human activities and is declining due to the rise of urbanization, population growth, industrial production, climate change and other factors. The resulting water pollution is a serious threat to the well-being of both the Earth and its population. The problem of water quality deterioration is mainly due to human activities such as disposal of dead bodies, discharge of industrial and sewage wastes and agricultural runoff, which are major cause of ecological damage and pose serious health hazards. The degree of pollution is generally assessed by studying physical and chemical characteristics of the water bodies. They may use the same polluted river water for drinking or bathing or irrigation. Water pollution is the leading worldwide impact of death and disease.

Industrialization is the means for the economic development of a nation. During the production, industries generate useless by-products and waste materials with 1 to 10% of the quantity of parent chemicals. The effluent discharged from industries contaminates our soil and water resources. River pollution is an environmental problem in third world countries. While developed nations adopt stringent water quality requirements to control river pollution from point and non-point sources, the situation is different in most developing countries. Wastewater treatment is not given the necessary priority it deserves



and therefore, industrial waste and domestic sewage are discharged into receiving water bodies without treatment . In India, there are 14 major rivers and most of the developmental activities are still dependent on rivers for cleaning as well as disposal purposes. River Yamuna is also one of the most polluted rivers of India. It becomes very important to systematically study the status of pollution of the rivers in relation to various anthropogenic activities. largely through the rivers Yangtze, Indus, Yellow, Hai, Nile, Ganges, Pearl, Amur, Niger, and the Mekong, and accounting for "90 percent of all the plastic that reaches the world's oceans.

MOST COMMON WATER POLLUTION DISEASES

The most widely recognized water contamination illnesses include harming scenes influencing the stomach related framework and additionally causing human irresistible maladies, water contamination may cause an enormous assortment of wellbeing sicknesses including: Infectious ailments brought about by pathogens (normally microorganisms) from creature fecal starting points, of which the most well-known happen in creating nations, including:

1. Typhoid
2. Giardiasis
3. Amoebiasis
4. Ascariasis
5. Hookworm

•Diseases brought about by contaminated shoreline water, including:

- a. Gastroenteritis
- b. Diarrhoea
- c. Encephalitis
- d. Stomach issues and hurts
- e. Vomiting
- f. Hepatitis
- g. Respiratory diseases

•Liver harm and significantly disease (because of DNA harm) – brought about by a progression of synthetic substances (e.g., chlorinated solvents, MTBE)

•Kidney harm brought about by a progression of synthetic concoctions

•Neurological issues - harm to the sensory system – more often than not because of the nearness of synthetic substances, for example, pesticides (for example DDT)

•Reproductive and endocrine harm including hindered sexual advancement, powerlessness to breed, debased resistant capacity, diminished richness and increment in certain kinds of malignant growths – brought about by a progression of synthetic compounds including endocrine disruptors

•Thyroid framework issue (a typical reason is introduction to perchlorate, which is a substance defiling enormous water bodies, for example, the Colorado River)

•Increased water contamination makes rearing reason for intestinal sickness conveying mosquitoes, which slaughter 1.2-2.7 million individuals every year



•A arrangement of less genuine wellbeing impacts could be related to washing in debased water (for example contaminated shoreline water) including:

- Rashes
- Earaches
- Pink eyes

CONCLUSION

Sharma Mandakini, Pal Brijesh:-

Dehradun has been a visitor place since long time. In excess of 80 percent of drinking water supply in Dehradun originates from ground water. The examination shows that the frequency of water-borne infections fluctuates starting with one territory then onto the next relying on the assurance of individuals wellbeing. The runs is water borne infection which is brought about by food contamination. Delineates that all out cases enlisted under Diarrhea from the city were 222 for every thousand man and the most extreme instances of loose bowels happens in Deepnagar (56 for every thousand individuals) in year of 2016. Gastro-enterostatins is additionally a water related illness which is caused because of essence of different synthetic concoctions in both ground and surface water. All out cases under gastric inconveniences from the city were 312 for every thousand individuals. The vector of jungle fever (anopheles' mosquito) is a water borne vector and is in charge of intestinal sickness. All out cases enrolled under intestinal sickness were 185 for every thousand people. Another sickness Typhoid is exclusively spread through sullied water. The bacterial activity is in charge of typhoid. The complete city cases were 177 for every thousand people. Cholera again is spread because of polluted water. All out cases were 246 for each thousand people from the city generally and most extreme cases were from Majra (55 for each thousand man).

Mukeshkatakwar:-

Study that streams bursting into flames on account of high contamination levels. The coasting dead angles in our stream, any shaded water in the waterway, or a terrible stench from the stream point towards stream contamination. The investigation gives proof that nearby networks are experiencing an assortment of medical issues that could be an immediate or backhanded, for example, skin issues, stomach issues, gastric ulcers, loose bowels, looseness of the bowels, yellow fever, cholera, dengue, intestinal sickness and other plague illness additionally accessible here. Narmada stream side towns and urban territory of Hoshangabad, is an extraordinary danger to biological system however a few parameters may not in the fall apart level but rather the state of the waterway side urbanization and industrialization may cause all sort of water contamination sooner rather than later. Then again, networks are experiencing an assortment of medical issues that could be an immediate or circuitous aftereffect of the release and stream of waste water. Skin issues may for instance be identified with the high pH of the water, which could surely bother the skin and result in wounds. The high pH levels are probably going to be the aftereffect of the huge amounts of harsh pop and soft drink cinder utilized in the coloring procedure. It is increasingly hard to ascribe the stomach issues to mechanical contamination as individuals in the zone don't drink surface water. Anyway gastric ulcers



and other comparable gastric issues might be identified with eating routine and the effects of the contamination on harvests and fish devoured by individuals living around Narmada stream. It is additionally conceivable that groundwater is being dirtied by invasion of modern affluent yet comparatively there has been no observational investigation into this. The issues of looseness of the bowels and diarrhea are probably not going to be caused straightforwardly by the mechanical emanating, as they are normally the aftereffect of microbial pollution. Be that as it may, the abnormal state of in-movement to the zone is putting extensive weight on poor sanitation foundation and might build the danger of contracting transmittable illnesses. By utilizing of stream water for washing attire and shower numerous waters conceived malady spread man to man. In any case, yellow fever, cholera, dengue, intestinal sickness and other pestilence ailment additionally accessible around there. The individuals live in the aria are likewise enduring by the scent contamination and by the respiratory issues. For the dirtied circumstance of the waterway maternal and tyke soundness of adjacent riverbank hammer are in a threat position.

Joshua NizelHalde, M. Nazrul Islam:-

In Bangladesh the Dhaka city is encompassed by various waterways of which Turag, Buriganga, Dhaleshwari, Balu and Shitalakhya are the significant ones. The waterways Buriganga, Shitalakhya, Turag and Balu have been so very contaminated that these have transformed into the streams of toxin since they got untreated sewage emanating, sewage dirtied surface run-off and untreated mechanical gushing from close-by private and modern zones which Sources of contamination of the water in these waterways likewise incorporate different mechanical release, local waste; unpredictable tossing of neurotic and business squanders, and so forth. On this part the primary objective was to discover the medical issues referenced that skin sicknesses, looseness of the bowels, gastric ulcers, and respiratory diseases (regular cold, asthma) were the most widely recognized medical issues among the populace in the territory. What's more, individuals likewise experience the ill effects of heartburn, hypertension, gout, stiffness, conjunctivitis, pneumonia, jungle fever, tuberculosis and disease. Skin issues, hypersensitive conditions, tingling and other skin sores are contact-type illnesses. It found that the antacid water, which is probably going to be inferable from the broad utilization of the soluble bases soft drink powder and scathing soft drink in the material coloring industry. The side effects of the skin conditions incorporate a rash, bubbles and aggravation. There are two primary reasons given by the networks with regards to the wellspring of the issue. The absence of legitimate sanitation frameworks, poultry homestead waste and absence of learning about cleanliness for the runs and looseness of the bowels, which are visit among youngsters, ghetto tenants and factoryworkers. Looseness of the bowels is one of the most predominant medical issues answered to be endured by youngsters. Gastric-ulcers have been recognized as a typical medical issue for laborers in the zone, including assembly line laborers. Respiratory issue was featured as a noteworthy issue in the investigation territory and members in additionally referenced the issue of asthma. the quantity of pregnancy and labor difficulties had expanded including: stomach torment during pregnancy; work torment yet "postponed conveyance" or births requiring cesarean, now and then still births. Swelling of the hands, feet and legs during pregnancy (edema);



strange dying, weakness and lack of healthy sustenance were likewise increasingly normal.

Result

All in all, The water nature of waterway has drained seriously at a few places along their courses to seas. Deforestation, urbanization and industrialization have antagonistically influenced hydrological system and condition. Contaminations are progressively added to the surface and groundwater framework through different human exercises and the common corruption forms. Untreated transfer of squanders are adding contaminations to the surface and groundwater framework and nonstop option quickens their development towards creation well. Mechanical squanders that incorporates substantial metals and harmful mixes are breaking down groundwater quality. By utilizing of stream water for washing attire and shower many water conceived sickness spread man to man. Notwithstanding, yellow fever, cholera, dengue, jungle fever and other pandemic illness additionally accessible around there. For the dirtied circumstance of the stream maternal and tyke strength of adjacent riverbank hammer are in a peril position.

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STATUS OF SNSs USAGE BY UNDERGRADUATE STUDENTS

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Abstract

Use of Social Networking Sites (SNSs) is very common these days. Undergraduates are the frequent users SNSs. They are spending lots of time on internet in visiting these sites for the purpose of their higher study, searching job and other opportunities. In this study researcher wants to gain an idea regarding the current SNS usage of the undergraduate students. To estimate its use, a SNSs Usage Inventory has been constructed by the researcher. In this research, researcher has selected three different aided Degree College in NCR region affiliated to CCS University, Meerut through random cluster purposive sampling technique. Only those students were chosen as sample, which were using SNSs. On the basis of descriptive analysis it was found that both male and female students were using SNS. Undergraduate students had average level of familiarity with the features of SNS. Most of them are new users. Majority of them update their SNS profile once in a week. About 70% of Undergraduate students check their SNS account on daily basis. Mostly Undergraduate students comment on others post at least once in a week and some of them rarely comment on other's post. Most of Undergraduate students were highly active to share the post on SNSs while very less of them never shares others post. The results of the study are useful for the students, parents, Lecturers, and administration of University.

Key Words: SNSs Usage, SNS, Undergraduate students

INTRODUCTION

In the digital age, the number of social media users is increasing. Everyone's connections are increasingly moving online. According to studies, the largest numbers of people (615.9 million) are using SNSs in Asian-Pacific regionsⁱ. The craze of SNSs in India is also increasing rapidly. Out of 1,256 million Indian populations, 106 million are active social media usersⁱⁱ. Out of this figure, Face book alone is adding 16 million new users since January 2014 and it can be said that one new user is being added every second. The number of face book users in India alone is over 100 million. Simultaneously other SNSs are also growing day by day by improving their number of users. Dingra(2011)ⁱⁱⁱ in his study on social media found that India comes third when it comes to social networking and photo sharing. The reason observed behind the astonishing excessive usage of SNSs as these are easy to use and navigate, does not require advanced knowledge and experience of the internet and are made up of a wide array of different formats and topics; this means that just about anyone can connect, the basic requirement is the availability of internet(Lunden, 2013)^{iv}.



SNSs are the online platform where users allowed sharing their ideas, pictures, posts, activities, events, and interests with people in their network. This also contain category places where people belong to same field connected (such as former schoolmates or classmates, professionals etc.), and have means to connect with family and friends (usually with self-description pages), and a recommendation system linked to trust. Since the times, SNSs became popular among teenagers and university students^v. Madge, Meek, Wellens and Hooley^{vi} in their research study on first year students called Facebook as a 'social glue' that helped students to settle into their university life. Hamat, Embi and Hassan^{vii} in their nationwide survey on tertiary level students in Malaysia was not found full 100% penetration of SNSs, as they assumed initially. Students was found to spent most time on SNSs for socializing rather than learning and they did not believe that the use of SNSs was affecting their academic performance. In Indian context Bharati and Singh(2018)^{viii} found that most of higher education students use the Whatsapp followed by Facebook. all the students (UG, PG and research scholars) have accepted that the social networking websites have a greater impact on their personality. Through this paper, the researcher is trying to detect the current status of the usage of SNSs among the undergraduate students in local context and also want to check the level to which students are engrossed in different activities on SNSs.

RESEARCH QUESTIONS

The main objective of this study is to know the current status and level of the use of online SNSs by the Undergraduate students of Aided Colleges.

The following research questions were used to guide the study:

- i. Who among male and female students more using SNSs?
- ii. How much they are using SNSs?
- iii. Since when they are using SNSs?
- iv. Which SNSs is popular among Undergraduate students?
- v. How much the Undergraduate students are familiar with the features of SNS?
- vi. How much time do Undergraduate students spend on the various activities on SNSs?

RESEARCH METHODOLOGY

The Descriptive research design and survey method has been chosen for this study.

POPULATION AND SAMPLE

The target population of this study was defined as the Undergraduate students belonging to the different Aided Degree colleges affiliated to CCS University, Meerut. First of all by using lottery technique, three Aided Degree colleges of NCR region were selected randomly, then all present SNS users Undergraduate students in the class were taken as sample from all three colleges. Overall 164 Undergraduate students were taken as a sample by Random cluster Purposive sampling.

A SNSs Usage Inventory was framed by the researcher to find the use of online SNSs by the Undergraduate students. This self-constructed SNSs Usage Inventory includes demographic details and sixteen items related to the SNSs usage of the participants. In



this study analysis was done with the help of MS Excel. The present study is limited to the Government Aided degree colleges affiliated to CCS University, Meerut only.

DATA ANALYSIS

1) Demographic Analysis–

In this research total 164 undergraduate students participated among which 43, 54 and 67 were selected from College A, B, and College C. Sample of 75 male and 89 female undergraduate students was taken from above said Colleges.

Gender	Total Number of Participants	Total Percentage (%) of Participants
Male	75	45.7
Female	89	54.3
Total	164	100

Table 1: Showing gender wise distribution of undergraduate students from Colleges A, B & C

Table1 clearly shows that 45.7 % male and 54.3% female undergraduate students participated in this study. Number of female participants is more than male.

2) Internet Usage By Undergraduate Students

After the analysis of data it was found that, 37.2 % undergraduate participants are frequent internet users while 57.9% use internet sometimes and only 4.9% use internet rarely.

3) SNSs Usage By Undergraduate Students

SNSs usage by the Undergraduate students was defined under following categories:

- i. Devices used for SNSs
 - ii. Frequency of SNS use
 - iii. Daily time spent on SNSs
 - iv. On an average time spent on SNS on each visit
 - v. Difference of time spent on SNS on week days and holidays
- i. As far as the devices for SNSs use concerned, it was found that 100% of participants use their mobile phones to access SNSs. While 34.15%, 26.83%, 17% and 12.2% participants also use their laptops, personal computer, college computer and cyber café respectively along with mobile to access their SNSs accounts. It is clearly shown in figure1.

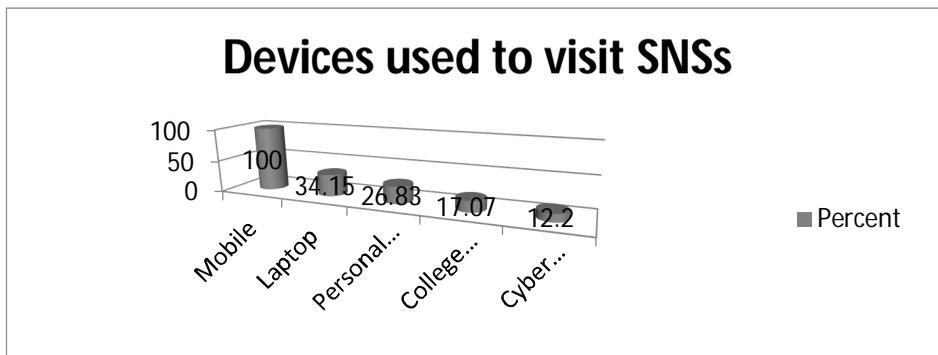


Figure 1: Representing Devices used for SNS usage by Undergraduate students

- ii. In case of frequency of SNSs (SNS) use by undergraduate students 39.6% participants visited multiple times a day, 37.2% visited daily once, 11% visited multiple times in week and 6.7% participants visited once in a week. Although very few 5.5% students also confirmed their monthly or rarely use of SNSs.
- iii. When asked about the daily time spent on SNSs 42.68% of participants responded that they spent less than one hour, 38.4% spent 1-3 hours per day, 8.5% spent 3-5 hours per day, 4.27% spent 5-7 hours and only 3.7% Undergraduate students spent 7-9 hour per day. While 2.44% participants were there who had reported their more than 9 hours usage of SNSs daily. After analysis it was found that 6% Undergraduate students are heavy users of SNSs as they spent more than 7 hours on SNSs daily.
- iv. On a question regarding an average time spent on SNS on visiting each time in it was found that 27.44% participant spent minimum 15 min or less time, 29.9% spent around half an hour, 20.7% spent around one hour, about 12.2% spent 2 hours and 6.7% spent 3-4 hours in a single visit on SNSs each time. While a few participants i.e., 3.05% has mentioned that they use SNS for more than 4 hours at once.
- v. In response to the question total hours spent on SNS in holidays 51.4% undergraduates responded that they spent same amount of time on SNS in holidays as well as on week days, 33.54% undergraduates declared that they spent more time on SNS in holidays in comparison to week days while only 24.4% of spent less time on holidays in SNSs.

4) Time Span For Using SNSs

Only few 4.3% participants reported that they were using SNSs from last 10 years and approximately same number of Undergraduate students 4.88% were using SNS from last 7-9 years, 12.20% students were using from 4-6 years, 17.07% using since last 2-4 years, While highest number 40.85% of students SNS from last 1-2 years and 20.73% students were using SNS since last six month. This description clearly shows that very few only 9% total Undergraduate students were using SNS since last 7-10 years and most of the students are new users of SNSs.



4) Popular SNSs among Undergraduate Students

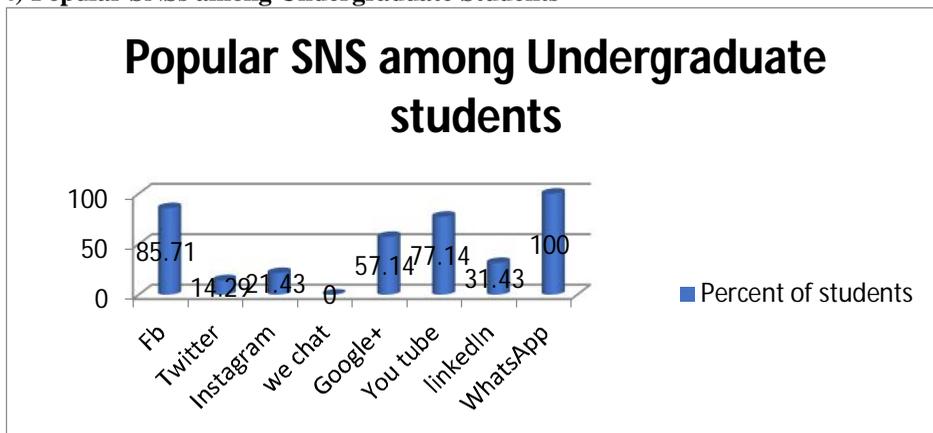


Figure 2: Representing Most Popular SNS among Undergraduate students

It is clearly shown in Figure 2 that WhatsApp was used by 100% undergraduate participant. While 85.71%, 77.14%, 57.14%, 31.43%, 21.43%, and 14.29% Undergraduate participants were using Face Book; You tube, Google +, LinkedIn, Instagram, and twitter respectively along with WhatsApp. On the other hand no participant has reported as We-chat Social Site user.

5) Familiarity with the Features of SNSs

Figure 3 clearly shows that 31.7 % Undergraduate students has find themselves very much familiar with the features of SNS, 30.5% find only a little familiar, 25.6% somewhat familiar and only 12.2% find themselves extremely familiar with the features of SNSs. They shows that every undergraduate participant who was using SNSs has different levels of familiarity with the features of SNS which vary from little to extremely.

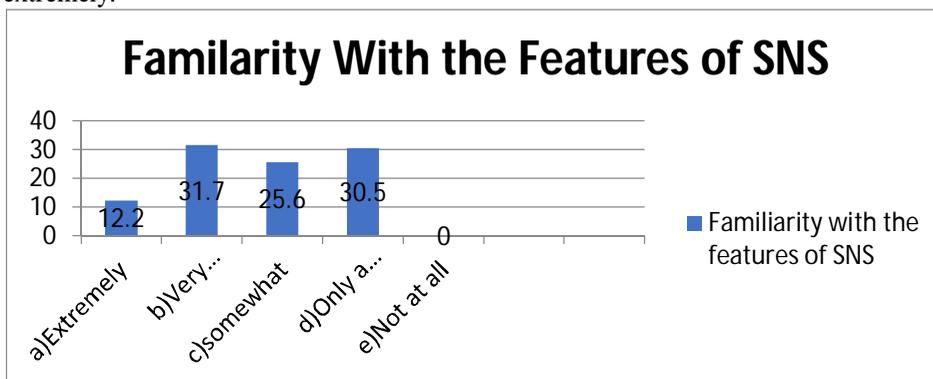


Figure3: Representing familiarity with the features of SNS

6)Time Spent on Various Activities on SNSs

In this study various activities done on SNSs by the Undergraduates students are categorized under following heads-



- A. Updating of the SNSs profile
- B. Checking own SNSs Account
- C. Commenting on others post on SNSs
- D. Sharing of other's post on SNSs
- E. Posting own photos on SNSs
- F. Check others comment on SNS profile

Result found after analysis are as follows:

- A) On updating of the SNS profile, mixed results were found 35 % participants updates their SNSs (SNS) profiles daily ,32% updates weekly , 19.5% updates monthly , 12.8 % updates rarely while 2.4% participants never updated their SNS profile.
- B) 72% Undergraduate students check their SNSs account on daily basis ,16.5% check weekly , 7.3% monthly and a very little 4.3% Undergraduate students rarely check their SNSs account .
- C) 53.04% Undergraduate students comments on others post on the daily basis week, 22.9% comments weekly,7.3% comments monthly, 14.6% comments rarely and very few 3% undergraduate students never commented on others post on SNS.
- D) 10.4% participants share the post on SNS multiple times a day, 16.5% shares daily once, 14.6% shares post multiple times in a week, and 6.7% percent of Undergraduate students share post once in a week on SNSs. 14.6 % participants share of post on monthly basis and at the same time 5.7% Undergraduate students never shared the post. Cumulatively this shows that 43.29% students share post on SNS daily and 21.34%, Share on weekly basis.
- E) 26.2% Undergraduate students post photos on SNSs (SNS) on daily basis, 28.04% weekly ,14.6% monthly and 11.6% rarely. 19.5% participants never used this platform to post their photos.
- F) 57.3% participants' check others comment on their profile daily, 15.24% check weekly, 12.2% check monthly and only 6.7% check rarely. Although 8.5 % never check other's comment on their SNS profile. Probable reason behind not checking others comment on their SNS profile may be their rarely updating of their SNS profile.

FINDINGS AND CONCLUSION:

Findings of this study shows that all undergraduate students are using internet and they are frequent users as well. All Undergraduate students are using their mobile to visit SNSs but only few visits to cybercafé due to the availability of options to visit SNSs. After the launch of Mobile Apps of various SNSs it becomes easier to use and access these sites frequently on mobiles rather than in computers. As far as daily use of SNSs is concerned, most of Undergraduate students are using SNS multiple times of the day. It shows their continuous connectedness with others. Majority of Undergraduate students spent less than one hour on SNSs it means they are using it at minimum level. On the other hand few undergraduate students spending more than 9 hours on SNSs, which is a serious issue, as a big amount of time is being given to screen which is harmful for their eyes and body. Most of the students are new users of SNSs and started using SNS latest by last year and only a few were using SNS from more than 4 years.



Most of students were spending a very little time on SNSs i.e., 15 minutes to one hour in their single visit on SNS. It clearly shows that Undergraduate students are well regulated to utilize their time on SNS. This study revealed that majority of undergraduate students use SNSs in a balanced way in weekdays as well as in holidays. Most of the Undergraduate students has recently started using SNSs since last year very less about 20% were using SNS since more than four years. It was found that every student is using WhatsApp and most of them were also using Face Book .In this way WhatsApp and Face Book were most popular among SNSs among Undergraduate students although YouTube was also preferably used by most of them. Similar to the previous studies of Chakraborty (2012) ^{ix},and Singh and Kumar (2013)^xFace book was found most popular among all category of students .

Most of the Undergraduate students had average level of familiarity with the features of SNS. Majority of them update their SNS profile once in a week. Most of Undergraduate students check their SNS account on daily basis. Mostly Undergraduate students comment on others post at least once in a weekand very less of them rarely comment on other's post. Most of Undergraduate students were highly active to share the post on SNSs while very less of them never shares others post. Majority of students post their photos at least once in a week and very less of them didn't like todo so.

CONCLUSION

In this survey on undergraduate level students studying in aided colleges of CCS, University Meerut located near to Delhi NCR region , researcher has found that SNSs are not fully used by every undergraduate student as initially assumed. This study supported that the Undergraduate students of present era are frequently using internet and SNSs as well. They also possess average level of familiarity with the SNSs features .This gives us evidences that technology is changing its shapes day by day and becoming more users friendly. Therefore the SNS usage pattern of students should also utilized in teaching and learning process efficiently. As far as higher education students are concerned they seem interested to use these platforms and spent their lots of time over it. By keeping these points in mind, teachers can use SNSs as an effective online learning platform for higher education students. SNSs can serve as an effective medium if properly used by the teachers as an extension of their classroom activity like discussion, their reflections, surveys etc. On this platform students can remain connected with their teachers even beyond the classroom and without disturbing them in real time simultaneously teachers can guide their students after the college hours too. But this cannot be implemented completely as the penetration of the technology is not hundred percent till now. There is a need to understand the security measures associated with these online sites well and make the student aware about it too before using it.

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ARTIFICIAL INTELLIGENCE: A TOOL TO REVOLUTIONAIZE HR

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Abstract

This is a basically a great news for Human Resources and for an organization. Conventional Human Resource is one step behind in the digital transformation but now AI has opened up a door of vast opportunities for HR. Artificial Intelligence can help eliminate repetition, accelerate talent hunt, reduce employee attrition and improve employee engagement. The algorithms train themselves to simulate human behavior and to re-imagine workers experience. AI reacts faster in helping draw out the insights and inferences that might otherwise take realms of manpower or stay uncovered at all. By amassing data from an automated performance appraisal software to determine engagement levels, feedbacks and insights on why employees leave, AI can provide predictions at the click of a button at team as well as company levels. The predictions can include anything from giving out names of employees that are worth retaining and the ones who are most likely to quit or the employees that will come up with the most innovative solutions. AI helps the systems to think and act like rational human beings so as to gain the benefits of performing the work at a faster pace with less computational errors and less fatigue.

Keywords: Human Resource, Artificial Intelligence, algorithms, software.

Introduction:

The latest in the technology bandwagon is the rise of Artificial Intelligence applications, especially on the human resources management front. The introduction of artificial intelligence in human resources has received a mixed reception. As AI tools can drastically improve efficiency when it is applied to high-volume tasks such as candidate vetting, and major benefit of it is it exacerbate biases in the recruitment process. However, to whatever extent the capabilities of AI continue to amaze, it cannot replace people; human capital and the ability to attract and retain talent remains key to an organization's success.

According to the father of Artificial Intelligence John McCarthy, artificial intelligence is "the science and engineering of making intelligent machines, especially intelligent computer programs". Artificial intelligence is a science



and innovation, is a method for making a computer, a computer controlled robot, or a prudent programming dependent on orders on a mocktail or blend of Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering.

A prodigious push of AI is in the improvement of PC capacities related with human knowledge, for example, thinking, learning, and critical thinking. This is essentially uplifting news for Human Resources and for business. Typically HR is one stage behind in the computerized change and AI currently offers the opportunity to get up to the speed. AI can help dispose of monotonous assignments, quicken the look for ability, decrease worker wearing down and enhance representative commitment. The calculations train themselves to mimic human conduct and to rethink specialists experience, AI responds quicker in helping draw out the bits of knowledge, in any case, numerous HR-experts are hesitant to grasp this leap forward innovation. A few feel calculations can never supplant human sympathy and instinct. There are questions about the availability and nature of information and whether AI can add something new to what HR department as of now think about the elements of the workforce. Reality has surpassed this discourse and digital intelligence is changing the work environment. Man and learning machines are working intently together in neural systems, controlled by a regularly expanding measure of information in the cloud and the utilization of huge information and man-made reasoning to dissect and guide them. This power crosses a wide scope of disciplinary and hierarchical limits and requires a monstrous move in pondering how to execute and work. Being the most complex, handcrafted and data-dependent business process, HR must rethink its added value and should focus on strategic and global HRM and it should license simple operative repetitive work. The judgment calls of the human professional are, and always will be, decisive in people management, but AI will provide more time, more capacity, more budget space and better information to do so.

Artificial intelligence and HR how they are integrated:

There is no better gathering spot for human and machine-based intelligence than our human resources (HR) departments. The HRM will be altogether changed through this collaboration and its effect on their daily selecting, appraisal, on boarding and the executives rehearses. Talent securing is the key duties of HR departments, but how one might guarantee that it's "talent" is right pick and fit, one might wind up with a smooth-talking and attractive worker who scarcely satisfies the underlying guarantee? As HR departments are populated by (spoiler ahead) error prone people, they are not resistant to human susceptibility in these procedures.



AI technology guarantees to streamline this procedure by depending more on the diagnostic handling of enormous measures of information rather than on individual perceptions. First of all, AI technology is invulnerable to generalizations and the effect the candidate's race, sex or ethnicity can have on the result of representative screening. The AI software can plan significant inquiries addresses that totally ignore somebody's experience to the detriment of concentrating on their expert competency for a specific employment. These appraisal addresses will be founded on the candidate's before work records and, significantly more imperatively, on the prerequisites of the activity they apply for. In the expressions of Google's previous HR manager, the utilization of AI for this kind of robotization considers quicker sifting of "brilliant competitors from the just extraordinary."

SCOPE OF THE STUDY:

This study is on perception and usage Artificial Intelligence in Human resource management and will be helpful in identifying the role of Artificial Intelligence in HRM in future in Indian Organizations to those who are intending for the same.

Objective of the study

To study the use of Artificial Intelligence in various areas of Human resource management through secondary data.

RESEARCH DESIGN AND METHODOLOGY:

Previous studies discussed about the **use of** Artificial Intelligence in various areas of Human resource management. The main aim of the study was to determine HR head perception towards new technology or Artificial Intelligence usage in HR. This study was based on primary and secondary data. The data for this study was collected from various resources. The topic was specific to the study of **use of** Artificial Intelligence in various areas of Human resource management so HR heads of various companies were interviewed through a structured interview. Methodology consist on research hypotheses, research design, tools, instruments, data specification, sampling frame and method of data analyzed.

DATA SOURCE:

Primary data: primary data was collected through one to one interview:

Secondary data: secondary data was collected from research papers, magazines and websites.

The AI technologies fall within one of seven of the maternity levels of artificial intelligence which according to Roy Wang at Constellation Research include:



- 1) Perception,
- 2) Notification,
- 3) Suggestion,
- 4) Automation,
- 5) Prediction,
- 6) Prevention and
- 7) Situational Awareness.

Still a number of HR and recruiting leaders still rely on staffing plans and dashboards that are managing and maintained mostly via spreadsheet. And yet here we are talking about the future of recruiting and talent acquisition. It's it strange that we spend such a great deal of time in Word, Excel, PowerPoint and email? These are likely the least strategic activities we do in our roles in talent acquisition and HR(Roy Wang).

LinkedIn, Pymetrics, Entelo, HiredScore, IBM, Textio, Talview, Unitive, PredictiveHire, and more using AI in Talent Management. There are likely a hundred or more AI technologies for recruiting with these numbers growing by the day.

AI in Talent Management

Some of the possible applications of AI which are sure to touch the business are:

1. **Hiring the right fit:** AI can help create “success profiles” for each role, based on the talent data available. HR professionals often talk about competency, skills etc. Using AI one can decipher what skills matter and what kind of people are the right fit, and even predict whether profiles would be successful or not. With AI, HR and business will be able to think far and wide, posing questions such as, “Do I have a continuity of success profiles in the organization?”
2. While it is popular perception that skills and knowledge are trainable, it is important to get the right people– the right organizational fit. This is where the value of AI will be- to decipher and “crack the code of psychological contract” and hire intelligently backed by data inputs and insights.
3. **Resource scheduling:** There is an ongoing debate about AI machines replacing people. On the contrary, the way resource scheduling can be done using AI, it can serve people better, rather than replacing them, by allowing a better view of the available resources. So this is where AI will start humanizing resources by scheduling the best people for each job, enabling efficiency and effectiveness.



4. **Skill development:** A pertinent talent conundrum is, “What are the skills we are looking at?” Whether it is getting a real-time view of technical skills such as STEAM (Science, Technology, Engineering, Arts and Math) or assessing the ability to apply these skills on real jobs, we need to add an element of design thinking in our needs analysis.

This calls for going deeper into human psychology and understanding people’s skills, in much more depth for both today and tomorrow. For example, change management as a skill is in demand because while technology is changing and being introduced, the adoption rate is not as high. Here is where cultural skills come into the picture. There is a need to drive a mindset change right from HR to business. And AI must be able to identify people who can do that.

Change starts from within, and the HR function itself must bring in new skills. HR leaders must ask themselves, “Can we start hiring people with hybrid skills?” It could mean going out of the HR fraternity and bringing technology people in the HR team. AI can thus change the entire approach to skill building and buying.

Managers make many decisions on gut feel, one study showed that most hiring managers make a decision on a candidate within the first sixty seconds of meeting a candidate, often based on look, handshake, attire, or speech. HR professionals use billions of dollars of assessment, tests, simulations, and games to hire people yet 30-40% of their candidates’ prediction go wrong. Algorithms based on AI can weed through resumes, find good internal candidates, profile high performers, and even decode video interviews and give us signals about who is likely to succeed.

A few AI Talent Acquisition Technologies which was found useful in IBM, Hiredscore, Pymetrics, HireVue and others are:

- **Arya:** offers automated AI sourcing: it scans the web selecting candidates and arranges interviews. It predicts how likely a candidate is to move and tries to identify if a candidate is the right cultural fit for a company. It of course also engages with candidates. No real info on the company, team, or platform.
- **Entelo:** Search passive candidates from multiple sources in a single platform. The proprietary algorithm lets you find candidates from underrepresented groups based on gender, ethnicity, and veteran status — right within our recruiting platform.
- **GoHire:** GoBe is a recruiting chat bot that can import your company’s jobs, pre-screen candidates, through customized pre-screening



questions, and route candidates to job specific recruiters, your company career site, or your applicant tracking system.

- **Hired:** simplifies your search by connecting the right people with the right companies at the right time. They use an algorithmic matching machine-learning algorithms take the guesswork out of finding the right fit, and make smarter matches over time.
- **TalkPush:** HR technology that offers many options for full cycle hiring including video interviewing, sourcing as well as chat bot functionality for Facebook which is the AI component.
- **Talla:** is an AI-driven assistant that handles your busywork allowing you to focus on your most important tasks. Talla can manage employee onboarding and polling, answering basic HR questions, and more beyond recruiting and hiring.
- **Wade and Wendy:** Wendy is an AI in-house hiring assistant. She understands the identity of your company and intelligently vets and delivers candidates who complement your mission and culture. Wade is a career guide for candidates. Wade grows with you throughout your career and opens your eyes to new professional opportunities.
- **In well-being and employee engagement,** AI is now being used to identify behaviors that cause poor work performance. In safety AI can identify behaviors and experiences that lead to accidents. A new breed of survey tools can identify patterns of stress and bad behavior and alert HR or line managers.
- (Vendors in this space include Limeaid, VirginPulse, Glint, Ultimate Software, CultureAmp, TinyPulse, Peakon, and more.)
- **In employee self-service and candidate management,** a new breed of intelligent chatbots can make interactions intelligent and easy.
- (Vendors in this space include IBM, ServiceNow, Xor, Mya, Ideal, Paradox, and more.)

In Performance Appraisal

Traditional performance management tools “need improvement.” Companies like Accenture have publicly tossed aside the annual employee performance review in favor of a system of “ongoing feedback.” Yet, no matter how frequent the review or feedback, human error and bias compromise the integrity of the employee review process. When these errors are present, a performance review may hurt employee morale and job performance, rather than helping as evaluation tool.

Using AI Can Counteract Certain Reviewer Biases

Performance evaluations are adversely impacted when managers employ logical fallacies based on emotional reasoning that ignores objective facts. A similar



result flows from the influence of “recency bias,” in which managers weigh what the employee appears to have done in the last weeks or months, rather than assessing the entire evaluation period. “Contrast bias,” when a manager incorrectly compares an employee to his or her peers, can also adversely impact the performance review process. For example, a manager may overlook employee potential by giving undue weight to a recent mishap in a performance review.

AI-driven technology that leverages data can help reduce certain biases that can impact the efficacy of performance reviews.

Literature review

(Itamar Arel, Thomas Karnowski, 2010)

Opined that deep learning has been successfully applied to challenging pattern inference tasks, the goal of the field is far beyond task-specific applications. It should also be noted that despite the great prospect offered by deep learning technologies some domain-specific tasks may not be directly improved by many schemes as the study reveals. An example is identifying and reading the routing numbers at the bottom of bank checks. Though these digits are human readable, they are comprised of restricted character sets which specialized readers can recognize flawlessly at very high data rates.

Researchers found that recent developments in facial recognition show equivalent performance relative to humans in their ability to match query images against large numbers of candidates, potentially matching far more than most humans can recall. Nevertheless, these remain highly specific cases and are the result of a lengthy feature engineering optimization processes. Despite the myriad of open research issues and the fact that the field is still in its infancy, it is abundantly clear that advancements made with respect to developing deep machine learning systems will undoubtedly shape the future of machine learning and artificial intelligence systems in general.

(Kowalski, 2010) Found that Research in AI has built upon the tools and techniques of many different disciplines, including formal logic, probability theory, decision theory, management science, linguistics and philosophy. However, the use of these disciplines in AI has promoted the development of many enhancements and extensions. Among the most dominant of these are the methods of computational logic. He argues that computational logic, fixed in an agent cycle, combines and improves upon both traditional logic and classical decision theory. He also argue that many of its methods can be used, not only in AI, but also in ordinary life, to help people improve their own human intelligence without the assistance of computers. Researcher has sketched two



ways in which the ALP agent model, building upon many different developments in Artificial Intelligence can be used by common people to progress their own human intelligence. It can help them express their thoughts more clearly and logically, and it can help them make better choices. I believe that the application of such techniques is a fruitful direction of research for the future, and a promising area for collaboration between researchers in AI and researchers in more humanistic disciplines.

(Shukla Shubhendu, Jaiswal Vijay, 2013) Found that it is quite possible that the near future will bring intellectual machines to make life more expedient and comfortable for all of us. Although some may argue otherwise, there is no need to fear artificial intelligence, Like all other machinery, researcher also found that AI machines do what human programmers tell them to do. There is, however, a need to understand AI, for it is through understanding that we can make the AI technology is most beneficial. While expert systems can be extremely helpful to human beings, there are tasks that current expert systems simply cannot accomplish. To return to our past example, the spellchecking utility can check mechanics of an article. However, it cannot check all important aspects of an article such as content and logic. Thus, it is only a marginally helpful proofreader. It would be a much more competent proofreader if it could identify logical shortcomings and so on. To do so, an expert system must be able to make cognitive connections between objects. AI just finished with its period of infancy. It has ramifications that yet remain unknown to everyone. The effort and research can bring the surprising innovations. There are also results which cannot be foreseen when the computer begins to think for itself. A computer it can be used in different ways depending on the user's needs.

Wolter et al. (2015) believe that one of the effects brought about by industry 4.0 is

the change in the structure of occupational fields. From his research he found that it will results in job reduction or cut in the manufacturing sector, job switching and improvement or change in qualifications. Consequently, it means that the adoption of new technologies may pose some potential negative challenges or to a certain extent result in negative outcomes such as future unemployment if what is required are not met. However, the technology will create avenue for new skills acquisition development that leads to specialization, improved innovation, competitiveness etc. In the other way, its potential negative challenges are that it may lead to loss of jobs or create unemployment (in the middle income section) as it reduces the need for people in many median skill jobs (Rotman,2013).

Also, Rotman (2013) affirmed that industry 4.0 has the capacity to destroy some jobs and render some employees jobless faster than it is creating the jobs. This



is because most median workers who have no technical know-how to work with the emerging technologies and

(Manju Amla, Prof. Meenakshi Malhotra, 2017) Conducted the study to find out the meaning of digital transformation in Human resource management and how HR functions are taking advantage of it. To our knowledge this study was first which have gone deeper into the meaning of digital conversion in terms of the whole HR by analyzing the current tools and technical solutions, which are used by the various HR functions. Artificial intelligence, Big Data, Cloud solution etc are some of the tools that companies are using in making their HR functions and employees, stronger, faster and smarter. The study also revealed about the challenges and the possible remedies for it. As HR is at the front of the fourth digital revolution it's important to facilitate this expansion without impeding the human element. In India also technology has helped companies like Reliance Jio, Hero Motor Corp., Kaya limited, Jindal Steel and power limited and many more companies in managing their talent, services and requirements in a more streamlined way. This paper investigated the idea of digital transformation in Human resources management and how new technologies are helping various HR functions and its employees. The study is descriptive in nature and secondary data has been used like company reports, web sources, expert blogs and research papers.

(Pooja Tripathi, Jayanthi Ranjan, Tarun Pandeya, 2012)

This study was conducted to know the impact of an expert system used as a decision aid in a job evaluation system. Both performance outcomes and psychological outcomes were analyzed in an experiment in which the intended users of the expert system served as subjects. The study draws largely from behavioral decision theory for its theoretical support. Although this study examines an expert system within an HRM context in the teaching and learning process, the results are useful as one test of expert system efficacy within the more general area of managerial decision making. As result of using the developed system, a cultural shift occurred within the educational institution. The Competence and Performance expert system implemented quality principles, utilized the value added approach to management and systematically used data that yielded positive results.

(Bertalan Mesko, Gergely Hetenyi, Zsuzsanna Gyorffy, 2018) Found that Artificial intelligence (AI) has the potential to ease the human resources crisis in healthcare by facilitating diagnostics, decision-making, big data analytics and administration, among others. The human resource crisis is widening worldwide, and it is obvious that it is not possible to provide care without workforce. How can disruptive technologies in healthcare help solve the variety of human resource problems? Will technology empower physicians or replace them? How



can the medical curriculum, including post-graduate education prepare professionals for the meaningful use of technology? These questions have been growing for decades, and the promise of disruptive technologies filling them is imminent with digital health becoming widespread. Authors of this essay argue that AI might not only fill the human resources gap, but also raises ethical questions we need to deal with today. While there are even more questions to address, our stand is that AI is not meant to replace caregivers, but those who use AI will probably replace those who don't. And it is possible to prepare for that. If we might be brave enough to articulate a vision, the authors of this debate article think that AI will eventually be evidence-based, widespread and affordable. Physicians have been translating the data they measured with rudimentary tools, like stethoscopes or blood pressure cuffs, and they will keep on doing the same with digital tattoo-like sensors and AI.

It seems this technology will reduce costs in providing care, making it faster and more efficient leading to a change in the medical profession that will involve more tasks related to creativity and critical thinking than time-consuming repetitions. In about 20 years, 50% of jobs will be outdated or not needed anymore, and healthcare is not an exception. While AI demonstrates significant potentials in improving diagnostics, it will probably not solve the HR crisis in healthcare, or at least it will not start with that. The chance for improving the job environment and conditions of physicians is higher, which can eventually lead to a general improvement in the quality of care. If it becomes able to take over important tasks from medical professionals, it might even bring forward a renaissance era in the doctor-patient relationship. While there are even more questions to address, our stand is that AI is not meant to replace medical professionals, but the ones using AI will probably replace those who don't. We also think that it is every caregiver's duty to prepare for a future like that.

Conclusion:

AI is not some magical computerized persona rather it is a wide range of algorithms and machine learning tools that can rapidly ingest data convert it in to information and predicts the trend. The system can understand speech, identify photos and use signals about mood, honesty and even personality. These algorithms are very fast and can analyze millions of bites of information. AI systems in HR looks at all the possible combinations like job history, age, gender and during the interview question can predict how well they will perform on the job, candidates who can complement company's mission and culture. Wade is a career guide for candidates.

“AI can help with all HR functions if it is used as a tool to add to our knowledge rather than a gatekeeper to make hard decisions Conclusion”



AI is the ability to deep-mine data to understand any patterns that can support advanced decision making. After reviewed many research papers it was found that human resource functions are turning more and more accountable for driving business outcomes since the last few years, harnessing the power of AI is one of the crucial and life-changing tech trend that HR managers and leaders can embrace to drive people management. With the staggering influx of data in the human resource arena, artificial intelligence can offer an ocean of insights in key areas that often go unnoticed such as productivity, managerial effectiveness, employee engagement and talent assessment to name a few. This would help HRs to understand their workforce in a much better way and foresee workforce trends as well as identify problem areas well in advance.

Many people are scared that AI innovation will put HR chiefs and staff out of work but at the same time one should not forget as steam machines and PCs did not send us into untimely oppressed worlds so AI tech guarantees to change HR departments, and will not make them jobless, AI tech promises to transform HR departments, not to make them redundant. All things considered, it is just an augmentation of innovation which numerous HR experts are still using in their departments, be it Cortana, Alexa or some other AI-based gadget.

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एक्यदक्यु एल c 0; oLFk v९ I edkyu jktufr dk ॐ0ko ॥556&1605॥

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dlnh; c९ fo | k l kFku ॥ ekur fo'oto | ky; ॥
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ॐLrouk

vi usfir k g९k; q }kjk NkMs x; s v0; ofLFkr e९y I kekt; ds LFkF; Ro¹ ds fy, i kn'kkg vdcj us viuh foy(k.k c९) eHk dk ifjp; nrsftu ufr; la dk l pkyu fd; k muea eul c 0; oLFk e९; ufr FkA² bl eul c 0; oLFk ds vLrZ- vdcj us vius fo'okl ik= vehjla o fglnturku jk; jvkn³ dls (ks= fo'kSk dh tlxh nrs gq eul cnkj cuk; k rFk bl l s l edkyu jktufr ij vR; Ur njxkeh v९ egRoivz i Hko i MA e९y eul c 0; oLFk o l edkyu jktufr l s i Musokys bu i Hko dksufu l oxZea j [k l drs g९

1. एक्य I kekt; dls LFkF; Ro %

g९k; ius e९y I kekt; dls iwr% vl urfyr voLFk ea NkMk Fk v९ fglnturku ea e९y I kekt; ds LFkF; Ro dh l Hkouk vR; Ur de fn [kA ns jgh FkA⁴ bl n'kk ea vdcj us Lo; a clknYyh ds vl; nkonjla l s cgrj 'kkl d fl) djs gq s viuh njn'k k k dk ifjp; fn; k v९ vius 'kkl u dky ds 11oa o'z ॥556&67A-॥ ea eul c 0; oLFk ufr dk l pkyu fd; k rFk bl eul c 0; oLFk dls vdcj us e९; , f'k; k ilr fd; k x; kA bl eul c 0; oLFk ds rgr vdcj us vius fo'okl ik= mejk dls eul c p; u djs gq s eul cnkj cuk; kA bu eul cnjla ea ॐjkuh&rjkuh o vQxkuh vehjla ds l kFk&l kFk fglnturku jktufr jkt jk; jk.kk jkor vkn Fk bl l s vdcj dls bu l cds chp 'kDr l Uryu cukus ea vkl kuh gA mnkj.k ds fy; s, d rjQ jkt eku fl g dk eul c 7000 rd dk igp x; k Fk rls ni jh rjQ fetz vtbt dskl dk eul c Hh 7000 dk FkA nikula gh vdcj ds 'kkl u dky ea vR; Ur egRoivz i nla ij vkl hu gA eul c 0; oLFk l s संबधित एक अन्य सारिणी को 1595 ई. में तैयार किया है था, जिसमें 5,000 या इससे ऊपर का मनसब प्राप्त करने वालों से ydj 200 rd dk eul cnkj dk foj.k g९ ydu bl eafdl h ; ९jkt dseul c dls 'kfe y ugha fd; k x; k FkA vdcj us l kekt; dh etarh ds fy, 16oa l nh ds fglnturku ds Lorl= o v} Lorl= NkMs o (ks-h; jktvla dls viuh v९ feyus ds fy; s mlga eul cnkj cukd (ks= fo'kSk dh fteenkjh l ९ h FkA fglnturku ea bu Nk/s jktvla dh l ९; k 61 Fk) ftuea l olz/kl l ९; k 40 jktufr eul cnkj kuh FkA bu l Hh eul cnjla use e९y 'kgh l ok Lohdkj djs gq s e९y I kekt; ds LFkF; Ro ea vR; Ur egRoivz Hkedk vnk dh Fk v९ yxHk nls 'krkfn; la rd e९y I kekt; bu मनसबदारों के सन्तुलन के कारण टिका रहा क्योंकि 1560—1575 ई. के बीच मुगल साम्राज्य में राजपूतों और भारतीय मुसलमानों dls mPp eul c fn; s tkus l sigys l se^o m rFk mPp inka ij ॐjkuh mejk vehj oxZ dk rjkuh jak : lk Qhdk i Mf k x; k l l kFk gh l kFk jkt; l axBu ea 0; klr pxrA ij Ei jkvl v९ jhfr&fjoktla ea deh vkrh x; hA

2. HgktLo 0; oLFkr gsk %

eul c 0; oLFk ylxw djs l s HgktLo ol yuea e९y l ekvla dls vkl kuh gA D; kcd vdcj ds l e; fglnturku ea Nk/s&Nk/s Lorl= o v} Lorl= 200&300 jktk ; k tehnik Fk v९ ; g vius&vius (ks= ea l ol olz gkrs Fk rFk ; s l elr fglnturku ds 1@6 Hk; jktLo ij v/klkj fd; s gq s FkA t s fcl ckcj us Lo; a fglnturku dls thrus ds n९ku dgk l bu jktvla ds (ks= ९ kT; ॥ s 8 ; k 9 djkm&dk Hk; jktLo vkr Fk tcd e९y I kekt; d y jktLo 52 djkm FkA ; s jktk ॥ tehnik k v k f k l f LFkr l setar gsk ds l kFk&l kFk ; g vPNs l s tkurs Fk fd fdl kula l s fdl (ks= ॥ k e ॥ s fdl l e; fdrul Hk; jktLo tekdjk; k tk; A vdcj dls vius l kekt; dh etarh ds fy, v/kl v k f k l l l k/kula dh t; jr FkA ; g l c rHh l Hko Fk) t c Hk; jktLo dh cl nyh dk Hk; LFkkuh; jk; jk.kk jkor vkn dls l ९ k tk; a D; kcd fdl ku Hh vius&vius (ks-h; jktvla l s i jh rjg tMs gq s Fk v९ ; g vius&vius jktvla dh v'kk dls utj vl nkt ugha dj l drs FkA bl dk , d vl; dkj.k ; g Fk fd bu jktvla ; k tehnik ds ikl 44 yk [k l suk FkA⁶ bl n'kk ea dka fdl ku vius jktk ; k tehnik ds f [kyQ cxlor djs dh l kp Hh ugha l drk FkA vdcj bl rF; dls vPNh rjg tkurk Fk fd e९y la ds fy, fglnturku , d u; k nsk gA vr% ml us dky d w ufr ds rgr (ks-h; jktvla o tehnik) t s vius&vius (ks= ea vR; Ur 'kDr' k y h FkA bu ea l s v f / k d r j jktvla v९ tehnik dls viuh v/khurk Lohdkj dj; h fQj mlga eul c inku djs gq eul cnkj cuk; k rFk bu eul cnjla dls (ks= fo'kSk dh tlxh inku dh Fk) bul s fu/kfzjr l ९; k eafdl kula l s HgktLo dls ol y djs kgh [ktus ea tek djs dls dgk x; k FkA bl dk l h/k yHk ; g gqk fd iln'kkg vdcj dls viuh ; k suk ds vud kj vkl kuh l s Hk; jktLo vl kuh l s ilr gsk yxk ft l l s 1601A- ea e९y I kekt; dh tek 5[03]82[56]318-5 nke@o'z rd gk x; hA ; g tek jk'k iln'kkg* vdcj ds 'kkl u dky ds vLre o'z 1605A- ea 5[83]46[90]344-5 nke@o'z rd tk igph⁷ vdcj dkyu e९y I kekt; ds foHku l uka ea HgktLo ॥ tek ॥ iroxZehy ds v/kj ij fukel LFkr dk vHkl gsk g s %



Øekad	l rck	Tkek@oxl ehv rFkk jktLo gtkj nkelæea	Øekad	l rck	Tkek@oxl ehv rFkk jktLo gtkj nkelæea
1-	Ykkg	10-3	2-	Ekyrku	2-3
3-	dkcy %FKVW½	2-5	4-	fnYyh	9-0
5-	vtxjk	11-8	6-	vo/k	7-6
7-	bygtkctn	6-1	8-	fcgkj	4-0
9-	cakyl mMhl k	4-7	10-	vtej	2-4
11-	ekyok	2-5	12-	ekyok %<+dls NkMdj½	4-6
13-	xqtjkr	5-6	14-	cjkj	12-6
15-A	[kurnsk %46 nke@Vdk dh nj½	25-7	15-B	[kurnsk %24 nke@Vdk dh nj½	38-6

3. dñh; –r l suk dk focld

vdcj jkjk bl eul c 0; oLFkk dsrgr eul cnkj cukus l s l suk ds j [k j [kko ij l hkk vl j i M k D; kñd vdcj l s iñz fglñrku dh jkt 0; oLFkk ea l 'kl= l sukvla dk fo' rsk egRo gkus ds cko tm dñh; Ñr l suk dh vo/kj. lk focld r ugha gis ik; h Fkk bl lFkfr ea 'kLclcha dls LFkkuh; jktkvla vñg tehnikja ij fuñg jguk i M k FkA dgh&dgh LFkkuh; jktk] tehnik brus 'kDr' kñh gñs Fks fd ; g l e; vñus ij vius 'kl dñ ds l keus hkkñs ds VVWmi lFkfr dj nrs Fñ bl dk vñkkl xqtjkr vñk; kku %4572&73A½ ds nñgku i kn'kkg vdcj dls Lo; a gñk FkA rñh ml us i hko' kñh Nkñ/Nkñ/s LFkkuh; jktk] tehnikja dñs eul c inku djrs eul cnkj cuk; k vñg mlga muds eul c ds fgl k l s fu/ñzjr l ã; k ea l suk j [kus dñs dgk x; k] ft l eamPp dkñV ds ?ññs o ?ñññ okj i ãk : lk l s 'kñfey FkA ?ñññ okja ds j [k&j [kko ea dñk /kñk u gñ bl ds fy; s i kn'kkg vdcj us vius 'kkl u dky ds 19oañz ea nñx 0; oLFkk dñs ykñwfd; kñ bl nñx 0; oLFkk dñs vñ; Ñr dñkjr k l s ykñwfd; k rFkk bl ds fy; s vdcj us 'kkgcct [kñ; dEw dñs fu; ðr fd; kA ; s eul cnkj vius eul c ds fgl k l s mPp dkñV ds ?ñññ s j [krs Fks ft l ea ãjkuh eqtkul] rñññ vñg ; kcu ?ñññ s i ãk FkA bl Ññkñ ds vuñ kj eul cnkj dk tñ & tñ seul c c<Fk Fkk oñ & oñ s bu eul cnkjñ ds ikl mudh Ññkñ ds vuñ kj ?ñññ dh l ã; k ea of) gñrñ gñ

ikn'kkg vdcj us 10 l okj Ññkñ ds eul cnkj l s 10 l Ñud o 20 ?ñññ s j [kus dk vñkñ fn; k FkA¹⁰ ; g fl) ñr vl; eul cnkjñ ij hñ ykñw gñk FkA rñd , d l B; ny ea l Ñudñ dh l ã; k l okj Ññkñ ds cjkj gñ rFkk ?ñññ ds h l ã; k bl l s nuñ gñ bl eul c 0; oLFkk dsrgr i kn'kkg vdcj dñs bu eul cnkjñ dh nñkñkñ ea , d mPp dkñV dh 'kñgh l suk j [kus ea vñl kñh gñA og fd l h eul cnkj dñs l suk ds l eLr fooj. k ds l kñk 'kñgh nñkj eami lFkfr gñus dk vñkñ dñh hñ nñl drk gñvñg ml sfd l hñ h l B; vñk; ku ij hñk l drk FkA

4. 0; oLFkñ Á'ñk u %

eul c 0; oLFkk ykñw gñus l s l hñs egñy i z kkl fud mlñkñf; Ro ij ; g i hko i M k fd bu eul cnkjñ dñs l B; 0; oLFkk ds l kñk&l kñk vl; egRo iñz i z kkl fud dk; Z l kñs x; s vñg ; s eul cnkj dñh&dñh brus 'kDr' kñh gñs tñrs Fks fd iñs l kñkT; ds dk; kñ dñs vius gñFkñ ea s ysrs FkA bl Øe ea i Fke o i ãk uke cñe [kñ; dk vñkñ gñA ; g vdcj ds l e; egñy l kñkT; dk i ãk oñh ; k ññhoku½ FkA nhoku 'Okj l h hñk' dk 'kñ gñ ft l s [kñkQk mej ds kkl u dky ea l cl s igñs viuk; k x; kA bl dk i z kñ os jktLo foñkñ ds fy; djrs FkA cñe [kñ; 5]000 tñr dk eul cnkj FkA¹¹ vdcj ds 'kkl u dky ds iñkñkñ dñs ea egñy l kñkT; ds l eLr i z kkl fud dk; Z bl h eul cnkj ds gñFkñ ea FkA eul cnkj l hñs i kn'kkg ds iñr mlñkñ; h gñs Fks rFkk bucs (ñ= %ñkññ½ ea ?ñññ gñus okñh i R; d ?ñññ ds fy; s ; s eul cnkj Lo; a ft Eñkñ gñs FkA

vdcj dk egRo iñz ml jk eul cnkj jktk Vñññey Fkñ ft l s cñe [kñ; ds dñ i kn'kkg vdcj jkjk l kñkT; ea vñ; Ñr egRo iñz i z kkl fud ft Eñkññ nh x; h Fkñ jktk Vñññey ds i ãk : lk l s hñk jktLo 0; oLFkk dñs 0; oLFkñ djus ds fy; s tkuk tñkñ gñ bl us i z kkl fud l ãk] ds vñrñr hñkñtLo 0; oLFkk dñs Bñd djrs gñs 'vñkñ& , ñgñl kyk i) fr' dk i pyu fd; k] tñs %ñkññ & , ñgñl kyk 0; oLFkk½ vdcj ds dñ hñ egñy l kñkT; ea pyñh jñh l cl s igñs jktk Vñññey dñs xqtjkr dh vñkññ 0; oLFkk dñs Bñd djus ds fy; s xqtjkr hñkñk x; k FkA¹² , d vl; egRo iñz eul cnkj eqtkñQ [kñ; dñs egRo iñz i z kkl fud ft Eñkññ ds vñrñr nhoku cuk; k x; k] tñs l ñkñ ds jktLo foñkñ dk iñkññ %ññkññ/gñkñ ds l kñk&l kñk tñkññññ eul cnkjñ ds foñkñ; i ãk/dk dk; Z dñs nñkñkñ Fkñ bl h ds dkj. k nhoku dñs egñy i z kkl fud l kñkñ ea i ãk LFkku feykñ 1582A- ea i kn'kkg vdcj jkjk jktk Vñññey dñs 'kñgh nhoku cuk; k vñg ml l s i z kkl fud l ãk] ds fy; , d fo' rsk ; kst uk rñkj djus ds fy; s dgk x; kA ; kñ; eul cnkj dñs i z kkl fud 0; oLFkk dñs l pñk : lk l s pykus ds fy; sfd l hñ hñr dk l ñkñkñ cuk; k tk l drk Fkñ bl 'Jsñh ea i ãk uke jktk eku fl gñ dk vñkñ gñ ft l s dñcy] cakñ] fcgkj l ñkñ dk l ñkñkñ cukdj egRo iñz i z kkl fud ft Eñkññ nh x; h Fkñ¹³



'kgh Qjeku ds }kjk dHh Hh okfi l yh tk l drh FhA fglnturku ds LFkkuh; jktkvla dls rshj vehjha ds l eku egRo feyus l seky l ket; ea, d l q i "V" l k l Nfrd n"V dsk viukus vq izkl u eamPp LRkjh; dtkyrk dk dk; Z djus dh ijEijk dk l ekr gya

jktir 'kkl dha dls oru tkxhj muds eul c ds vk/kj ij fu/Mjr oru ds cnys nh tkrh FhA budh vupkur vk; eul c ds fu/Mjr oru dk , d Hkx gsrh FhA oru tkxhj dh vk; dls vk/kj ekudj eul c ds oru dh ckdh jde dls ij k djus ds fy; sbudks n h tkxhj ainku dh tkrh FhA

vdcj ds 'kkl u dky ds 26os o"Z 1/4 582A:1/2 ea eky izkl u ds dha ea 9 fglnturkuh jktk iezk inka ij vkl hu Fk ftuea jktk VMjey jk; nqkz jk; l qz j yudjuj vl djuj txe y vkn iezk FhA 1586A- ea eky l ket; ds 12 l eka ds izkl dh; vf/kd f; ka ds rgr jkti rka dks nhoku gk fde vq ehjc l'kh t s egRo i w l in fn; s x; s FhA jktk VMjey dks nhoku ds l k f k l k f k ylgj dh l eknjh Hh nh x; h FhA rjk pln dls fl w k 1/2 cky 1/2 ea c l'kh cuk; k j bl h Oe ea jktk txlu Fk j vtej ds jk; nqkz vq jktk vl dju dls vlxjk dk gk fde cuk; k x; kA

10. A'kl fud ru= ea0; kid cnylo %

ikn'kg vdcj }kjk eul c 0; oLFk ylxw djus dk , d ifj. ke ; g gya fd bl eul c 0; oLFk eky izkl u dh vk/kj LFk bdkA meje l x Bu fotrkh; l x Bu ea cny x; k D; kid fglnturku ds LFkkuh; jktkvla dls 'kfe y djus l s bl izkl fud mi Oe ea Ajkuh rjkuh v'ejh vQxkuh vq fglnturku ds vehjha LFkkuh; jktkvla dk l eko k gis x; k j tks vdcj l sigys bl vfkttu vmejw oxz dh l jpu k ea Ajkuh rjkuh o vQxkuh mejk dk , d f k d k j gsrk FhA bl eul c 0; oLFk l fglnturku ea oLFk fde feyk t y k mejk oxz kkl d oxz dk mn; gya D; kid eul c 0; oLFk ds rgr gh bl s 0; ogk f d : l kinu fd; k x; k FhA bl ds i h Ns e f ; dk j . k ; g Fk fd ikn'kg vdcj bl rF; dls Hk y h Hk f r l e > p q k Fk fd 16oha l nh ds fglnturku ea 'kkl u djus ds fy, ; gha ds LFkkuh; jktkvla v'etehnj k dls eky 'kkl u ru= dk vfuok; l vax cukuk vfr vko'; d ga

11- l fg". k r k i w l u f r d k l H k j k %

vdcj }kjk i j k h dh x; h bl eul c 0; oLFk us n k ea l cds l k f l fg". k r k i w l u f r d k l H k j k viukus dls i f j r fd; k D; kid ikn'kg us fglnturku ea eky 'kkl u dls l p k : l k l s p y k u s ds fy, ; g k ds LFkkuh; jktkvla v'etehnj k dls eul cnj k cuk; k FhA eul cnj k u k r l e ; bl rF; dk fo'k k / ; ku j [k k fd eul c n s u l s 0; f D r dh ; k k ; r k H h cuh j g A , d h l F k f r ea ; g t : j h g l s x ; k Fk fd ikn'kg vdcj , d , d h egRo i w l u f r d k l p k f y r d j j f t l l s f d l h dh k f e b l H k o u k d l s B l u i g p A l cds l k f l fg". k r k i w l u f r d k l H k j k viukus ds ckjs ea ikn'kg vdcj dk dguk Fk &

“; s o f f i l l u l e p k ; [l n k A [k t k u s g s t l s [l n k u s g e l y s g o k y s f d ; s g A b l h : l k e a e g a m u l s e g l c r H h d j u h p l f g , A g e a b l c r i j i j k H k j d k g u k p l f g ; s f d g j k e l d l s m l [l n k d h j g e r g l f y g A r g & f n y l s g e a b l c r d h d l s k k d j u h p l f g ; s f d g e l y g & , d h y d s g j & H k s c k d s v e u p l s O k ; n k m B k ; A [l n k f e u k d l s H s n H k o f d ; s l H h b l l k u l a i j j e r d h o k f ' k d j r k g A g p e j k u k j a d k j t s / k j r h i j A ' o j d s u e k b l n s g A d H h b l m l y l s e g u g h a e k M e k p l f g ; d ' l c d s l k f l fg". k r k i w l u f r d k l H k j k viukus dk gh ifj. ke Fk fd eky 'kkl u ea f e f J r 'kkl d oxz dk mn; gya vq fo'k V 'kkl dha ea l s f d l h vfr [kkl l e p k ; v'ejh ds i H k o e a o f) i j f o j k e y x x ; k A

11. LFkku; jktkvla }kjk vius Afrufufk; l e d k 'kgh njokj ea Hstuk %

ikn'kg vdcj }kjk LFkkuh eul c 0; oLFk dk ifj. ke ; g gya fd ikn'kg vq ml ds 'kkl u ds ifr oQknjh fn [kku ds fy; s LFkkuh; jktir vq e l l y e jktk 'kgh njokj ea vius i e ; k f d l h H k A & c l u / q d l s v i u s i f r u f u k d s : l k ea Hst : n r s FhA 'kgh njokj ea bu LFkkuh; jktkvla ds }kjk cl / d ds : l k ea Hst s x ; s i f r u f u k ; ka dh l p h y e c h f e y r h g A t g k x j d s 'kkl u dky ds i k j E k e e a y l g j l e k d s i g M h v e h j h a L F k k u h ; j k t k v l a d s 3 2 i f r u f u k c l u / d d s : l k ea e k y n j c k j e s F h A ¹⁹ i k n ' k g v d c j d s l e ; e o k M + i e z k j k . k H h v i u s i e v e j f l g d k i f r u f u k d s : l k ea 'kgh njokj ea Hst : u s d k j k t h g l s x ; k Fk A

12. Eky l e M j k t d e j r f Fk v l ; m e j k d s l E e u e a o f) %

eul c 0; oLFk ylxw g l s l e e k y i k n ' k g j k t d e j r v q b u d s l s u k i f r d s 0 ; f D r x r l E e u e a o f) g A A e o k M + i e z k j k . k i r k i . } k j k i k n ' k g v d c j d k l E e u i n ' k u d j u s d s f y ; s v i u s i e v e j f l g d l s 'kgh njokj 'kgh Hst : u s d k m Y y e k f e y r h g A ²⁰ H k v k d s j k t k j e p l a e u s i k n ' k g d s i f r l E e u f n [k k u s d s f y ; s v i u s i e d l s k g h n j c k j H s t f n ; k F h A t c v d c j v i u s ' k k l u d k y d s 2 8 o a o ' z 1 / 4 5 8 3 A : 1 / 2 b y k g i c l n d s i k l d s l B ; v f k ; k u i j F k j r c j k t k j e p l a e u s i k n ' k g d s l E e u e a : f p u g h a y h A c k n e a v c m l d s j k t ; i j v k O e . k d j u s d h / k e d h n h x ; h j r c o g i k n ' k g d s l E e u e a v i u h l s u k d s l k f k v k ; k A b l h i z k j j k t e / m j j u s ; o j k t e j k n d k l E e u e k y o k v k r s l e ; f d ; k x ; k A ²¹ i k n ' k g v d c j d k v k n e [k j x D j k d s } k j k 0 ; f D r x r l E e u e f d ; k x ; k j t c m l d s v k l s j k t ; d l s y s f y ; k x ; k A r c x D j k v e j h l e ; & l e ; i j i k n ' k g d s i f r l E e u e i n ' k r d j u s d s f y ; s ' k g h n j c k j v k r s j g A d k y l u r e a v i n e [k j u s v i u k o k ; n k u g h a f u k k ; k A m M h l c d s j k t k j e p l a e u s e k y l s u k i f r e k u f l g d k l E e u e c n ' k u d j u s d s f y ; s v i u e v s d l s H s t k j y f d u c k n e a m l d s j k t ; i j v k O e . k e k y l s u k u s d j f n ; k j d k j . k c r k ; k x ; k f d e k y l s u k i f r d k m f r l E e u e u g h a f d ; k x ; k i j u r r t c i k n ' k g v d c j } k j k l B ; v f k ; k u d l s j k d s t k u s d h l p u k f e y u s i j j k e p l a e u s v i u s i e d l s l s u k i f r e k u f l g d k l E e u e d j u s d s f y ; s H s t f n ; k A ²² t c f d , d v l ; e k e y s e a ; o j k t e j k n } k j k j k t e / m j j c n y k d s j k t ; i j v k O e . k d j u s d s f y ; s i k n ' k g d h e j k n d l s Q V d j k H h > y u h i M h F h A ²³



ikn'kg vdcj us vius 'kkl u dky ds 370a o'wz 1/592&93A-1/2 ea 0; fDrxr l Eeku inf'kr djus ds fy, eolM+ ds jktk Nw/ nsnh x; h D; kld ikn'kg eolM+jkt; dh lFkkr l e> pqlk FkA
LFkkuh; jktk ikn'kg vq; o jktk dk 0; fDrxr l Eeku cfn'kr djus ds fy; sviuk cfrfu/fk Hkst nrs Fks vq; ikn'kg l s ; g elak djrs Fks fd ekpy l kekt; dk mPp cfrfu/k gekjs jkt; ea Hkst fn; k tk; A LFkkuh; jktk/vla dk ; g vuigk l kekt; r%eku fy; k tkrk FkA

13- egROIwz iskd'k niiglj½dlsinlu djuk %

Ekpy ikn'kg ds utnhd igppus ds fy; s LFkkuh; jktk ikn'kg dls iskd'k 'vegROIwz miglj½ nrs Fk½ ft l l s fd ekpyla dh foLrkjoknh ulfr l s cpk tk l dA ; s LFkkuh; jktk vi us&vius jkt; la l s eiv; oku vHkKk. k %dherh ghjla l s ds gq ½ f'kdjkh 'tkuojl½ qkM/la vq; ; q; ds gffk; ka dls Hkst rs FkA l ukykglj ds vlrxz' d'ehj ds igMk jktk/vla }kjk f'kdjkh 'tkuojl½ %ts ghjka o jRula ds cus gars Fk½ dls iskd'k ds : lk ea Hkst rs Fk½ tcd fcgj] caky vq; mVh k ds LFkkuh; jktk/vla }kjk l kekt; r% gffk; ka dls iskd'k ds : lk ea Hkst tkrk FkA te dHh&dHh ; g iskd'k ds : lk ea udn /lu dls Hkst rs FkA HkVk ds jktk jke plae 1583&84 A- ea 'kgh c'kkl u dls dsk ds : lk ea iskd'k Hkst rFk bl jktk us 120 gffk; ka vq; 50]000 #i; s ds yk jRu] iskd'k ds : lk ea fn; A²⁴ vdcj ds 'kkl u dky ds 300s o'wz 1/585&86A-1/2 ea fl jgh 1/2tej l uok½ ds 'kkl d us l kekt; ; }kjk r; dh x; h iskd'k dls vnk fd; k FkA²⁵ oLrq'ad l s fdruh ekpy l kekt; ds fy; s iskd'k nsh gq; ; g 'kgh c'kkl u gh r; djrk FkA

Ekpy c'kkl u dls iskd'k nsh dk dlj k ; g Hh Fk fd ; s LFkkuh; jktk ekpy c'kkl u dls vi u&vius jkt; la l s jktLo ds Lo: lk tks iskd'k nrs FkAog tek dk gh , d Hkx glrk FkA dhdj ds jktk us ekpy 'kkl u dls HgkTLo 1/4kkl u }kjk fu/wjzr fd; k Hke yxku½⁶ vnk fd; k x; kA l kekt; r%; g iskd'k ekpy c'kkl u yxkrkj ds Hkst tkrh FkA ; g iskd'k LFkkuh; jktk/vl½ muds i-q-ka; k jktir/la }kjk 0; fDrxr l Eeku eam l e; nh tkrh Fk½ te; s l Ecu/kr LFkkuh; ds jkt; ds l ehi l B; vHk; ku ij glrs Fks vq; ; g iskd'k ekpy l suk dsc<rs nco dls de djus ds fy; s glrh FkA Ttek LFkkuh; jktk/vla }kjk o'wz ea, d ckj gh HgkTLo Lo: lk ekpy 'kkl u dls nh tkrh Fk½ tcd iskd'k ekpy 'kkl u dls LFkkuh; jktk/vla }kjk fd l h l e; fo'kkl ij nh tkrh Fk½ ft l l smudk jkt; ekpy l kekt; l s vyx cuk jgA

14- l oLprk ds fl)kr dk fodkl %

ikn'kg vdcj }kjk viuk; h xA bl eul c 0; oLFk ds vlrxz' l edkyhu jktulfr dk , d egROIwz cHkko ; g iMk fd ekpyla }kjk yxHkx l Ei w l i'f'pekklj fglntRku dls vius vf/ckj ea dj fy; k x; k vq; LFkkuh; jktk/vla dls viuh l qo/k vuq kj eul c forfjr fd; s ft l ds dlj .k buds i s d ttxhja 1/4s-kk ea ekpy "kkl d us yxHkx l Hh vf/ckj cklr dj fy; s ft l ds ifj .kkelo: lk viuh bPNkuq kj ikn'kg fd l h Hh LFkkuh; jktk ml ds jkt; ea te plgs glr/ld dj l drk FkA bl l s ekpy l oLprk ds vlrxz' l oLprk ds fl)kr dk fodkl gvk vq; l oLprk ds bl fl)kr dls ikn'kg mlkj kf/ckdj; ka us 180ha' krk'knh rd cuk; s j [k FkA

15- LFkkuh; jktk/vla dk foHku l oxlaeac]uk %

ekpy eul c vq; l edkyhu jktulfr ds rgr 61 LFkkuh; jktk/vla %tehtj] jktk] jk; jkor vkn½ dls eul cnkj cuk; k x; k bl ea l s 40 eul cnkj vtej l uok ds 'kkl dh; ifjokj l s l Ecu/kr Fk½ ft u ea 27 eul cnkj dPNokg oak ds FkA 'kkl 13 Hh eul cnkj Hh bl h l uok %tkkij] chckuj vq; gMk ds jkBq] eolM+ ds fl l q; k vq; tkyq; ds vQxku½ ds FkA²⁷ cps gq; s 21 eul cnkj ekpy l kekt; ds foHku Hkoxla l s l oLkr FkA ylgj l uok ds vlrxz' 7 eul cnkj la ea 6 eul cnkj xD[kj oak l s gh l Ecu/kr FkA²⁸ dPNokg vq; xD[kj oak ds eul cnkj la ds l kfk vl; oak ds eul cnkj la dh vi'kk vf/ld mnkjrk iwz 0; ogkj ikn'kg }kjk fd; k x; kA

vtej l uok ds vlrxz' l cl sigysmu dPNokgla dls eul c fn; s x; } ftUgla ekpyla dh l g'wz v/khurk Lohdij dh FkA gMk ds jkBq] la us ekpyla dh cklk Rrk dk vkr'kd cfrjkk djrs gq; s 'kgh l ok ea tkuk Lohdij fd; k vq; eul c cklr fd; A bl h 0e ea deky [k; xD[kj us vdcj ds 'kkl u dky ds cjk fHkd fnula ea LoBNK l s 'kgh l ok ea 'krfey gluk Lohdij fd; k FkA ; g l c ekpy l kekt; ds fy; s fu. kiz d i (k Fk D; kld bl l e; pklja vq; l s vQxkula }kjk ekpyla dls ppp'ri fey jgh FkA²⁹ dPNokgla xD[kj la vq; dN l hek rd jkBq] la dls vdcj ds 'kkl u ds cjk fHkd o'kka ea mnkj rk iwz eul c fn; s x; A dPNokgla ds ckjs ea ikn'kg vdcj dk eluuk Fk fd ; g vldkj ea cgr; cM/vucl jkt; ka l s l oLkr gluk½ g vq; l suk ds fy; s mi; q; r; gq; , d k gh xD[kj oak ds ckjs ea Hh vdcj dk fopkj Fk fd bu ea cgnjh vq; Aekunijh l ckl; Z djus dh yxu Hkh gq; h gA vdcj ds 'kkl u dky ds cjk fHkd fnula ea deky [k; xD[kj us ikn'kg ds fy, oQknjh ds l kfk vQxkula l s; q; yMk Fk] ; gh dlj .k Fk fd ml ds oak ds tethtj la dls eul c fn; s x; s FkA

eul cnkj ij 'kgh l ok/vla dk dloH mYk kf/ckjkh glrk FkA ; s vko; drk ds vuq kj ekpyla dls l suk mi yC/k djrs FkA T; knkrj eul cnkj 'kgh l B; vHk; ku ij vius jkt; l snj pys tkrk FkA eul c 0; oLFk ea foLrkj gks l s blga vPNh ttxhja feyus yxla bu ea l s dN ttxhja eul cnkj la ds oru ttxhja ds : lk ea ekpy l kekt; ds foHku Hkoxla ea nh tkrh FkA i fke l oxz ds vlrxz' dPNokgla vq; jkBq] la dls bl h cdlj dh oru ttxhja eul c ds : lk ea feyh gA FkA ; s eul cnkj ekpy c'kkl u ea l gk; d ds : lk ea dk; Z djrs FkA bu ea jkBq] o dPNokgla dls c'kkl u l s egROIwz ft tethtj nh x; h bl oak dPNokgla ds eul cnkj la s 3 dls foHku l us dk nloku cuk; k rFk dPNokg oak ds 6 eul cnkj la dls , d gh l e; foHku l uok dk l usknj fu; q; r; fd; k FkA

f)r;h; l oxz ds vlrxz' os LFkkuh; jktk Fk½ tks 'kgh l suk ea 'krfey rls gq; s yfdu mlga eul c ugha fn; s x; s bl ea jkt'gh dckj] t l oku] tke] xq;] unA] Hkook] vej dM] ekoh] gyohn] ukoux] vyhelgu] y[kuq] peikju] mT'tsh;] fx/kq;] MMxij] dckj rFk fo'kuij ds jktk 'krfey Fk½ ftUgla vkr l eizk djrs gq; s 'kgh l ok cklr dA



I kelu; r% buds jkt; I hekoriz l uka ds vlr xz' vkrsgA ch/wh pln dckjk dk jktk Fk] ft l seul c ugha fn; k x; k vq og eqy l ok ea FkA fcgkj ds LFkkuh; jktkvla us' kgh vfk; ku ds l e; fcgkj caky vq mVh k e ae qy ka dh l ok dhA iatic ds LFkkuh; jktkvla us iatic vq d'ehj ea eqy l B; vfk; ku ea l ok dhA tc ; seul cnkj 'kgh l B; l ok ea ugha gkr s Fk rc ; s'kgh 'kkl u ds fy; s O k n j h f n [k u s ds fy; ; o j k t k a r F k v l ; o j ' B e q y v f / d k f j ; l a d s c g e v ; I k e l u d k s i s d ' k d s : l k e a n s F k A

rhl jsl dxZ ea os LFkkuh; tehnik jktk Fk ftUgla us u' kgh l ok ikr dh vq u gh eqy 'kkl u ea eul c ckr fd; A bl Oe ea rrcr & , [k] frccr & , dcyku ekA] dPN] Anj] Mxj ij] o k o k j k j fl j k g h ds LFkkuh; jktk ceq[Fk A o l r r % LFkkuh; jktk rhu l dxZ ea c a s g q s F k & F k e l dxZ ea os LFkkuh; jktk ftUgla us eqy 'kkl u ea eul c ckr d j d s 'kgh l ok dhA

f}rh; l dxZ ea os LFkkuh; jktk ftUgla us' kgh l ok dh o eul c ckr ugha fd; A
rhl jsl dxZ ea os LFkkuh; jktk Fk ftUgla us eul c ckr fd; svq u gh eqy l ok ea x; A

16- jkt i n i a d s y y k v V e l f l e z i j V h d k y x k u k %

eul c 0; oLFk vq l edkyu jktuhr dk , d l k j . k e ; g g y k f d f g l n r k u ds LFkkuh; jktkvla us' kskdj jkti i n i a d s y y k v q e q y j k t o k d s l e c u l k v i l e a d k Q h ' ? k u ' B g k s x ; s D ; k i d b l g a e u l c c n k u d j u s l s i k n ' k g m l k j k t i r k a d s j k t x n a h n y k u s e a l g k ; r k d j r s F k t s i k n ' k g v q m l d h l e h r k e a i n i z l o k f e h k d r j [k A , d k d j u k i n ' k g v i u h l o k p r k d k c r h d e k u r s F k A b l h u h r d s r g r i n ' k g v d c j u s f d l h j k t i r j k t k d h e q ; g k u s i j m l d s m l k j k f / k d k j h d s y y k v V e l f l e z i j V h d k y x k u s d h j e l e v a j e i j k e ' k q d h F k t s c n e a e q y l k e t ; d h , d p p r i j e i j k u x ; h a b l i j e i j k e a e r j k t k j k j e u k u h r m r j k f / k d k j h d s y y k v i j V h d k y x k ; k t r k F k A k f o o l n x l r m r j k f / k d k j h d s e k y s e a v f l o k e u k u h r m l k j k f / k d k j h d h l o k f e h k d r e a l n g g k u s d h l f l k r e a e q y i n ' k g j k j v i u s f o ' o k l i k = 0 ; f d r d s y y k v i j V h d k y x k f n ; k t r k F k t s k f d c h k u s d s j k ; j k t f l e j k j e u k u h r l i j f l e g d s V h d k u y x d j n y i r f l e g d s y y k v i j j k t x n a h d k V h d k y x k ; k x ; k j y d u t c n y i r f l e g e q y l e h r k d k f o j k h g k s x ; k j r c ' k g h l g k ; r k s l i j f l e g d s y y k v i j c h k u s d h j k t x n a h d k V h d k y x k ; k x ; k F k A

17- jkVh; jktRo dh l adYiu k %

ikn'kg vdcj jkjk eul c 0; oLFk yxw d j u s d k l V h d i j . k e ; g f u d y k f d f g l n r k u d s j k t i n i a d s y y k v H k j r h ; e q y e k u l a v Q x k u l A j k f u ; l a v q e ; o r t ; f k ; k e y d s e q y e k u l a d s e u l c n k j c u k d j v d c j , d f l f j v q l n i z t h o h l k e t ; d h l F k i u k d j u s e a l Q y j g k A i k n ' k g d h v i u h e u l c 0 ; o L F k d s r g r e q y c ' k l u e a u l l h h m e j k d s c ' k l f u d n (r k c k r g A) b l s i k n ' k g v d c j d s e q y l k e t ; d h e t o r v k / k j ' k y k [k n k d j u s e a v k l k u h g q h a b l e u l c 0 ; o L F k d s r g r e q y l k e t ; d s c ' k l u e a f o f h k u ' k f d r k ; l a d s , d t k / d j u s e a i k n ' k g v d c j d e g j r g k f y g A D ; k i d i k n ' k g v d c j d h b l u h r u s m p p l r j h ; ; k s k v l a v q f o f h k u e y o k y s v f k t k r o x l a d s m e j k (v e t j k a d s e g r o d s c j k j i j y f n ; k A

ikn'kg vdcj us jkVh; jktRo dh l adYiu ds rgr vius l ket; ea ekud fl Doka d s i k j k f d ; k j f t l s e q n d c . k k y h d k , d h d j . k g y k A b l d k l h / k h c h k o ; g i m k f d f g l n r k u d s n k s H k S k s y d e k u d f o l n g m r j o n f f k . k e a < k y s t k u s o k y s v y x & v y x l f D c s / p k n h l k u s d h t x g , d g h c d j d h e n k d k c p y u g y k v s v d c j d s ' k l u d k y d s v l r r d n f k . k f g l n r k u e a l k u s d s f l D o k a d h t x g p l n h d s f l D o k a d s c p y u u s t i j i d h k v q n f k . k f g l n r k u e a v d c j d s ' k l u d k y d s v k f [k j h o ' k a 1/2 56 & 1605 A - 1/2 e a p l n h d s f l D c s < k y u s d s V d ' k y a d h l e ; k 0 l s < d j 03 g k s x ; k a v d c j d s ' k l u d k y d h

fu" d' V

eqy eul c 0; oLFk vq l edkyu jktuhr 1/2 556 & 1605 A - 1/2 ds rgr in'kg vdcj jkjk fgl n r k u ds LFkkuh; o ' k f d r ' k y h j k t k v a d s e q y e u l c n k j c u k u s l s e q y l k e t ; d s t s e t o r v k / k j l r e h k c n k u f d ; k j m l s e q y l k e t ; d k , d v k / k j l r e h k e q y a d s g k f k j g k j r k m l j k v k / k j l r e h k f g l n r k u ds LFkkuh; o ' k f d r ' k y h j k t k v a u s o k s k d j j k t i r j k t k v a d s g k f k j g k A i k n ' k g v d c j j k j k ; g k d s LFkkuh; jktkvla us' kskdj jkti i n i a d s y y k v f d ; s x ; s o b k f g d l e c u l k v l s e q y l k e t ; d s d j . k g h t g l e c h j o ' k g t g k ; t s o b k o ' k y h i k n ' k g f e y A i k n ' k g v d c j d h b l u h r l s e q y & H k j r h ; l a n f r d k v k / k j l r e h k r s k j g y k j f t l u s v f [k y H k j r h ; c ' k l f u d < k p k d k ; e f d ; k A i k n ' k g v d c j j k j l c d s l k f y d j p y u d h u h r l e y g & , d c y 1/2 o r k s e d [k ' k k l r o l n n h k o 1/2 u h r u s 16 o h a l n h d s f g l n r k u e a l k e l u ; o k r t o j . k r s k j f d ; k j f t l d c k j . k i k n ' k g v d c j d k f o f h k u N k v & N k v s j k t ; l a e a f o h k f t r 16 o h a l n h d s f g l n r k u e a e q y l k e t ; d h e t o r u h o j [k u s d l k f k l k f k ; g k d s y k s l a e a j k V h ; r k d h H k o u k d k l u h r d j u s d k , d l Q y r v x x l e d n e F k A

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1- n h u l u j b f y ; V % Q i d y k j , . M f m l v k ; i k u v k h n j d v k Q n u k f r & o l v c l o u l t v k h b f . M ; k j y l n u l 1869] H k x 2] i " B 359A



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- 8- ogh i"B 105
- 9- fofy; ej bfoL% n vlei vkQ bf.M; u ekyt % cMkx , .M ojhQdskuj tuhy vkw jkwy , f'k; kVd l kd k; Vh vkw caky] dydUk] tyaA] 1896] i"B 51
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A COMPARATIVE STUDY OF VALUES AMONG TEACHER EDUCATORS IN RELATION TO THEIR SELF-CONCEPT

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Abstract

It is the value education which has the capacity to transform a diseased mind into a fresh, innocent, healthy, natural and attentive mind. The transformed mind is capable of higher sensitivity and heightened level of perception. This leads to fulfilment of the evolutionary role in life. The chaotic conditions observed in almost all spheres of our life therefore, today values in our education system are earnestly required. If contemporary education is to be value-based, it can never be done without the teachers themselves understanding, appreciating and upholding the life-sustaining moral values. If one cannot practice these values, one should not dream of teaching as a job. Effective teaching is a mission and vision for life and for prosperity for a nation. A comparative and correlational study was conducted to know values among teacher educators in relation to their self-concept. The population for the present study comprised of teacher educators working in teacher education colleges located in Faridabad district of Haryana state. The sample for the present study consisted of 100 (50 male and 50 female) teacher educators teaching to B.Ed. course in teacher education colleges located in Faridabad district of Haryana state was drawn randomly from ten teacher education colleges. The findings of the study show that there is no significant difference between values of male and female teacher educators at 0.05 level of significance. The number of the male and the female teacher educators differed almost in every level of self-concept, but this difference is very small. A significant correlation was found between self-concept and values of the teacher educators working in teacher education colleges located at Faridabad district of Haryana.

Keywords: Self-concept, Values, Teacher Educators.

INTRODUCTION

Teacher Education plays pivotal role in process of making value based teachers and teachers are the nation builders. A nation can progress if the teachers of that nation are dedicated having high moral value. A teacher's behaviour can make or mar a student's life. In spite of the importance of teachers, they have



their particular place and position in the society. There are various factors, which affect them and in due course affect their work. Such factors are internal and external. Among so many factors, values and self-concept of teacher educators affect their work and effectiveness. Values play an important role in the life of an individual. The values of teacher educators are the chief determinant of their behaviour. Different types of values like theoretical, social, political, aesthetic, religious and economic etc. act as a motivating force in the behaviour of an individual. In the current scenario, education has a pivotal role to play in the economic and social development of any nation. Bearing in mind the importance of education it is the need of the hour to promote values and self-concept of teacher educators which form the concrete foundation for the country's progress.

At present, our education system is largely involved in preparing the younger generation of developing their cognitive domains. But lack of value education has been an important factor in the global scenario of growing violence and terrorism, pollution and ecological imbalances. The gradual experiment research and statistical evidence brought to light the facts that besides, cognitive, affective and environmental aspects of personality self-concept also play a vital role in developing personality of an individual. In the recent years, there has been a growing realization of self-concept for understanding and predicting human behaviour. Without proper understanding of self, the understanding of human behaviour remains incomplete and inaccurate. Self-concept is what an individual thinks of himself which is the core of his personality. The development of a right kind of self-concept is very essential to ensure the development of a right kind of personality. According to **Sarvepalli Radhakrishnan**, vital dynamism, intellectual efficiency and spiritual direction are the three things together constitute the proper aim of education. Moral and spiritual training is an essential part of education. it is said by **Rabindranath Tagore** that, "Education must aim at the development of moral, spiritual and ethical values and we should seek them in our own heritage as well as in other cultures and civilizations it should be such that Indians do not lose sight of their rich heritage – their thought must be rooted to the ideals set forth in the great writings and works of our sages, poets and philosophers, the noble goals and high values set forth in our precious culture must be adhered to".

VALUES

Value literally means something that has a price, something precious, dear and worthwhile. In other words, values are a set of rules and regulations of behaviour. In the words of **Dewey**, "the value means primarily to price, to esteem, to appraise and to estimate". Values are regarded as desirable, important, and held in high esteem by a particular society in which a person



lives. Thus values give meaning and strength to a person's character by occupying a central place in his life. Values reflect one's personal attitudes and judgements, decisions and choices behaviour and relationships, dreams and vision. Values influence our thoughts, feelings and actions which guide us to do the right things. But values may differ from one society to the other.

Value education means inculcating a sense of humanism which teaches us to preserve whatever is good and worthwhile in what was inherited from our culture. It helps us to accept respect, the attitude and behaviour of those who differ from us. Value education does not mean value imposition or indoctrination. Value education helps oneself and one's relation to society that makes one peaceful in his personality and adds peace to the society. According to **Gandhiji**, real education does not consist in packing the brain with information facts and figures, or in passing examinations by reading the prescribed number of books, but by developing the right character.

Value education makes the youth powerful. They contribute a great deal to the national reconstruction and national development. Therefore, **The Education Commission (1964 – 66)** and the **National Policy on Education (NPE – 1986)** stressed the importance of value oriented education in our country. **The Ramamurthy Committee Report (1990)** recommended that the imparting of value education should be an integral part of the entire educational process.

In the article, "Values in the Modern Indian Education Thought" rightly observes: plain living and high thinking is becoming an outdated nation. Increase of one's needs and desires and the efforts to fulfil them all has become the philosophy of life and education in the modern world".

The teacher educators should expose the traditional values and ethics of education through teacher education programmes. They should not confine to their job to a mere matter of completing syllabus and following the curriculum. There should be a platform for teacher educators to deliberate on any sensitive issues or topics as and when the need arises. They should also expose the ideas of accepting modernization, globalization and liberalization from the academic point of view. They should inculcate these values among pupil teachers while imparting their duties for which they are meant. According to Allport (1969), "Anything that yields a satisfaction or provides a mean for such satisfaction is designated as value". In the present study, theoretical, economic, political, social, aesthetic and religious values are taken into consideration.

SELF-CONCEPT

Self-concept is defined as the sum total of person's perceptions about his /her physical, social, temperamental and academic competence. It covers beliefs, convictions and values the person holds. It also includes attitudes of himself or herself as a person, his/her worth, his or her right to have his/ her own feelings



and thoughts and making his /her own decisions (Sood 2006).

Self-concept is the self-image of an individual which he perceives of himself which includes an individual's judgment of his own assets-liabilities, strengths-weaknesses as well as talents and deficiencies which he perceives within himself. Self-concept is the self-perception of one's-own personality structure as a whole. It personifies his self-image as he visualizes himself. With his perspectives and limitations, the self-concept is that what the person thinks what he is regardless of what others think of him that what he is and what he is not. An individual's self-concept is his self-understanding, self-estimation and an assessment of his own personality as a total human being in all possible respects and aspects.

Self-concept is not innate, but is developed or constructed by the individual through interaction with the environment and reflecting on that interaction. This dynamic aspect of self-concept is important because it indicates that it can be modified or changed. Franken (1994). Self-concept is not a substance but a process in which a conversation between the "I" and "ME" takes place. The "ME" is the more or less integrated set of attitudes and ideas of other people which we have built together as our conscious experience and from which we also choose roles to represent our own ideas of ourselves (Uma Devi et al., 1998).

The development of adequate personality has been found to be closely related to the development of adequate self-concept. According to **Lewin**, the self-concept is represented by a life space region which determines present belief about the self. The term "life space" is a psychological concept to be distinguished from physical space. It includes the individual's universe of personal experience as a space in which he moves.

The self-concept has been defined in different ways by different psychologists. A few of them are given below;

James (1950), "A man's self is the sum total of all that he can call his, not only his body and psychic powers, but his clothes and his house, his wife and children his ancestors and friends, his reputation and works, his lands and horses and yacht and bank account.

Sartain et al (1958), "The individual's beliefs about the kind of person he is (and he is not) may be called his self-picture".

Jourard (1963) adds that the self-concept comprises of all the beliefs the individual holds concerning what kind of person he is; i.e. conclusions concerning his modal or typical reaction patterns to typical life situations.

Paderson (1965) defines self-concept as "An organized configuration of perception beliefs, feelings, attitudes and values which the individual view as a part of characteristic of himself.

Saraswat and Gaur (1981) defined self-concept as "The individual's way of



looking at himself. It also signifies his way of thinking, feeling and behaving.

NEED AND SIGNIFICANCE OF THE STUDY

The teacher occupies the pivot role in an effective and efficient education system. In order to inculcate values in the students, the teachers should themselves have natural value fixation/orientation in them. If the teacher's behaviour is value-oriented his power to influence the student increases tremendously towards right direction. Effective and productive learning on the part of the students can be achieved by employing teachers with desirable attitudes, values and beliefs for shaping the behaviour of the students in desired direction.

India has been subjected to lot of transformation as a result of many foreign invasions, many cultural sub groups changed the way of living though and values of India, a glance of political, philosophical, historical, political and social aspects revealed that there was a major shift of values orientation from past to present day.

Self-concept which originally was considered to be the key stone in non-directive counseling by Rogers, is now taken as of major importance in the field of education also, because it is observed that self-concept has close connections with some personal aspects like learning, motivation, attitudes, perception and adjustment which determine the academic and other success of the individual in and out of the school, college or institution. The development of personality is very much linked with the kind of self-concept an individual cherishes. Development of self-concept lays the foundation of personality. Healthy personality growth was defined in terms of the degree of congruence between the real self (what the person really is) and the ideal self (what he aspires to be). Self-concept is considered to be the most significant factor in human life as everyone is continuously striving towards self-actualization, self-realization, and self enhancement and is constantly wishing to avoid self-condemnation and self-lowering experiences. As the self-concept develops it brings with it a unique perspective of viewing one's relationship to one's world. What a person perceives and how he interprets what he perceives is conditioned by his concept of self.

Hence the present study was carried on to study the values of teacher educators in relation to their self-concept. The present study is very important as it examines how a teacher educator performs his/her duty is much dependent on his/her values. In the light of above context, the investigators decided to study values of teacher educators in relation to their self -concept.

STATEMENT OF THE PROBLEM



The title of the study is given as: “A Comparative Study of Values among Teacher Educators in Relation to Their Self-Concept”.

OBJECTIVES OF THE STUDY

1. To study the values of teacher educators.
2. To compare the values of male and female teacher educators.
3. To study the self -concept of teacher educators.
4. To compare the self-concept of male and female teacher educators.
5. To investigate relationship between values and self-concept of teacher educators

HYPOTHESES

In the present study the following null hypothesis had been tested.

1. There exists no significant difference in the values between male and female teacher educators.
2. There is no significant difference between the self-concept of the male and female teacher educators.
3. There is no significant correlation between values and self-concept of teacher educators.

RESEARCH DESIGN

According to Fred Kerlinger (1924), “Research design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and control variances”. Research design set up the framework for the whole study. According to **McMillan (1989)**, the design describes the procedure for conducting the study, including when, from whom and under what condition the data will be obtained. The study is descriptive which is correlational in nature.

Population: The population for the present study comprised of teacher educators working in teacher education colleges located in Faridabad district of Haryana state.

Sample: The sample for the present study consisted of 100 teacher educators teaching to B.Ed. course in in teacher education colleges located in Faridabad district. There was equal number of male and female teacher educators selected by random sampling technique.

TOOLS USED

The tools used in the present study are as given below;

1. Teacher Value Inventory (1994) by Dr. (Mrs.) Harbhajan L. Singh and Dr. S.P. Ahulwalia.



2. The “Self-concept Inventory” developed by Dr. Raj Kumar Saraswat.

STATISTICAL TECHNIQUES EMPLOYED

Mean, Standard Deviation, t-Test and correlation coefficient were calculated for analyzing and interpretation of the data. Pearson’s correlation coefficient was calculated to know relation between value and self-concept of the teacher educators teaching to teacher education colleges.

DELIMITATIONS OF THE STUDY

Due to paucity of time the present study was delimited to;

1. Teachers working in teacher education colleges only.
2. Both male and female teachers working in teacher education colleges.
3. Teacher education colleges located at Faridabad district of Haryana only.

ANALYSIS AND INTERPRETATION OF THE DATA

The data were analysed by calculating Mean, Standard Deviation, t-Test and correlation coefficient as given below;

Comparison of Values between Male and Female Teacher Educators

Table 1 shows the t-ratios of values between male and female teacher Educators as given below;

Group	N	Mean	S.D.	‘t’-ratio	Remarks
Male Teacher Educators	50	23.76	5.47	0.83	Insignificant
Female Teacher Educators	50	24.62	4.91		

The t-ratio between the mean scores of values of male and female teacher educators was calculated to be 0.83 which is statistically not significant at 0.05 and 0.01 level of significance. Thus, it can be concluded that there exists no significant difference between values of male and female teacher educators with respect to their values. Hence, the hypothesis that there is no significant difference between values of male and female teacher educators is accepted. Thus, it can be concluded that the male and female teacher educators do not differ in their total values.

Comparison of Self-concept between Male and Female Teacher Educators

The descriptive statistics i.e. number of teacher educators, the mean and standard deviation of the score of self-concept of teacher educators is given



below. The table-2 also shows the t-ratio between the male and the female teacher educators with respect to their self-concept.

Table 2: Comparison of the Self-Concept between Male and Female Teacher Educators

Variables	N	Mean	S. D.	t-value	Remarks
Male Teacher Educators	50	131.66	55.17	0.16	Insignificant
Female Teacher Educators	50	133.44	52.82		

The calculated t-ratio between scores of self-concept of male and the female teacher educators was found to be 0.16 which is less than 1.96 significant at 0.05 level and 2.59 significant at 0.01 level of significance. Thus, it is concluded that there was no significant difference between self-concept of male and female teacher educators. There is low degree of difference of self-concept between the male and the female teacher Educators. Female teacher educators had a little bit more positive self-concept.

Correlation between Values and Self-Concept of Teacher Educators

Table -3 shows the coefficient of correlation between the self- concept and values of teacher educators.

Table 3: Correlation Between Self – Concept and Values of Teacher Educators

Variables	N	Mean	S. D.	Correlati on coefficient	Remarks
Self-concept	100	132.55	53.74	0.92	Significant
Values	100	24.19	5.19		

The calculated coefficient of correlation (r) between scores of self-concept and values of teacher educators was found to be 0.92 which is significant at 0.05 level and 0.01 level of significance. Thus, it can be concluded that there was significant correlation between self-concept and values of the teacher educators working in teacher education colleges located at Faridabad district of Haryana. So the null hypothesis is rejected.

MAJOR FINDINGS OF THE STUDY

- No significant difference was found between values of male and female teacher educators at 0.05 and 0.01 level of significance.
- The number of the male and the female teacher educators differed almost all levels and all dimensions of self-concept. The results are in accordance with the Taygi and Kaur (2001) who reported that respondents in general have positive self-concept towards themselves.



- There was no significant difference between self-concept of male and female teacher educators located at Faridabad district of Haryana. A slight difference was observed between self-concept of the male and the female teacher educators which is statistically not significant. Female teacher educators had a little bit more positive self-concept.
- A significant correlation was found between self-concept and values of the teacher educators working in teacher education colleges located at Faridabad district of Haryana.
- In the present study female teacher educators had higher Self-concepts which might have made them to feel worth and competent about themselves, whereas male teachers had poor self-concept compared to female teachers which ultimately led to lower values.

CONCLUSION

The findings of the study show that there does not exist a significant relationship between theoretical, economic, aesthetic, social and political values of teacher educators. For religious values male and female teacher educators differ significantly and for other values no significant difference was found between them. The study has provided evidence to show that there is a positive relationship between values and the Self-concept of teacher educators working in Teacher education colleges' in Faridabad. However, the study did not reveal any statistically significant difference between the self-concept of male and female teacher educators of Teacher education colleges. This finding provides evidence to suggest that when both male and female teacher educators are given equal opportunities and support in colleges, both sexes will see themselves as academically capable and competent and will thus strive to work hard to achieve their educational goals. It is very important that teacher educators should express their affectionate nature so that students can feel free to exchange their ideas, view and feelings with them.

SUGGESTIONS FOR FURTHER STUDIES

Based on the findings of the current study, some of the suggestions for further research in the area of values and self-concept are identified as follows:

1. Due to paucity of the time, money and energy, the present study has been confirmed to the teacher educators of Faridabad only. Hence, conclusions drawn from the study are applicable to teachers of teacher education colleges of Faridabad only. The study can be extended at state or national level.
2. Further researches may be taken upon a wider population of in other states or comparing the values and self –concept of government and private colleges' students and teachers in order to make broader generalization



about values and Self-concept.

3. The present study has been conducted on teacher educators. Similar studies may be conducted at different levels of schooling and college.
4. The similar study can be extended to a larger sample and for longer span of time. In the present study the investigator studied only the influence of values on Self-concept and vice versa. Further researches may include other variables like level of aspiration, mental health and academic motivation.
5. Studies may be conducted on specific classroom environment like science, commerce and arts class room environment.
6. A similar study may be undertaken to cover the other age groups/standard of children drawn from the population.

EDUCATIONAL IMPLICATIONS

- The finding of the study supports the view that self-concept correlates positively with values of teacher educators. Individuals with high self-concepts are more likely than those with low self-concept to study hard in order to perform well academically.
- The interaction of teachers should be such that they are intended to encourage, suggest, assure and reinforce students that they are academically capable and can do well if they work harder. These words of encouragement are likely to have an impact on the self-belief of the students making them see themselves as academically competent and capable, and thus strive to study hard in order to perform well academically.
- Gender difference in the self-concept of teachers was not found in the study. Male and female teacher educators had the same level of self-concept. To sustain this level of self-concept in the students, parents, teachers and the society as a whole should see both male and female teacher educators as equal competitors in education and should extend equal attention and opportunities to both sexes.
- Any form of gender bias or stereotype in the education sector that favours any of the sexes should be avoided.

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RESTORATION OF HORTICULTURAL WASTE INTO ORGANIC FERTILIZER BY VERMICOMPOSTING TECHNOLOGY: LOOM FOR SOLID WASTE MANAGEMENT

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Abstract

Horticulture Productions in Bangalore has a unique demand in India. Horticultural waste refers to tree trunks and branches, plant parts and trimmings generated during the maintenance and pruning of trees and plants all over in district. Wastes recycling can bring tremendous benefits to agriculture and land management in long run. The use of earthworms in the degradation of various types of wastes is continuing from the past for so many years. Vermicomposting is a bio-conversion process which is widely being used for solid waste management. In this bio-conversion of horticulture waste process, earthworms feed on the organic waste to produce more cocoons, vermicomposts and vermiwash as product. The process can be completed by 90 days using earthworm *Eudrilus Eugenia*. Vermicompost and vermiwash can be used for all crops as bio-fertilizers. Vermicomposting can be used for solid waste management and the production of bio-fertilizers.

Keywords: Horticulture waste; Earthworm; Vermicompost; Vermiwash; Plant growth;

Introduction:

Administration of Horticulture waste has become one of the biggest problems that we are facing today. Vermicomposting is the better option to tackle with this problem. Vermicomposting is a non-thermophilic, biooxidative process that involves earthworms and associated microbes. Vermicomposting is the process of conversion of organic wastes by earthworms to valuable humus like material which is used as a natural soil conditioner. Vermicomposting is environment



friendly and cost effective technique for solid waste management. Vermicomposting serves two main purposes for the welfare of humans as it helps in the degradation of solid waste and the cast produced during this process is used as a natural fertilizer. Vermicompost is a finely divided, peat like material with high porosity, good aeration, drainage, water holding capacity, microbial activity, and excellent nutrient status and buffering capacity thereby ensuring the required physiochemical characters congenial for soil fertility and plant growth. Vermicompost enhances soil biodiversity by promoting the beneficial microbes which in turn enhances plant growth directly by production of plant growth-regulating hormones and enzymes and indirectly by controlling plant pathogens, nematodes and other pests, thereby enhancing plant health and minimizing the yield loss. Due to its innate biological, biochemical and physiochemical properties, vermicomposts may be used to promote sustainable agriculture and also for the safe management of organic wastes which may otherwise pose serious threat to life and environment. The enhancement of plant growth by vermicomposts may not only be nutritional, but due to its content of biologically active plant growth-influencing substances. Vermicompost plays a major role in improving growth and yield of different field crops, vegetables, flower and fruit crops

Research Methods or Methodology:

A substantial amount of horticultural waste is generated from tree trunks and branches during the pruning process as part of periodic maintenance of trees and plants. Horticultural debris Collected from landscape maintenance contractors. The city does not collect waste that has been cut by private contractors. About 20 metric tons (MT) waste from horticulture generated in the city also ends up dumped unprocessed at the already overflowing landfill. The biomass decomposes gradually thereby steadily releasing nutrients to the soil. The earthworms *Eudrilus Eugenia* were collected from ICAR, Bangalore.

Experimental Procedure:

The experiment was carried with Horticulture waste + cow dung + soil+ Earthworm (*Eudrilus Eugenia* -1 kg). The research were undertaken to study the role of and *Eudrilus Eugenia* respectively on the quality of vermicompost produced. This was studied in terms of various parameters such as pH, EC, moisture content, TOC, TKN and C: N ratio. The effects of vermicompost and vermiwash on various plants have been studied. Vermicompost and vermiwash influence on plants such as marigold and mango Graft has been examined.



Vermicompost Technology:

Horticulture Wastes and *Eisenia Foetida* earthworm species were used for the waste degradation process. Chambers with dimension of 5cm length, 1.5m width and 1.5 m height were constructed for the preparation of compost. The chamber was covered by jute bags. One layer of Horticulture waste were spread over the ground in the chamber followed by soil and then the cow dung slurry equal to 20% weight of biomass was sprinkled. The mixtures were turned over manually everyday for 15 days in order to eliminate volatile substances that are toxic to the earthworms. After 15 days, 1 kg of *Eudrilus Eugenia* earthworms were introduced into Chambers. The moisture content was maintained at 60–76% throughout the study period by periodic sprinkling of adequate quantities of water. Stop watering before one week of harvest. Heap the compost. The material is sieved in 3 mm sieve, the material passed through the sieve is called as vermicompost which is stored in a polythene bags. Cocoons are collected after sieving. Recomposting is done in the same pit or bed. Similar to the above described. For draining of vermiwash a hole was provided which was connected to a tank with PVC pipes in order to use the vermiwash can be utilized as liquid manure. After twelfth weeks the samples were taken and were analyzed of various parameters such as pH, EC, moisture content, TOC, TKN and C: N ratio. The effects of vermicompost and vermiwash on various plants have been studied

Vermiwash:

Vermiwash is a leach ate that is produced during the vermicomposting process and is dark brown in color. It is a collection of excretory and secretory products of earthworms, along with major micronutrients of the soil and soil organic molecules that are useful for plants. It is applied as foliar spray. This is transported to the leaf, shoots and other parts of the plants in the natural ecosystem. It contain various enzymes cocktail of protease, amylase, unease and phosphatase. These are beneficial for growth and development of plant and stimulate the yield and productivity of crops and also microbial study of vermiwash found that nitrogen fixing bacteria like *Azotobacter*, *Agrobacterium* and *Rhizobium* and some phosphate solublizing bacteria are also found in vermiwash.

Benefits of Vermiwash an Effective Biopesticide:

Vermiwash acts as a plant tonic and helps to reduce many plant diseases. A mixture of vermiwash (1litre) with cow urine (1litre) in 10 liters of water acts as biopesticide and liquid manure.



Results:

The pH and EC of samples were recorded by a digital pH meter and conductivity meter, respectively. These values were recorded continuously throughout the experimental period. Total N was estimated by the Kjeldahl method. Total organic carbon was measured by the method of Nelson and Sommer. Total potassium was determined after digesting the sample in diacidic mixture (HNO₃: HClO₄ = 4:1, v/v), by flame photometer (Elica, CL 22 D, Hyderabad, India). Total phosphorus was analyzed using the calorimeter method with molybdenum in sulphuric acid.

Table 1 Physicochemical analysis of Horticulture waste based Vermicompost

S.No	Parameters	Initial value (%)	Vermicompost Values In Percentage (%)
1	PH	7.2	5.8
2	Electrical conductivity(EC)	3.50	3.01
3	Total Kjeldahl Nitrogen (TKN)	0.46	0.57
4	Total Phosphorus (TP)	0.04	0.29
5	Total Potassium (TK)	0.38	0.47
6	Total organic carbon (TOC)	22.3	9.8
7	Carbon Nitrogen Ratio (C:N)	51.6	21.23

Earthworms play an important role in maintaining soil fertility through vermicomposting. In the present study, The lowering of pH due to production of CO₂ which was an acidic gas and when it came in contact with water it might had formed carbonic acid, due to which pH had decreased. Generally there was an important decrease in EC, which is superlative for plant growth. With a low EC, the Organic fertilizers releases the mineral salts gradually, which is adequate for plant escalation. There was a noticeable reduction in the TOC and TOM in the final vermicompost prepared from waste using *Eudrilus Eugenia* and *Eisenia foetida*. It is due to the microbial respiration. The N content percentage increase might instigate from the addition of nitrogen through the earthworm itself in the form of mucus, nitrogenous excretory substance, growth stimulating harmones and enzymes. Phosphorus increased by the closing stages of the process owed to the mineralization of organic matter. Increase in K

possibly due to the direct action of earthworm guts and indirectly by the stimulation of micro flora. Moreover, the Increase in earthworm population might also be attributed to the C: N ratio decreasing with time. Decline of C: N ratio to less than 20 indicates an advanced degree of organic matter stabilization and reflects a satisfactory degree of maturity of organic waste.

Application of Vermicompost & Vermiwash to Crops:

Vermicompost can be used for all crops such as agricultural, horticultural, ornamental, and vegetable etc.

Table 2 General rate of vermicompost application in different crops

crops	Rate
Field crops	3-5 t/ha
Vegetable crops	5-7 t/ha
Fruit crops	3-5 kg/tree
Flower crops	100 g/pot
Nursery bed and lawns	1-2 kg/m ²

But generally, vermicompost is recommended for high value vegetables and fruit crops.



Figure 1: Growth of Marigold Grafts using Organic Fertilizer

Figure 2: Growth of Marigold Grafts using Chemical Fertilizer

Vermicompost plays a major role in improving growth and yield of different field crops, vegetables, flower and fruit crops. Compared to inorganic fertilizer, organic manure is readily available to the farmers and the cost is also

low. Various reports suggested that worm worked waste and their excretory products can induce excellent plant growth (Kaur et al, 2015). It is a well known fact that organic fertilizers provide nutrients to the plants in adequate amount for optimum growth of plant and may increase the uptake of nutrients, assimilation capacity and the hormonal activity. As for plant growth, vermicompost helps to speed up the growth cycle right from germination leading to increased yield.



Figure 3: Growth of Mango Grafts using Organic Fertilizer



Figure 4: Growth of Mango Grafts using Chemical Fertilizer

This study showed that increases in growth and yield at low amounts of vermicompost in the potting medium could probably be due to improvement in the physicochemical Properties of the container medium, increase in enzymatic activity, increases in microbial multiplicity and activity, nutritional factors and plant growth regulators.



Figure 5: Growth of Brinjal as Potted plant using Vermicompost as a fertilizer

Discussion:

It is completed that Eudrilus Eugenia is more efficient in bioconversion of horticultural waste into nutrient rich vermicomposts. Worm castings, which are product from vermicomposting, also hold moisture better than plain soil and contain worm mucus which allows for the prevention of nutrients being washed away at first watering. In this way both the purpose of improved indoor climate as well as organic farming is achieved. Thus, Vermicomposting was proved to be a better technology than that of sole composting. Recycling of Solid Wastes



in to Organic fertilizers using low cost treatment: Vermi-composting (Londhe and Bhosle, 2015). Vermicomposting appears to be the most promising as high value bio-fertilizer which not only increases the plant growth and productivity by nutrient supply but is also cost effective and pollution free. (Nisha Jain, 2016) reported that Effect of vermicomposts on plant growth and its relationship with soil properties. Earthworms feed on the waste and their gut act as the bioreactor where the vermicasts are produced. These vermicasts are also termed VC and are rich in NPK and micronutrients. Vermicompost can be used for all crops agricultural, horticultural, and ornamental and vegetables at any stage of the crop. It will reduce the requirement of more land for disposal of fruits and vegetable wastes in near future. It helps to create better environments, thus reduce ecological risk. (Ravimycin et al., 2016).

Conclusion:

Vermicompost is the best way of disposing waste coming from Horticulture waste. Through this process no chemicals; no any reaction needed to convert these wastes into manure. On analysis of the data the following conclusions were made; the results from the Vermicompost analysis had revealed that the Horticulture waste can be converted into usable form with its nutrient release. The compost which is rich in microorganism enhances the plant growth hormones. This is an eco friendly and cost effective method. It is an ideal method for the management of solid waste. To conclude hold promise to play a significant role in protecting environment as it uses waste as raw material and in building up of soil fertility and improving soil health for sustainable agriculture.

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SMALL TEA GROWERS (STGS): A SOCIOLOGICAL STUDY ON PROBLEMS AND PROSPECTS WITH RELEVANCE TO SIVASAGAR DISTRICT OF ASSAM

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Abstract

This study reveals the small tea growers as a key feature in tea industry of Assam. Assam is the state of India which contribute to economic development of India. Assam is known as miniature of India which identify from diverse culture, race, language and especially introduce from tea production practice. The small tea growers are indirectly product of tea industry. The tea growers try to practice tea production from the followers of the big tea industry. The small tea growers are known as those growers who try to utilize homestead land, economic profit and productive tea quality to selling marketing practice. The small tea growers want to produce quality tea leaves but they face various problems regarding this cultivation practice. The main problems of small tea growers including from land, labourers, tea agent, maharis, tea price, marketing pattern and other activities. Besides various problems in tea cultivation, the small tea growers are seen future opportunities behind this cultivation.

KEY WORDS: Small Tea Growers, problems, prospects, tea industry, production

INTRODUCTION

The identification of tea industry indirectly introduce from small tea growers. The small tea growers are significant key to develop tea industry. The tea agricultural systems are sign from small tea growers. The small tea growers are identifying from Tea Board of India from the expectation tea cultivation practices, which is more than 75 bigha (Ten Hectare). The small tea growers are developed from three reasons- i) fulfill expected target of tea industry, ii) try to create a relationship within international market and iii) quality tea production. After the independence of India, the scenario of small tea growers is uprising in Indian tea cultivation.

The term tea as defined in Tea Act, 1953, tea means the plant *Camellia Sinensis* as well as varieties of the product known commercially as tea made from leaves of the plant *Camellia Sinensis*. The tea seeds include seeds, roots, stumps, cuttings, buds and any living portion of the plant *Camellia Sinensis* that is used to propagate the plant. (Chakravorty 1997:06)

Tea originated in China about 3000 years ago and it was first cultivated in South- East China. The word 'tea' is derived from 't' e' of Chinese Fukien Dialect. (Baruah, 2006: 23) Tea originated in China and it became popular as a beverage in many European countries, particularly in the United Kingdom. Mitra (2010:13) writes that a Chinese emperor ShehNung, accidentally discovered tea in 2737 BC when a leaf of tea drooped into his bowl of hot boiling water while he was in the garden near tea plant. An Arabian Merchant named Soliman travelled to China about 850 A.D and in an account of his travels described the use of tea in that country. (Gordon 1971:20) The East India Company traded tea and imported huge quantities to London for internal consumption in the 17th and 18th century as tea was very popular among the British. (Baruah, 2006:1).

The discovery of indigenous tea in Assam in 1823 led to the origin of the tea industry in India. A local Assamese nobleman ManiramDewan, who later worked in the Assam Company for some time, discovered the tea plant of Assam. India started tea cultivation in 1834 after the Tea Committee of Lord William Bentinck decided to encourage planned cultivation of tea.



Tea is considered an important crop in India. India is the second biggest foreign earner and it exports tea to about 85 countries. The tea as a plantation industry was developed in the British colonial period. The Tea industry is a labour intensive industry because employees (labourers) play a major role in the tea industry.

In India, tea is grown in different regions. Banerjee and Banerjee write that 'The tea grown in different regions of India like Assam, Darjeeling, Tripura, Tamil Nadu, Kerala, Karnataka, Orissa, Nagaland, Meghalaya, Mizoram, Manipur, Sikkim, Arunachal Pradesh, Himachal Pradesh, Bihar and Uttaranchal have a distinct class.' (Banerjee and Banerjee, 2008: 1) Assam is the pioneer of tea production and known as the 'Garden of the Tea World'. (Srigupta, 2009:63) Different types of tea like- Orthodox tea, green tea, instant tea, CTC tea are found in India.

The tea is a significant part of the Indian agricultural system. India is the world's largest producer, consumer and exporter of tea. It is a rurally based agro-industry. "The tea sector of India ... serves as major livelihood opportunities for its countrymen; therefore the role of tea industry is significant" (Das, 2014:1). Out of 4907104 tonnes of tea produced in the world, India produces 1200410 tons (2013), which is about 24.46 per cent of the world tea production. Assam produces about 629050 tones (2013) which are about 52.4 per cent of Indian tea production.

The concept of small tea cultivation came into existence when Kenya in the 1950s had decided to produce tea for export. The Kenyan successful experience had created a model of small tea growers in developing & underdeveloped countries. Since then, there has been a steady shift in tea cultivation from big plantation to smallholdings. (Borah 2013:81)

The origin of Small Tea Cultivation is a recent phenomenon in Indian tea production. It is related to homestead tea garden and agro-based cultivation. The decline of quality tea leaves and production of tea estate sector is the main factor to the development of small tea cultivation in India.

Farmer-based tea cultivation in India started in the 1930s in Nilgiris mainly by Bagada community. (Hayami and Damodarani 2004:5) In Kerala, small tea gardens are concentrated in the districts of Kottayam and Idukki. A majority of small tea gardens in these districts came into existence in 1950. (Ganguli 2013:8) The small tea plantation emerged in the early 1960s in India & these were mainly concentrated in South Indian states of Tamil Nadu, Kerala & Karnataka. (Hayami and Damodarani 2004:5) It was only late 1980's or early 1990's, the cultivation spread to the other tea producing states of India like- Assam & West Bengal. The Government based on Eight Five-Year plan (1992-1997) emphasised on increasing the small cultivation in India. It encouraged landless labourers and unemployed youth to take up tea cultivation in the tea growing areas of India. (Borah: 2013:81) In 1998, the small tea gardens are found in Kangra valley of Himachal Pradesh.

It is significant that the rise of small tea growers in India is primarily due to the failure of the tea industry to meet the expected growth target & decline in demand in international market, quality being one of the factors. (Barua 2015:88)

The small tea cultivation is a new development process in Assam. The advent of Small Tea Growers in Assam started with the small tea plantation carried out in the district of Golaghat in 1986 heralding a new era in plantation history of Assam. In 1978, Someswar Bora, the then minister of Agriculture and co-operative of Assam from Janata party announced freedom to establish tea garden movement in Assam. His pioneering role in encouraging homestead tea growing earned him the title 'Father' of small tea garden in Assam. (Neog 2009:12)

Tea became a farmer's crop, ushering in new avenues for employment. The abundance of uplands, availability of proven agro-technologically skilled labour, established and assured green leaf market, advantages of a long-term plantation crop in comparison to the other seasonal agricultural crops, blessings of suitable soil, climate were some of the factors that encouraged the small and marginal farmers as well as the unemployed to take up tea plantation. The growth of this sector was phenomenal as it assumed a form of socio-economic revolution within a short period



and served as a vehicle of social transformation in the state. It led to the establishment of a large number of tea factories in the small-scale industrial sector, which also opened up employed opportunities in the tea estate. (Neog, 2009:13) It is a new agricultural livelihood opportunity for people of Assam. The small tea cultivation helps begin entrepreneurship of Assam.

Definition of Small Tea Growers (STGs):

Small Tea Growers (STGs) is a significant part of tea production system. A Small Tea Growers, as defined by the Tea Board of India, is one whose holding does not exceed ten hectares. (Reddy and Bhowmik, 1989:145) The Government of Assam considers only those growers as small tea growers with a maximum tea holding size at 30 bighas(4.0 hectare). (Neog, 2009:13) Production of Small Tea Growers of Assam is estimated at 220168 tones (2013) which are around 35 per cent of the total tea production of Assam. (Barbora 2014:181) A small grower is the owner and worker of their small tea garden. The growers try to produce green tea leaves, manufacturing and selling their green tea leaves.

The small tea cultivation is identified from the structure of small tea growers, labourers, middleman (tea agent) and maharis (supervisor). The labourers, middleman and maharis are connected to help the growers indifferent activities such as- plucking green tea leaves, cleaning the garden, spraying the garden, cutting waste leaves, transportation facilities and selling green tea leaves. The maharis roles are found to help the small tea growers who are unable to maintain tea garden from them.

The small tea growers in Sivasagar district of Assam are help to inclusive development of small tea cultivation. The Sivasagar district is significant to characterized third position regarding Gross Value Output of tea cultivation in Assam. The present study reveals the problems of small tea growers in Sivasagar district of Assam. The future opportunities is finding regarding small tea cultivation practice in Assam, which is important to from sociological viewpoint.

This study mainly focus on small tea growers which taken an important role in tea cultivation practices in Assam. The small tea growers face lots of problem in small tea cultivation which is important to know from sociological perspective. This study concerned on prospects of small tea cultivation in Assam.

OBJECTIVES OF THE STUDY:

- i. To study the problems of small tea growers in study area
- ii. To highlights prospects of small tea cultivation in Assam

MATEIAL AND METHODS

This study tries to explore the new data regarding small tea growers from Sivasagar district of Assam. The Sivasagar district is selected for present study because the small tea growers taken major role in tea cultivation. The primary data are help to collect new data, which is possible from interview schedule and observation method. The secondary data is preferred as important material such as- books, journal, newspaper, official document etc. are help to know the resource of small tea growers. The Sivasagar subdivision is selected for study which significant contributor of tea cultivation in Sivasagar district. The purposive sampling is use for collecting new data. Total 100 of respondent's are opinion about the challenge of small tea cultivation practices in Assam. Directory of Small Tea Growers (Volume- IV, 2014) mention there is total 10,116 number of registered small tea growers found in Sivasagar district. Therefore, it should be necessary to study on small tea growers in Assam.

ANALYSIS:

Tea is a significant sector of the Indian agricultural system. The tea industry is playing role as an agro based industry in India. The Small Tea Growers are an integral part of the tea industry. The STGs contribute 35 per cent of total production in Assam. The Small Tea Growers of



Sivasagar District plays a significant role in tea production of Assam. The small tea growers face various problems in small tea cultivation.

PROBLEMS OF SMALL TEA GROWERS (STGs):

Problems faced in price of green tea leaves: The fluctuating price of green tea leaves is the main problem of Small Tea Growers in Sivasagar district of Assam. In this study it is found that the average price of green tea leaves is seen a changing nature. Generally, the green tea leaves are plucked from the month of March to December. In these months, the prices of green tea leaves fluctuate season wise. The small tea growers mention that in the month of March to August the price of tea leaves seen at average 17-20 rupees. After the month October to December, the price of green tea leaves falls down to 7-14 rupees. The tea leaves price is not fixed in all plucking times. It hampers the small tea growers in the cultivation system.

Land-related problem: The small tea growers face land-related problems in small tea cultivation. In this study, STGs face problem of no-permitted pattas land, problem for lease land and problem for lack of scientific idea about land use for tea cultivation. In this study, the tea growers are suffering from an interstate dispute of land used. It hampers in the production of small tea cultivation.

Lack of awareness regarding Tea Board of India registration: Lack of awareness regarding the registration of Tea Board of India is another problem of Small Tea Growers in Sivasagar district of Assam. The maximum respondents have lack of awareness regarding the registration of Tea Board of India. It is significant that without the registrations of Tea Board of India, the STGs are not getting different facilities from this institution and other government scheme and policies. Lack of awareness about the registration of Tea Board of India, the STGs is not developing small tea cultivation in a scientific way.

Labourers problem: About the respondents opinion, it reveals that the STGs in Sivasagar district of Assam face certain problems from labourers. It is found that the labourers are creating a problem for lack of interest in work while labourers are highly demanding pay for plucking tea leaves. For excessive drinking habit of the labourers, the small tea growers face problem in small tea cultivation. The scarcity of labourer for tea garden works is another problem face by STGs respondents. It shows that the STGs face problem for the labourers have the habit of taking money in advance for tea leaves plucking. Absenteeism is another problem faced by STGs in Sivasagar district. Due to unskilled workers, the STGs face problem in small tea cultivation.

Middleman (tea agents) problem: Middleman or tea agent is an important part of small tea cultivation. In this study, the small tea growers are face problems from middleman. It is found that the small tea growers are suffering from tea agents for no fixed price of green tea leaves. The cause of theft of green tea leaves is the problem for small tea growers. It shows that STGs face problem from the tea agent for lack of interest in work. On the other hand, STGs respondent face problem from middleman because they are not interested in giving advance pay to the respondents and this respondents face problem for the low price of green tea leaves.

Maharis problem: In this study, the STGs face problems from maharis. It is seen that the STGs face problem for lack of maintaining tea garden. The respondents are face problems for demanding high wages in small tea cultivation. It shows that the STGs are face problems for no regular attendance in work.

Problems faced in oversupply of green tea leaves: In this study, the STGs face problems for an oversupply of green tea leaves. In peak season, the production of tea leaves highly grow. When Bought Leaves Tea Factories (BLTF), tea estate and tea agents refuse to collect oversupply of green tea leaves the STGs face problem for selling tea leaves.

Health problem: The STGs face health-related problem from small tea cultivation. The Small Tea Growers are faced health related problem for lack of proper using pesticide, insecticide in tea garden. The STGs have seen lack of awareness about cultivating an organic method of cultivation.



Lack of awareness about planning and schemes: Lack of awareness among the various schemes and planning for upgrading small tea cultivation the small tea growers are deprived of different facilities. The Tea Board of India and government facilitate various schemes such as- family scheme, group insurance scheme, and Nehru award for student, education scheme, accident insurance, subsidy etc. for small tea growers. It shows that the lack of awareness for the registration of ea Board of India the STGs are not benefited from these facilities.

Lack of awareness for environment conservation: The STGs discuss on environment conservation. It is found that the respondents are found lack of awareness about scientific method of cultivation, the respondent are seen lack of awareness about organic method of cultivation while they face problem for ecological imbalance. Due to environmental degradation, the respondents are faced problem in small tea cultivation.

Financial problem: The STGs in Sivasagar district are faced financial problem. Different problem including-lack of financial support from Tea Board of India, institutional credit, not getting advance pay from tea agent, low price of tea leaves etc. problems are faced by the STGs.

Entrepreneurship problem: During the study, it is found that the entrepreneurship problem is seen behind small tea growers in Sivasagar district. Different problem such as- insufficient capital, problem for weak management, marketing problem, poor infrastructural facilities are major problems related with small tea growers.

Information deficit regarding tea: The Small Tea Growers in Sivasagar district of Assam are face problems for information deficit regarding tea. The tea growers are deprived from different information such as- training, policies, schemes, subsidies and up gradation towards small tea cultivation.

Marketing of green tea leaves: It is found that to sell green tea leaves the STGs are depend on big tea garden, Bought Leaf Tea Factories (BLTF) and tea agents. They have no right to choose for marketing of green tea leaves. Therefore, the STGs are deprived of their market price in tea production. The small tea growers are face problem to market price because a gaping relationship found between producer and buyers. There is no bargaining power of STGs on market price of green tea leaves.

Lack of awareness in chemical using: The Small Tea Growers are not aware to using the chemical. The small tea growers are mainly concerned about quantity tea leaves not quality tea leaves. They are using chemicals directed by sellers and labourers. They are not getting information from Tea Board of India. It hampers on organic tea cultivation. The sustainability of green tea leaves are less found in small tea cultivation.

Problems of Labourers:

The tea is the product of the labourers. The labourers in the tea industry has a vital and significant role in the development and progress of the tea industry. The labourers are faced different problems in small tea cultivation.

The study reveals the types of labourer in small tea cultivation of Sivasagar district. In this study, four types of labourer are found- temporary labourers, permanent labourers, contract labourers and family labourers. The labourers are faced different problems in small tea cultivation. These are-

Low wages for work: It is found that, the labourers in small tea cultivation face main problems for low wages. The average rupees of wages are given 80-150 rupees as daily wages. The labourers are answered that the small tea growers do not give sufficient wages for a labourers. The basic needs of labourers are not fulfilled form minimum wages. The opinion is found that the average rupees of wages are given for male labourer is 150-200 rupees and the female labourer wages are given as 80-150 rupees. The differentiate prices are found between male and female labourers. The labourers are paid low wages in comparison to another sector.

No permanent employment: The labourers in Sivasagar district of Assam face the problem of no permanent employment in small tea cultivation. The small tea growers employ the labourers during only plucking season. A small group of labourers is engaged in peak season. It seen that during the



month of March to November they involve in plucking tea leaves, managing tea garden, spraying pesticide, cleaning the garden and so on other activities. On the other hand, in the months of December to February the small tea growers are not engaged in their work. Therefore, the labourers face problem in permanent settlement.

Lack of bonus facilities: The labourers are opinion that the small tea growers are not interested to give bonus in different festivals and occasion. The big tea garden labourers are paid bonus during festivals and the extra amount in festival time. Lack of bonus facilities the laborers are not interested to work in small tea cultivation.

Poor living condition: The labourers face problem for the poor living condition. The labourers are not able to fulfill the basic needs of daily life due to lack of sufficient wages. The labourers are living in unhygienic condition, low economy and poor socio-economic status which given indirectly dissatisfaction in their work.

Lack of proper facility given: The labourers in the study area face problem for no proper facilities taken in small tea cultivation. The small tea growers are not giving different facilities to labourers. The health benefit, family facilities, food, shelter etc. are not given in small tea cultivation. It is significant that, the Plantation Labour Act, 1951 are not applicable in small tea cultivation. The facilities of Plantation Labour Act, 1951 is not getting by the labourers in small tea cultivation.

Problem face from STGs behavior: The labourers face problem in adjustment from STGs behavior. The dominant roles of STGs create problems for labourers in working time.

Poverty: Poverty is another problem faced by the labourers in Sivasagar district of Assam. The poverty is seen due to lack of fulfillment in minimum needs of life. The absolute poverty concept is related to the labourers of small tea cultivation.

Health Problem: The health problem is important problem of labourers. Due to poor working condition, highly using pesticide, chemicals, unhygienic condition etc. are responsible for the health problem of the labourers. The health related problem like- skin problem, back pain, hypertension, anemia are faced by labourers in small tea cultivation. Women and children of working classes face the nutritional problems. The high using of alcohol is also responsible for health disease.

Lack of health benefit scheme: The small tea growers do not take steps regarding health benefit scheme for laourers. The Plantation labour act, 1951 does not benefit the labourers in small tea cultivation. The maternity benefit, child care, health secure schemes are not taken for labourers in small tea cultivation. The maternity benefit, childcare facilities are not offered in working time.

Gender biasness: The gender biasness problem is faced mainly the women labourers. Regarding income, wages, social behavior, status etc. the women labourer face gender bias problem. The low wages is the main problem faced by women labourer in small tea cultivation.

Educational problem: The educational problem is another problem of labourer. The maximum labourers are seen with low literacy level. They are not interested in education. Sometimes, the labourers are not interested to take education for their children.

Communication problem: Communication problem is another problem of the labourers. The communication process between labourers and small tea growers is not too good. A communication gap is seen between labourers and STGs.

Family problem: The workers of small tea cultivation face family related problem. Some workers do not fulfill the basic needs of family such as- food, shelter, firewood etc. are not fulfilled by some workers. The workers face problems including economic necessities of family members, education problem etc. Sometimes, the spousal conflicts are seen between the workers in small tea cultivation.

Problem faced to maintain of social life: The workers of small tea cultivation face problem to maintain a social life. The labourers are face problem in maintaining their social life. Due to low wages, they are not able to maintain their social life. The labourers are seen isolated from society. Sometimes, the social status problems are also faced the labourers in small tea cultivation.



Uncertainty about their job: The labourers in small tea cultivation face problem of uncertainty about their job. The owners of the small tea cultivation are not giving assurance in working time. The workers participation is seen in the peak season of tea cultivation. The casual workers are working only with the owner's permission. This less assurance about their job is another problem faced by labourers in tea cultivation.

Problem faced in social security: The labourers in small tea cultivation face problem in social security. The labourers are excluded from social security. The economic, social, educational securities are less seen in worker section of small tea cultivation.

Problem faced in life chances: The term life chances refer to the opportunities of individual to improve their quality of life. The labourers face problem to procure goods, inner satisfaction, and fulfill the basic needs of human life. The basic elements of life chances like higher education, health benefits, social position, status, power are seen less getting by labourers in small tea cultivation.

Problems of Middleman (Tea Agents)

The middleman is another important part in small tea cultivation. Middleman engaged in tea business operate as brokers as well as an agent. The middleman helps in selling tea leaves of small tea growers. There are various problem faced by middleman, such as-

Sale low quality tea leaves: The tea agents face problem for sale low quality tea leaves. Sometimes, the small tea growers are selling low- quality tea leaves. When tea agents buy low quality tea leaves from small tea growers, they face problem in selling. The bought leaf tea factories and tea estate refuse to accept low quality tea leaves. The STGs are seen less aware of tea leaves plucking.

Problem in oversupply green leaves: It is significant that, the middleman are selling their tea leaf with an agreement between factories and tea estate. When the brokers oversupply the green tea leaves, the factories refuse to collect this tea leaves. Therefore, the tea agents face problem in oversupply the green tea leaves. The tea agents face problem for lack of storage facility.

Demanding advance pay: The tea agents face problem for demanding advance rupees by Small Tea Growers. The STGs demand advance rupees for maintain garden and other activities. When the STGs highly demand advance rupees, the brokers face problem in there.

Lack of interest from STGs sides: Sometimes the behavior of STGs creates a problem for middleman in the tea business.

Economic problem: The middleman face economic problem in the small tea business. It is seen that due to selling low quality tea leaves, demanding advance rupees by STGs, irregular pay from factories and tea estate etc. middleman face problem in there.

Family problem: The middleman face problem in family maintain. Lack of financial support the tea agents are face family problem.

Communication problem: The tea agents are facing communication problem. The tea agents are the mediator between factories and tea growers. The factories and tea estate give basic knowledge to middleman about tea cultivation. The small tea growers are not interested to communicate with middleman regarding the matter of price of tea leaves, using plant protection code. Therefore, the tea agents face problem for poor communication between STGs and factories.

Uncertainty about their job: The tea agents are working as a contractual activity. The tea agent is selling and buying tea leaves for one or two year agreement between factories and STGs. The tea agents are not permanent in this occupation. It is seen as a dynamic nature.

Problems of Maharis in small tea cultivation

The maharis in small tea cultivation face problems in Sivasagar district. It is found that the maharis face problem for STGs behaviors. The behavior of STGs is not good. It is seen that the respondents face problems for low wages. In small tea cultivation, the STGs are not giving satisfied wages to maharis. For the low wages, maharis are also not interested in work. It is found that respondent's face financial problem and supervisor are not trained from Tea Board and other



government, which creates a problem in management of small tea cultivation. The maharis face problem for improper maintain of families.

PROSPECTS OF SMALL TEA GROWERS

The small tea cultivation is an integral part of the tea industry of Assam. The small tea cultivation takes a role in new way of life in Assam. The Assam land, climate, monsoon season are suitable for tea cultivation. Therefore, the small tea growers are interested homestead tea garden in the rural area. The economic scenario of Assam has been changed from this cultivation. The upgrading nature of small tea cultivation started in Assam after 1978. The homestead tea garden concept helps in rural development of Assam. The agricultural scenario of Assam changes from this cultivation. It gives sustainable livelihood for the young generation. The entrepreneurship natures of rural and urban youth are growing from this cultivation. The financial support is increasing from this cultivation. The small tea growers are integral part of a green revolution in Assam. The Gross Domestic Product (GDP) is increased from this cultivation. The small tea growers in Sivasagar district contribute a significant part in foreign exchange earned through the export system. The small tea cultivation encourage the farmers to utilize unused and investment of their own land. The small tea cultivation encourages benefited small tea grower's families, labourer, middleman, supervisor from this cultivation. The mini industry, micro industry, nursery are growth from this cultivation. The small tea growers of Assam contribute to national income development. The small tea growers help to increase tea with pioneering efforts. The schemes and policies are taken a role in the growth of small tea cultivation in Assam. The small tea growers play role in agro industry in Assam.

The concept of green marketing practices started after liberalization era in India. The green marketing practice is related to phosphate free, recyclable, ozone friendly and eco friendly nature. The small tea grower helps in practices of green marketing. In the liberalization era, the environmental sustainability consciousness started through green marketing practices. The small tea growers cultivate different types of tea habit. There are seen a way of opportunities to channelize the marketing process through green tea cultivation. The small tea cultivation practices are the way for starting environment green consciousness.

Organic small tea cultivation gets the benefit to small tea growers. Organic tea cultivation is related to handmade tea cultivation. The organic tea is related as green tea. A large number of profits are seen from this cultivation. The organic tea cultivation gives opportunities to the foreign export system. The organic tea cultivation is useful for increase antioxidant and soil fertility.

The concept of environmentally friendly is premise focused on the environment, no harm to the environment, and interaction with the environment. It creates a relationship between the environment and nature. The small tea grower is one of the agents of saving eco friendly nature. The small tea grower helps prevent the environment and human health benefit. The small tea growers have taken a small step towards environmental nature. In a rural area, environmental friendly awareness is growing up from small tea cultivation.

The small tea cultivation plays a pivotal role to solve the unemployment problem. The unemployed youth of rural and urban area take the step from this cultivation. Different way like-establishment of mini and micro tea industry, selling tea leaves, tea agent etc. source help to solve the unemployment problem. The unemployed youth of rural and urban area are setting up financial support from this cultivation.

Borah(2011:40) in his article mention entrepreneurship as the process of assembling necessary factors of production consisting on human, physical and human resources and doing in an efficient manner. A successful entrepreneurship aims at the cost management in the production process leading to the profit maximization in the business. It helps to a better outcome of the entrepreneurial ability of a group of local youth. The rural economy is increasing through entrepreneurship development.



Rural development refers to the process of infrastructure development. The small tea cultivation has an impact on the rural economy. The small tea growers help to bring changes in the rural area of Assam. It is seen as a significant contributor to develop rural economy. The socio-economic development of the rural economy is seen from this cultivation.

Drinking the beverage tea has been considered a health promoting habit. Tea plant *Camellia Sinensis* has been cultivated for thousands of years and its leaves have been used for medicinal purposes. Tea is used as a popular beverage worldwide and its ingredients are now finding medicinal benefits. The drinking habit of tea helps to prevent diseases like- cancer, human health, anti diabetic, cardiovascular, heart disease. The organic tea and green tea are beneficial for human health.

The Tea Board of India approves for setting up mini and micro factories. The Tea Board of India gives subsidy for registered small tea growers. It helps to increase quality tea leaves. The Tea Board of India defined micro factories as with capacity up to 200 KGs made tea production per day. The mini factories defined below 500 KGs made tea production per day. The Tea Board certified the small tea growers to set up factories and selling tea leaves. It gives opportunities to improve plucking standards, economic benefit, less transportation. It also gives self-employment opportunities for small tea growers.

The small tea cultivation gets opportunities to practice of two or more crop in the same land. It is a way of poly culture. The mix cropping cultivation includes in small tea cultivation like- battle nut, neem, medicinal trees, coconut tree, mango tree, black peeper are the tree of income opportunities related with small tea cultivation. The multiple cropping systems help to benefit the tea growers from different cropping. The land is also used for growing commercial and market channel. The mixed crops help to get regular income. The small tea cultivation is helpful to grow up multi-crop cultivation in the specific area.

The small tea cultivation helps to channelize the marketing system from own business. The small tea growers give opportunities for developing marketing practice. The small tea growers develop their marketing channel and packing system through own brand. The tea bag, selling green tea, white tea, black tea etc. are the way for packaging and marketing of Assam tea. The Tea Board, Tea Auction centre, Assam Agricultural University are the agent to channelize the business of small tea growers in Assam.

The dimension of empowerment is related to psychological, social, economic and political factors. The small tea cultivation empowered many people in rural area. It provides self-employment opportunities to educated and uneducated youth of the rural and urban area. The economic, social, education empowerment is interrelated with this cultivation. The self -employment opportunities are related to this cultivation. It also gives opportunities in income, training and skill development. The small tea cultivation practices help more than 10,0000 people give opportunities to economic development.

The idea of utilization of unused land is related to small tea cultivation. The small tea cultivation helps to utilize land for tea cultivation. Different types of unused land are used to utilize for this cultivation. The grazing land, wasteland etc. unused land are utilized for economic benefit. The ecological changes are seen from this cultivation. The sustainable land use concept is linked with small tea cultivation.

The small tea growers have taken initial steps to bring green revolution practices in Assam. Green revolution helps to change of agricultural practices. The high yielding practice, goods, modern machinery, irrigation facility, quality production help to change in agricultural production. It helps in economic benefit. The green revolution helps in improving agricultural practices.

Sustainable livelihood refers to the enhancement of people's capacities to secure their own livelihood. It helps to comprise capabilities and activities for a living. It benefits human life and ecological conservation. It helps in economic up- gradation. The poverty eradication is also related with sustainable livelihood. It is a way of capabilities, activities for a means of living. It provides



livelihood opportunities for future generation. The local and global level development is related with this cultivation. Sustainable rural livelihood practices are related to there. The natural capital, economic capital, human capital, social capital strategies are pursuit from livelihood opportunities. The educated youth, ex-service man, unemployed youth have opportunities to start small-scale industry through small tea cultivation. The small tea industry and bought leaf factories are developed from small tea cultivation.

The globalization process gives opportunities to open up the economy with the world economy. The Assam tea occupies a new trend in the international market. The small tea cultivation helps to increase the market of international import and export system. The small tea growers contribute their business to foreign countries. The small tea growers help to create a relationship with foreign companies, foreign market and better production. The small tea growers help to fulfil national and international demand for green tea leaves. The organic tea, black tea production of Assam is seen in a high demand in international market.

The small tea growers play a vital role for the tea market. The tea cultivation practice gives opportunities to develop tea market. The small tea cultivation help to increase market oriented business. The small tea growers are concerned with the market to sell their product.

The small tea cultivation is one of the ways of social change. It helps to change the socio-economic status of growers. The cultivation system helps in better livelihood opportunities, social style, and prestige change. The small tea cultivation helps economic support to growers.

Small tea growers are an agent of socio-economic development in a particular region. The small tea cultivation plays role in the reduction of poverty, employment opportunities. The small tea industry plays vital role in the global economy as well as national economy. The small-scale industry helps to build up financial support. It helps directly as well as indirectly as financial support. The small tea cultivation gives directly as well as indirectly economic benefit to small tea growers. It gives economic support to small tea growers. The financial potentialities are related to this cultivation.

The small tea cultivation gives indirectly an opportunity in educational support. The human resource development scheme had taken by the Tea Board of India for educational support of tea grower's children. It gives better opportunities in educational development. Different schemes like-HRD scheme are taken for students benefit.

The small tea cultivation helps in human development. The social, economic, educational status are changed and developed from this cultivation. It gives income opportunities.

The small tea cultivation helps in structural changes of rural industrialization process. The rural industrialization refers to the acquiring process industry in the rural area. The small tea cultivation is the way of attraction to young generation to grow up industry in the rural area.

The small-scale industry provides income opportunities to build up financial support. It helps directly as well as indirectly financial support.

The small tea of Assam is a way of chances for tourist attraction. The beauty of green tea nature attracts tourists to travel in Assam. The small tea growers help to conserve the environment of Assam. The tourist and foreigners visit to taste different types of tea.

CONCLUSION:

The small tea growers in Sivasagar district of Assam faced certain problems in small tea cultivation practice. The main problems of STGs are seen for no fixed price in green tea leaves. The majority of respondents are not getting sufficient prices for tea leaves. The land related problem such as-pattas problem, lease land, interstate dispute, lack of scientific idea about land use are problems faced by small tea growers. The major land related problem is seen for lack of idea about scientific method of cultivation. The majority of respondents are seen less aware the registration of Tea Board India. Majority of small tea growers faces the labourer problems. The major problem of labourer side is a scarcity of labourer and high demanding price for plucking tea leaves. The middleman problem is faced by STGs for mainly no fixed price rate and the low price given for tea



leaves. On the other hand, the maharis problem is mainly seen for demanding high wages to supervise tea garden.

The small tea growers face problem for an oversupply of green tea leaves, lack of awareness for planning and schemes, environment conservation, financial problem, entrepreneurship problem, chemical using, marketing of tea green tea leaves etc. The health related problem is another problem faced by small tea growers.

Different kind of labourers problem are found like- low wages, no schemes benefit, economic problem, health problem, educational problem, communication problem, problem in family maintain, gender bias problem are faced by labourers in small tea cultivation.

Majority of middleman problem is related with demanding advance pay by STGs, lack of awareness regarding tea leaves plucking etc. Majority of maharis face problem for finance and low wages given by small tea growers.

The small tea cultivation has opportunities for change in the rural scenario of Assam. The future opportunities are reflected in this tea cultivation. The small tea cultivation helps to benefit the tea growers in different way. The future opportunities like- green marketing practice, bio tea cultivation, environment friendly nature help to grow a relationship between men and the environment are seen in small tea cultivation of Assam. The rural development, entrepreneurship development, employment opportunities, for rural and urban youth, education facilities, human development, financial support are related to small tea cultivation. The establishments of mini and micro factories help in a market benefit for young people. The rural industrialization nature is improving from this cultivation. The national income, gross domestic product, tourism industry are developed from this cultivation. The majority of respondents are concerned with the utilization of their unused land, which is important for development of Assam.

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THE LAND RIGHTS QUESTION IN THE POST-1950 FOREST VILLAGES OF ASSAM WITH SPECIAL REFERENCE TO FRA 2006

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Abstract

The year 2006 marked a significant event in the lives of the forest villagers of India, as in that particular year the Scheduled Tribes and Forest Dwellers Act came into existence which is also popularly known as the Forest Rights Act (FRA) 2006. The FRA 2006 came into existence with a significant attempt to undo the historical injustices with the forest communities, to which they were subjected to since colonial time. The FRA 2006 can best be defined as a piece of legislation which has made an attempt to recognize the customary rights of the forest dependent people, who have been residing in the forest lands for generations and still does not poses legal land rights over their land. But saddest thing is that despite the existence of the FRA in India, in many parts of the country the forest villagers are still struggling for getting their land rights. Within this context this research paper brings to light the plights of the inhabitants of the post-1950 forest villages of Assam.

Key Words: Forest Land, Forest Villager, Land Rights, FRA 2006, Jokai Reserve Forest

I. Introduction

The origin of the forest villages in India can be traced back to its colonial era. The forest villages are not the types of forest land like the reserved forest rather they were the administrative category which facilitated the colonial masters in carrying out the forestry work by supplying forest labourers. Thus forest villages can also be defined as hamlets established by the Britishers within the reserved forest area for uninterrupted labour supply for forestry work. Interestingly those colonial established forest villages are still found in many parts of the reserved forest areas of the post independent Indian state but those particular villages have lost their significance which they used to enjoy during the colonial period. It was because, after Independence the forest administration of India turned into less labour intensive. Therefore the needs of labourers for forestry work gradually reduced which ultimately leads to diminishing the significance of the forest villages. At present in India there exists 2,474 number of forest villages amongst which the state of Assam has 499. In case of Assam however some of the forest villages came up in the post 1950 period. Thus along with the colonial established forest villages, Assam has witnessed the emergence of forest villages in the post colonial period also under some special circumstances. The great earthquake which took place in Assam in the year of 1950 resulted into the tragic incidences of flood, soil erosion which ultimately rendered a large number of its people landless. Thus in the 1950s the demand for land by the landless peasants reached a higher level of politicization and it became the core agenda of the legislative debates of Assam Legislative Assembly during that period. It



was estimated that by the end of 1951, there were more than one lakh peasants in Jorhat sub division who had applied for land. Those landless peasants were moving from place to place in search of land and many local leaders were emerged to take initiative in the mobilization of those peasants. Under such conditions the government of Assam came under tremendous pressure to take the policy of distributing land amongst those landless peasants and due to the absence of enough revenue land the reserved forest areas were mainly targeted for resettling those people. As a result many human settlements came up throughout the reserved forest areas of Assam in the form of 'forest villages'. It was estimated that during that particular period 37,290 bighas (approx) of forest land had been distributed amongst the 6,300 landless peasants and this trend of forest land occupation continued till the 1970s without any uniform pattern of land occupation. It must to note here that like the other forest villages of the country, in those lately came up forest villages of Assam also the absence of legal land rights has always been a major burning issue, as it makes their life uncertain and vulnerable to eviction. Therefore the coming of FRA in the year of 2006 has been perceived by those villagers as a major relief in terms of getting their legal land rights. But their journey of getting land rights under the act is seems to be full of hurdles and here the case of non Scheduled Tribe (ST) forest villagers is worse in comparison to their ST counterpart.

II. Historical Background of the FRA 2006

The FRA 2006 in India has had its origin in the large scale eviction campaign which was carried out in the country in May 2002. In 1995, T N Godavarman Thirumulpod filed a PIL in the Supreme Court of India to protect the Nilgris from the deforestation caused by the illegal timber felling. In this case the Supreme Court gave its judgment in the year of 1996 and ordered all the state governments to take measures for checking deforestation in their respective states. In compliance to the judgment of the Supreme Court, the Ministry of Environment & Forest (MoEF) issued an order to all the state governments to evict the post 1980 settlements in the forest areas. This unilateral decision of the MoEF resulted into a brutal eviction campaign in the country. It rendered a large number of forest villagers of India homeless. It was estimated that between 150,000 to 300,000 families were evicted in India during this eviction campaign. Such tragic incident had ultimately resulted into a massive uproar in the country. The political parties also took interest in this issue and made every effort to won the support of the forest villagers.

In May 2004 the Congress led UPA formed the government at the centre and included the issue of the land right of the forest villagers in its common minimum programme. The programme clearly stated that the eviction would be stopped in the country and accordingly the MoEF also issued a letter to all the state governments to stop the eviction process of the forest villagers till their land rights had been settled. But such arrangements were not enough as soon after this order of MoEF, 180 huts were burnt down in Madhya Pradesh in the year of 2005. Therefore under such circumstances the need for drafting a specific bill on the land rights of the forest villagers was greatly realized and accordingly the task of drafting the bill was entrusted upon the Ministry of Tribal Affairs (MoTA) and finally in the year of 2006 the FRA came into existence. It must to note here that, though the FRA 2006 for the first time makes legal arrangement for granting land rights to the forest villagers, but the act is not welcomed by the some sections of the society.



Particularly the wildlife conservationists of the country are more skeptical about this act. During the drafting of the act also, they strongly protested against it. Nevertheless despite facing so many hurdles the FRA 2006 became operative in the country and legal land rights are now distributed under this act. As per the government report the land titles distributed under the FRA 2006 during the period of 2012 -2015 are given in the following table:

Table: Number of the land titles distributed under the FRA 2006 during 2012-2015

Year	No of land rights distributed
2012	12,79,076
2013	14,18,078
2014	15,56,676
2015	16,85,907

*Source: Retrieved from,

<http://pib.nic.in/newsite/printrelease.aspx?relid=123516>, on 1/2/2016

However though the land rights are distributed under the FRA 2006, but it cannot be considered as a triumph for all the forest villagers of the country. Because so far the implementation of the FRA has done till now, it comes to notice that only the tribal forest villagers are given upper hand in getting their land rights under the act. Interestingly the FRA 2006 comprises the rights of both the ST forest dwellers and the non ST forest dwellers (Other Traditional Forest Dwellers), but some of the states like West Bengal, Uttarakhand etc. have continued to push the act as a tribal scheme and so initiated the process to implement the act only in tribal districts. Thus though the FRA 2006 makes an attempt to undo the historical injustices with the forest dwellers, but it seems to be a half hearted approach. The following case study which was carried out in the forest villages of Jokai reserved forest of Assam has thrown light on many conflicting issues relating to FRA which needs serious attention.

III. Land Rights Distribution in the Jokai Forest Villages of Assam under the FRA 2006

The Jokai reserved forest is located 15 kilometer distance from the Dibrugarh town of Assam. This particular reserved forest has attached with a Jokai Botanical Garden. In Jokai reserved forest there are in total six forest villages as per the official record. All of them were established after the great earthquake of Assam in 1950. The detailed information of those six forest villages of Jokai reserved forest area has been given below:

Table: List of the forest villages of Jokai Reserved Forest

Name of the forest villages	Year of constitution of forest Village	Recorded population.
Actrisghoria Kumar forest village	1955	329 Nos



SaitrisghoriaKaibarta forest village	1957	615 Nos
SataisghoriaKaibarta forest Village	1953	568 Nos
NaghoriaKaiborta Forest Village	1958	180 Nos
Baroghoria forest village	Not available	Not available
BisghoriaKachari forest village	1955	212 Nos

***Source:** Government of Assam, report on reserve forest and forest villages.

It must to note here that amongst the six forest villages of Jokai reserved forest the Baroghoria and Bisghoria forest villages are identified as ST forest villages as both of them comprises of ST villagers. On the other side Saitrisghoriakaibarta forest village, Sataisghoriakaibarta forest village and Naghoriakaibarta forest village are mainly comprises of the people belonging to the OTFD community.

Like the other parts of the country in the forest villages of Jokai also the task of distributing land rights to the forest villagers has been taken place under the FRA 2006 and it is the Sub Divisional Level Office (SDLC) of Dibrugarh district which has been authorized to implement the act. As per the information given by the members of the SDLC the procedure of granting the land rights to the inhabitants of the forest villages of Dibrugarh district including the Jokai reserved forest has followed the same process as has been mentioned in the FRA 2006. At first a meeting of Gram Sabha will be convened in a forest village, in which the land rights are going to be distributed. At that meeting Forest Rights Committee (FRC) has been constituted by the villagers of that particular village. The committee will act as a mediator between the villagers and government officials in facilitating the implementation of the Act. After that the people from the circular office will go to that respective village and take measurement of the land of each householder. After that the whole issue will be discussed at the SDLC level. In Dibrugarh district the SDLC comprises the Sub Divisional Level Officer as a chairman, the Welfare Officer as a member secretary, the Assistant Conservator of forest as a member and two other members from any Village Panchayat nearby of those forest villages. After discussion the decision of the SDLC will be sent to the District Level Commission (DLC) which will take the final decision on granting land rights to the forest villagers. The DLC of Dibrugarh district comprises of Deputy Commissioner of Dibrugarh district as a chairman, Project Director of Integrated Tribal Development Programme (ITDP) as a member secretary, Divisional Forest Officer (DFO) of the Dibrugarh district and Panchayat President of any two villages.

Till now in Jokai reserved forest only two forest villages are granted land rights and interestingly those two forest villages are inhabited by the ST people. On the other side the remaining four forest villages which are inhabited by the OTFD community are still far away from getting their land rights under the act. It must to note here that in Dibrugarh district the whole process of granting the land rights has been running under the ITDP project which implies that the act has mainly taken as a tribal development programme and therefore the ST forest villagers are given more preference over the OTFD community. Apart from it the criteria of 75 years of residential proof as enshrined



in the FRA adding more plight to the miserable situation of the OTFD community of Jokai reserved forest areas. Section 2(o) part of the act has defined the OTFD as that community who have been residing in forest land for three generations prior to 13th December, 2005 and dependent on forest land for bona fide livelihood needs. In other words people belonging to the OTFD category have to provide 75 years of residential proof (prior to 13th December, 2005) for claiming land rights in the forest land. But since the forest villages of Jokai came into existence in the post 1950 period, therefore till 2005 those villages have completed only 55 years of settlement. Therefore the non tribal forest villagers of the Jokai reserved forest are disqualified under the Act for claiming the land rights as it has sought for 75 years of residential proof. It makes one thing clear that during the time of framing this particular criterion for the OTFD category, the specific cases of the post 1950 forest villages of Assam did not taken into consideration. Therefore though for the first time FRA 2006 deals with the land rights issue of the forest villagers but it become exclusive with regard to the OTFD community of Jokai reserved forest of Assam.

Conclusion

It seems to be very ironical that the FRA itself mentions about both ST and non ST forest villagers as a claimant to the legal land rights on the forest land but on implementing ground the act has mainly taken as a tribal act. Assam is also not exception to this trend, as here also only the tribal forest villagers are able to getting their land rights and no effort has been taken for granting land rights to the OTFD community. However apart from the non tribal forest villages of Jokai, the situation is more or less same in case of the other non tribal forest villages of Assam also e.g. in Namerireserved forest area only the tribal forest villages namely Dharikati, Eraliloga, Bogijuli and Sotai have got land ownership certificates under the FRA 2006. Thus the implementation of the FRA 2006 in Assam can said to be bias towards the tribal forest villagers like some other parts of the country. Thus as soon as possible such discriminatory attitude towards the non tribal forest villagers of the state should be eliminated and the provision of 75 years of settlement proof needs to be redefined as it bears no relevancy in case of the OTFD community of post 1950 forest villages of Assam.

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DOES PRODUCTIVITY OF WEAVING INDUSTRIES INCREASE? –AN EVIDENCE FROM WEAVING INDUSTRIES OF MISHINGS IN LAKHIMPUR, DHEMAJI AND GOLAGHAT DISTRICTS OF ASSAM

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Abstract

The weaving industries form a major part of composing production, employment and trade in many developing countries. These industries are important in economic and social terms, in the short-run by providing incomes, jobs, especially for women, and foreign currency receipts and in the longrun by providing countries the opportunity for constant economic development in those countries with appropriate policies and institutions to amplify the dynamic effects of weaving. Many academicians and researchers have done lots of work regarding the productivity of these industries by using different methods of estimation of the analysis. This paper attempts to study various literatures regarding the productivity of weaving industries to find out whether the productivity of these industries increase or decrease. The study attempts to review various works on the productivity of weaving industries from various countries of the world, various states of India, various districts of Assam and specially Lakhimpur, Dhemaji and Golaghat districts. As the Mishings are the perfect weavers among the indigenous people of Assam, so the study try to concentrate the performances of weaving industries of the Mishings.

Key words : amplify, dynamic, productivity, literature review, weaving industries.

Introduction:

Nowadays, productivity is an important issue for the industries. In weaving industries, productivity has a great influence on cloth production. It is a big challenge to optimizing the output in this sector. To achieve this goal, the role of the weavers of these industries has a great importance. These have been well recognised in these literatures. The Mishing women of Assam are engaged in weaving industries since time immemorial. The classic uses of designs, unique colour combinations, selection of decorative designs prominently characterize the Mishing clothes. There have been many attempts across the globe to study the productivity of weaving industries and the Mishing weavers, specially women, participation in this sector.

The Mishings are an autochthonous inhabitants of Assam and Arunachal Pradesh. According to 2011 census, the population of Mishing in Assam is 6,80,424. They live 10 districts of Assam, namely, Lakhimpur, Dhemaji, Golaghat, Tinsukia, Sivasagar, Majuli, Charaideo, Sunitpur, Jorhat and Dibrugarh and in the three districts of Arunachal Pradesh. The Mishing women are excellent weavers. They weave variety of cloths in a



year. Nowadays, Mishing clothes are domestically and internationally popular are highly demanded by the people.

There are various works that has been done by many academicians, and researchers regarding the productivity of the weaving industries and the performance of the weavers of mishings by using different methodology, statistical tools etc. This paper attempts to study various analytical tools regarding the productivity of the weaving industries as well as the performances of the weavers through the literature reviews.

Conception of productivity:

In the production process the productivity means ,output per unit of input employed .Productivity can be measured in various ways.In factories ,productivity might be measured based on the number of hours it takes to produce a good and in service industries productivity might be measured based on the income generated by an employee divided by his or her salary.In an organization productivity is the ratio of output and input.

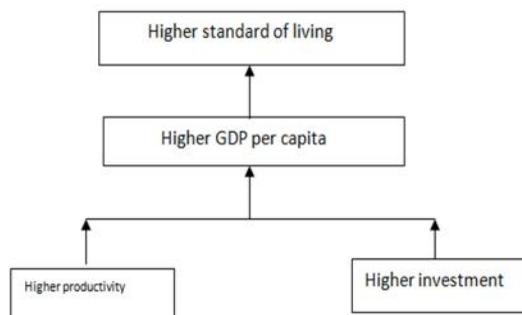
$$\text{Productivity} = \frac{\text{output}}{\text{input}}$$

Where, output is the quantity of production and input is the form of resources.(i.e.land ,wages of labour, prices of capital etc.)

There are various methods of improving productivity.These are:

- (a) Increase output while input remains same.
- (b) Decrease input while output remains same.
- (c) Increase input resulting in a very large increase in output.
- (d) Decrease input by a very large amount with a resultant small reduction in output.

Importance of productivity:



Description of the study:

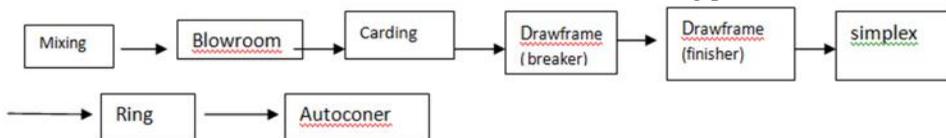
There have been many attempts across the world to study the productivity of weaving industries and the performances of the weavers and some of these are well documented.In this context this paper attempts to review various literatures of the productivity of weaving industries.

Farah Naz1, Hafsa Khan2 and Madeeha Syyed3(2017),in their article “Productivity and Efficiency Analysis of Pakistani Textile Industry using Malmquist Productivity Index Approach ‘ analysed productivity performance of the Pakistan’s textile manufacturing industry using firm-level panel data of a total of 64 firms for the period 2011-2015.



Moreover, the sources of expansion and compression in output are acknowledged for the whole textile industry as well as for the three sub sectors comprising of 35 firms from spinning, 21 from composite and 8 from weaving textile sector. They have evaluated the total factor productivity of the textile sector by using DEA (Data Envelopment Analysis) and also identifying the components which play a significant role in the growth of productivity. According to their study, total factor productivity growth of composite, spinning and weaving textile sectors are not presenting skewed distribution. Moreover, the component of technological change had a negative impact on spinning textile sector and technical efficiency and technological change, both, had a positive impact on the productivity of composite and weaving textile sectors. Finally their study found that, the spinning textile sector has no contribution in the productivity growth. This study also contributed information to the decision makers and policy makers about the allocation, acquisition and anticipation of the resources.

Muhammad Asif Umar Javed Jarral (2010), Masters in Applied Textile Management at Swedish school of textiles, in his book, "To study how to improve the productivity of yarn and fabric production in a production mill", mentioned that, there are many factors by which we can improve productivity. According to them, productivity increases with a variation in a raw material staple length and machine efficiency, which is directly dependent on the staple length of a raw material. This study was based on, the spinning and weaving sector of Pakistan Textile Industry. Both secondary and primary data were collected for this study. This study was conducted, one of the most renowned textile mills in the textile industry of Azad Kashmir, Pakistan, that is situated 18 km from Mirpur on Bang Canal Road Mangla. This mill was established in 1976 by Azad Kashmir Government but later on his rights was undertaken by Mr. Ch. Saeed, chief executive Azad Group of Companies and former President of federation of Pakistan Chambers of Commerce and Industry (FPCCI). In this mill Cotton is processed as Raw Material & wide range of counts are produced normally ranges from 10s to 52s carded. This study was conducted on the basis of Flow Chart of Yarn manufacturing process :



In "Productivity, Technology and Industrial Development"- A Case Study in Textiles, Howard Pack, Published for the World Bank, OXFORD UNIVERSITY PRESS (1987), had its origins in the need to make informed choices about the desirability of proposed industrial projects in developing countries. This book tried to study, various productivity performances of developing countries by using different methods for analysis. In chapter 2, "Technical and Economic Issues in Cotton Textile Production", found that, it is difficult to find out any simple relation between total-factor intensity and the importance of particular goods in the consumption baskets of different income groups. On the other hand, at the same time, the choice of technology, at least in spinning and weaving,



significantly affects the direct employment generated by a given investment. For these Analysis, the researcher used,

(a) Total factor productivity method:

By using, the functional relation, $Q = \frac{R}{T} e$

Where, Q = output per spindle hour for a given count of yarn depending on the speed,

R = at which spindles rotate per minute,

T = the numbers of twists, inserted per inch, and the hourly rate of spindle utilization,

e = known among textile technologists as machine, or spindle, efficiency

(b) Factor substitution:

As breakage rates rise above a desired level, firms may try to maintain spindle efficiency by adding spinners to existing frames, a practice that reduces the time it takes to notice and repair a broken yarn. Hence, achievable levels of efficiency (the percentage of time during which a spindle is spinning) can be calculated from standard machine interference tables; they depend on the number of end breaks, b , the machine-worker ratio, k , patrol speed, p (the time it takes the spinner to walk around the set of frames he or she is tending), and rest time.

Given the spindle-labour ratio initially adopted, b and p , are the potential level of spindle efficiency that can be calculated.

The relationship between k , b , p , and e grants choices to be made about factor proportions even after a specific type of equipment has been installed.

Hence, the expression for the optimal spindle assignment per worker $(K/L) = k$ that a cost-minimizing firm would choose can be shown to be

$$k = \sqrt{2w/rbp}$$

where w is the hourly wage and r the hourly user cost of a spindle.

(c) The Production Function.:

This discussion can be summarized in a simplified engineering relationship describing the output of the spinning process as

$$Q = A \frac{R}{T} qe, (b, L)$$

Where, Q = output per hour per set of ring frames,

A = set of engineering constants,

R = spindle speed,

T = twists per inch,

e = "normal" efficiency achievable,

b = end breaks per hour

L = quantity of labour

q = measures the impact of all procedures that reduce operating efficiency to less than normal levels.

A. N. M. Masudur Rahman & Md. Ruhul Amin. Ahsanullah University of Science and Technology 141-142, Love Road, Tejgaon I/A, Dhaka-1208, Bangladesh. (2011), in their article, "EFFICIENCY ANALYSIS IN RAPIER LOOM", published in "International Journal of Basic & Applied Sciences IJBAS-IJENS Vol: 11 No: 03" used, various parameters such as weaver's skillness, loom speed, weave structure, pick density and



R.H%, loom allocation per weaver, size take up %, tension on warp etc. to study efficiency of rapier loom .

Their study found that the cost of actual weaving operation in mills with modern preparatory machines and automatic looms about 60%- 65% of the total cost for conversion of yarn into fabric. That means , a small increase in loom shed efficiency via productivity will result in considerable reduction of manufacturing cost and more importantly an increase in efficiency will bring in additional realization on the extra fabric available. Moreover,for a medium size average mill, an increase of 2% in loom shed productivity can increase the annual cash flow by about Tk. Ten lakhs.

For this study ,the researchers used the following materials :

No. of looms used: 20

Weft insertion type: Rapier

Loom type: Flexible rapier.

Loom maker: PROMATECH S.P.A, ITALY.

Loom model: THEMA SUPER EXCEL.

Loom speed: 450-575 r.p.m

Reed width: 66"-67"

Reed space: 64"-65"

Weft Selection 8colors pick with programmable microprocessor.

Shed Formation Electronic dobby (STAUBLI).

Weft Stop Motion Electronic 8 hole weft slide sensor.

Warp Detection Electric dropper pin type with 6 rows.

Let-Off Electronic let-off system ensuring uniform warp beam tension.

Take Up system Electronically controlled.

Weave type: Plain, Twill, and Satin.

Count of yarn: 16 Ne, 20 Ne, 40Ne and 50 Ne combed yarn.

The researcher used loom efficiency method for this study by using the following formula

$$\text{Loom Efficiency (\%)} = \frac{\text{ACTUAL PRODUCTION}}{\text{CALCULATED PRODUCTION}} \times 100$$

Amal S Das, P V Gopinadhan(2016),in their paper, "Productivity Improvement Using Industrial Engineering Tools – Case Study Of a Typical Spinning Mill" published in , International Journal of Engineering Development and Research (www.ijedr.org Volume 4, Issue 3 | ISSN: 2321-9939),

Found that,spinning and weaving mill, under the study faces many issues related to productivity loss. The study identified power failure and worker absenteeism as the major cause for loss of ,Under this study, DMAIC technique was used for productivity increase with why - why analysis in the analysis stage to find out the root causes of losses and Pareto chart was used to plot various factors that affect productivity.

VIRAMBHAI S. ZALA,(2010),in his thesis, "A STUDY OF PRODUCTIVITY AND FINANCIAL EFFICIENCY OF TEXTILE INDUSTRY OF INDIA" SUBMITTED TO SAURASHTRA UNIVERSITY,found that, the overall productivity was improving, so the material, labour and overheads had been utilized efficiently by the company during the period under study. For the study ,the researcher had made for the period of six years from accounting year 2002-03 to 2007-08. Researcher had selected the base year 2002-



03. The various statistical techniques had been used for this study, such as: Chi-square test, index numbers, arithmetic mean, standard deviation, coefficient of variations etc.

Dr. R. KadharMohideen & P. Muthuraju (2016) in their paper, "AN ANALYSIS OF TREND AND GROWTH RATE OF TEXTILE INDUSTRY IN INDIA" published in Shanlax International Journal of Commerce, vol.4, issue 3, ISSN 2320-416 found that, the textile exports show the upward trend after 2002. Textile exports during the period 2006, 2007, 2008 were 19146.04 US\$ million, 22146.78 US\$ million, 21226.34 US\$ million recording a growth of 9.28%, 15.67%, 4.15% as compared to the corresponding period of previous year and during the period April-September 2010 the textile exports were 11264.58 US\$ million. At aggregate level the cultivated area was 77 in 2002-2003 and it has increased to 117, 2011-2012. The production was 136 and it has increased to 325 in 2011-2012 and yield rate per hectare also increased from 302 in 2002-2003 to 496 in 2011-2012. For this analysis, secondary sources of data had been collected from various sources. The study was conducted into some selected states of India from period 2002 to 2012.

Dr. Alok Sen, Tanaya Choudhury, Assam University, Silchar, in their paper, "Present status of traditional handloom industry in Cachar District of Assam" published in PARIPEX - INDIAN JOURNAL OF RESEARCH, Volume : 4 | Issue : 9 | Sept 2015 ISSN - 2250-1991, found that, the position of Cachar in respect of handloom production is deteriorating day by day.

For this section of the study, the researcher presented an overview of handloom in Cachar district based on secondary data. Here in Barak valley this traditional handloom textiles exists and also quite a good number of peoples were engaged with this industry.

Bhabesh Hazarika, Kishor Goswami, in their article, "Micro-entrepreneurship Development in the Handloom Industry: An Empirical Analysis Among the Tribal Women in Assam" analysed

the factors that affect tribal women to own a handloom microenterprise. The study was based on primary data collected at firm level from two major tribes in Assam, namely Bodo and Mishings. The data were collected from five different districts in Assam namely Kokrajhar, Baksa, Udalguri, Lakhimpur and Dhemaji and these districts were selected purposively given the commercial concentration of handloom activities among the tribal people. Where tribal communities were operating handloom businesses. The sample units so defined were interviewed through a semi-structured interview schedule covering various aspects of handloom micro-entrepreneurship during December 2012 to June 2013 and the study employed a multi-stage sampling method. On the basis of the expected utility framework of occupational choice i.e. assuming that the individual 'i' possesses a random utility function from choosing occupation 'j' as mentioned in the following equation:

$$U_{ij} = V_{ij} + e_{ij}$$

Where, (V_{ij}) is the average utility of individual 'i' for any chosen decision given the observed characteristics,

and a random error element (e_{ij}) that measures the deviation from the population mean, they find that, Women involved in weaving activities significantly contribute towards economic development of a nation and with a rural production base, the



handloom industry offers a proper background to analyse the significance of women-owned micro-enterprises towards local economic development. The study revealed that the involvement in the handloom activities helps the tribal women not only taking up the challenge of indulgent and gender inequality but also making them more empowered.

Dr. Amrit Paul, in his paper, "Financial management of Muga silk industry: A study of Lakhimpur district of upper Assam" published in Journal of Modern Management and Entrepreneurship, found that the traditional weaving industries of the study area, required a meagre amount of capital and highly labour intensive and very rewarding business. For this study, he had collected both primary and secondary data from 11000 households of Lakhimpur districts. For analysis the data, he used table, line chart, frequency distribution, mean and chi-square test. This study was carried out from 2011 to 2016.

Sunayana Dutta in her project report, "Livelihood of Mishing Women in the present era: A case study of Dhakuakhana Lakhimpur" submitted in Tata Institute of Social Science, Guwahati (2015), found that weaving was the main source of livelihood of these people. They can earn sufficient amount of income from production of these industries, that helped Mishing women weavers to economically empowered. For this study, she had collected primary data from 3 Mishing villages of Dhakuakhana in Lakhimpur District, in the period from 1st January 2014 to 20th January 2014. The analysis was descriptive in nature.

Conclusion :

From the above literature review, we get a clear picture about the productivity of the weaving industries. Various methods have been used to analyse the productivity of these industries. From various analysis it is seen that productivity, in some cases increases and in some cases decreases. Again, productivity determines not only the economic status of an area but also the economic empowerment of the women weavers, specially tribal women in the study area, so from the above discussion it is clear that, higher the productivity, higher will be the women empowerment and higher economic growth of a nation. So, to improve productivity of weaving industries in the weaker sections of a nation the government should provide necessary facilities to these industries as well as to the weavers.

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A STUDY ON PRE-SCHOOL EDUCATION OF JORHAT DISTRICT

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Abstract

Pre-school is the education programme for those who is not yet eligible for formal education. It is for the child who is below the age of 6 from 3 years of age. The benefit of pre- school education for children is lasted into adulthood. It can be helpful for the child brain development like : 5 rs - read, rhym, reward, relationship. But in our country or state i.e. Assam there is a major challenges regarding pre-school education. It may be due to the illiteracy of parents or negative attitude of parents towards pre-school education. Here in this present study the researcher want to identify attitude of parents towards pre-school education and the facilities, problems and practices done by the pre-school education institution. The targeted population in this study included 4 pre-school education institution 10 parents and 8 employees of Jorhat district of Titabor.

1.1.INTRODUCTION :

In India the formal education system is divided into four stages i.e. pre-primary , primary , secondary and higher education. The primary and secondary stages of education isthe doorstep or entry step of higher education, and is important for the society for ending the poverty and boosting prosperity. As the higher education which provides certificates, diplomas or degrees and helps to getting an establishment. In pre-school education there is no any kind of such benefits for getting this. The elementary education is compulsory and free for the children from the age group of 6 years up-to 14 years of age. But in pre-school there is no such benefits as the elementary and higher education do. Instead of this the pre-school education can helps a child in developing brain, and the development of cognitive, emotional and socialization.Also for the physically challenged children the pre-school can greatly beneficial. In India according to the 2011 census data, there are 164.48 million children of 0-6 years of age. So for the healthy and sound mental development it is needed



to provide them the quality pre- school education. Thus recognising the need of the pre-school education a number of constitutional and policy provision have been made such as 86th constitutional amendment which is introduced in article 21A on the right to free and compulsory education for the children age group of 6-14 years of age. And article 45 to urge the state to provide pre-school education for all the children until they complete their age 6 years.

Although the pre-school education is not recognised as a compulsory provision by Right to Education, but RTE urges state to provide free pre-school education for children below age 6 years. The 12th five year plan acknowledge the importance of pre-school education and improving school preparedness.

The government of India approved the national early childhood education or pre-school education policy and also includes three national curriculum framework and quality of pre-school education. The nodal department of Ministry of women and child development is responsible for integrated child development services programme covering the 1.4 million Anganwadicentres. The ICDS programme includes package of services such as supplementary nutrition, immunisation, health check-up, nutrition, health and referral services. Despite the recognition of the importance of the pre-school education by the govt of India ,the challenges in implementation is still remain. There are still sustainable numbers of children are not enrolled in pre-school of India. Some studies related to the learning assessment also showed that literacy skills are poor in early primary grades. There are many reasons such as lack of proper trained professionals, proper facilities and somehow the lack of literacy and negative attitudes of parents towards pre-school.

1.2. CONCEPT OF PRE-SCHOOL EDUCATION:

It is an educational institution for the child who are too young for formal education. Pre-school education is the school for children who are between the age group of 3 to 6 years of age. Pre-school is also called an early childhood care and education programme in which children combine learning with play in a programme run by professionally trained teachers. The term pre-school education includes two types of education such as government and private run pre- school education system. Anganwadi pre-school education is run by the govt and the kindergarten, nursery school may run by the private organisation.

1.3. BRIEF DESCRIPTION OF THE JORHAT DISTRICT :

Jorhat is an administrative district of Assam, which is situated in the central part of the Brahmaputra valley. The district is bounded by Lakhimpur district on north , Nagaland state on the south, sibsagar on the east and Golaghat on the west. The district occupied an area of 2,851 square kilometres (Wikipedia). There are six legislative assembly constituencies i.e Jorhat, Teok, Mariani,



Titabor, Dergoan and Majuli. According to 2011 census the total literacy rate of the district is 83.42% of the total population. Earlier there are three (3) sub divisions i.e. Jorhat, Titabor, Majuli but now Majuli is declared as a separate district of Assam.

1.4. NEED AND SIGNIFICANCE OF THE STUDY :

Pre-school education for children is necessary now a days for sound physical and mental health and all round development of children. But for this India is still relatively a young place in terms of play school/ pre-school.

Pre-school education is now considered as beneficial for child's scholastic and non scholastic success. At pre-school they became introduced to numbers, colours, shapes and learn to pray and most importantly known to communicate with others. Child's brain development is highest during the first four years of life. They can learn the basic capabilities that prepare them for the future success in school and life. And most importantly prepare them to get ready for primary education. For these a good programme of pre-school with necessary equipments and professionally trained teachers are required. Which is lacked in our locality. In our society most of parents considered that the pre-school education is the official start of their child's education, instead of some other parents may denied that the pre-school education is for only the financially well-off families concern. Thus it is necessary to study the pre-school education .

1.5. OBJECTIVES OF THE STUDY:

- 1.5.1. To study the facilities provided by the pre-school of Jorhat District.
- 1.5.2. To identify the current practices of pre-school education of Jorhat District.
- 1.5.3. To examine the problems of pre-school education of Jorhat District.
- 1.5.4. To compare the facilities of govt and private pre-school education of Jorhat District.
- 1.5.5. To study the teaching methods using by the pre-school teachers of Jorhat District.
- 1.5.6. To study the attitude of parents towards pre-school education of Jorhat District.

2.1. METHODS AND PROCEDURE :

The descriptive methods is used for the present study. The interview schedule and observation method is also used for the present study.

3.1. SAMPLE OF THE PRESENT STUDY :



For the present study the 4 pre-schools of Jorhat District is used through using the purposive sampling technique.

TABLE -THE SAMPLE OF THE PRESENT STUDY .

SL.NO	NAME OF THE PRE-SCHOOL CENTRE	MALE	FEMALE	TOTAL
1	275 Baliyan 'B' (AWC)	2	3	5
2	90 Na-chungi AWC	3	5	8
3	282 No, Ujani Gajpuria AWC.	13	1	14
4	Holy Heart pre-school.			
	TOTAL	18	9	27

4.1. TOOLS USED IN THE PRESENT STUDY :

In the present study researcher used a self made questionnaire and interview schedule for the teachers and parents, and also the observation method is used for collection of the data.

5.1. ANALYSIS AND INTERPRETATION OF DATA :

Objective no 1: To Study the facilities provided by the pre-school of Jorhat District.

There are no any basic facilities such as drinking water and toilet facilities are provided in the govt undertaking pre-school centre.

The playing equipments are very limited such as ball and toys. The over all infrastructure of the pre-school centre is not good.

Objective no 2: To identify the current practices done by the pre-school education centre of Jorhat District.

The above mentioned pre-school education centre is started from the morning 8 a.m to the 12 p.m. The workers and helper were teach them with playing by doing. To taught them drawing, Storytelling, and taught them the colour with the help of different colouring chart. In between that the meal for the children were provided.

Objective 3 : To examine the problems faced by the pre-school education centre of Jorhat District.

The majority of the govt pre-school education centres the entire building condition is not good. Problems related to the playing equipments .there are very limited playing equipments for the children.

No any toilet facilities and drinking water facilities provided in govt under taking pre-school education centre.



Problems related to lack of community participation. The parents of the children study in pre-school education centre is not aware and interested to send their children in to the centre.

Objective 4 : To compare the facilities provided between private and govt under taking pre-school education centre.

In the govt under taking pre-school education centre there are no any drinking water facility on the other hand in the private under taking pre-school education centre there are a water filtration facility. In the govt pre-school education centre there are no any sufficient playing equipments such as- bal and toys,instead in the private under taking pre-school education centre there are enough playing equipments such as- skipping, ball, toys, colourful artificial fruits, charts, colouring pencils and different types of outdoor playing instruments like- kids cycle, baby swings etc.

Objective 5 : To study the teaching methods using by the private and govt under taking pre-school education centre.

The govt pre-school education centre using the playing by doing methods, taught them to draw, teach them storytelling etc.

On the other hand in the private under taking pre-school education centre the teacher adopt playing by doing method, to draw different things, teach them the different colour through their lunch box, i.e. the private undertaking pre-school education centre authority ordered children's parents to provide different colour of food in their lunch box. For example to teach the colour of red the authority may tell the parents to provide red food like- apple, cherry and anything else related to the colour red. They provide proper toilet training to the children. To developed the cooperation among the child they give some group activity such as playing in a group wise.

Objective 6 : To study the attitude of parents towards the pre-school education. Most of the parents of govt undertaking pre-school education centre can't agree to send their child daily into the pre-school centre. On the other hand among the private under taking pre-school centre majority of the parents are agree to send their children to pre-school centre everyday.

Majority of the parents thought that pre-school education can't help for the child motor development, skill and social and emotional development. Most of them send their children to pre-school for their day care and due to their daily work and due to their job purpose.

6.1. MAJOR FINDINGS OF THE STUDY :

1. Each of the govt pre-school education centre is managed by two employees. One is worker and another is helper.
2. The pre-school education institution is started from 8 am to 12 pm in the working days.



3. The govt workers and employees get the training separately.
4. The workers get Job training, refresher training and Integrated Management of new born and childhood illness(IMNCI) training. The IMNCI training is organised for 8 days. The refresher training is for worker is organised for 7 days.
5. The helper of govt pre-school education get training of cleanliness and feeding training.
6. The workers and helper of govt pre-school education can used different kind of techniques and methods to teach the children. Such as for their motor skill development and mental health development they can use story telling between them. Taught them to some local play for their physical development.
7. The govt provided the playing equipments to the govt pre-school. Such as : balls, skipping, toys etc.
8. Tor the govt pre-school the food is provided. Such as : Rice, Arti food (packaging food), etc. Here the children which age is between 3 -6 years is allowed for food in the pre-school education institution. The govt pre-school can provided the child for making food such as khisri, Dalia, boil egg etc.
9. The attitude of parents in govt pre-school education is very low towards pre-school education. Their children are very irregular to the govt pre-school education centre. Most of the parents in govt undertaking pre-school education centre were illiterate.

CONCLUSION :

From the above discussion regarding the pre-school education of Jorhat District , it can be concluded that the overall condition of government pre-school education is not good enough. There is no any kind of drinking water facilities in the pre-school education institution. The rate of enrolment is less and children are absent most of the working days. The playing equipments are not enough for their motor skill and physical development. Very few govt pre-school education institution have average infrastructure facilities. The positive attitude towards pre-school education is very less among most of the parents. It also reveals that the private pre-school have good infrastructure facilities then the govt pre-school education institution. The parents of private pre-school is aware about their child pre-school education in compare to the govt pre-school institution.

The term pre-school education is not compulsory for entry into the further educational stage but it can be beneficial for the whole life for a sound mental health and adjustment to the elementary stage. Thus the organisation related to the pre-school education system should provide sufficient fund and facilities to develop the condition of pre-school education institution. Some awareness



programme is also necessary for the rural areas towards the benefit and necessity of the pre-school education.

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FUZZY CONTROLLER BASED VIRTUAL INERTIA AND SMALL SIGNAL STABILITY ANALYSIS OF DC MICRO GRID

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Abstract-

In this paper we use power converters to control the inertia occurred in the wind energy system which shows the effect on the DCmicrogrid. Among many controlling methods the change rate of the DC voltage is very fast under power variation. In this study, a distributed virtual inertia control is proposed to enhance the inertia of the DCmicro grid and decrease the change rate of the DC voltage. The kinetic energy in the rotor of the permanent magnet synchronous generators (PMSG)-based wind turbine, the energy stored in batteries and the energy from the utility grid is used to improve the inertia in the DCmicrogrid. By introducing a virtual inertia control coefficient, a general expression of the inertial power provided by each controllable power sources is defined. The proposed inertia control is simply a first-order inertia loop and is implemented in the grid-connected converter, the battery interfaced converter and the PMSG interfaced converter, respectively.

The small-signal model of the DCmicro-grid with the proposed inertia control is established. Finally, a typical DCmicrogrid is built and simulated in Mat Lab/Simulink, and the effectiveness of the proposed control strategy and correctness of the stability analysis are verified.

Index Terms-DC Micro-grid; Virtual inertia; Battery storage; fuzzy control; Small signal stability.

I. Introduction

With the increasingly serious problems of energy shortage and environmental pollution, renewable energy has attracted more and more concerns. As an effective way to integrate the distributed renewable energy sources, microgrids have been widely developed. Microgrids can be generalised as ac and DCmicrogrids. Compared to ac microgrids which require multiple ac/DC and DC/ac conversions, DCmicrogrids have higher efficiency and reliability. Therefore, they have great potential in applications such as future building electrical systems, data centres, and plug-in hybrid electric vehicles [1, 2]. Distributed energy resources (DER), such as wind, solar photovoltaic, and energy storage units, are usually connected to the DCmicrogrid through fast-response power electronic converters. Under the classic control strategy of the interface converters [3, 4], the kinetic energy stored in the rotor of permanent magnet synchronous generators (PMSG)-based wind turbines and the energy stored in energy storage units cannot be used to slow down the dynamics of DC voltage. In the event of load switching or output fluctuations of intermittent DERs, dynamic support to the DC voltage can only be provided by DC capacitors [5]. As a result, the DC voltage will fluctuate drastically and the stability of the DCmicrogrid will be reduced [6]. To address the low inertia issue of DCmicrogrids, several solutions have been proposed. Since the inertia of DCmicrogrids is mainly provided by DC capacitors, one straightforward way to increase the inertia of DCmicrogrids is to adopt larger capacitors. In DCmicrogrids, electrolytic capacitors are usually used as DC capacitors. Due to the disadvantages of electrolytic capacitors, such as bulky volume, low power density and short lifespan, larger DC capacitors are not acceptable for the scale expansion and application of DCmicrogrids. An approach using super-capacitors to improve the inertia of DCmicrogrids is presented in [7]. However, the costs of super capacitors are relatively high. Moreover, when the DCmicrogrid is in the steady-state operation, the super



capacitors are idle, which decreases their performance– price ratio. It is desirable that the enhancement of DCmicrogrid inertia can be achieved through proper control of existing power sources. Voltage source converters (VSCs) have been widely used as interfaces between the DCmicrogrid and the utility grid. Researches about the virtual inertia control of VSCs mainly focus on the frequency regulation of the utility grid or the ACmicrogrid. A well known virtual inertia control strategy is to operate VSCs as virtual synchronous generators (VSGs) [8–13]. VSGs show the same transient characteristics as those of the synchronous generator by emulating its fundamental swing equation. In order to enhance the virtual inertia of DCmicrogrids, a virtual inertia

control strategy of grid-connected VSCs is proposed analogized with VSGs [14]. By introducing virtual inertia control, the grid-connected VSC can quickly extract or inject current from or to the DCmicrogrid to prevent the sudden change of the DC voltage. However, the proposed virtual control can only work when the DCmicrogrid operates in the grid-connected mode. When the DCmicrogrid operates in the islanded mode, the grid-connected VSC is out of service, and the inertia of the DCmicrogrid cannot be improved. Inspired by the VSG techniques, a virtual capacitor control strategy is proposed for DCmicrogrid and applied to the four switches buckboost converter interfacing a lithium-ion battery pack in [15]. However, the dynamic performance of the DC voltage is not desirable. In order to regulate the DC voltage, converters in the DCmicrogrid often adopt power-based or current-based voltage droop control for power sharing [1]. The different operating mode of converters can be coordinated using the DC bus signalling approach [16–18]. A virtual inertia control strategy based on the variable droop coefficient is proposed in [19, 20] to improve the inertia of the DCmicrogrid. In [19], the virtual inertia response is achieved by modifying the droop coefficient of the P–V curve. By introducing an arc-tangent function, the virtual inertia control ensures that the droop curve swings within the allowable range. In [20], a similar virtual inertia control is implemented by modifying the droop coefficient of the admittance-type droop control and is compared with the impedance-type droop control. However, both strategies are not suitable for the wind power generation units; therefore, the rotational kinetic energy of wind turbine cannot have contributed to increasing the inertia of the DCmicrogrid. A virtual inertial control for wind-battery-based islanded DCmicrogrid is proposed . By adding a high-pass filter, the DC

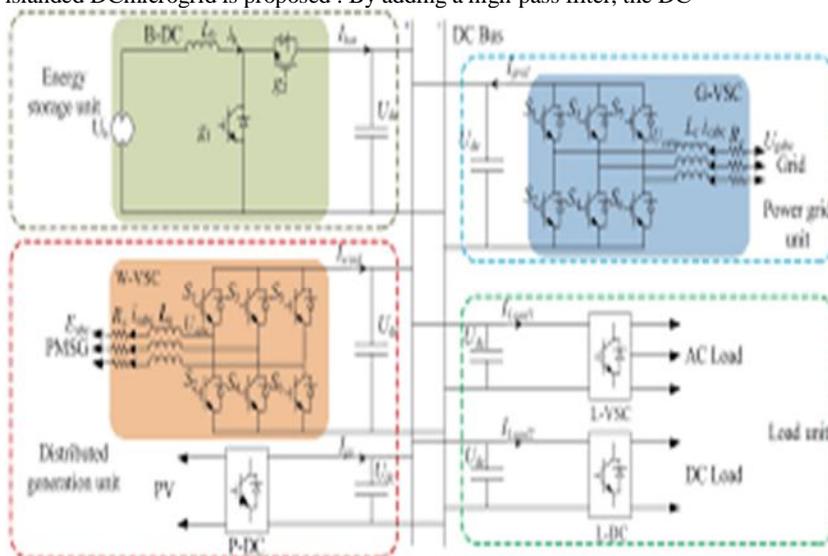


Fig 1:- Schematic diagram of DCmicrogrid



voltage inertia control is introduced to the speed regulation of PMSG-based wind turbine, and the kinetic energy is utilized to supply inertia to the DC microgrid. However, the high-pass filter may bring in high-frequency disturbances and a general inertia control strategy for wind turbines, batteries and utility grid interfaced converters need to be further explored. To address the aforementioned challenges, a general virtual inertia control strategy is proposed and implemented in the wind turbines, batteries and utility grid interfaced converters in this paper. The high-pass filter is replaced by a first-order inertia loop to avoid high-frequency disturbances. The proposed virtual inertia control can improve the inertia of the DC microgrid no matter the DC microgrid is operating at the grid-connected mode or at the islanding mode. The remaining of the paper is organized as follows. The configuration of the DC microgrid is introduced briefly in Section 2. Then the general virtual inertia control is proposed and implemented in Section 3. In Section 4, the small-signal model of the DC microgrid is built. The stability of the DC micro-grid is analyzed, and the range of virtual inertia control coefficient for each converter is determined. Simulations verify the theoretical analysis in Section 5. Finally, some conclusions are given in Section 6.

II. Configuration of DC microgrid

The typical structure of a DC microgrid is depicted in Fig. 1 and the DC bus signaling-based coordination control strategy is adopted for power sharing among converters [18]. The grid-connected converter works as the interface between the DC microgrid and the utility grid. In this paper, the DC microgrid is integrated into the utility grid through a grid side VSC (G-VSC). When the DC microgrid is operating at the grid-connected mode, GVSC maintains the DC voltage in per unit within the range of (0.98, 1.02) according to the V-I droop control. Whereas when the output current of G-VSC reaches its maximum value or faults occur in the utility grid, G-VSC works in the current limiting mode and loses the ability of DC voltage control. The energy storage unit is connected to the DC microgrid through a battery side DC-DC converter (B-DC). When the DC bus voltage in per unit is within the range of (1.02, 1.05) or (0.95, 0.98), which can occur during ac faults, islanding or G-VSC reaching its maximum output, B-DC controls the DC voltage according to V-I droop control. Two kinds of distributed generations are considered in this paper, PMSG-based wind turbine and PV, which are connected to the DC microgrid through a wind power side VSC (W-VSC) and a PV side DC-DC converter (P-DC), respectively. When the DC voltage in per unit is within the range of (0.95, 1.05), W-VSC and P-DC operate under MPPT mode to maximize the utilization of renewable energy power. When the DC voltage exceeds 1.05 p.u. which can occur for high battery state of charge (SOC) conditions, generation curtailment is adapted to maintain the stable operation of the DC microgrid. When the DC voltage is lower than 0.95 p.u., which can occur for low battery SOC conditions, the load unit carries on the load shedding control according to the priority to ensure the power balance and power quality of the important load in the DC microgrid. The load units including ac and DC loads are mainly constant power loads, which are connected to the DC microgrid through a load-side VSC (L-VSC) and a load-side DC-DC converter (L-DC).

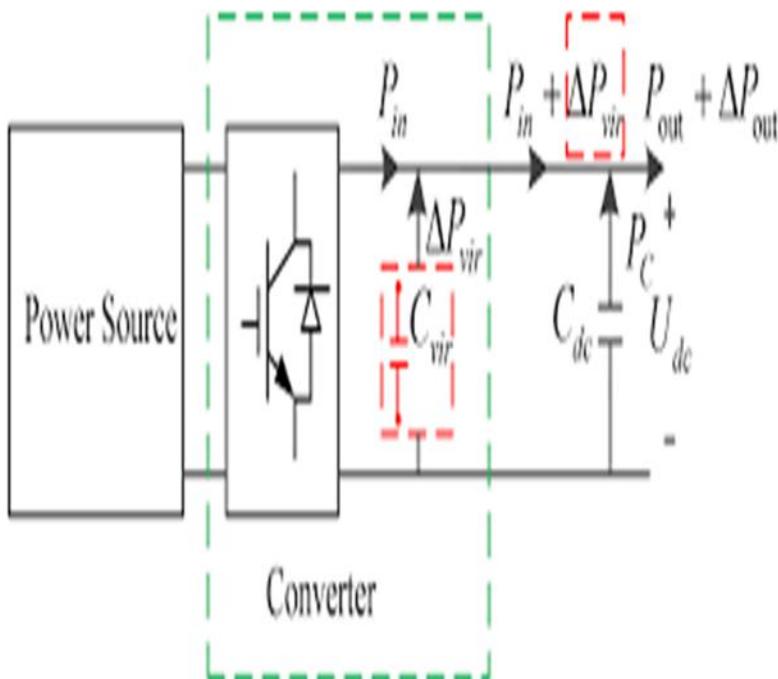


Fig 2: Analysis diagram of DCmicrogrid virtual inertia

III. Virtual inertial control of DCmicrogrid

i. Virtual inertial analysis of DCmicrogrid:

A general schematic diagram of power sources connected to the DCmicrogrid through a power converter is shown in Fig. 2. According to Fig. 2, with no power change in the DCmicrogrid and no additional control added to the converter, the active power balance at the DC link can be expressed as

$$P_{out} - P_{in} = C_{DC} U_{DC} \frac{dU_{DC}}{dt}$$

where P_{in} is the active power output from the converter; P_{out} is the active power injected into the DCmicrogrid; u_{DC} is the DC bus voltage; C_{DC} is the DC capacitor. When the DCmicrogrid operates in a steady state, the DC voltage maintains constant, $P_{in} = P_{out}$. Suppose that P_{out} changes by ΔP_{out} , the unbalanced power will cause C_{DC} to discharge or charge to reduce the change rate of the DC voltage. Limited by the actual capacity of C_{DC} , the inertia of the DCmicrogrid is small, and the DC voltage will fluctuate drastically. However, the controllable power source connected to the converter, such as wind turbine, battery or utility grid, has the ability to provide additional power to decrease the change rate of the DC voltage under an additional inertia control. As shown in Fig. 2, assuming that the inertia power provided to the DCmicrogrid by the controllable power source in the event of a sudden power change can be expressed by ΔP_{vir} . Hence the power balance at the DC link can be expressed as follows:

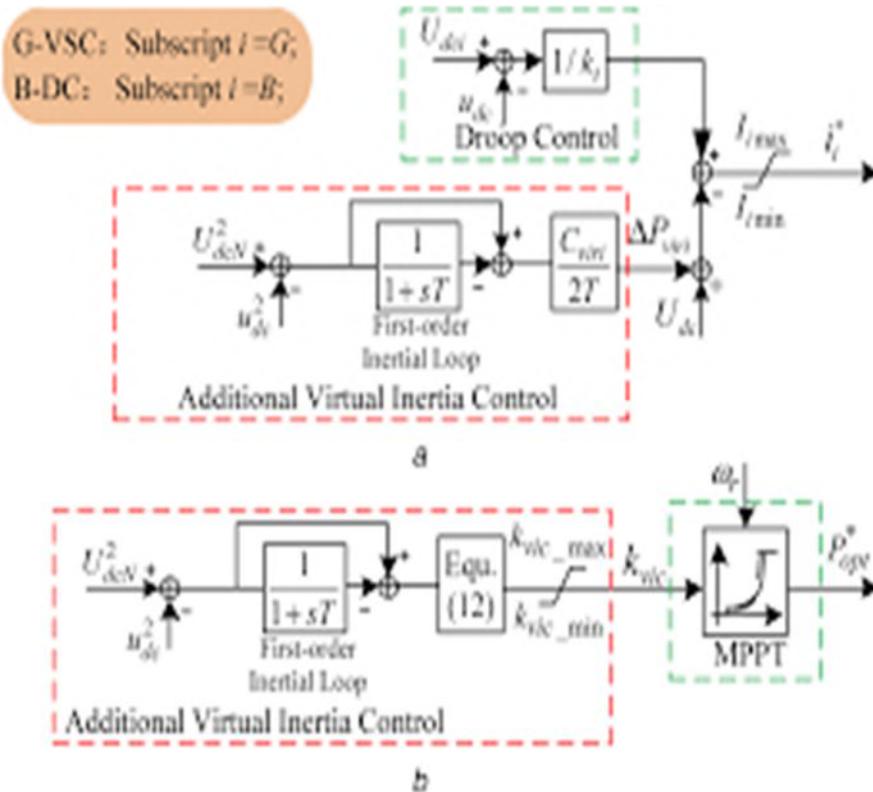
$$\Delta P_{out} = \Delta P_{vir} + C_{DC} U_{DC} \frac{dU_{DC}}{dt}$$

As can be seen from (2), ΔP_{out} can be balanced by ΔP_{vir} and the discharge power of capacitor C_{DC} . Since ΔP_{vir} is able to take on most unbalanced power, the discharge power of capacitor



CDC will be reduced, i.e. for the same ΔP_{out} , the change rate of the DC voltage can be reduced and the inertia of the DCmicrogrid is improved.

Since ΔP_{vir} can improve the inertia of the DCmicrogrid, which is mainly provided by the DC capacitor, by emulating the expression of the discharge power of capacitor CDC, ΔP_{vir} can be defined as follows:



Block diagram of virtual inertia control for G-VSC/B-DC and WVSC
 (a) Virtual inertia control for G-VSC/B-DC, (b) Virtual inertia control W-VSC

$$\Delta P_{vir} = C_{vir} u_{DC} \frac{du_{DC}}{dt}$$

where C_{vir} is the virtual inertia control coefficient of the converter and can be considered as a virtual capacitor. According to (3), ΔP_{vir} can be reasonably adjusted by changing C_{vir} , and thereby the inertia of the DCmicrogrid can be regulated.

Substituting (3) into (2) yields

$$\begin{aligned} \Delta P_{out} &= CDCu_{DC} \frac{du_{DC}}{dt} + C_{vir} u_{DC} \frac{du_{DC}}{dt} \\ &= CDC + C_{vir} u_{DC} \frac{du_{DC}}{dt} \end{aligned}$$



It can be seen from (4) that the impact of the inertia power ΔP_{vir} on the DC microgrid can be considered as adding a virtual capacitor C_{vir} parallel with CDC, as the red dash line block shown in Fig. 2. Increasing the virtual inertia coefficient C_{vir} may reduce the demands of the actual capacitor capacity in the DC microgrid, which is beneficial to the operation of DC microgrid.

3.2 Virtual inertia control of DC microgrid

Considering the potential inertia of rotating equipment and energy storage equipment, the virtual inertia control for G-VSC, W-VSC and B-DC are presented as follows.

3.2.1 Virtual inertia control for G-VSC:

As a large power source, the utility grid has the ability to provide inertia power quickly under the maximum allowable capacity of the grid-connected converter. According to (3), the inertia power can be obtained by differentiating the DC voltage. However, signals are easily interfered due to the high sensitivity of the differential element to high-frequency interference in the input signal. Therefore, the first order inertial loop is adapted to replace the differential loop in this paper.

Integrating (3), the following expression can be obtained:

$$\int \Delta P_{vir} G dt = \frac{1}{2} * C_{vir} G (u_{DC}^2 - u_{DC0}^2) \quad (5)$$

where u_{DC0} is the DC bus voltage of the previous sample, $C_{vir} G$ is the virtual inertia control coefficient of G-VSC, $\Delta P_{vir} G$ is the inertia power provided by G-VSC. Considering that the DC bus voltage is in the vicinity of the rated value U_{DCN} , (5) is rearranged as follows:

$$\int \Delta P_{vir} G dt = -1/2 * C_{vir} G [(u_{DCN}^2 - u_{DC}^2) - (u_{DCN}^2 - u_{DC0}^2)] \quad (6)$$

During a sampling period, the virtual inertia power provided by GVSC can be expressed as follows:

$$\Delta P_{vir} G = -1/2 * C_{vir} G * (d(u_{DCN}^2 - u_{DC}^2)/dt) \\ \approx -C_{vir} G / 2T * [(U_{DCN}^2 - u_{DC}^2) - (U_{DCN}^2 - u_{DC0}^2)] \quad (7)$$

The block diagram of the proposed virtual inertia control for GVSC is depicted in Fig. 3a, where the output of the virtual inertia control is added to the output of the droop control and the summation of two currents forms the reference current of the inner current controller.

3.2.2 Virtual inertia control for W-VSC:

Through the MPPT control of W-VSC, PMSG outputs the maximum wind power. However, there is no direct relationship between the rotational speed of the wind turbine and the DC bus voltage, which leads to the rotational kinetic energy 'hidden' and contributes little to the inertia of the DC microgrid. According to the rotor motion equation, the change of the output electrical power caused by the speed change of the wind turbine rotor is as follows:

$$\Delta P = P_T - P_E = 2H\omega_r * (d\omega_r/dt) \quad (8)$$

where P_T is the mechanical power of PMSG; P_E is the electromagnetic power of PMSG; ω_r is the rotor speed; H is the inertia time constant defined as a ratio of kinetic energy to the rated DC capacity of the wind turbine at rated speed. Assume that the virtual inertia power of W-VSC is provided by the kinetic energy stored in the rotor during the voltage fluctuation of the DC microgrid. Therefore, by combining (3) with (8), the correlation between the DC voltage fluctuation and the rotor speed variation is obtained as follows:

$$2H\omega_r (d\omega_r/dt) = C_{vir} W u_{DC} (du_{DC}/dt) \quad (9)$$

where $C_{vir} W$ is the virtual inertia control coefficient of W-VSC. However, there is a mutual interference between the additional

inertia control and MPPT control. For example, in the case of DC voltage drop, the electromagnetic power is increased by the additional inertia control according to the change rate of the DC voltage. At this moment, the unbalance between electromagnetic power and mechanical power could lead to a decrease of rotor speed, and the active power reference value of the MPPT control is reduced due to the decrease of the speed, which is undesirable to provide the active power support to the system. In order to avoid



the contradiction between the rotational speed and the electromagnetic power in these two control methods, a method of changing the coefficient of maximum power tracking is introduced into the design of inertia control, and hence the change of the wind turbine operating point is realized through switching of power tracking curves.

By integrating (9) and invoking the nominal voltage, the relationship between the wind speed and the DC bus voltage is obtained

On the premise of a constant wind speed and small speed change range, the mechanical power captured by the wind turbine is

considered to be approximately equal. Moreover, the input mechanical power and output electromagnetic power are also balanced. So, with the equilibrium relations above, it can be easily obtained that the wind turbine has the following approximate

relation at the power balance point when the power tracking coefficient changes where kept is the maximum power tracking coefficient of the wind turbine, and k_{vic} is the virtual inertia control coefficient. It can be seen from (12) that the proposed control of W-VSC can respond quickly to the voltage disturbance of the DC microgrid. As shown in Fig. 4, when a sudden decrease of DC voltage occurs, the maximum power tracking coefficient will shift to the virtual inertia control coefficient to increase the output electromagnetic power of PMSG, and the operating point will switch from A to O. Due to the rotational inertia of the rotor of wind turbine, there is a lag in the change of the speed which leads to the unbalance between output electromagnetic power and input mechanical power. According to the corresponding relationship between the rotor speed and the output electromagnetic power in the virtual inertia control curve, the wind turbine reaches a new stable operating point (point B) by changing the rotational speed to release the rotational kinetic energy of the rotor. When the bus voltage stabilizes, the operation point returns to A. In addition, to ensure the stable operation of the wind turbine during the speed regulation, the limitation of the changing range of the power tracking curve is considered, which is shown in Fig. 4 as the curves P_{vic_max} and P_{vic_min} , and the corresponding virtual inertia control coefficient is given by the following equation:

$$k_{vic_min} \leq k_{vic} \leq k_{vic_max} \quad (13)$$

Fig. 3b shows the diagram of the proposed virtual inertia control of W-VSC.

3.2.3 Virtual inertia control for B-DC:

The virtual inertia power supplied by the battery through the additional inertia control of the DC/DC converter can be expressed as follows:

$$\approx -C_{virB}/2T^*[(U_{DCN}^2 - u_{DC}^2) - (U_{DCN}^2 - u_{DC0}^2)] \quad (14)$$

where C_{virB} is the virtual inertia control coefficient of B-DC, ΔP_{virB} is the inertia power provided by B-DC. The control structure of the battery with additional virtual inertia control is demonstrated in Fig. 3a. Since the voltage threshold is set for the hierarchical control, the battery may be uninvolved in the droop control of active power regulation under a DC microgrid disturbance. However, if the additional virtual inertia control is adopted, the battery can always respond in time to the sudden change of the DC voltage and will then provide inertia power to prevent DC bus voltage from mutation and improve the efficiency of the battery as well.

Simulations:

To verify the effectiveness of the proposed control strategy and the correctness of the stability analysis results, the following simulations have been carried out in Mat Lab/Simulink. The schematic diagram of the studied DC microgrid is demonstrated in Fig. 1, which includes a direct-driven PMSG wind turbine with the rated power 60 kW and rated wind speed 12 m/s, W-VSC with the rated capacity 60 kW, a PV array with the rated power 6 kW under standard test conditions: temperature 25°C and insolation intensity 1000 W/m²; P-DC with the rated capacity 10 kW; a storage battery with the rated voltage 120 V and rated capacitance 100 Ah, B-DC with the rated capacity 30 kW; G-VSC with the rated capacity 30 kW; and DC bus with the rated voltage 400 V.



The parameters of the converters and line components in DCmicrogrid are the same with those given.

Table 1 Parameters of dc microgrid

Converters	Parameter	Stable value	Parameter	Stable value
G-VSC	L_{cd}, L_{cq}	0.15 p.u.	k_{cd_p}, k_{cq_p}	1
	R_c	0.0015 p.u.	k_{cd_l}, k_{cq_l}	50
	k_G	0.0667		
W-VSC	L_{sd}, L_{sq}	0.00105 p.u.	k_{sd_p}, k_{sq_p}	4
	R_s	0.02235 p.u.	k_{sd_l}, k_{sq_l}	20
	k_{opt}	0.4351	ψ_f	1.075 p.u.
	H	0.8319		
B-DC	L_b	0.05 p.u.	k_{b_p}	0.0005
	k_B	0.1	k_{b_l}	0.1
others	C_{dc}	0.04 F	T	0.05 s
	P_{Load}	0.6125 p.u.	P_{pv}	0.0875 p.u.

5.1 Analysis of virtual inertia control for different converters

5.1.1 Scenario 1: For a grid-connected DCmicrogrid under the voltage hierarchical coordinated control, the following conditions

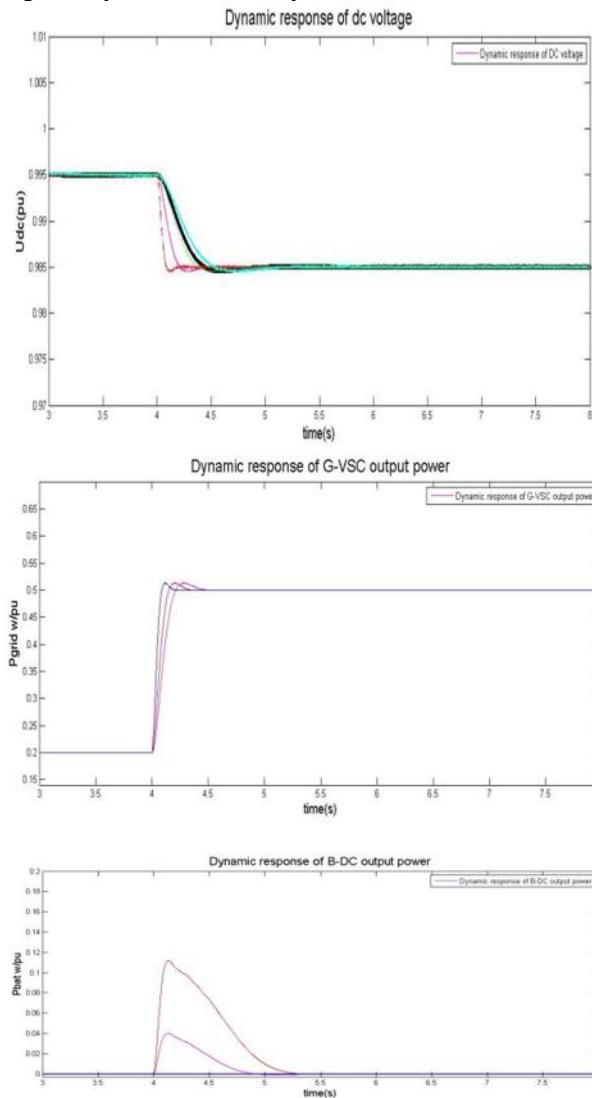
in the process of simulation are assumed: the wind speed is 9 m/s, so the power of the wind turbine is about 30 kW; the isolation

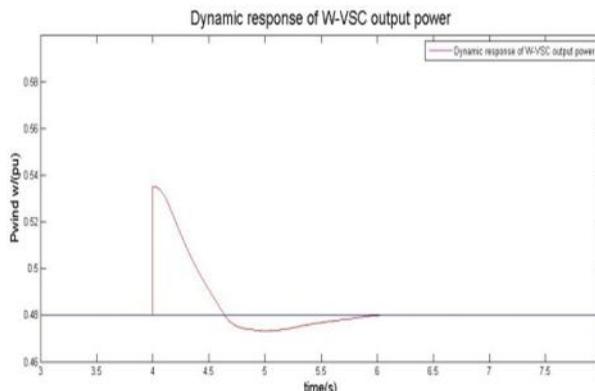
intensity is 1000 W/m² and the temperature is 25°C, so the power of the PV is about 6 kW; the initial load is 42 kW. Under hierarchical control, the power shortage of about 6 kW is all provided by the utility grid. At $t = 4$ s, the load is suddenly increased by 10 kW. The dynamic response of DC bus voltage UDC, grid power P_{grid}, wind turbine power P_{wind} and battery power P_{bat} with different C_{vir} values are shown in Figs. 5a–d, respectively. Waveform 0 in Fig. 5a presents the dynamic response curve of UDC under droop control, and the waveforms 0 in Figs. 5b–d give the corresponding P_{grid}, P_{wind} and P_{bat}. As waveform 0 depicts, under droop control only, UDC declines quickly as the load increases, and P_{grid} increases instantaneously to balance the load changes while P_{wind} and P_{bat} have no change. Waveform 1 in Fig. 5a presents the dynamic response curve of UDC under both droop control and inertia control, in which the inertial control coefficients of G-VSC, W-VSC and B-DC are C_{virG} = 2, C_{virW} = 2, C_{virB} = 2, respectively. The corresponding P_{grid}, P_{wind} and P_{bat} are demonstrated as waveform 1 in Figs. 5b–d. Compared with waveforms 0, it is obvious that the change rate of DC voltage has slowed down significantly as the load increases.

Under inertia control, not only P_{grid} but also P_{wind} and P_{bat} increase instantaneously to balance the load changes. As can be seen from the waveforms, the utility grid provides the highest inertia



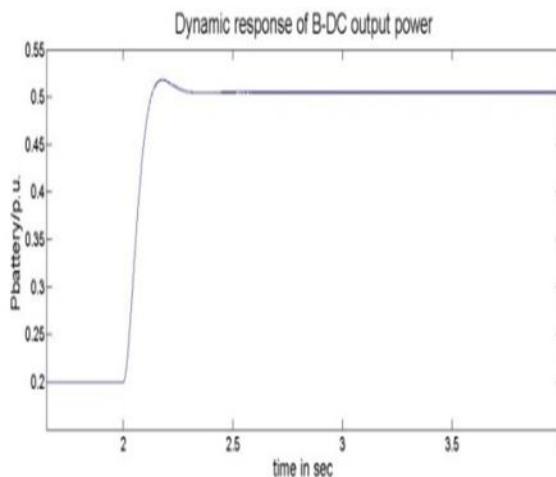
power, followed by the storage battery, while the wind turbine provides the lowest inertia power. Waveform 2 in Fig. 5a presents the dynamic response curve of UDC under both droop control and inertia control, in which C_{virW} increases from 2 to 50, while C_{virG} and C_{virB} are of the same value as those of waveform 1. Waveform 2 in Fig. 5c gives the corresponding P_{wind} . Compared with waveforms 1, the change rate of DC voltage has slowed down further as the inertia power provided by the wind turbine increases with a larger C_{virW} . However, in the process of speed recovery, the wind turbine absorbs the same amount of power from the DC microgrid, so the process should change slowly to avoid secondary disturbances on DC bus voltage. Waveform 3.

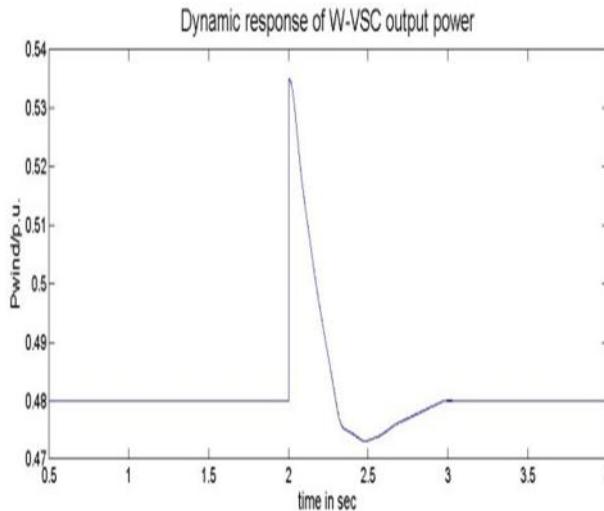
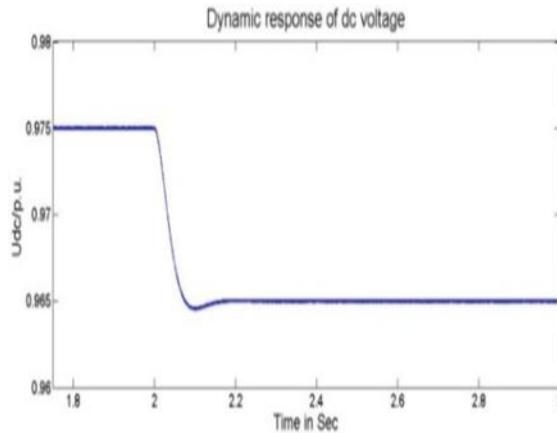




5.1.2 Scenario 2: The grid-connected DC microgrid being changed to the islanded operation mode, the rest is exactly the same as described in scenario 1. About 6 kW power shortage is all provided by the storage battery. At $t = 4$ s, the load is suddenly increased by 10 kW. While P_{wind} has no response. Waveform 1 in Fig. 6a presents the dynamic response curve of UDC under both droop control and inertia control, in which $C_{virW} = 50$ and $C_{virB} = 2$. Waveform 2 in Fig. 6a presents the dynamic response curve of UDC under both droop control and inertia control, in which $C_{virW} = 10$ and $C_{virB} = 8$, respectively. The waveforms 1 and 2 in Fig. 6b give the corresponding P_{wind} and P_{bat} , respectively. Compared with waveforms 0, it is obvious that the voltage drop tendency has slowed down significantly when the load increases. Under the action of inertia control, not only P_{bat} but also P_{wind} increase instantaneously to balance the load changes. Comparing the waveforms 1 and 2 in Fig. 6, it can be seen that with a higher C_{virW} value, the PMSG-based wind turbine can provide more inertia power to the DC microgrid; however, an obvious secondary voltage disturbance can be seen from waveform 1 due to the speed recovery progress of the PMSG. Therefore, a smaller C_{virW} and a higher C_{virB} are preferred to obtain a better dynamic response of the DC bus voltage as shown in waveform 2.

5.2 System simulation under random load fluctuation





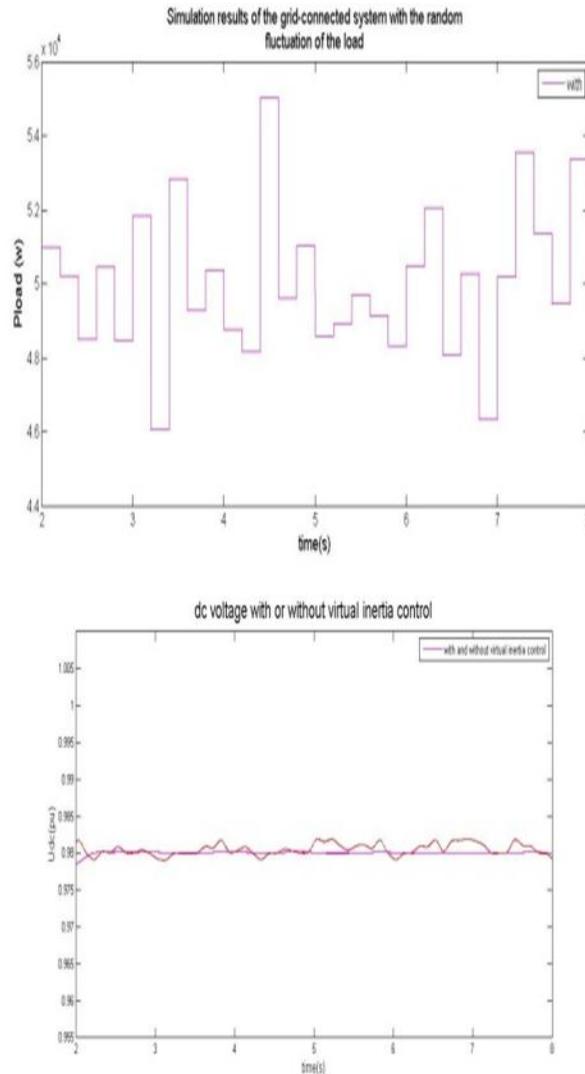
In scenario 1, when load randomly fluctuates between 45 and 55 kW, the change of load PLoad and the dynamic response of DC voltage UDC are shown in Figs. 7a and b, respectively. In Fig. 7b, the black dotted line represents the DC voltage response under the classical droop control, the red solid line represents the DC voltage response with the proposed virtual inertial control, and the blue dash line represents the voltage boundary of the operation mode change for G-VSC and B-DC. It can be seen from the black dotted line that the DC voltage fluctuates intensively under the droop control since the inertia power can only be provided by DC capacitors. However, under the proposed virtual inertial control, the load change can be balanced not only by the discharging power of DC capacitors but also by the inertia power provided by the utility grid, the battery and the PMSG-based wind turbine. When the inertia power provided by the controllable power sources take on most of the load change, the unbalanced power on the DC capacitors is much smaller than that under the droop control, thus, the DC voltage fluctuation becomes much smoother. Under the voltage hierarchical coordinated control, when the DC voltage is lower than 0.98 p.u., B-DC controls the DC voltage under droop control; when the DC voltage is higher than 0.98 p.u., G-VSC



controls the DC voltage. Without virtual inertial control, it can be seen from the black dotted line in Fig. 7b that the DC voltage fluctuates around 0.98 p.u., which means that the DC voltage control will be switched from G-VSC to B-DC frequently. However, when the proposed virtual inertial control is adopted, the DC voltage is almost stable at 0.98 p.u. Therefore, the frequency of the DC voltage control switching from G-VSC to B-DC will be decreased significantly.

5.3 System simulation under a sudden change in the distributed generated power

In scenario 1, when the temperature and the insolation intensity are suddenly down to 15°C and 800 W/m² at t = 8 s, and the wind speed is suddenly increased to 11 m/s at t = 12 s, the dynamic response of the DC voltage UDC and the unbalance power on DC capacitors are shown in Fig. 8.

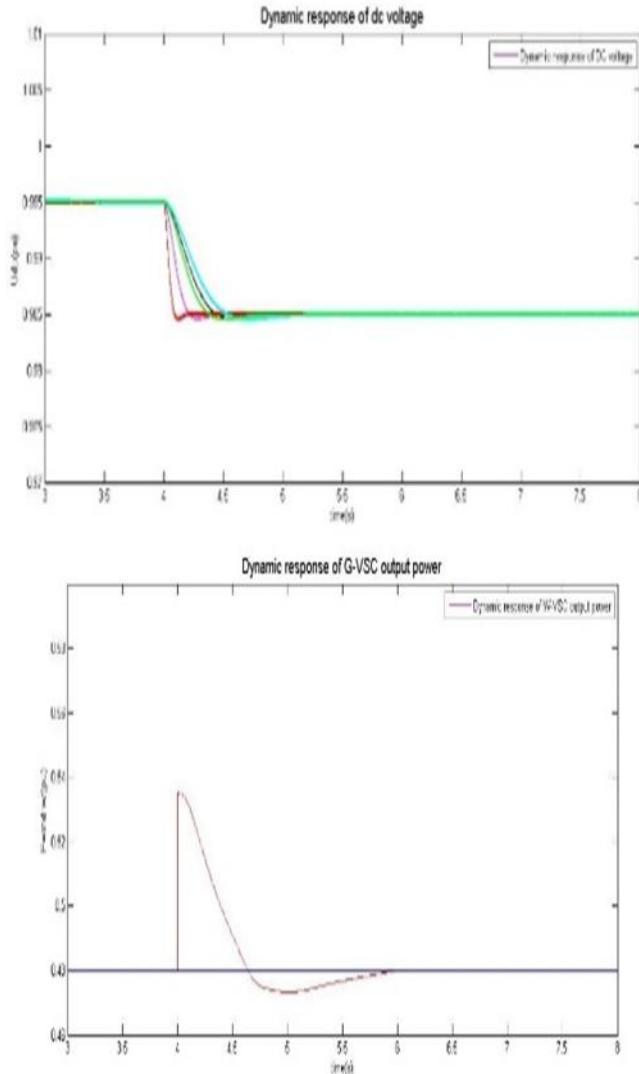


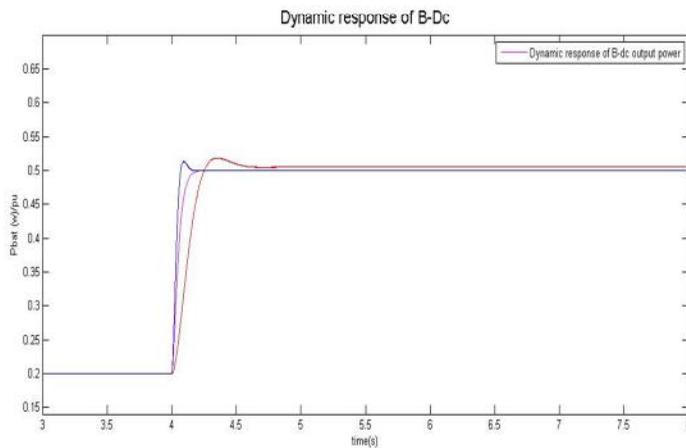
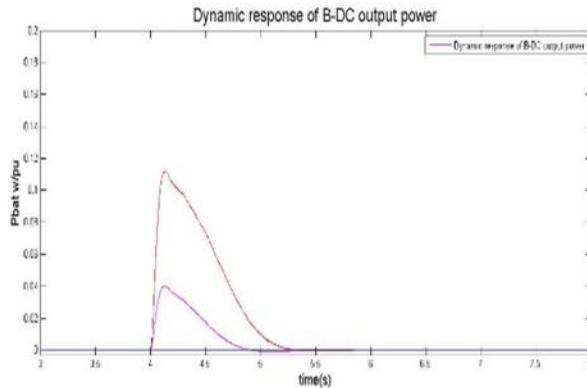
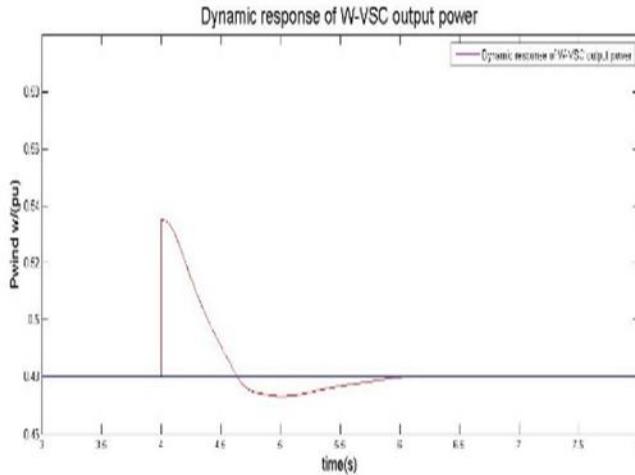


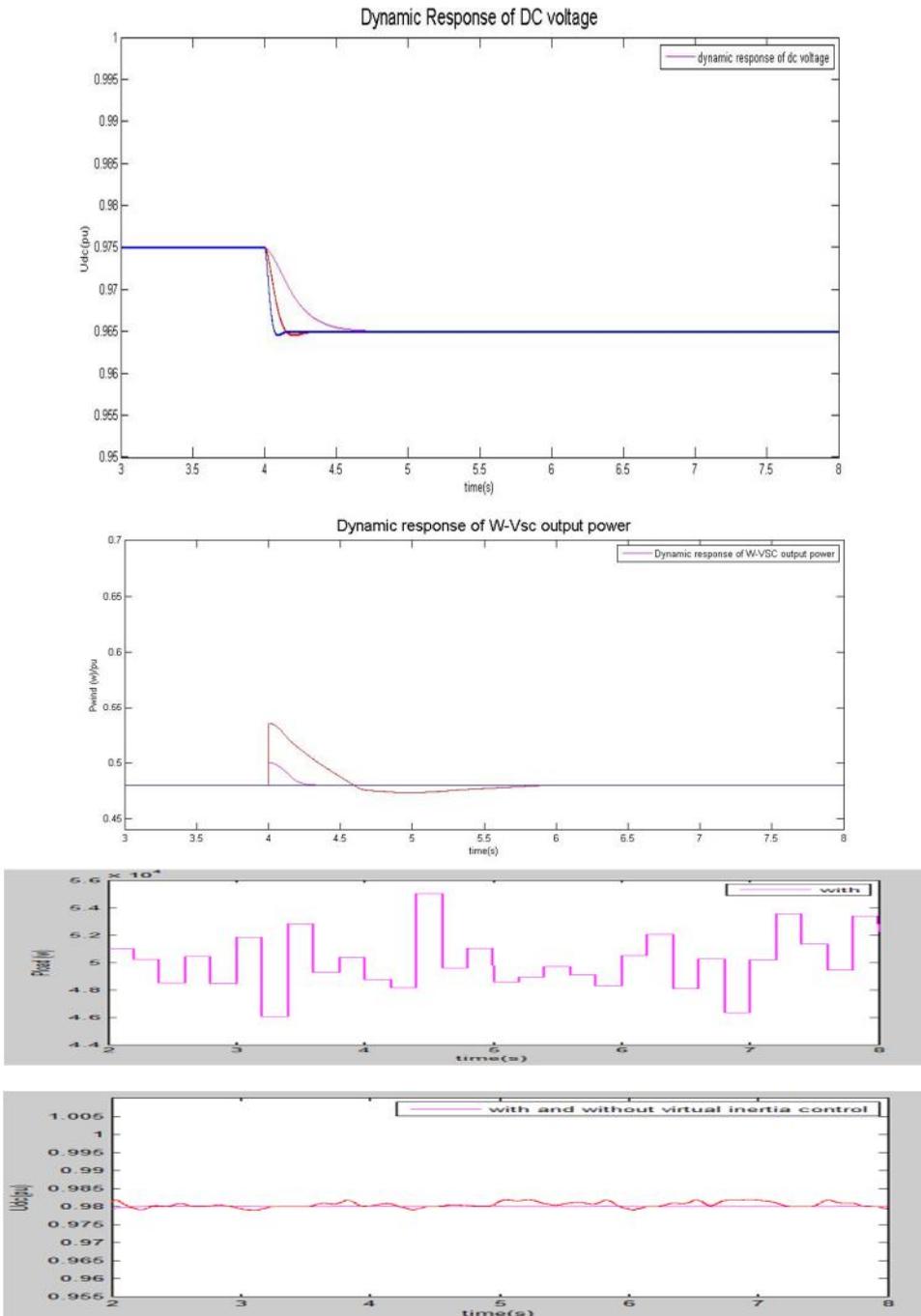
In Fig. 8a, the black dash line and the red solid line represent the DC voltage response without and with the proposed virtual inertia control, respectively. In Fig. 8b, the black dash line and the red solid line represent the unbalance power on DC capacitors without and with the proposed virtual inertia control, respectively. At $t = 8$ s, the photovoltaic power decreases. When only the droop control is adopted, the DC voltage drops quickly, and G-VSC adjusts the power injected into the DCmicrogrid to maintain the power balance.

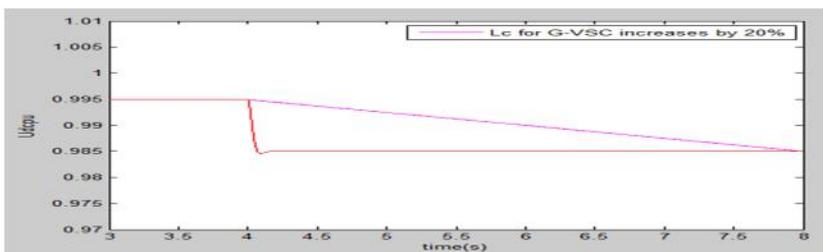
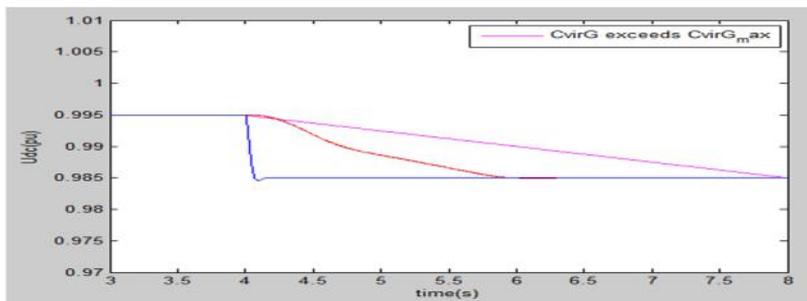
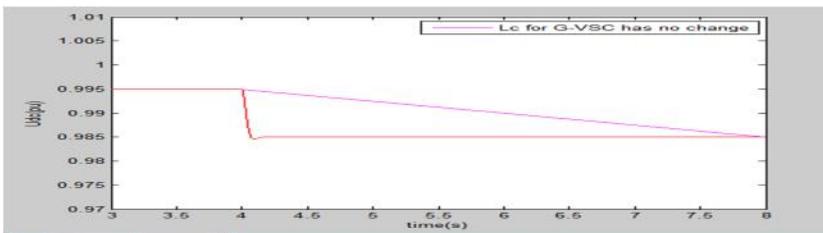
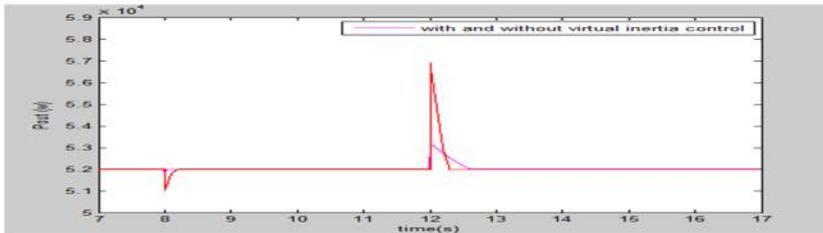
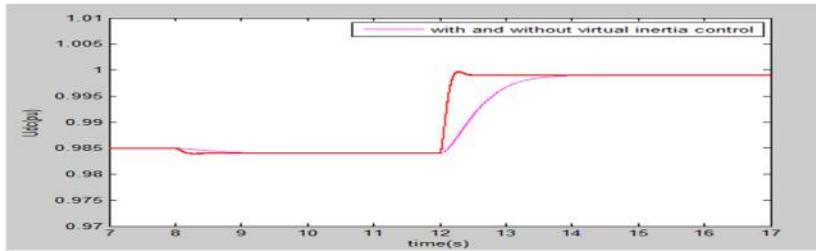
Extension results:

Extension with fuzzy











6 Conclusions

In this paper, the virtual inertia control of the DCmicrogrid is proposed and the small-signal stability analysis is carried out for the DCmicrogrid with virtual inertia control. Conclusions are summarised as follows:

- I. Considering the potential of inertial support capability of rotating equipment and storage equipment in the DCmicrogrid the virtual inertial control of G-VSC, W-VSC and B-DC, are designed to provide a virtual inertial support for the system. Especially, the inertia power provided by the utility grid, wind turbine and battery can be adjusted by modifying the corresponding coefficient of virtual inertia control.
- II. A small-signal model of the DCmicrogrid is established. The stability of the DCmicrogrid with additional virtual inertia control is analysed and the range of the virtual inertia control coefficient is determined.
- III. The proposed virtual inertia control is suitable for both ac/DC converters and DC/DC converters, and is unconstrained by the voltage hierarchical coordinated control strategy. Once the voltage fluctuation occurs, the inertia power provided by the proposed virtual inertia control can help to improve the inertia of the system.

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POWER QUALITY IMPROVEMENT BY USING ANFIS TO CONTROL AND ENERGY MANAGEMENT OF A LARGE SCALE GRID CONNECTED PV SYSTEM

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Abstract

Power quality is featured as an essential parameter in present day control systems. In addition, lattice associated photovoltaic power plants are expanding fundamentally in size and limit. Somewhere else, because of the dynamic mix of nonlinear loads in the grid, the main job of a Solar Energy Conversion System (SECS) isn't just to catch the most extreme power from sun based yet, likewise to guarantee some auxiliary services and improve the quality of power. This paper shows a novel methodology devoted to improve the management of dynamic power generation, reactive power compensation and power quality of a SECS, while ensuring the likelihood of abusing the full limit of the Power Conditioning System (PCS) and the Photovoltaic System (PVS). The proposed control algorithm is connected to an extensive scale PVS associated with the grid through a cascade of a DC-DC converter and a PWM inverter. This control technique deals with the SECS capacity's needs, between principle dynamic power generation, reactive power compensation and active filtering in such an approach to ensure a smooth and stable DC voltage and guarantee a sinusoidal grid current. Top need is given to the dynamic power generation over power quality improvement. At that point, need is given to reactive power compensation over mitigation of current harmonics consumed by the non-linear load associated with the Point of Common Coupling (PCC). In addition, the entire system maximum points of confinement of active and reactive powers have been resolved in the (PQ) control plane based on PVS accessible power, converters evaluated power and DC bus voltage smoothness and stability. At long last, adaptive neuro-fuzzy inference system (ANFIS) control system committed to the estimation of the inverter current commands is proposed so as to abuse the full limit of the SECS and regard the decided power limits. Simulation results affirm the viability and the execution of this control methodology and demonstrate that the SECS can work at its full power while the power quality can be improved by reactive power compensation and active filtering.

Keywords: Power decoupled control, Harmonic currents, Power quality, Active filtering, Reactive power compensation, SECS full power exploitation, ANFIS

I. Introduction:

Worldwide energy crisis and environmental concerns from customary fossil fuels have pushed analysts to elective energy sources which are cleaner, inexhaustible and produce less natural effect (Kandemir et al., 2017). Among these elective sources, sunlight based PV energy based generation is a standout amongst the most famous and promptly accessible sustainable power sources. Specifically, huge scale network associated PVSSs have expanded and expected to develop quickly in future because of a few preferences, for example, simplicity of establishment, silent operation, more secure task with lower operational expenses, and ecological advantage (Liu et al., 2015a; Roy and Mahmud, 2017). Regardless of various points of interest of PVSs associated with the utility grid through power hardware converters, it is important to control the grid current amid typical/broken conditions and guarantee grid synchronization (Lakshmi and Hemamalini, 2016). Additionally, it is realized that the broad utilization of present day electronic devices and nonlinear burdens prompts the issue of no sinusoidal current and reactive power drawing from the source.



This conduct causes voltage distortion that influences different loads associated at the equivalent PCC. Thus, the power quality issue has caught expanding consideration in power engineering as of late. Note that, the measure of power quality relies on the requirements of the equipment that is being provided (Sezen et al., 2014; Arul Murugan and Anbarasan, 2014).

In the literature, a few research considers in the zone of power generation and power quality improvement utilizing SECS, have been performed. Concerning the harmonic filtering, passive filter is a standout amongst the most utilized devices to address this issue. For instance, Hanif et al. (2014) have utilized an active damping technique for LCL filter based grid associated PVSs to accomplish powerful dynamic damping for three stage grid associated PV inverters. In Naveena and Kuthsiyatjahan (2015), a double-tuned parallel resonant circuit has been proposed to attenuate the second and fourth order harmonics at the inverter DC side, improve the power quality and increase the system efficiency. In this paper, a modified carrier based modulation technique for the current source inverter was utilized to polarize the DC-link inductor by shorting one of the bridge converter legs after each dynamic switching cycle. Besides, an improvement strategy is proposed by Mishra and Ray (2016) to tune the LCL filter parameters of a photovoltaic fed distributed static compensator. In this work, the structure technique incorporates harmonic elimination, power factor improvement, and transient behavior enhancement. For another situation displayed in Sakar et al. (2017), facilitating limit of a distorted distribution system because of photovoltaic association has been tended to. As indicated by this examination, the passive filter is utilized to expand the harmonic-constrained facilitating limit which at that point improves the voltage waveforms, and power factor, and filters current harmonics.

Somewhere else, the reactive power compensation is basic for the next-generation of grid associated PV inverters so as to permit high penetration of PVS. Truth be told, Liu et al. (2015b) have demonstrated the impact of optimized reactive power compensation on PVS activity execution. This investigation assesses principally the impact of this compensation on system reliability and power quality.

What's more, various research papers have managed reactive power capability of photovoltaic generation systems. Practically every one of these papers have proposed different control schemes in single-phase and three phase network associated PVS to infuse/retain reactive capacity to/from the framework through PV inverters without talking about the restrictions of the PVS as far as reactive power (Lal et al. 2013; Freddy et al. 2017; Ahmad and Singh, 2018). Notwithstanding, the reactive power capacity is liable to a few impediments (coming about because of voltage, current, and climatic conditions) that change with the system working point. To address this issue, a few investigations have been as of late performed to to analyze and estimate the PVS limits in the (PQ) control plane. In Delfino et al. (2009), a kind of capacity diagram of the entire grid associated system (PV panel+inverter+transformer) as far as dynamic and reactive power created at the AC side has been characterized. Based on an improved model, this examination has been done to delimit the focuses set in the (PQ) plane, at steady state without over-rating all the included devices. Albarracin and Alonso (2013) have contemplated likewise the reactive power cutoff points of PV inverters by thinking about inverter current and voltage breaking points, and PV dynamic power limit. In this investigation, the capacity to infuse/assimilate reactive power so as to diminish over-voltages when PV generators are disengaged has been tended to. Yet again, the investigation is created by considering just PV generator and inverter impediments. Somewhere else, the reactive power capacity of PV plants is broke down in Huang et al. (2015). In this paper, the reactive intensity of a PVS is thought to be constrained just by the capacity of inverters and inward transmission misfortunes (unit transformers, primary transformer and authority lines). So as to ascertain the ability of PVS as far as reactive power, the points of confinement of the power factor



at the yield of PV inverters have been fixed to ± 0.85 (that relates to reactive power limits of ± 0.46 pu as indicated by the inverter evident power limit). Another examination has been created by Cabrera-Tobar et al. (2016) where the PV inverters capacity bends of a PV generator is acquired by thinking about factor sun based irradiance, temperature, DC bus voltage level and inverter modulation index. For this situation of a direct coupled inverter to the PV generator, impediments of current, voltage, dynamic power and reactive power have been considered. The DC input voltage is constrained between as far as possible required by the inverter which decrease the scope of the PV generator yield control (since there is no DC-DC converter to tune this voltage). Moreover, a basic phasor outline of the PV inverter interconnected with the grid has been utilized to delimit likewise the entire system capacity as far as reactive power in the (PQ) plane.

Somewhere else, a PVS working in the MPPT mode, associated with a three phase grid and joining a shunt Active Power Filter (APF) has been introduced in a few works (Ibrahim et al., 2013; Sreerami Reddy and Hameed, 2015; Bouzelata et al., 2015; Bag et al., 2016; Bhole et al., 2017; Abouddrar et al., 2017; Tareen et al., 2017). In every one of these works, the PVS is utilized to create control from the sun cluster and feed to the grid while the shunt APF is utilized to improve the power nature of the photovoltaic generation dependent on d-q hypothesis. Moreover, extraordinary control approaches for reactive power compensation and harmonic filtering strategies of grid associated PVSs are accounted for in literature. In Renukadevi et al. (2015), harmonic filtering and reactive power compensation of a grid associated PVS have been considered. In this work, a synchronous reference outline methodology is picked and the grid associated photovoltaic generation system is controlled to send dynamic capacity to the grid, compensate harmonics and absorb reactive power generated by local loads. In a similar setting of intensity quality improvement, Patsalides et al. (2016) have proposed a conventional transient PVS demonstrate that can be tuned so as to speak to precisely the dynamic conduct of PVSs for both balanced and unbalanced conditions. Harmonics were additionally joined into the model to feature its ability for use in total power quality investigations. Hamrounia et al. (2017), have recommended additionally a methodology of a grid associated PV control scheme that gives ideal PV power and high caliber of current infused into the grid and, along these lines, high power quality. This undertaking has been performed by consolidated current control and power control circles. One can likewise refer to crafted by NirmalMukundan and Jayapraksh (2017), that has tended to a sun oriented PV cascaded h-bridge multilevel inverter utilized in a two phase 3-stage matrix associated PVS to guarantee MPPT task and power quality improvement. In this commitment, the system is controlled to create dynamic power and improve control nature of the grid by injecting reactive power, balancing source currents and supporting harmonic demand of load.

Besides, a hybrid combination of filters utilizing inactive and dynamic channels has been utilized for the advancement of power quality. In Patra et al. (2016), the authors have recommended a similar evaluation for power quality that can be accomplished with two sorts of circuits; a double stage that comprises of a boost based VSI and a single stage grid associated PVS utilizing a Z-Source Inverter. In this paper, the power quality of signals in both circuits is analyzed during transient variations of solar intensity and load conditions, with and without the use of a hybrid filter. As can be seen, control quality issues are tended to passive filters and/or more advanced filtering technologies. Be that as it may, the shunt APF is the most prevailing and productive arrangement against issues of power quality, with receptive power and current sounds pay. Most of the above announced arrangements utilize extra devices rather than misusing the system PCS to do this task. Moreover, the implication of DC bus voltage stability and smoothness, and current commands calculation have not been resolved on-line to work the PVS under its full ability as far as dynamic power generation, reactive power compensation and active filtering to allow an to



allow a efficient utilization of such systems as far as power generation and power quality improvement.

In this paper, an essential decoupled control methodology of dynamic and reactive forces of a vast scale PVS (Hokuto super sun powered station) is exhibited and approved by test information of Konishi (2014) and Konishi et al. (2011). At that point, the entire system control limit has been delimited in the (PQ) control plane based on accessible PVS control; device converters appraised forces and DC bus voltage smoothness and dependability for various working conditions. Plus, a management strategy is proposed to accomplish an on-line full ability task of SECS as far as power generation, reactive power compensation and active filtering of nonlinear load harmonic currents. This methodology is utilized to direct the PWM inverter so as to deal with the SECS vitality capacity's needs. Top need is given to the dynamic power creation over power quality improvement. At that point, need is given to reactive power compensation over mitigation of current harmonics absorbed by the non-linear load associated with the PCC.

At last, the maximal ability of the SECS is completely misused (if necessary), with no exaggerating of power electronics converters or danger of DC voltage insecurity, by utilizing a technique that computes on-line the inverter order flows based on the conceivable working zone delimited already. In rundown, here are the primary commitments of this paper:

- A hierarchical power management procedure that gives top need to dynamic power generation, then reactive power compensation and finally active filtering has been proposed.
- The entire system limit as far as dynamic and reactive forces is effectively delimited in the (PQ) control plane so as to keep away from the system parts over-rating or potentially insecurity.
- A control technique is created to work on-line the SECS at its full limit of power.

The rest of this paper is composed as pursues. Segment 2 gives an itemized portrayal of the considered grid associated huge scale PVS. At that point, Section 3 shows the examined network associated PVS including a DC– DC converter, a three phase PWM inverter and a nonlinear load, and mathematical modelling of sun powered cells. In Section 4, we examine the system control scheme dependent on the utilization of p– q hypothesis to control the SECS for power generation and harmonic mitigation, the assurance of the entire system limit confines regarding dynamic and reactive powers, and the proposed control methodology used to deal with the SECS vitality capacities' needs. The reproduction results are examined in Section 5. At last, Section 6 closes the paper by some finishing up comments.

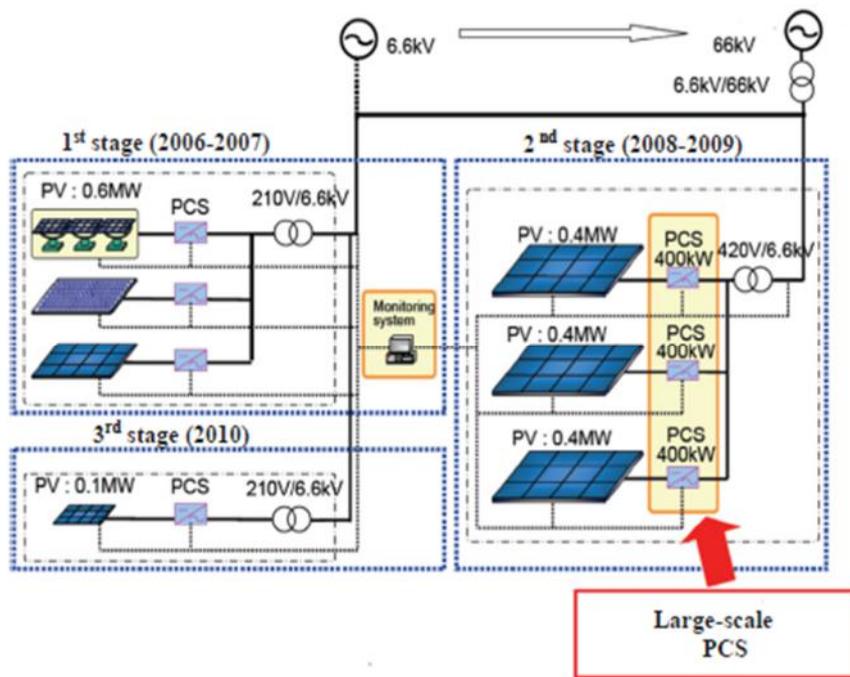


Fig. 1. Configuration of Hokuto mega-solar station.

2. Description of the studied grid connected PVS

Large-scale PVSs have become a major development area for research. The power of this kind of energy systems has increased progressively over the last decade with frequent new capacity records. As of January 2017, the largest PVS (Longyangxia Dam Solar Park in China) power in the world is about 850 MW. Then, one can state the Kamuthi Indian photovoltaic power station with a capacity of 648 MW, it was the largest PV power plant in the world in 2016 in front of the Topaz Farm of California (550 MW), previous holder of this title (Porrometo, 2017).

The large scale PV grid-connected system studied in this article is one of the PVS high penetrations into the high voltage transmission grid in Japan. It is the Wakkanai project central station PVS. Wakkanai is the northernmost city (Hokuto) in Japan. It is the symbol city of renewable energy because there are large wind-farms and this mega-solar station. This station can develop a capacity of 1.9 MW. The area of this PVS is of 95.656m², it is installed on the period 2006–2010 and performed on three stages; see Fig. 1 (Konishi et al., 2007):

- The 1st stage was achieved in the period from 2006 to 2007 and is characterized by a capacity of 0.6 MW.
- The 2nd stage with a capacity of 1.2MW was installed in the period 2008–2009.
- The 3rd stage is the final step of this project. It is characterized by a power of 0.1MW and was achieved in the period from late 2009 to early 2010.

Let us take the 2nd stage, size it again and model its PV generators. This stage contains three PCSs. The schematic of each conditioner and its specifications are given by Fig. 2 and Table 1. respectively (Konishi et al., 2011). It consists of two choppers of 200 kW each and an inverter

Table I
 Specifications and developing targets of a PCS.

Capacity	420kVA/400kW
AC voltage	420V ± 10%
Permissible DC voltage	600V
Input DC voltage	230-600V
Switching frequency	4-6 kHz
Conversion efficiency	> 95% from 30 to 100% of the output power
Control functions	MPPT by choppers Minimizing harmonics

3. Modelling of the SECS

The synoptic scheme of the studied system is shown in Fig. 3. It is composed of a PV field, a DC–DC boost chopper, a three-phase PWM inverter and a nonlinear load connected to the PCC of the electric grid. Let us now describe and model this PVS.

3.1. Photovoltaic generator description

The PV generator is composed of three fields of 2000 PV modules. The rated power of each PV panel is of 200 W. Thus, the output power of each field is about 0.4MW and the total generated PV power is 1.2 MW. On the other hand, each PV field includes N_s modules in series and N_p parallel branches that can be calculated as follows:

$$\begin{cases} N_s = \frac{V_{maxDC}}{V_{maxM}} \\ N_p = \frac{I_{maxDC}}{I_{maxM}} \end{cases} \quad (1)$$

Where V_{maxDC} is the maximum input voltage of the PCS, ($V_{maxDC}=600$ V) and V_{maxM} is the module voltage corresponding to the maximum power operating point (it is equal to 24.5 V in this case). Thus, the series modules number is: $N_s=25$. Afterwards, the total number of parallel branches is deduced: $N_p=80$. So, each field of the PVS comprises 80 parallel arms of 25 modules in series. This implies that each chopper is powered by a half of the PV field (40 parallel strings of 25 modules in series).

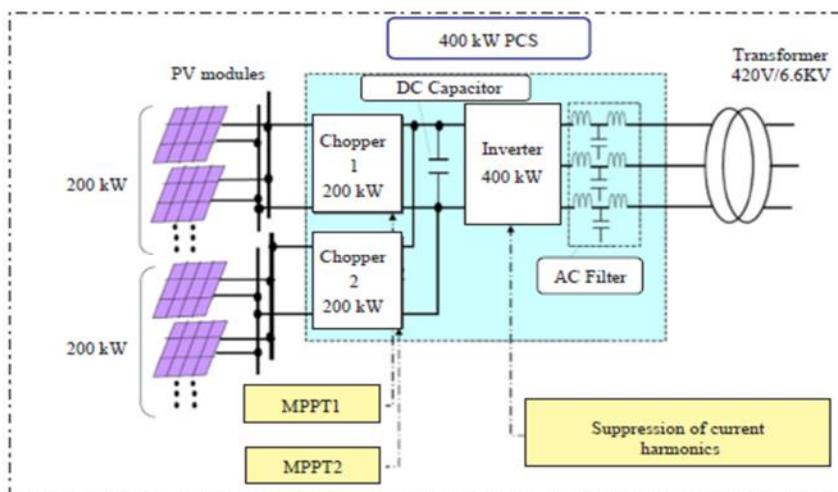


Fig. 2. Configuration of a 400 kW PCS.

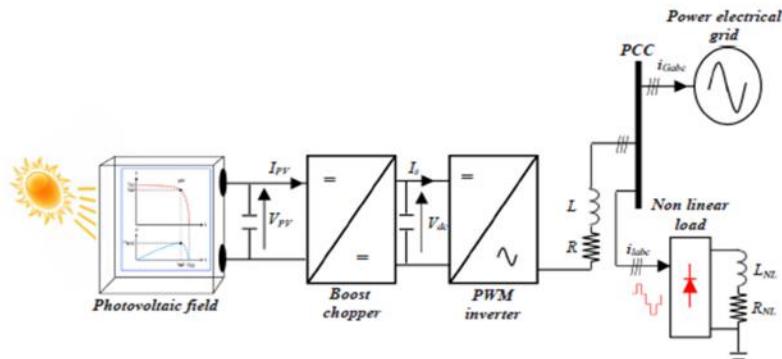


Fig. 3. Synoptic scheme of the studied system.

3.2. Photovoltaic array modelling

The PV cell is the basic unit of a photovoltaic module; it transforms the sun rays or photons directly into electric power. The equivalent circuit of a practical PV cell is shown in Fig. 4 (RamalingeswaraRao and Srikanth, 2014). It comprises a current source, an anti-parallel diode, a series resistance and a shunt resistance. Based on the Shockley and Queisser diode equation, the I_{pv} - V_{pv} characteristic equation of a PV cell is given by Patra et al. (2016):

$$I_{pv} = I_{ph} - I_0 \left[\exp\left(\frac{V_{pv} + R_s I_{pv}}{nV_T}\right) - 1 \right] - \frac{V_{pv} + R_s I_{pv}}{R_p} \quad (2)$$

Where I_{ph} is the current generated by the incident solar radiation, I_0 is the reverse saturation or leakage current of the diode; it is given by the following expression

$$I_0 = \frac{I_{cc}}{\left[\exp\left(\frac{V_{oc}}{nV_T}\right) - 1 \right]} \quad (3)$$

R_s is the intrinsic series resistance of the solar cell, R_p is the equivalent shunt resistance of the solar array (its value is usually very large) and V_T is the thermal voltage of the PV module, it is given by the following equation:

$$V_T = \frac{KT_c}{q} \quad (4)$$

Where K is the Boltzmann constant ($K=1.38 \times 10^{-23}$ J/K), q is the electron charge ($q=1.6 \times 10^{-19}$ C), T_c is the absolute temperature in Kelvin, and n is the diode ideality factor ($1 < n < 1.5$). Elsewhere, the value of the short-circuit current expressed for other conditions of solar intensity and temperature is given by Kumar et al. (2012):

$$I_{cc}(G) = I_{ccref} \frac{G}{G_{ref}} \quad (5)$$

$$I_{cc}(T) = I_{ccref} (1 + \alpha(T - T_{ref})) \quad (6)$$



where G_{ref} , T_{ref} , $I_{sc,ref}$ are the standard values of solar intensity, cell temperature and short-circuit current respectively, and α is a temperature coefficient (A/K). Similarly, the saturation current is expressed, for a given temperature level, as (Bouzelata et al., 2015):

$$I_0(T) = I_0(T_{ref}) \left(\frac{T}{T_{ref}} \right)^{\frac{1}{n}} \left(\exp \left(\frac{-qE_g}{nK} \right) \left(\frac{1}{T} - \frac{1}{T_{ref}} \right) \right) \quad (7)$$

PV cells connected in parallel increase the total output current of the PV module whereas cells connected in series augment the total output voltage of the cell.

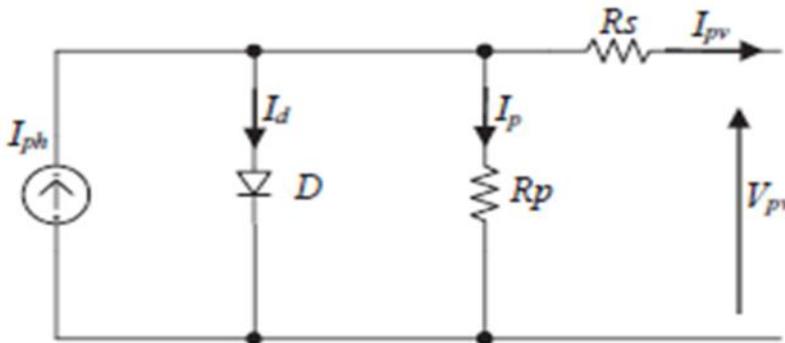


Fig. 4. Equivalent circuit of a PV cell.

4. Power control and management strategy

In 1983, Akagi suggested a new concept called the p–q theory. First, uses the Clarke transformation to transfer three-phase voltages and currents from abc coordinate to $\alpha\beta$ coordinate in order to compensate the harmonics and negative components (Belaidi et al., 2011). The real and imaginary instantaneous powers theory is based on time-domain analysis, what makes it valid for operation in steady-state and transient regime, as well as for generic voltage and current power system waveforms (Sreerami Reddy and Hameed, 2015). The Clarke transformation can be expressed for a three phase system (voltage/current/nonlinear load current) as follows (Sreerami Reddy and Hameed, 2015; Tahmi et al., 2014):

$$\begin{bmatrix} v_{\alpha} \\ v_{\beta} \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix} \begin{bmatrix} v_a \\ v_b \\ v_c \end{bmatrix} \quad (8)$$

$$\begin{bmatrix} i_{\alpha} \\ i_{\beta} \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix} \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} \quad (9)$$

$$\begin{bmatrix} i_{\alpha} \\ i_{\beta} \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix} \begin{bmatrix} i_{a1} \\ i_{b1} \\ i_{c1} \end{bmatrix} \quad (10)$$

Then, previous (voltage/currents) components in the α - β coordinate are transformed into d-q coordinate as shown in the following equations (Ibrahim et al., 2013):



$$\begin{bmatrix} v_d \\ v_q \end{bmatrix} = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} \begin{bmatrix} v_\alpha \\ v_\beta \end{bmatrix} \quad (11)$$

$$\begin{bmatrix} i_d \\ i_q \end{bmatrix} = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} \begin{bmatrix} i_\alpha \\ i_\beta \end{bmatrix} \quad (12)$$

$$\begin{bmatrix} i_{id} \\ i_{iq} \end{bmatrix} = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} \begin{bmatrix} i_{i\alpha} \\ i_{i\beta} \end{bmatrix} \quad (13)$$

Moreover, the instantaneous active and reactive powers delivered to the grid have been calculated as follows (Sezen et al., 2014):

$$P = v_d i_d + v_q i_q \quad (14)$$

$$Q = v_d i_q - v_q i_d \quad (15)$$

Elsewhere, different MPPT methods dedicated to pilot PVSs have been proposed in the literature and can be classified into direct and indirect methods. Indirect methods require prior knowledge of the PV array characteristics under different irradiance/temperature conditions. In contrast, direct methods use voltage and current measurements from the PV array to achieve the optimal operation point (Franco et al., 2017). On the other hand, several techniques have been used to perform a decoupled control of PVS active and reactive powers injected to the grid such as PI controller (which is simple to implement but underperforming and less robust against parametric and operating point variation) and advanced strategies (such as sliding mode, adaptive control, optimal control) which are high-performing but more complicated. The fuzzy logic control is a good between these techniques in terms of effectiveness and robustness.

In this paper, a DC-DC converter has been controlled using a fuzzy robust controller proposed by Benlarbi et al. (2004) to ensure the MPPT operation for different climatic conditions (irradiation and temperature). This technique permits a ‘blind piloting’ of the chopper by adjusting its duty cycle; it can replace the well-known pilot cell used for MPPT purposes, see Fig. 5. Furthermore, the fuzzy logic technique has been applied to guarantee an effective decoupled control of the PVS output active and reactive powers injected into the electrical grid through the PWM inverter for different operating conditions. This converter is controlled to ensure also an active filtering of the nonlinear load harmonic current. Consequently, the SECS depicted in Fig. 5 can:

- Capture a maximum of power from the fluctuating solar energy (MPPT mode).
- Inject different levels of active and reactive powers into the grid through a PWM inverter.
- Compensate reactive power and improve the power quality via current harmonic filtering.

a)ANFIS (Adaptive neuro fuzzy inference system): ANFIS is a learning technique with data that uses Fuzzy Logic to transform given inputs into a desired output through highly interconnected Neural Network, which are weighted to map the numerical inputs into an output. ANFIS combines the benefits of the two machine learning techniques (Fuzzy Logic and Neural Network) into a single technique. An ANFIS works by applying Neural Network learning methods to tune the parameters of a Fuzzy Inference System (FIS).

Using a given input/output mapping data, the ANFIS toolbox constructs a fuzzy inference system (FIS), whose membership function parameters are adjusted using either back-propagation algorithm or combination of back propagation algorithm and least squares type of method. This process of learning is called Hybrid Learning technique. This allows fuzzy systems to learn from the data they are modeling.

1) **Procedure for ANFIS:** ANFIS require input and output data sets. These input and output data sets are taken from the system operating constraints. There are two possible ways to collect training data. One is collecting data from the real-time system, another one is from simulation by developing an accurate dynamic model for PV module. Collecting data from the real-time system was very difficult due to the irregular nature of weather and the inability to control the weather conditions. Therefore, the training data were collected in this work from simulation after the development of dynamic PV module.

In addition, Fig. 6 shows the details of the PWM inverter control block of Fig. 5. The available power of the PVS (P_{max}) and the power reference P_{ref} are used to determine the effective power command P_{ref}^* of the PWM inverter. Moreover, the reactive command power Q_{ref}^* is determined on the basis of the reactive reference, whilst the whole system capability is respected (see Section 4.2.1 for more details). Then, the two fuzzy logic controllers generate dq current references i_{dref} and i_{qref} . To achieve the active filtering operation these currents commands must be added in tandem with harmonic current dq components to be filtering (i_{ldh} , i_{lqh}). The total references i_{dref} and i_{qref} are limited by $i_{drefmax}$ and $i_{qrefmax}$, respectively to gives the effective commands of the inverter output currents in the dq frame (i_{dref}^* and i_{qref}^*). The limitations applied on the current references i_{dref} and i_{qref} are based on the whole system capability in terms of power and the block priority management of different operations (active power generation, reactive power compensation and active filtering). This strategy is presented in details in Section 4.2.

4.1. Active filtering operation

There are various methods to identify the harmonic currents of a nonlinear load. Practically, a Selective Pass Band Filter (SPBF) or a Low Pass Filter (LPF) can be used to extract the harmonic currents components (Boutoubat et al., 2013). Frequency domain compensation, which is based on Fourier analysis, is not very used because it requires more real time processing power (Prabhakar and Bhattar, 2015). The most classical methods are “instantaneous power theory p-q” or “d-q or synchronous detection method”. In our case, the harmonic current components in the (d-q) reference frame are obtained after subtracting the LPF outputs (direct current components) from the dq currents of the nonlinear load (the whole currents are composed of a fundamental part which is constant in the dq frame and a harmonic part), as depicted in Fig. 7.

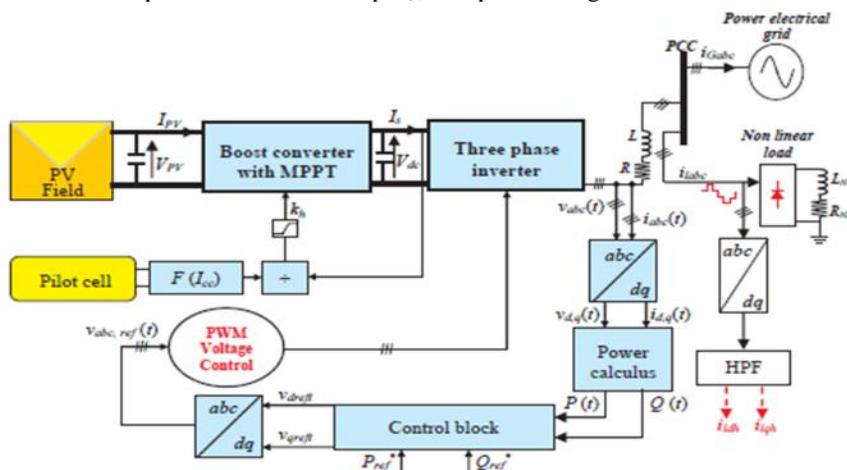


Fig. 5. Control scheme of the PWM inverter for power generation and harmonic mitigation.

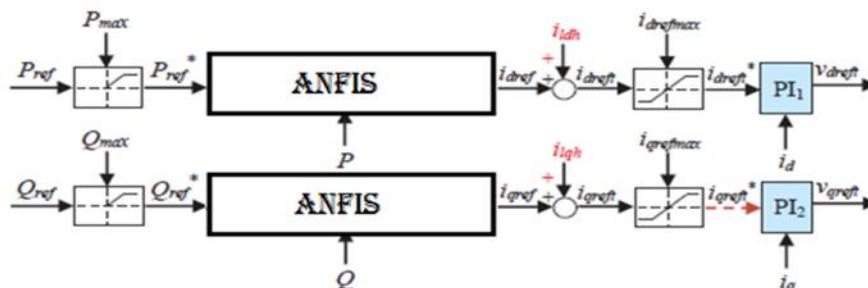


Fig. 6. Control block of the PWM inverter.

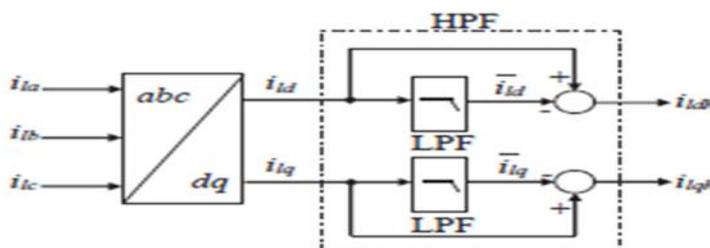


Fig. 7. Extraction of the harmonic components of the non-linear load current.

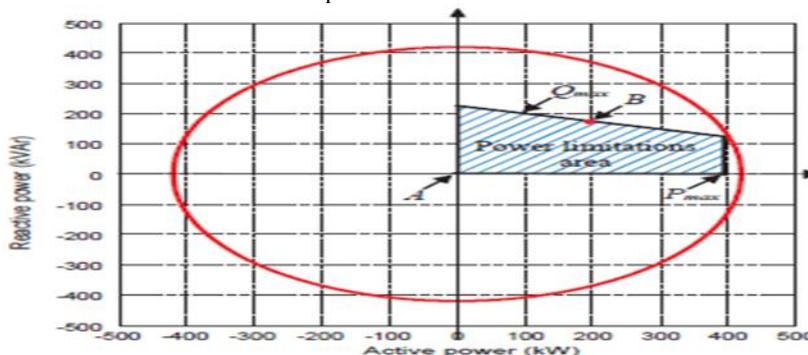


Fig. 8. Power limitations of the SECS.

4.2. SECS capabilities and power quality improvement

Due to the integration of nonlinear loads in the grid, the SECS is not used only to capture the maximum power from the sun, but also to participate in power quality improvement. In this section, the whole system power capacity will be delimited in the (PQ) plane to manage the power of the PVS and improve its quality within the possible limits.

4.2.1. Active and reactive power capabilities of the SECS

To avoid the over-rating of the SECS components during its control for both MPPT power generation and power quality improvement, it is required to know its active and reactive powers capabilities. The area of Fig. 8 shows the whole system capabilities in terms of active and reactive powers limits that will be respected. The circle centered at the point A with a radius of 420 kVA delimits the set of the PWM inverter possible operating points. The two DC-DC converters of the system and the PVS rated power ($2 \times 200 \text{ kW} = 400 \text{ kW}$) determines the active power maximum limit of the system. Moreover, simulation tests have been performed for different active power levels in



order to determine the maximal reactive power that can be generated by the system at the output of the PWM inverter without destabilizing the DC bus voltage. This limit of reactive power (Q_{max}) delimits the upper edge of the trapezoidal shaded area of Fig. 8. An energetic analysis can be used for the delimitation of the whole system reactive power capability in the (PQ) plane. It may be performed on the basis of the DC bus voltage energy balance. For a given active power, one can express the energy to be stored and given back by the DC bus capacitance per cycle. This energy corresponds to a DC bus voltage ripples level. Then, the reactive power that gives a DC bus voltage variation (inside the values permitted by the inverter due to its operation according to the grid ac voltage) can be taken as the upper limit of reactive power (Q_{max}). Under the upper limit of reactive power, the DC bus voltage remains smooth and stable. Note that, in the case of a pure generation of reactive power, the system can inject up to 220 kVar. So, the shaded area that specify the powers limitations of the whole system is determined by the PVS available powers (for a temperature of 25 °C and an irradiation of 1000 W/m²), the DC-DC converters rated power (2×200 kW), the inverter rated power and the DC bus voltage (600–900 V) smoothness and stability.

4.2.2. Management of PVS function's priorities

The capability of the SECS in terms of power is characterized by a maximal current modulus I_{max} that can be calculated on the basis of the power limits P_{lim} and Q_{lim} of Fig. 8. One can write:

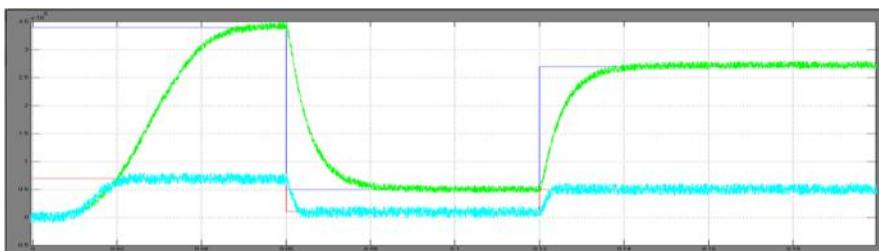
$$I_{max} = \sqrt{2} \frac{\sqrt{P_{lim}^2 + Q_{lim}^2}}{3V_{PCC}} \quad (16)$$

Where V_{PCC} is the bus-bar RMS voltage, P_{lim} and Q_{lim} are the active and the reactive powers limits of the SECS for a given operating point.

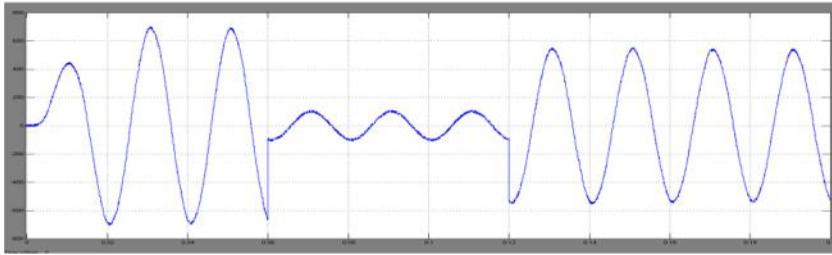
To manage the SECS energy, the first priority is given to active power production over power quality improvement. Thus, the maximum value of the available reactive current to be used for reactive power compensation and harmonic currents mitigation is calculated from the following equation (Gaillard et al., 2009):

$$i_{qrefmax} = \sqrt{I_{max}^2 - i_{drefmax}^2} \quad (17)$$

In order to exploit the SECS at its full capacity in terms of power, it is proposed in this paper to express the total references of the d-q currents for active power production, reactive power compensation and harmonic mitigation by the following equations:



(a)



(b)

Fig. 9. Simulation results of a decoupled power control of the PVS: (a) Active and reactive powers in (kW) and (kVAr) respectively, (b) Phase current i_a (A) at the output of the inverter.

$$i_{dref} = i_{dref} + k_0 i_{ldh}$$

$$i_{qref} = i_{qref} + k_0 i_{lqh} \quad (18)$$

where k_0 is a positive gain which can vary between 0 and 1. Then, the second priority is given to compensate the reactive power over harmonic mitigation. Hence, one can distinguish the following situations:

(a). First, if the reactive current command i_{qref} verifies:

$$i_{qref} \geq i_{qrefmax} \quad (19)$$

Then $i_{qref} = i_{qrefmax}$ and the SECS operates at its full capacity in terms of power. In this case only active power production and reactive power compensation are practically possible (i.e. $k_0=0$). And the total PWM inverter current commands are given by:

$$i_{dref} = i_{dref} \quad (20)$$

$$i_{qref} = i_{qref}$$

(b). Second, if the reactive current command i_{qref} verifies:

$$i_{qref} < i_{qrefmax} \quad (21)$$

Then a portion of reactive current is available and can be used for harmonic filtering. Two cases can be distinguished:

1. The first case occurs for:

$$(i_{dref} + i_{ldh})^2 + (i_{qref} + i_{lqh})^2 \leq I_{max}^2 \quad (22)$$

In this situation, the PWM inverter can be used for both reactive power compensation and total harmonic current filtering (i.e. $k_0=1$) without any over-rating of the system capability. Consequently, the total current commands are expressed by the following equations:

$$i_{dref} = i_{dref} + i_{ldh}$$

$$i_{qref} = i_{qref} + i_{lqh} \quad (23)$$

2. The second case verifies:

$$(i_{dref} + i_{idh})^2 + (i_{qref} + i_{iqh})^2 > I_{max}^2 \quad (24)$$

The value of k_0 can be found by solving this second order equation. Then, the total current commands are calculated from Eq. (18).

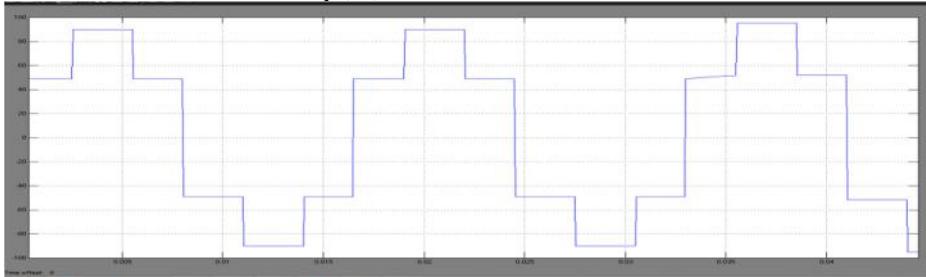


Fig. 10. Characteristics of the studied non linear load: (a) Phase current component i_{la} (A)

5.1. Simulation results of a decoupled power control of the PVS

To show and validate the decoupled power control performance used to manage the PVS energy in terms of decoupling and power limitations, simulation results have been carried out in the same experimental tests conditions presented in Konishi, (2014). In this case, the following operating points (note that the power levels considered here are evaluated per PCS) of Hokuto mega solar plant have been chosen from Fig. 7 of this reference:

($P=341.67$ kW; $Q=64.91$ kVAr), ($P=50$ kW; $Q=9.5$ kVAr) and ($P=275$ kW; $Q=52.25$ kVAr).

These three operating points have been recorded at 13:00, 14:09 and 15:00 respectively (see Fig. 7 of Konishi (2014)). The PVS powers are controlled by the line current components i_d and i_q , the phase angle between the active and reactive powers is chosen equal to $\phi=10.76^\circ$ ($\tan\phi=Q/P=0.19$), (see Fig. 7 of Konishi et al. (2011)) and the switching frequency of the PWM inverter is fixed to 4 kHz (see Table 1. of Konishi (2014)) as in the experimental conditions. Step changes in the active and reactive power commands (P_{ref} , Q_{ref}) are introduced and the actual active and reactive powers delivered by the inverter are presented in Fig. 9(a). One can note that P and Q track properly their commands (P_{ref} , Q_{ref}) respectively in the steady state after a rapid transient of few milliseconds. Moreover, the current amplitude changes depending on the required apparent power, under practically a constant power factor (see Fig. 9(b)).

Elsewhere, the grid current THD is calculated for these operating points, see Table 2. Note that in all cases, the calculated grid current THD is closer to the experimental measurement (THD=2.8%), see Fig. 8 of Konishi (2014).

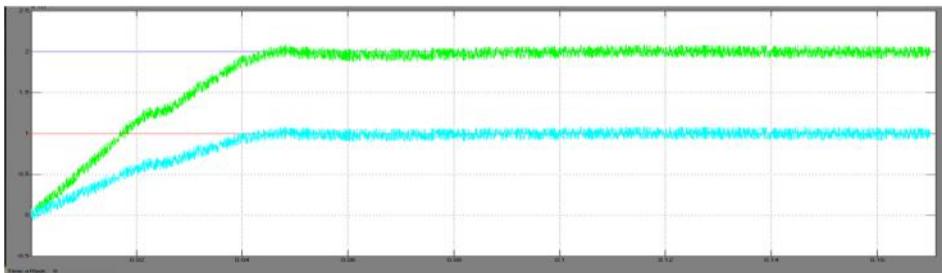
5.2. Simulation results of reactive power compensation and harmonic mitigation in the case of non-saturated current commands

In this section, reactive power compensation and harmonic mitigation, without saturated current commands, are studied. A non-linear load of 80 kW is coupled at the PCC; it is supplied by the PVS via the PWM inverter and draws harmonic currents continuously. Fig. 10 illustrates the non-linear load, its fundamental component and the harmonic part which will be compensated by the active filtering current. The active power to be injected in the grid is 200 kW and the reactive power to be compensated is 100 kVAr ($P_{ref}=200$ kW and $Q_{ref}=100$ kVAr). Before performing the active filtering operation, the DC bus voltage is maintained constant practically and the PVS powers track properly their commands (see Fig. 11(b) and (a)). On the other hand, Fig. 11(c) shows the current waveform injected in the grid before activating the filtering operation. It is non-sinusoidal due to the presence of the non linear load. Moreover, Fig. 11(d) shows the harmonic

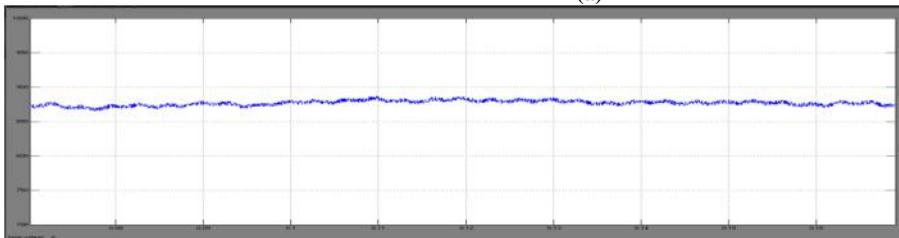


spectrum of this current with a THD of 6.77% for an inverter switching frequency of 4 kHz. Note that, the instantaneous d-q currents track adequately their references (see Fig. 11(e, f)).

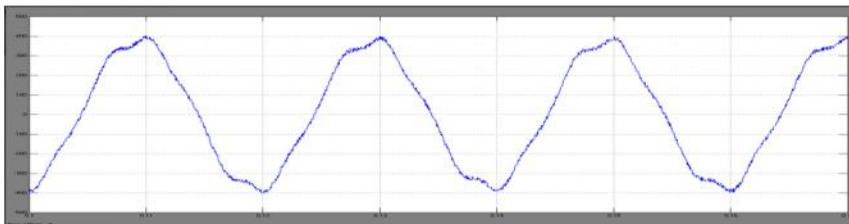
Elsewhere, in the case of performing the active filtering operation, one can notice only small ripples of the DC bus voltage V_{dc} as shown in Fig. 12(a). Moreover, Fig. 12(b) and (c) show the grid current waveform and its spectrum in this case of active filtering operation. One can conclude the filtered grid current and its THD has been successfully reduced under 5% from about 6.77% to 3.42%) to meet the IEEE std 519-2014. Consequently, the RMS of the 5th and the 7th harmonic components have been reduced from about 12.25 A to 1.43 A and from 8.94 A to 1.12 A respectively. Not also that, the instantaneous d-q currents track adequately their references, in this case of active power production, reactive power compensation and total harmonic currents filtering (i.e. $k_0=1$) with some delay at the commutation points of the non linear load characterized by an abrupt variation of the current (see Fig. 12(d, e)).



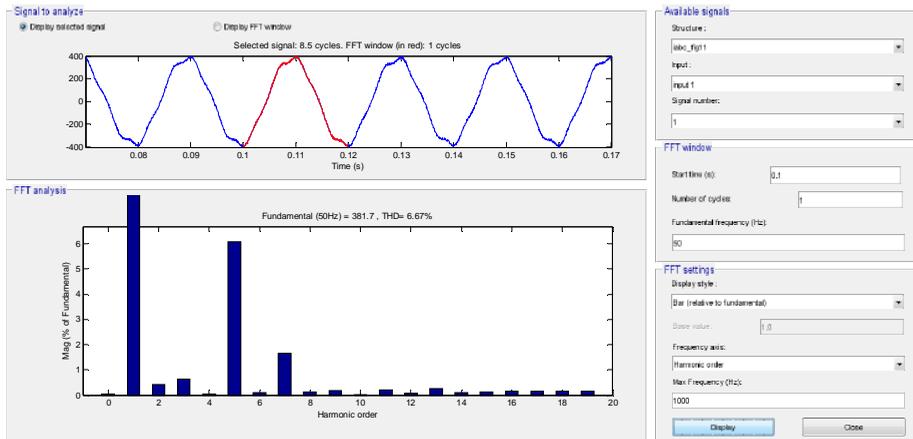
(a)



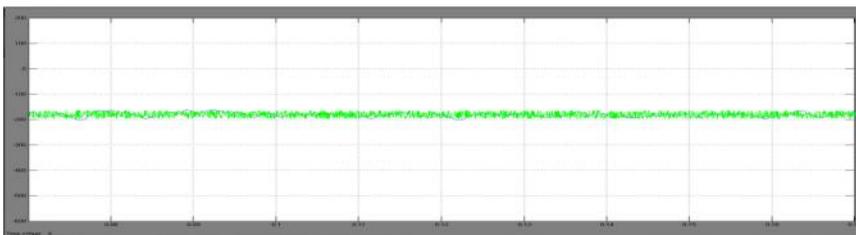
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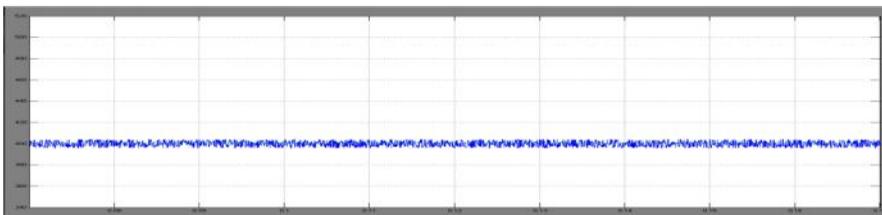
(c)



(d)



(e)



(f)

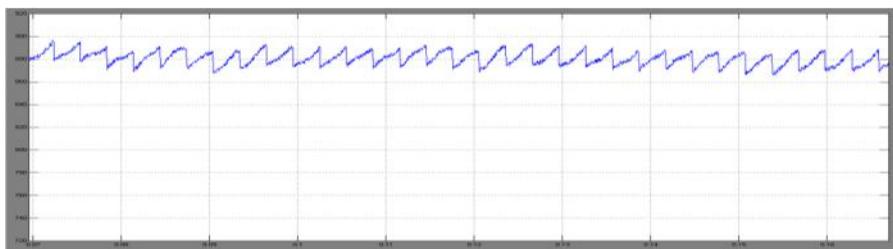
Fig. 11. Simulation results without active filtering under a non-saturated current command: (a) Active and reactive powers injected into the grid P (W), Q (VAr), (b) DC bus voltage V_{dc} (V), (c) Grid current i_{Ga} (A), (d) Grid current spectrum, (e) Direct current component i_d (A) and its command, (f) Quadrature current component i_q (A) and its command.

Elsewhere, Fig. 12(f) shows that the current modulus command doesn't exceed its maximum limit. In addition, Table 3. summarizes simulation results of the grid current THD with and without active filtering, for some operating points corresponding to different active and reactive power levels in this case of a non-saturated current command. This shows explicitly the importance of the proposed filtering strategy in terms of grid current depollution and power quality improvement especially in the case of low injected.

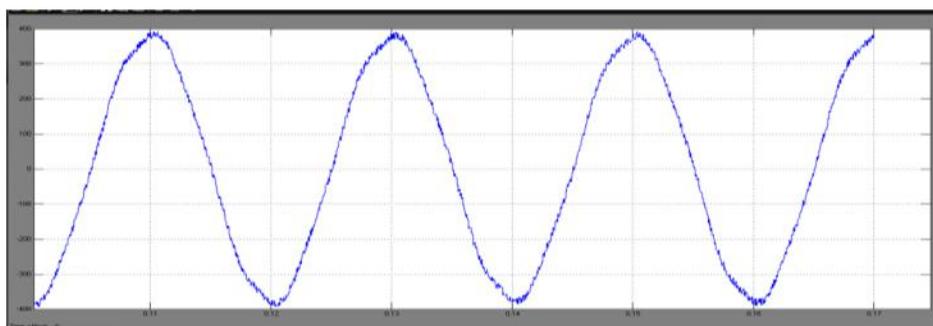
5.3. Simulation results of reactive power compensation and harmonic filtering in the case of saturated current commands

As has been discussed previously (see Section 4.2.2), the current command limit could be reached due to the reactive power current command or to the harmonic current command. These two situations of saturated current command are studied in the two following sections. • Case 1: Saturated current command due to reactive power compensation.

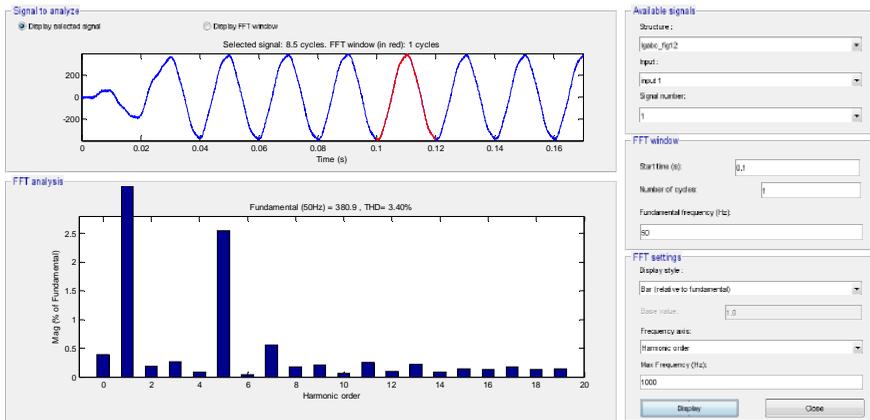
For an active power of 200 kW, the maximum value of the reactive power which can be compensated by the PVS is about 170 kVAr (point B in Fig. 8). To be under the condition of the saturated current command, one can choose exactly the maximum reactive power as a command ($Q_{ref}=Q_{lim}=170$ kVAr) and a non-linear load (of 80 kW) similar to that of Section 5.2. Figs. 13 and 14 show the simulation results under a saturated current command without and with active filtering respectively. Fig. 13(a) shows the current waveform injected into the grid without active filtering, its THD is about 5.98% in this case, as shown in Fig. 13(b). Moreover, this current remains almost the same with active filtering, as can be seen in Fig. 14(a). As a result, its THD is reduced only from 5.98% to 5.85%; see Fig. 14(b). In this situation, the total rated current commands are saturated (see Fig. 14(c)) and the system operates at its full capacity. On the other hand, all the 170 kVAr of reactive power has been well compensated, therefore only a small portion of harmonic currents can be filtered without over-rating the SECS power capability (optimum gain k_0 varies between 1 and 0.28), as can be seen in Fig. 14(d). Due to current command saturation, THD limit specified in IEEE Std 519-2014 is not met. To improve even more the grid current waveform, a coordinated control of the different PCSs (remember that, the 2nd stage of Hokuto mega- solar station contains three PCSs, see Fig. 1) of the studied PVS can be used to well reduce current harmonics generated by the nonlinear load. For this purpose, let us dispatch the reactive power to be compensated between the three PCSs and evaluate again the grid current harmonic distortion. Simulation results show that the THD is decreased from 5.85% to 3.75% and met the limitation defined by IEEE std 5.19 norm.



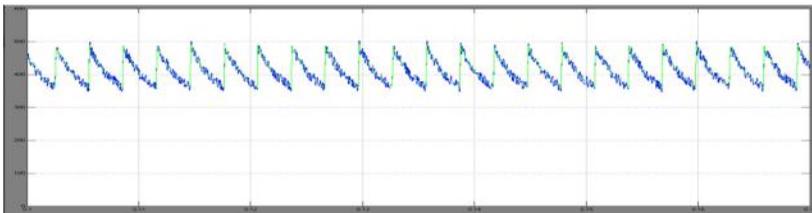
(a)



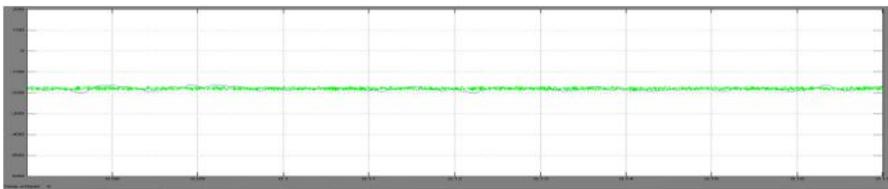
(b)



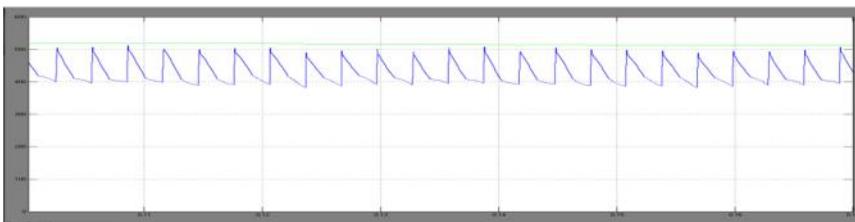
(c)



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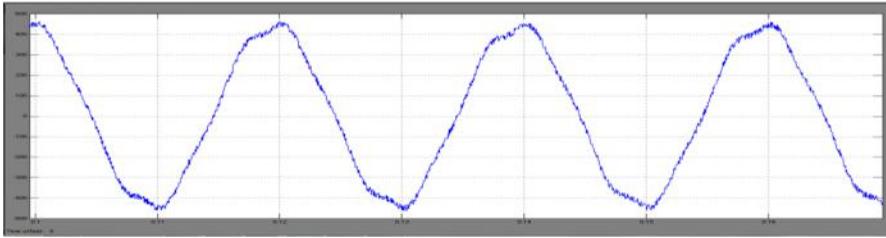


(e)

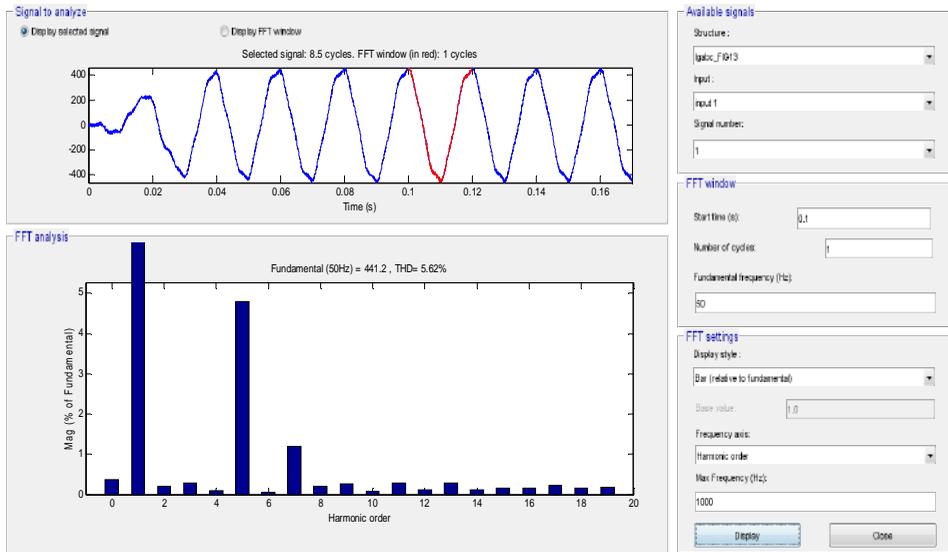


(f)

Fig. 12. Simulation results in the case of active filtering under a non-saturated current command: (a) DC bus voltage (V), (b) Grid current i_{Ga} (A), (c) Grid current spectrum, (d) Direct current component i_d (A) and its command, (e) Quadrature current component i_q (A) and its command, (f) Grid current modulus I (A) and its maximum limit I_{max} (A).

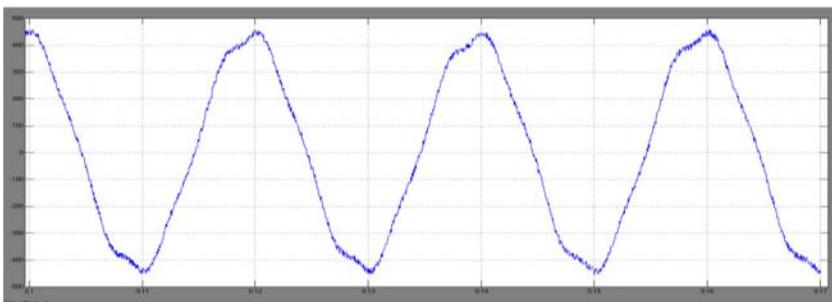


(a)

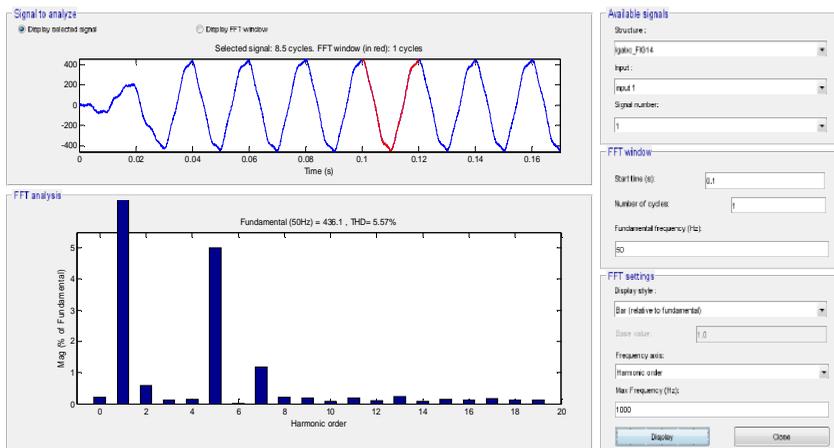


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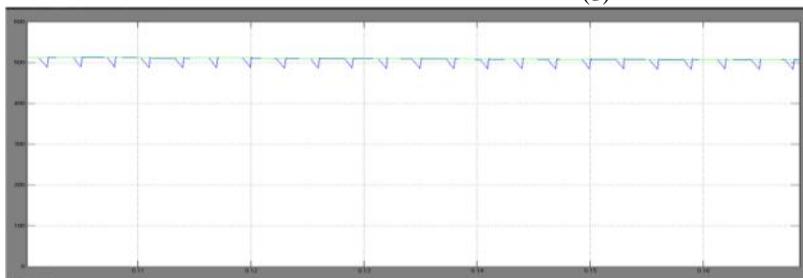
Fig. 13. Simulation results without active filtering under a saturated current command due to reactive power compensation: (a) Grid current i_{Ga} (A), (b) Grid current spectrum.



(a)



(b)



(c)

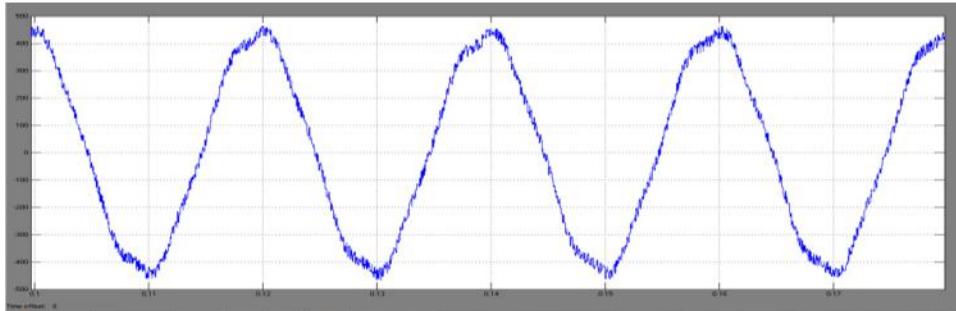
Fig. 14. Simulation results with active filtering under a saturated current command due to reactive power compensation: (a) Grid current i_{Ga} (A), (b) Grid current spectrum, (c) Grid current modulus I (A) and its maximum limit I_{max} (A).

• Case 2: Saturated current command due to harmonic filtering

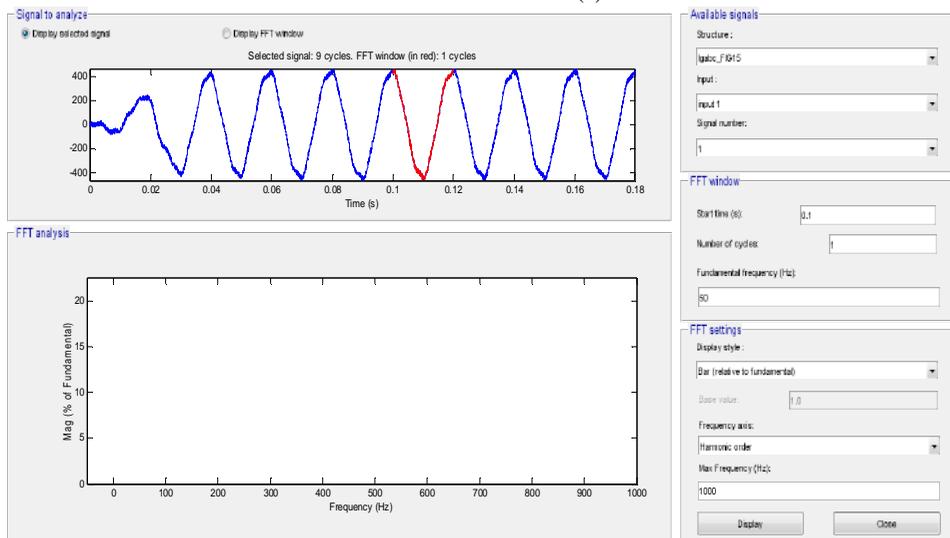
To show the ability of the proposed strategy which permits to exploit the full capability of the SECS in terms of active filtering, it has been chosen to compensate a reactive power of about 160 kVAr and to filter harmonic currents of the same non-linear load of Section 5.2. In this case, the inverter can compensate the total reactive power because it is less than the system upper limit (170 kVAr). So, a portion of 10 kVAr is available and can be used for active filtering. This quota of reactive power is not enough to compensate the whole harmonic currents without over-rating the system limits. In this situation, two cases have been investigated (with and without active filtering, see Figs. 15 and 16 respectively). The unfiltered grid current waveform is shown in Fig. 15(a) and its harmonic spectrum is shown in Fig. 15(b). In this case, the current THD is about 6.03%.

Elsewhere, it can be seen that the grid current becomes less distorted when the active filtering procedure is activated as shown in Fig. 16(a). In fact, the THD value of the grid current in this case is 4.40%, this means 1.63% less than the THD of the non-filtered current, which is an important improvement, (see Fig. 16(b)). Note that, the current command is saturated due to harmonic filtering and the optimum gain k_0 varies between 1 and 0.49, so that to keep the instantaneous current lower than its maximal value as shown in Fig. 16(c, d). During this time, the full capability, in terms of active filtering of the SECS has achieved. Moreover, some simulation results of the grid current THD without active filtering, with active filtering and with active filtering whilst taking into account the system limits for different non-linear load values in the case

of a saturated current command due to harmonic filtering are summarized in Table 4. This shows a relative improvement of the grid current THD while keeping the system operation under its limits.

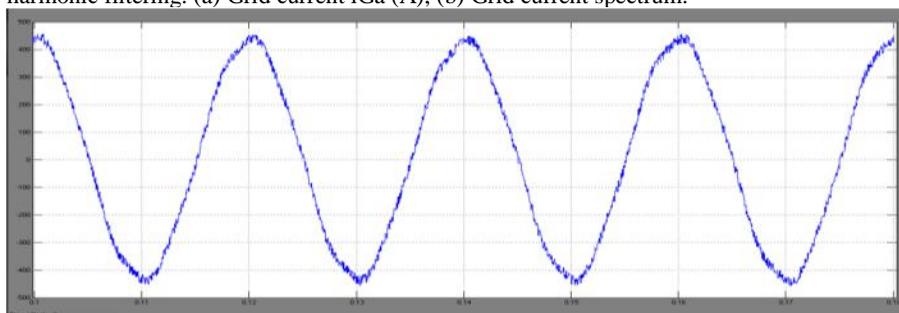


(a)

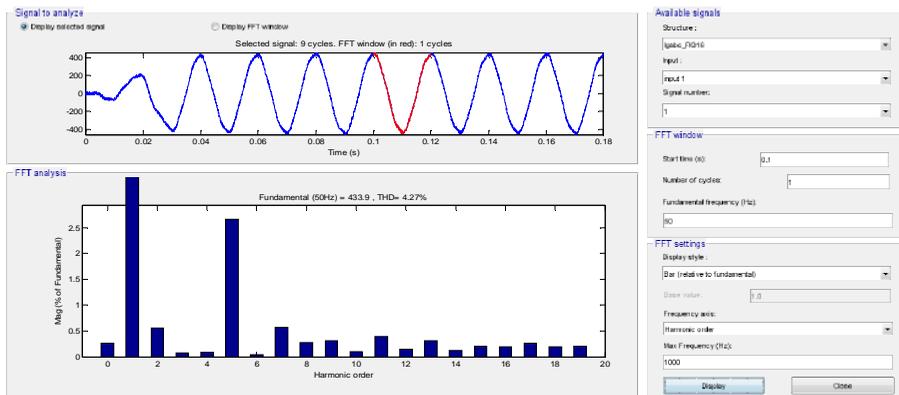


(b)

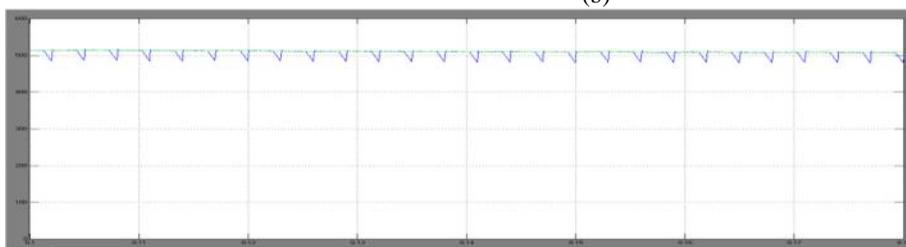
Fig. 15. Simulation results without active filtering under a saturated current command due to harmonic filtering: (a) Grid current i_{Ga} (A), (b) Grid current spectrum.



(a)



(b)



(c)

Fig. 16. Simulation results with active filtering under a saturated current command due to harmonic filtering: (a) Grid current i_{Ga} (A), (b) Grid current spectrum, (c) Grid current modulus I (A) and its maximum limit I_{max} (A)

Note that, to filter the harmonic currents of a given non-linear load, the proposed approach has been successfully applied to pilot the PWM inverter of the PCS in order to exploit the full capacity of the SECS. Economically, the use of our approach is better and permits to exploit the existing PWM inverter of the PV PCS. But technically, a parallel active filter (the most dominant and efficient filter in practice) may give results slightly better than our results since this filter is a less powerful converter with higher switching frequency.

6. Conclusion

In this paper, a novel system has been proposed to oversee and improve the power nature of a grid associated substantial scale PVS. All the more precisely, ANFIS controller have been utilized to ensure a decoupled control of dynamic and reactive powers injected into the grid. The PWM inverter is controlled in such an approach to oversee between dynamic power generation and power quality improvement without surpassing the entire system control limit. The proposed need control square gives top need to dynamic power creation, at that point reactive power compensation and finally active filtering. The power ability of the entire system has been delimited in the (PQ) control plane (based on the PVS accessible power, the power electronics converters appraised control and the DC transport voltage smoothness and solidness) and completely misused without over-rating, calculation of an appropriate portion of current commands in order to ensure a better active filtering quality and hold the inverter current under its farthest point esteem relating to the entire system control limit. Simulation results demonstrate the adequacy and the execution of the proposed methodology as far as power generation, reactive power compensation and active filtering.



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MAXIMUM POWER POINT TRACKING OF PHOTOVOLTAIC (PV) ARRAY USING PSO

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Abstract

This Project presents Particle Swarm Optimization and Incremental Conductance-ANN methods is used to find the optimum operating parameters of a solar photovoltaic panel under varying atmospheric conditions. A fast and dynamic MPPT technique is desirable to track environmental variations without losing too much energy gains. In order to track the maximum power, an intelligent controller based MPPT algorithm for a standalone PV system is presented in this paper. For that purpose, hybrid techniques based Particle Swarm Optimization (PSO) and Incremental Conductance Artificial Neural Network (INC-ANN) are proposed and comparative analyses are made. In addition to that, mathematical modeling of PV array is analyzed using a single-diode model using MATLAB/Simulink environment. It is evident from the results that the control scheme based on the hybrid INC-ANN with MPPT method is promising in tracking the maximum power with less oscillations under variable climatic conditions and load variations compared to other available techniques.

Index Terms: Particle Swarm Optimization, Maximum power point tracking, Constant power generation control, PV systems, Perturb and Observe, Incremental conductance.

1. INTRODUCTION :

A rapid growth of industries and population needs energy to maintain the economic development. The combustion of fossil fuels to generate electricity is one of the largest sources of CO₂(is a heat-trapping “greenhouse” gas) emissions, which will cause the increasing hazard of global warming and climate changes. During the last decade, non-conventional energy sources such as wind, solar, bio-mass, geothermal and hydro power showed penetration growth all around the world. The absence of CO₂emission and free availability made these energy sources more attractive in the recent years. Owing to low installation cost and sun light throughout the year, solar PV energy system is of high interest and most promising energy source for future energy demand. However, it suffers



from several drawbacks; most notably, the cost of solar panels is high, while its conversion efficiency from sunlight into electricity is low. In ordinary units the conversion efficiency can be as low as 12%, whereas in very special setups, it can reach a maximum of 42.8% [1]. The power delivered by the PV system is intermittent in nature as the power output characteristics largely depend on solar irradiations and cell temperature variations.

With the intention of achieving the maximum possible power, load impedance should be matches with the source impedance which brought the line near to the maximum power point (MPP). For that purpose, a MPPT controller is normally integrated into a dc-dc converter control system [2–4]. For the impedance matching, MPPT controllers are effectively employed to dynamically adjust the duty cycle of dc-dc converter. Dc-dc converter and the controller together are then referred to as the MPPT solar charge controller or Power Conditioning Unit. In order to achieve the maximum MPP, researchers are going for variety of MPPT techniques, which have been proposed in their research. Due to nonlinear nature of solar panel which utterly depends upon solar irradiation and cell temperature, the researchers put more attention in the MPPT tracking system. Various types of MPPT algorithms are developed by the many researchers they are hill climbing algorithm, perturb and observe (P&O), constant voltage and current method, incremental conductance (INC), artificial intelligent techniques like Neural Network(NN), Fuzzy logic control system, and, genetic algorithm (GA) [5–10] Particle swarm optimization (PSO) come under optimization methods. In fig 1 ,hybrid techniques based Particle Swarm Optimization (PSO) and Incremental conductance (INC) Artificial neural networks (INC-ANN) are proposed. In the recent literature, hybrid MPPT techniques such as ANN based INC, FLC based INC, Neuro-fuzzy based MPPT have been proposed by many researchers to track the maximum power efficiently [11–13]. The hybrid system also includes optimization techniques such as GA based Fuzzy, PSO based Fuzzy and GA based ANN [14–16]. The Author in [17] explains the combination of traditional P&O with learning automata (LA) optimization to search Maximum power point of solar PV system .The traditional MPPT algorithms are P&O and INC used by researchers in his research. P&O has some drawbacks compared to INC, as its output power may oscillate around the MPP regardless of changes in irradiation. Among the different artificial intelligence MPPT techniques, PSO gives better performances. The MATLAB/Simulink environment is used to analyze and model the dynamic performance of the MPPT controller with solar PV system. In order to study the dynamic performance of the system and to confirm the analytical findings, the models are simulated in the MATLAB/Simulink environment and the results are analyzed.

2. PV MODULE ANALYSIS:

2.1. MATHEMATICAL MODELING USING SINGLE-DIODE MODEL:

A practical array consists of number of series connected cells is modules which increases the system voltage and number of series connected cells is modules which increases the system voltage [18]-[19].

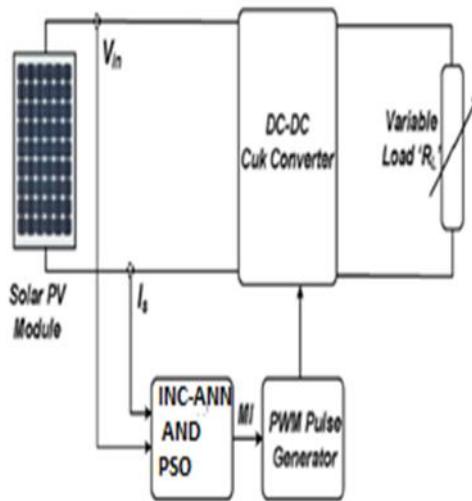


Fig. 1. Schematic diagram of solar PV system with Dc-Dc Cuk converter.

A basic solar cell comprises the parallel combination of current source a diode as shown in Fig. 2. This is called a one-diode model. The mathematical equation illustrates the I–V relationship of ideal PV cell, based on the Shockley and Queisser (SQ) diode equation, from Fig. 2 as follows:

$$I = I_{ph} - I_d(1)$$

Where

$$I_d = I_o \left[\exp \left(\frac{qV_d}{AKT} \right) - 1 \right] (2)$$

Substituting Eq. (2) into Eq. (1) exhibits the I–V relationship of the solar PV cell.

$$I = I_{ph} - I_o \left[\exp \left(\frac{qV_d}{AKT} \right) - 1 \right] (3)$$

There are various models available and numerous researches are going on the modeling of solar panel to predict the accurate characteristics performance of solar PV model. Among them, two-diode model is more accurate and popular. However, it has two exponential terms in the mathematical equations and seven unknown parameters. It takes more computational time and many more complications are involved to find out these parameters. However, B.C.Babu et al. has proposed a novel simplified two-diode model with reduced computational burden in addition to negligible series and shunt resistances [21]. The present work consists of one-diode model with Rs (four parameter model) is considered for modeling the solar panel.

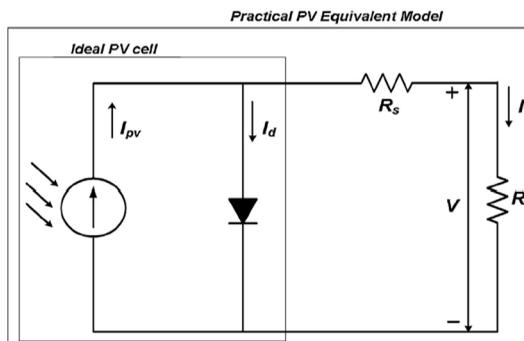


Fig. 2.Equivalent circuit of solar PV cell.

The parallel resistance R_p is considered to have a high value close to infinity, so it can be neglected. This model needs calculation of four parameters such as I_{ph} , I_0 , R_s and A . The following mathematical equation describes the I–V characteristics of the solar cell in series with R_s

$$I = I_{ph} - I_0 \left[\exp \left(\frac{q(V + IR_s)}{AKT} \right) - 1 \right]$$

(4)

Where,

q - Electron charge (1.6×10^{-19} Coulombs),

K - Boltzmann constant (1.38×10^{-23} Nm/K),

T - PV Module temperature in Kelvin,

I_0 - Reverse saturation current of diode,

A - Diode ideality constant of diode,

I_{ph} - Light generated current of PV cell in Ampere,

R_s - Series Resistance of PV cell,

N_s - Number of PV module connected in series,

I - Output current of PV cell in Ampere

A correlation between reverse saturation current and cell temperature will affect the power delivered by the solar panel. Increase in the cell temperature T will increase I_0 and hence, the PV output power will be reduced [22]. The I_0 varies with cell temperature and that can be expressed as

$$I_0 = I_{rs} \left(\frac{T}{T_r} \right)^3 \exp \left[\frac{qE_g}{AK} \left(\frac{1}{T_r} - \frac{1}{T} \right) \right]$$

(5)

I_{ph} which depends on solar irradiation G and temperature T .

$$I_{ph} = I_{sc} [1 + a * (T - T_r)] * G \quad (6)$$

The diode ideality factor depends on types of semiconductor materials used by the PV technology. The value of "a" only depends on semiconductor materials used in the PV technology and is independent of cell temperature and solar irradiance.



2.2. CUK CONVERTER TOPOLOGY:

Dc-Dc converter is the heart of the MPPT system. The MPPT utilizes the converter to regulate the input voltage at the PV module and maintains the operating point of the load at Pmax, when load impedance is equal to PV module impedance. The impedance matching can be obtained by continuously varying the duty ratio D of power MOSFET. The input resistance of the Cuk converter R_i during the continuous conduction mode is given by

$$R_i(\text{CCM}) \in [0, \infty] R_i(\text{CCM}) = \frac{2L_{eq}f_s}{D^2}$$

(7)

Where $L_{eq} = L_1 + L_2$ and f_s – switching frequency

The input resistance R_i during the discontinuous conduction mode is given by

$$R_i(\text{DCM}) = \frac{K \cdot R}{D^2} \quad (8)$$

Based on the above, the Cuk converter is capable of sweeping the entire I–V curve of a solar PV module in CCM from open circuit voltage (V_{oc}) to short circuit current (I_{sc}) condition. Based on the pair of inductors used in the input and output in the Cuk converter, the input current is non-pulsating. Therefore, it is convenient to sweep over the I–V curve with less oscillation. Since the Cuk converter has the advantages of continuous input and output current [2], it is used in the proposed study. The circuit diagram of the Cuk converter is shown in Fig. 3.

3. MAXIMUM POWER POINT TRACKING:

There are a number of MPPT techniques available in the literature [24,25]. P. Bhatnagar et al. discussed the various MPPT techniques that the tracking ability of these techniques can varied by parameters such as design complexity, tracking accuracy, tracking speed, real time observation developed as hardware [26]. K. Ishaque et al. Explains mainly the P&O, INC. and Hill climbing [27] and also Intelligent MPPT techniques are considered under uniform isolation and partial shaded conditions as well.

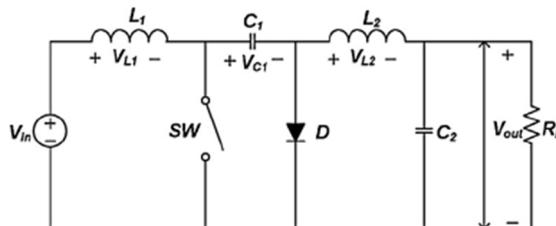


Fig. 3. Circuit diagram of Dc-Dc Cuk Converter.

3.1. ARTIFICIAL NEURAL NETWORK

Artificial Neural Network (ANN) is an intelligent system that adapts itself easily to non-linear and even abstract systems by learning about them through a set of training data. The ANN is comprises with large number of neurons which is called as parallel and distributed processing system [11]. It uses a single or multilayer feed-forward network. The multilayer feed forward architecture consists of input and output layer combined with one or more hidden layer. Back propagation algorithm is the cornerstone of the ANN training process.

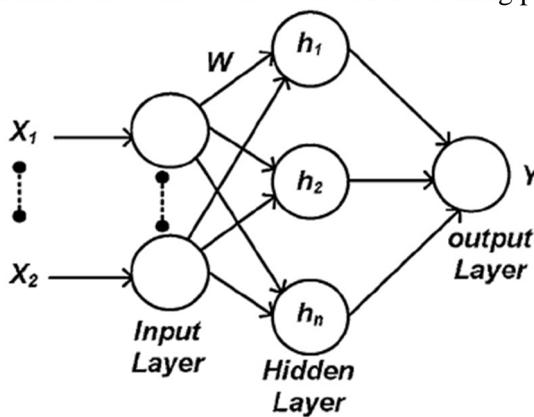


Fig. 4.Architecture of feed forward network.

The gradient descent technique can be used to minimize the cost function is equal to Mean Squared Error (MSE) which is defined as the difference between the desired outputs and the actual network outputs. Multi-dimensional mapping problems can also be easily handled using a multi-layer feed forward network. A two-layer network is shown as a particular example in Fig. 4. It consists of input neuron and output the one layer of sigmoid hidden neurons is placed in between the input neurons and the other layer of linear output neurons. The output neuron is the function of the weighted sum of the inputs neuron along with the bias is follows:

$$y_j = f[(w_{ij} + x_{ij}) + b_j] \quad (9)$$

As mentioned, the layered feed-forward ANNs is trained by the back propagation algorithm. The input neurons send their signals “forward”, and then the errors are propagated backwards to adjust the weights. In order to activate the network, supervised learning technique is used in the back propagation algorithm, from which the error is calculated. The error is the difference between actual and expected outputs and it can be calculated by algorithm with set of inputs and outputs. This error is reduced by using back propagation algorithm until the ANN learns the training data. The key factor of ANN is to train data with random weights and adjust them to minimize the error. One of the major advantages of



neural nets is their ability to generalize. The performance of the network can be evaluated using Mean Squared Error (MSE) as follows:

$$MSE = \frac{1}{n} \sum_{i=1}^n (P_{\text{estimated}} - P_{\text{target}})^2 \quad (10)$$

3.2 PARTICLE SWARM OPTIMIZATION APPLICATION TO MPPT CONTROL

In this section the problem involved in solving the MPPT control using PSO technique is discussed. The PSO method is a simple and effective meta-heuristic approach that can be applied to a multivariable function optimization having many local optimal points. The PSO uses several cooperative agents and each agent shares the information attained by each individual during the search process. Here PSO initializes the variables randomly in a given space. The number of decision variables determines the dimension of space. Each optimization problem is to search the solution space of a particle, each particle runs at a certain speed in the search space, the speed of particles is in accordance with its own flight experience and flight experience of other examples with dynamic adjustments. In the optimization space, each particle has decided to adapt the objective function value, and recorded their own best position P_i found so far, and the entire group of all particles found in the best position P_g . Velocity and position update formula are as follows[3].

$$V_i^{K+1} = wV_i^K + c_1r_1(P_i^k - X_i^k) + c_2r_2(P_g^k - X_i^k) \quad (9)$$

$$X_i^{K+1} = X_i^K + V_i^{K+1} \quad (10)$$

Where

V_i^{K+1} Is the particle velocity

X_i^{K+1} Is the current position of a particle.

P_i^k is the Pbest and

P_g^k is the Gbest,

r_1 & r_2 is the random number between 0 & 1,

c_1 & c_2 are learning factors. Usually $c_1=c_2=2$.

Algorithm for PSO Implementation:

Step 1-

Set the number of particles and searching parameters along with the limit for position and velocity

Step 2-

Randomly initialize Position and velocity of each particle.

Step 3-



Compute the fitness value of each particle.

Step 4-

The particle having the best fitness value is set as Gbest (Global Best).

Step 5-

Update the position and velocity of each particle with respect to the Gbest.

Step 6-

Repeat Step 3 & 4 till the optimum solution is reached.

Step 7-

Gbest at the end of the last iteration gives the optimized value.

Step 8-

Compute the Duty-cycle using the given formula

$$D = \frac{1}{1 + \sqrt{\frac{R_{in}}{R_{out}}}}$$

The PSO is a swarm intelligence-based algorithm used to find the global optimal solutions. The reasons why PSO has gained the popularity is because it has only a very few parameters that need to be adjusted. Although PSO is still in its infancy, it has been used across a wide range of applications.

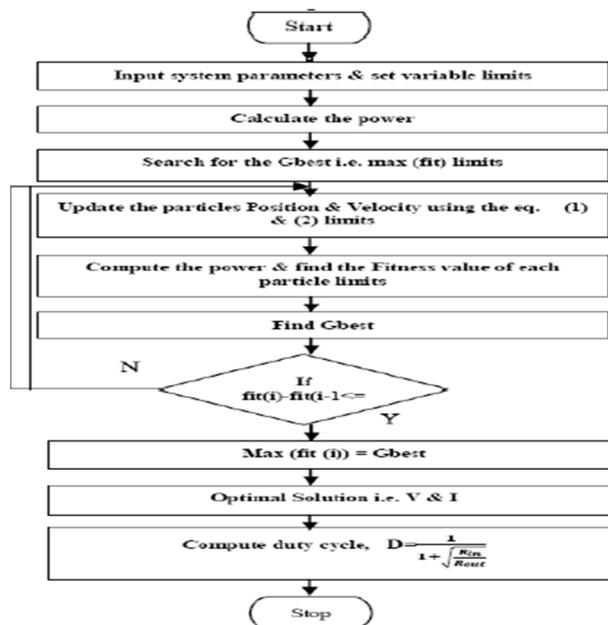




Fig. 5: PSO method flow chart

On the other hand P&O method has simple structure and high reliability. The said techniques find the optimal electrical operating points and corresponding duty cycle at which the maximum power can be transferred. The performance of the proposed MPPT methods is tested by simulation at different irradiation and temperature using MATLAB. Fig 4 shows flow chart diagram of particle swarm optimization method.

3.2. Incremental conductance algorithm:

To eradicate the drawback of P&O, the better choice is the Incremental Conductance (INC) algorithm is extensively used by many researchers in their research. INC is based on comparing instantaneous conductance (I/V) with incremental conductance ($\Delta I/\Delta V$). The PV system voltage is increased or decreased based on the output obtained from the above comparison. The MPP is attained, when the $dP/dV = 0$.

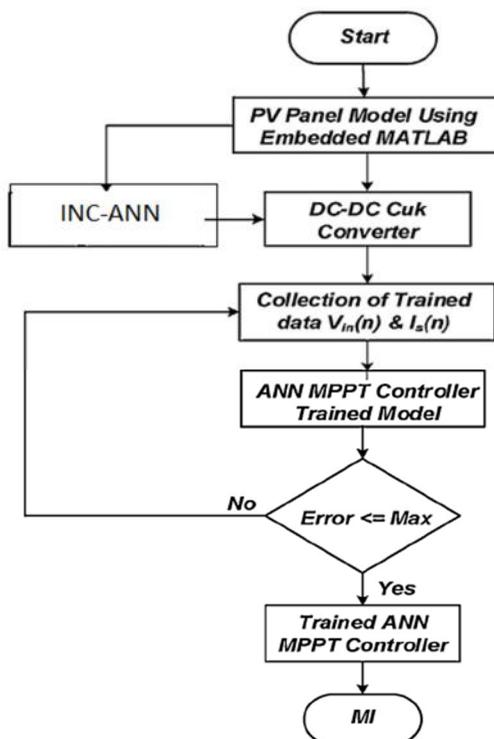


FIG 6:INC-ANN Method flow chart

3.3. Hybrid PSO and INC-ANN method:

Initially, the performance of INC-ANN MPPT controller is analyzed for PV panel with Cuk converter. The PSO and INC-ANN MPPT controller are tested

under various irradianations and cell temperature, as result, the PSO exhibits more oscillation than INC-ANN MPPT controller during sudden change in irradiation. The flowchart given in Fig. 5 shows the PSO or INC-ANN MPPT controller to reduce the drawbacks found in the INC MPPT controller.

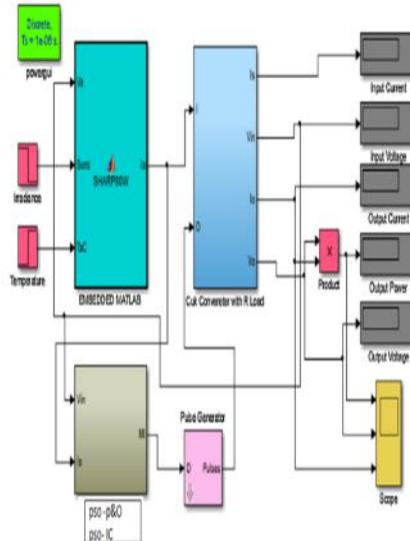


Fig. 7. Simulink diagram of overall system.

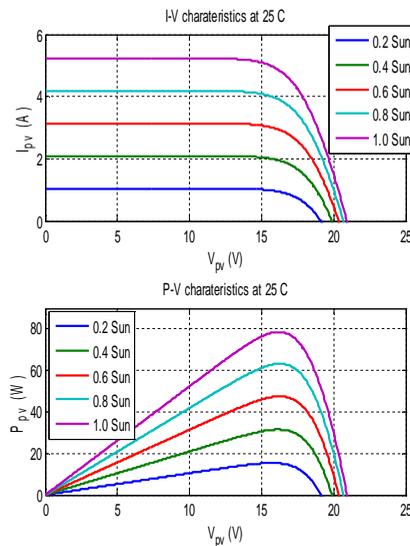


Fig. 8. (a) P-V curve for various irradiation G at T = 25°C and (b) I-V curve for various irradiation G at T = 25°C.

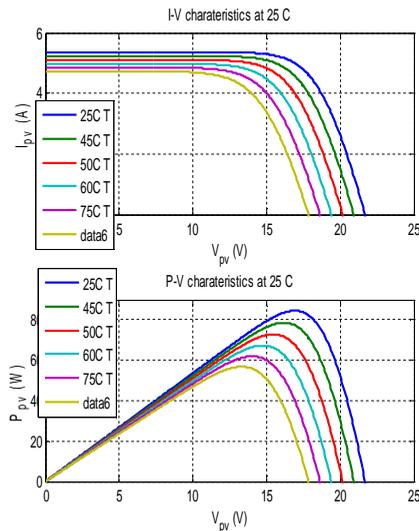
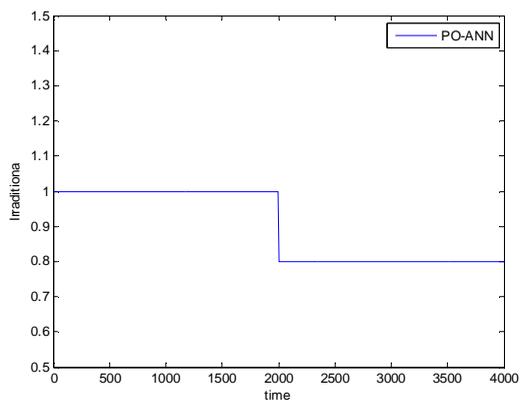


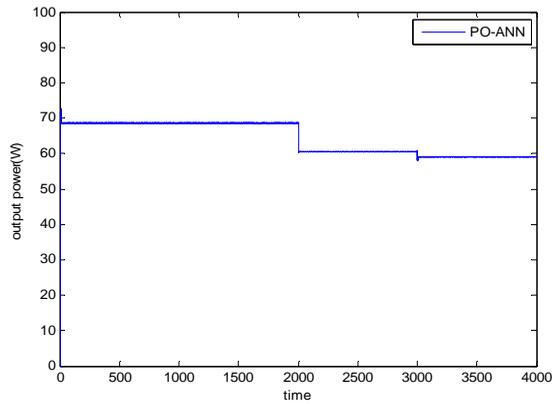
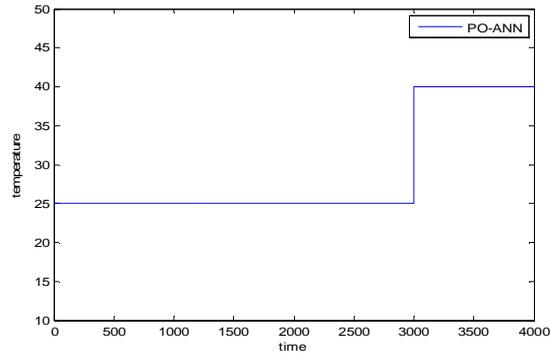
Fig. 9. (a) P–V curves for various temperature T at $G = 1$ suns (1000 W/m^2) and (b) I–V curves for various temperature T at $G = 1$ suns (1000 W/m^2).

4. SIMULATION RESULTS

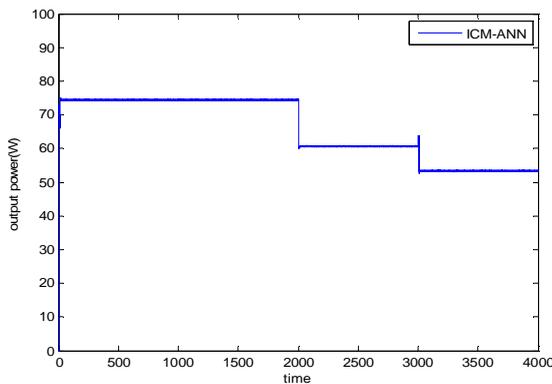
The proposed study is analyzed using MATLAB/Simulink environment and the numerical results are presented here. The P–V and I–V characteristics are analyzed using Embedded MATLAB function by using Newton Raphson Algorithm which is given in Appendix A. The MATLAB/Simulink environment is used to implement INC-ANN with SAEs MPPT controllers. The SIMULINK block diagram is shown in Fig. 7.



(i)



(iii)



(iv)



Fig. 10. Simulation of (i) irradiance and (ii) temperature & Output Power corresponds to (iii) INC-ANN and (iv)PO-ANN MPPT Controllers under dynamic variations.

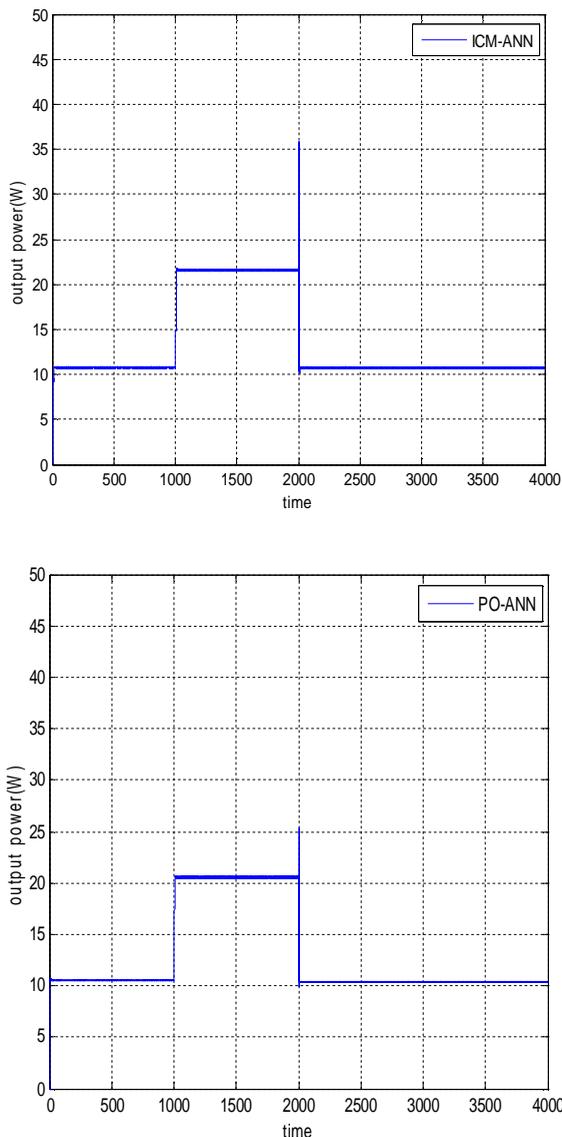


Fig. 11. Shows the output power variation under irradiation (460wb/m2) and cell temperature (27) for varying load with PO-ANN& IN-ANN

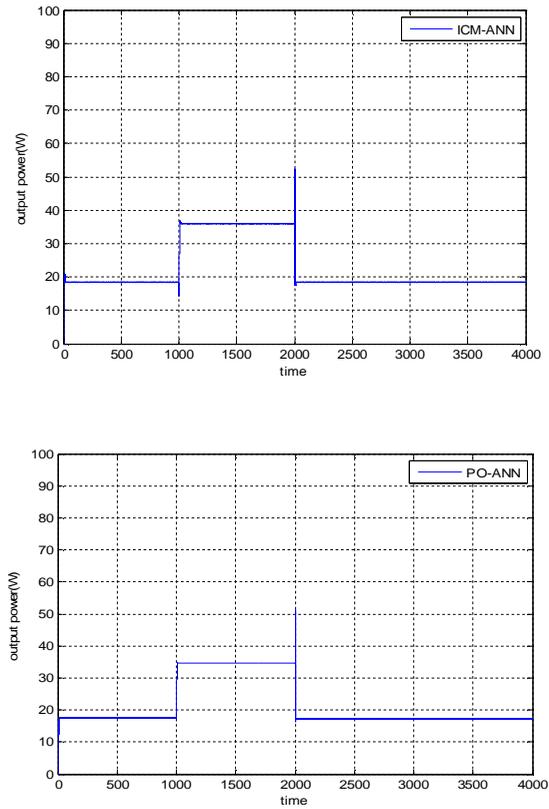
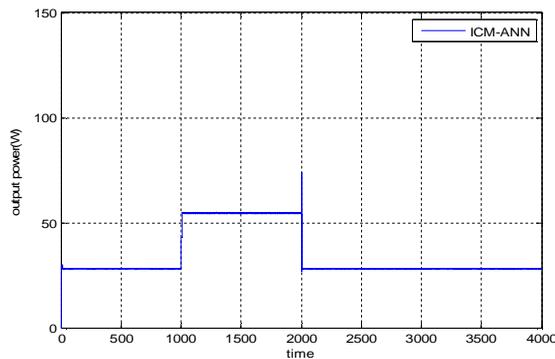


Fig. 12. Shows the output power variation under irradiation (600wb/m²) and cell temperature (31) for varying load with PO-ANN &IN-ANN



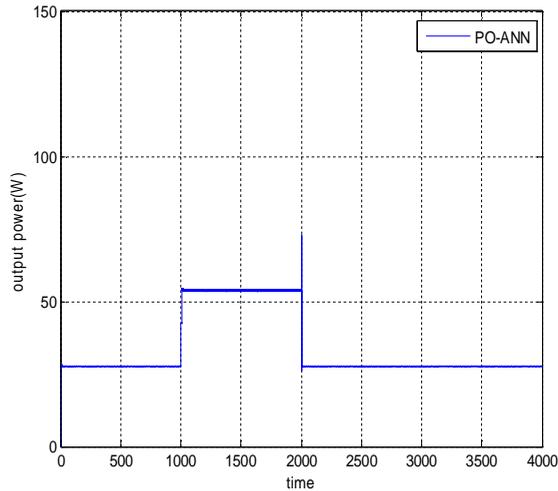
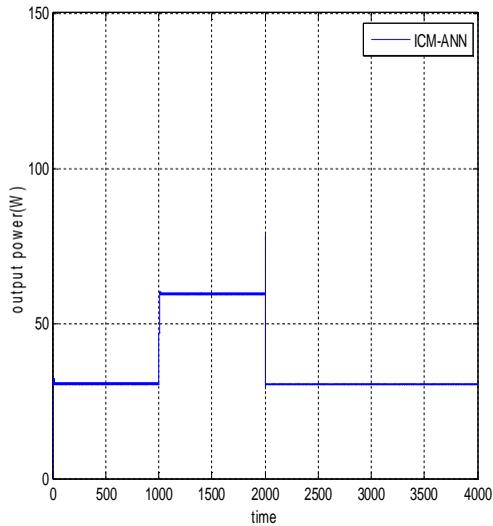


Fig. 13. Shows the output power variation under irradiation (750wb/m2) and cell temperature (30) for varying load with PO-ANN &IN-ANN



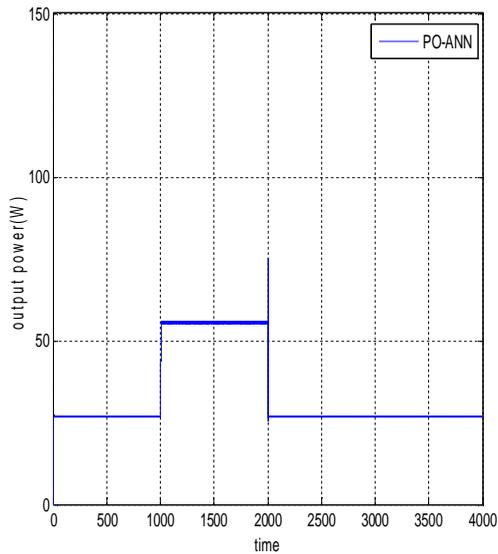
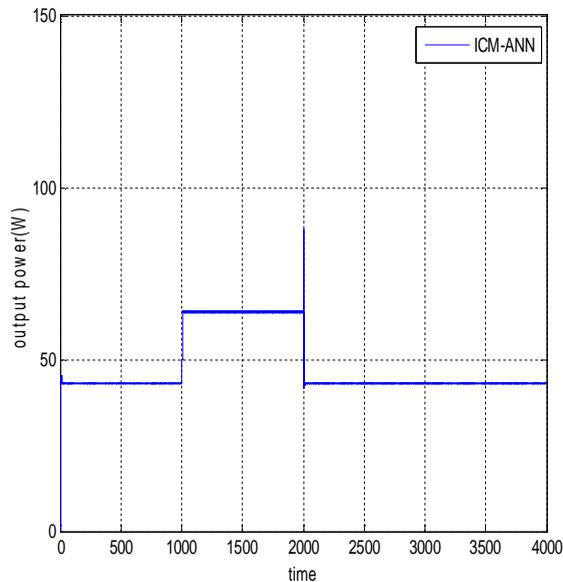


Fig. 14. Shows the output power variation under irradiation (800wb/m2) and cell temperature (35) for varying load



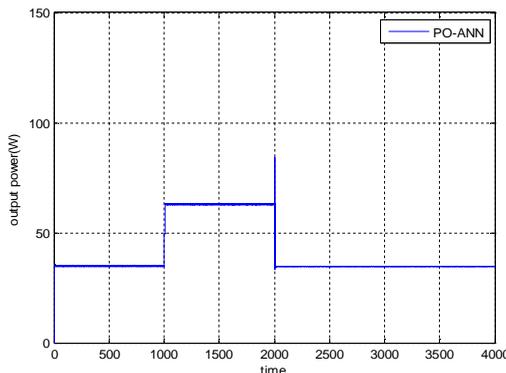


Fig. 15. Shows the output power variation under irradiation (950wb/m2) and cell temperature (40) for varying load

Case-1: Dynamic variation of both irradiation and temperature with Constant load

In practice, the trained ANN has been tested using sudden change in irradiation and temperature. The irradiance is maintained as 1 suns and the temperature is also maintained as 25.C up to 2000 s. After 2000 s the irradiation is suddenly changed from 1 suns to 0.8suns whereas the cell temperature is maintained as 25.C up to 3000 s.

After 3000 s, the temperature is varied from 25°C to 40°C and the irradiance is retained at 0.8 suns up to 4000 s. For all the above cases, the resistive load is fixed as constant i.e. 20ms. The simulation is performed for individual hybrid MPPT algorithms using cuk converter with resistive load. The simulation results of INC-ANN and PO-PSO MPPT controllers are shown in Fig. 10.

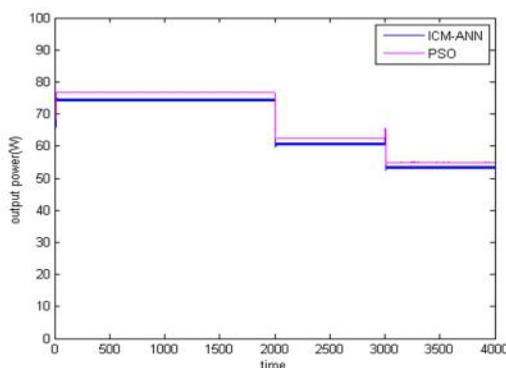


Fig. 16.Simulation of Output Power corresponds to INC-ANN and PO-PSO MPPT Controllers under dynamic variations.

Case-2: Constant irradiation and cell temperature with variable load

The simulation results are presented to show the efficacy of proposed MPPT algorithm for variable load with constant temperature and irradiation. The load variation of 20 ohms from $t = 1000$ to 2000 s and 10ohms from $t = 2000$ to 4000 s. In the load variation, at constant irradiation and cell temperature, the output voltage decays quickly. Table 5 gives the patterns which are used to simulate the MPPT algorithms and Fig. 13 shows the output power variation under constant irradiation and cell temperature for varying load. It can be observed that, between INC-ANN and PO-PSO MPPT algorithms, INC-ANN with SAEs is able to extract more power than PO-PSO with less oscillations during the load variation.

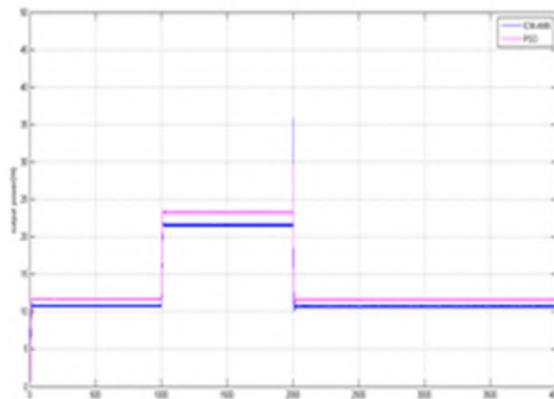


Fig. 17a. Shows the output power variation under irradiation (460wb/m^2) and cell temperature (27) for varying load

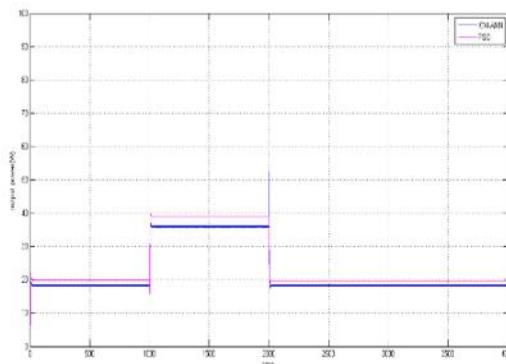


Fig. 17b. Shows the output power variation under irradiation (600wb/m^2) and cell temperature (31) for varying load

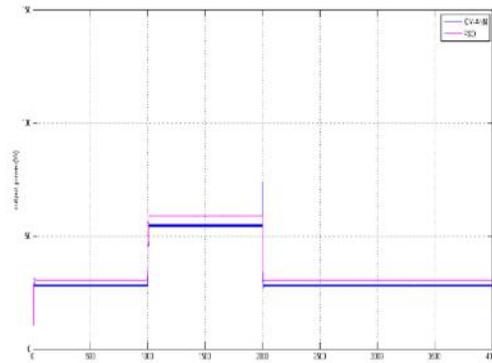


Fig. 17c.Shows the output power variation under irradiation (750wb/m²) and cell temperature (30) for varying load

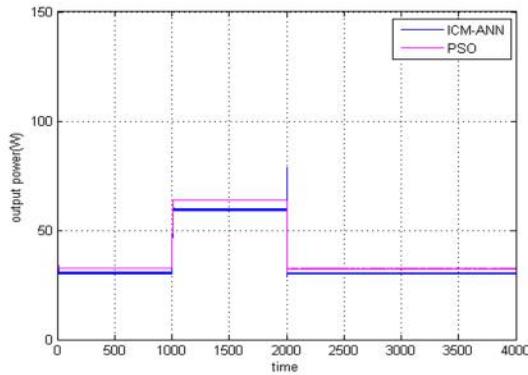


Fig. 17d.Shows the output power variation under irradiation (800wb/m²) and cell temperature (35) for varying load

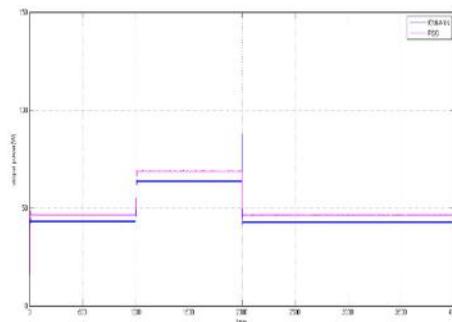


Fig. 17e.Shows the output power variation under irradiation (950wb/m²) and cell temperature (40) for varying load.



5. CONCLUSION and FUTURE SCOPE

In this paper, the performance of MPPT algorithm is analyzed by using hybrid intelligent controller based on PSO and INC-ANN with SAEs controllers for PV system. To achieve the performance through the proposed MPPT controller, the solar module is modelled and dc-dc Cuk converter is analyzed. The complete system is modelled and simulated using MATLAB/Simulink environment and the results are analyzed. The obtained results prove that, INC-ANN with SAEs MPPT controller exhibits reduced oscillation and attain maximum power for a dynamic change in irradiation, cell temperature and load. Moreover, the performance efficiency of PSO with SAEs is better than the INC-ANN with SAEs. The proposed ANN with SAEs based MPPT controller can track the maximum power with less oscillation for a sudden change in irradiation and temperature and can work efficiently during the rapid change in atmospheric conditions and also during load variations.

This work can be further elongated by considering and applying the concepts of Gravitational Search Algorithm(GSA), Firefly Algorithm(FA), Hybrid PSO, Artificial Bee Colony Algorithm(ABC) to the MPPT Controller can track the maximum power with less oscillation for a sudden change in irradiation and temperature and can work efficiently.

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REVIEW ARTICLE: ELECTRONIC WASTE MANAGEMENT IN INDIA- POLICIES & PROBLEMS

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Abstract

Electronic waste or E-squander is moderately a novel expansion to the consistently developing risky waste stream. It incorporates disposed of electronic and electrical gear. Creating nations are confronting gigantic moves identified with the age and the board of E-squander which are either inside produced or imported wrongfully; India is no exemption to it. In any case, the current administration practices identified with E-squander in India are sensibly poor and can possibly chance both human wellbeing and nature. In addition, the arrangement level activities are not being executed in a suitable manner. The stark issue of E-squander alongside its approach level ramifications is viewed in the paper. Over the span of the investigation it has been discovered that there is a critical need to deliver the issues identified with E-squander in India so as to maintain a strategic distance from its negative future outcomes.

Keywords: E-waste, hazardous waste, risk, management.

Introduction:

Assembling of electrical and electronic gear (EEE) is the rising worldwide exercises. Indian Information Technology (IT) division is one of the significant supporters of the worldwide economy. The primary elements recognized to be in charge of the expanded utilization and preparations of electrical and electronic hardware are financial development, industrialization and urbanization. Simultaneously, it is in charge of the age of the greater part of E-waste or Waste Electrical and Electronic Equipment (WEEE) in India. In spite of the fact that the worldwide E-squander issue has had the option to stand out over the world, very little accentuation has been given to the E-squander induced in creating nations. Creating nations like India, today, is loaded with the giant issue of E-squander which is either privately produced or globally imported, making genuine threat human wellbeing and condition. The risky parts in electrical and electronic gear are a noteworthy worry during the waste administration stage. With regards to India, reusing of Waste Electrical and Electronic Equipment isn't attempted to a satisfactory degree. Be that as it may, one of the serious issues identified with E-squander is that there is no standard meaning of WEEE/E-squander. Various nations have turned out with their very own definitions, understanding and utilization of the expression "E-squander/WEEE". The most generally acknowledged definition and portrayal of WEEE/E-squander is according to the European Union mandate. The Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic hardware (WEEE) covers all electrical and electronic gear utilized by customers. For the motivations behind this Directive, after definitions are connected.



'Electrical and electronic gear' or 'EEE' signifies hardware which is subject to electric flows or electromagnetic fields so as to work appropriately and hardware for the age, move and estimation of such flows and fields falling under the classes set out in Annex IA and intended for use with a voltage rating not surpassing 1 000 Volt for rotating flow and 1 500 Volt for direct flow.

- Categories of electrical and electronic equipment covered by this Directive within ANNEX IA are as follows:
 - Large household appliances
 - Small household appliances
 - IT and telecommunications equipment
 - Consumer equipment
 - Lighting equipment
 - Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
 - Toys, leisure and sports equipment
 - Medical devices (with the exception of all implanted and infected products)
 - Monitoring and control instruments

10. Automatic dispensers
A wide scope of items is incorporated inside every class referenced previously. A wide scope of items is incorporated inside every classification referenced previously. In India, E-squander is canvassed in Schedule 3 of "The Hazardous Wastes (Management and Handling) Rules, 2003". Under Schedule 3, E-squander is characterized as "Squander Electrical and Electronic Equipment including all segments, sub-congregations and their divisions aside from batteries falling under these standards". "Rules for Environmentally Sound Management of E-squander" detailed by the Ministry of Environment and Forest, Government of India, in the year 2008 pursued a similar definition.

As indicated by the ongoing "the e-squander (Management and Handling) Rules, 2011", 'electrical and electronic gear' signifies hardware which is reliant on electric flows or electro-attractive fields to be completely utilitarian and 'e-squander' signifies squander electrical and electronic hardware, entire or to a limited extent or rejects from their assembling and fix process, which are expected to be disposed of. A wide scope of writing is accessible on the age and the executives of E-squander, particularly in the created nations. Be that as it may, the work done on the Indian situation of E-squander the executives is nearly less. Sepulveda, A.; Schlupe, M.; Renaud, F.G.; Streicher, M.; Kuehr, R.; Hagelüken, C.; Gerecke, A.C.(2009) state that with the expanding worldwide lawful and unlawful exchange of waste electrical and electronic gear (WEEE) comes a similarly expanding worry of poor WEEE reusing methods. Creators Oyuna Tsydenova and Magnus Bengtsson (2007) expressed that alongside numerous different issues, for example, the segments and dangerous substances in Waste Electrical and Electronic Equipment (WEEE), the perils and dangers related with treatment of WEEE in both created and creating nations ought to be tended to in detail. Understanding the developing worry over E-squander, the Government of India (GOI) has been supporting a few activities. Of specific significance is the evaluation directed by the Central Pollution Control Board (CPCB) on the administration and treatment of E-squander prompting the readiness of "Rules for Environmentally Sound Management of E-squander" in May, 2008 and "the e-squander (Management and Handling) Rules, 2011".



Methodology:

The investigation was led in the system of "Waste and Risk" as proposed by Joost Van Loon in "Hazard and Technological Culture: Towards a humanism of destructiveness" (2002). Waste speaks to uncontrolled issue strange, openly communicating and responding, developing microbes, growths and poisons that may posture direct dangers to our wellbeing (Loon 2002). Waste is viewed as that issue which is to be disposed of or made to vanish, frequently by straightforward methods for evacuation, for example, reject accumulation, landfill dumps, burning and so forth. As indicated by Loon, squander is maybe the most all inclusive case of natural dangers in regular day to day existence. Almost all natural dangers relate somehow to squander, all the more explicitly to contamination. One can have the case of "strong waste contamination" in these respects. Regardless of whether it is atomic waste, biomedical waste or electronic waste, dangers are constantly installed in the materials associated with these waste. Two of the reflections determined by Loon are considered with the end goal of the investigation.

“Cause and Effect” Relationship:

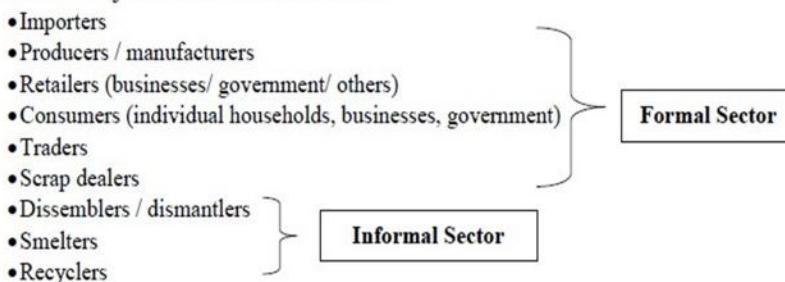
The connection among circumstances and logical results is significant in a wide range of waste. Here the causes might be portrayed as the reasons for the age and quick out of date quality of electrical and electronic hardware. The purposes behind brief age and obsolesce of E-squander incorporate quick financial development, urbanization, industrialization, expanded commercialization and so on. The impacts are the wellbeing and natural dangers related with E-squander. The impacts of ill-advised transfer of E-squander are watched generally after a significant lot of time. At the point when an electronic contraption is discarded with all its perilous components implanted in it, problematic wellbeing and natural impacts are not watched right away. It requires some investment to have a viewpoint of the real chance from the waste. This strengthens the issue of acknowledgment of the risks from waste.

Major Issues Related To E-Waste in India:

While considering the problems related to E-waste in India, there are five major components which should be focused upon. These are Main Sources of E-waste in India, Magnitude of the Problem with respect to the Indian scenario, Health and Environmental Implications of E-waste, Current Management practices of E-waste in India and Policy level initiatives in the country.

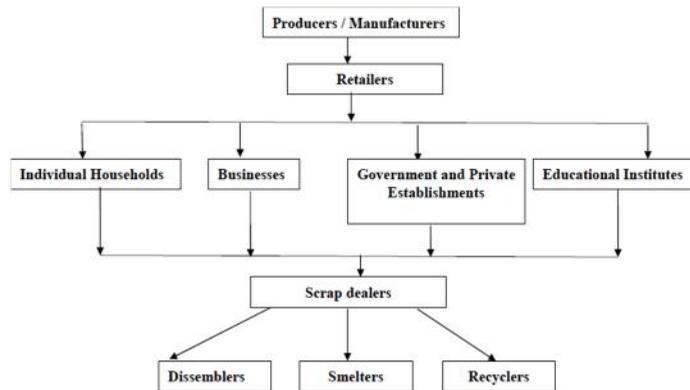
Main Sources of E-Waste:

Some of the major sources of E-waste include





The involvement of various sectors could be observed as the sources of generation of E-waste. The general flow of E-waste across different sectors are tried to represent by the following flow chart.



Magnitude of the Problem with respect to the Indian scenario:

As indicated by a Delhi-based non-legislative association (NGO) Toxics Link, India every year creates \$1.5 billion worth of E-squander locally, with the blasting IT area being the biggest patron, as 30 percent of its machines arrive at out of date quality every year. Bangalore, the IT center point of India, alone creates 8,000 tons per year. The reusing of E-squander is a noteworthy worry in India. The laborers in the reusing division are ruled by the urban poor with low proficiency levels and thus they have almost no mindfulness in regards to the potential risks of E-squander. Among the urban poor, there are a considerable number of ladies and youngsters occupied with different reusing exercises which further misrepresent the issue of E-squander as they are increasingly powerless against the perils from this sort of waste.

One of the significant concerns identified with E-squander, especially in creating nations like India and China, are dumping of E-squander from some created nations. Huge amounts of utilized hardware are normally offered to nations like India, China and different nations in the Asia Pacific locale. These gadgets have exceptionally high fix capacity and high crude material interest. This can bring about high collections of buildup in poor regions without solid ecological laws. Significant purposes behind these fares are shoddy work and absence of ecological and word related benchmarks in Asia. Along these lines the dangerous gushing of the created countries would flood towards the world's most unfortunate countries.

In Indian setting, the hardware business has risen as the quickest developing portion of Indian industry both as far as creation and fares. The Information Technology Revolution of the mid 1990s increased the issue of E-squander in India. Sixty-five urban communities in India produce over 65% of the complete E-squander created in India. Ten states create 75% of the complete E-squander produced in India. Maharashtra positions previously pursued by Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab in the rundown of E-squander producing states in India. Among the main ten urban areas creating E-squander, Mumbai positions originally pursued by Delhi, Bangalore, Chennai, Kolkata, Ahmedabad,



Hyderabad, Pune, Surat and Nagpur (Guidelines for Environmentally Sound Management of E-squander, 2008).

Health and Environmental Implications of E-waste:

Transfer of E-squanders is an unembellished issue looked by numerous areas over the globe. Electronic squanders that are land filled produces defiled leachates which in the end dirty the groundwater. Acids and slime got from dissolving PC chips, whenever arranged on the ground causes fermentation of soil. For instance, Guiyu, Hong Kong a prospering region of unlawful E-squander reusing, is confronting intense water deficiencies because of the tainting of water assets. This is because of transfer of reusing squanders, for example, acids, slimes and so forth in streams.

Electronic and Electrical Equipment are made out of a colossal measure of parts. Huge numbers of them fall under the unsafe classification. Dominant part of these segments contain dangerous substances that impact sly affect human wellbeing and the earth if not dealt with appropriately. Regularly, these risks emerge because of the ill-advised reusing and transfer forms that are by and by in the vast majority of the creating nations including India. Such hostile practices can have genuine repercussions for those remaining in closeness to the spots where E-squander is reused or consumed.

Mercury filters when certain electronic gadgets, for example, circuit breakers are wrecked. The equivalent is valid for polychlorinated biphenyls (PCBs) from condensers. At the point when brominated fire resistant plastic or cadmium containing plastics are landfilled, both polybrominated biphenyl ethers (PBDE) and cadmium may filter into the dirt and groundwater. It has been discovered that critical measures of lead particle are disintegrated from broken lead containing glass, for example, the cone glass of cathode beam tubes, gets blended with corrosive waters and are a typical event in landfills.

What's more, uncontrolled flames may emerge at landfills and this could be a successive event in numerous nations. At the point when presented to fire, metals and other synthetic substances, for example, the amazingly lethal dioxins and furans (TCDD tetrachloride dibenzo-dioxin, PCDDs-polychlorinated dibenzodioxins, PBDDs-polybrominated dibenzo-dioxin and PCDFs-poly chlorinated dibenzo furans) from halogenated fire resistant items can be emitted¹. The most perilous type of consuming E-squander is the outdoors consuming of plastics so as to recoup copper and different metals. The lethal drop out from outside consuming influences the nearby condition and more extensive worldwide air flows, saving exceptionally dangerous side-effects in numerous spots all through the world.

E-Waste Management in India:

In India, it has been seen that in the vast majority of the cases, electronic things are put away unattended in light of absence of learning about their administration. Such electronic trashes lie in houses, workplaces, distribution centers and so forth. By and large, these squanders are blended with family unit squanders, which are at long last discarded at landfills. This requires usage of suitable administration measures including stringent guidelines. The administration rehearses as of now in activity in India have extreme wellbeing and ecological ramifications.

The arrangement of E-squander comprises of differing things a considerable lot of which contain risky components. Accordingly, the real way to deal with treat E-squander is to lessen the centralization of these dangerous synthetic substances and components through



reuse and recuperation. During the time spent reusing or recuperation, certain E-squander portions go about as optional crude material for recuperation of profitable things. In Indian setting, principally reusing, reuse and recuperation are done as measures to treat E-squander. The reuse and recuperation incorporates the unit activities like destroying, isolation of ferrous metal, non-ferrous metal and plastic by shredder procedure, restoration and reuse, reusing/recuperation of significant materials and treatment/transfer of perilous materials and waste. Destroying incorporates evacuation of parts of the electrical and electronic gear containing unsafe substances (CFCs, Hg switches, PCB); expulsion of effectively open parts containing significant substances (link containing copper, steel, iron, valuable metal containing parts and so forth.). Restoration and reuse of E-squander has potential for those utilized electrical and electronic gear which can be effectively revamp to put to its unique use. Reusing/recuperation of important materials incorporates reusing and recuperation of significant materials from the E-squander stream like non-ferrous metals in purifying plants, valuable metals in isolating works. As the vast majority of the electrical and electronic hardware contain numerous valuable metals, this procedure is a significant advance in the administration of E-squander. The materials of potential risk are discarded in landfill locales or now and then burned. Be that as it may, the procedure of cremation is very costly. CFCs are dealt with thermally, PCB and Mercury is frequently reused or discarded in underground landfill locales.

Favorable position of cremation of E-squander is the decrease of waste volume and the usage of the vitality substance of burnable materials. By burning some naturally perilous natural substances are changed over into less risky mixes. Drawback of burning are the discharge to quality of substances getting away pipe gas cleaning and the enormous measure of buildups from gas cleaning and ignition (Guidelines for Environmentally Sound Management of E-squander, 2008). Squander cremation plants contribute fundamentally to the yearly emanations of cadmium and mercury.

The evaluation of E-squander reusing part in India shows that E-squander exchange begins from formal destroying segment and moves to casual reusing division (Guidelines for Environmentally Sound Management of E-squander, 2008). The whole E-squander treatment is being done in an unregulated domain, where there is no control on discharges. There are two E-squander destroying offices in formal part in India. These offices are M/s. Trishiraya Recycling offices, Chennai and M/s E-Parisara, Bangalore2.

In India, fundamentally two kinds of transfer choices dependent on the synthesis are by and by. These are Land filling and Incineration. Be that as it may, the ecological dangers from land filling of E-squander can't be dismissed in light of the fact that the conditions in a landfill site are not the same as a local soil, especially concerning the draining conduct of metals. Furthermore, it is realized that cadmium and mercury are produced in diffuse structure or by means of the landfill gas burning plant. In spite of the fact that the dangers can't be evaluated and followed back to E-squander, land filling does not have all the earmarks of being a naturally solid treatment strategy for substances, which are unstable and not organically degradable (Cd, Hg, CFC), relentless (PCB) or with obscure conduct in a landfill site (brominates fire retardants). As an outcome of the mind boggling material blend in E-squander, it is beyond the realm of imagination to expect to reject ecological (long haul) chances even in verified land filling (Guidelines for Environmentally Sound Management of E-squander, 2008).



Implemented Policy for E-Waste in India:

In perspective on the evil impacts of risky squanders to both condition and wellbeing, a few nations admonished the requirement for a worldwide consent to address the issues and difficulties presented by unsafe waste. Be that as it may, the approach level activities in regards to E-squander in India is very simple and requirements quick consideration. Following are a portion of the arrangement level activities in India in regards to E-squander.

The Hazardous Wastes (Management and Handling) Amendment Rules, 2003:

Under Schedule 3, E-squander is be characterized as "Squander Electrical and Electronic Equipment including all segments, sub-gatherings and their portions aside from batteries falling under these standards". The definition gave here is like that of Basal Convention. E-squander is just quickly incorporated into the standards with no detail depiction.

Guidelines for E-Waste Management, 2008:

This rule was a Government of India activity and was endorsed by Ministry of Environment and Forest and Central Pollution Control Board. It characterized the E-squander as indicated by its different parts and structures and basically underscores on the administration and treatment practices of E-squander. The rule fused ideas, for example, "Expanded Producer Responsibility".

The E-Waste (Management and Handling) Rules, 2011:

This is the exceptionally ongoing activity and the main endeavor in India implied exclusively for tending to the issues identified with E-squander. These standards are not executed in India up 'til now and will just come into training from first May, 2012. As indicated by this guideline, 'electrical and electronic gear' signifies hardware which is reliant on electric flows or electro-attractive fields to be completely useful and 'e-squander' signifies squander electrical and electronic hardware, entire or to a limited extent or rejects from their assembling and fix process, which are proposed to be disposed of. These guidelines are intended to be connected to each maker, customer or mass purchaser engaged with assembling, deal buy and preparing of electrical and electronic gear, accumulation focuses, dismantlers and recyclers of e-squander. Obligations of makers, gathering focuses, shoppers, dismantlers, recyclers and so forth are characterized and fused in these guidelines.

Summary & Conclusion:

In India, the measure of E-squander created is rising quickly. With the expanding reliance on electronic and electrical hardware, the ascent of E-squander age is very much expected in the nation. Be that as it may, the administration of the equivalent is a noteworthy tested looked by the nation. As, in India, there are just two approved little E-squander disassembling offices working in Chennai and Bangalore. All things considered, the expanding age of E-squander requests a lot increasingly such units the nation over. There is no enormous scale sorted out E-squander reusing office in India and the whole reusing exists in sloppy division. Also, the administration practices are frequently ineffectively planned and have a great deal of wellbeing and natural repercussions. Association of urban poor, particularly ladies and kids and unlawfully imported E-squander from created nations further misrepresent the issue of E-squander in India. The absence of open mindfulness with respect to the transfer of electronic products and insufficiency of approaches to deal with the issues identified with E-squander



improve the issue in India. In the greater part of the cases, the majority of E-squander stays unattended in family units and open workplaces. Once in a while a few parts like a portion of the IT organizations practice Extended Producer Responsibility or Take Back Policies. Because of the absence of mindfulness, a few people dispose of E-squander with customary city strong waste which is an incredibly sketchy practice. Individuals tend not to think about the confidence of the waste once these are disposed of, in this manner fulfilling the guideline of "out of the picture and therefore irrelevant". Indian individuals are still to understand the relationship between the reason for age of E-waste and its belongings including impeding wellbeing and ecological impacts. Another significant factor in Indian setting is that despite the fact that the data innovation upset began in India route back in mid 1990s, the primary principle solely managing E-squander came up as of late after just about 20 years as "e-squander (Management and Handling) Rules, 2011". Legitimate execution of the "e-squander (Management and Handling) Rules, 2011" is exceedingly basic to address the regularly developing heap of E-squander in the nation.

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A STUDY TO ASSESS THE KNOWLEDGE ON RISK FACTORS OF HYPERTENSION AMONG PREGNANT WOMEN IN SELECTED HOSPITAL

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Abstract

Introduction: Hypertension is one of the common complications met with in pregnancy and contributes significantly to maternal and prenatal morbidity and mortality. The identification of this clinical existing and effective management play a significant role in the outcome of pregnancy both for the mother and the baby. Some of the risk factors of hypertension are prim gravida, family history of Hypertension, preeclampsia and placental abnormalities, like poor placenta (placenta not formed properly). **Aim:** assess the Knowledge on Risk Factors of Hypertension among Pregnant Women. **Methodology:** A survey research approach was used and the research design adopted for the present study was descriptive. Convenient sampling technique was used to select the 64 pregnant women who are admitted having blood pressure more than 140/90 mmHg in Sharda Hospital, Greater Noida, UP. **Material:** structured knowledge questionnaire was used to obtain information regarding knowledge on risk factors of hypertension among pregnant women. **Results:** The results of the study reveals that out of 64 majority 52 (81.3%) of the pregnant women has good knowledge regarding risk factors of hypertension 11(17.2%) have average knowledge & 1(1.6%) has poor knowledge. **Conclusion:** This study concluded that majority of the pregnant women have good knowledge regarding risk factors of hypertension. The findings of the study can help the pregnant women a base line data about risk factors of hypertension. An awareness program can be deployed to the pregnant women regarding the risk factors of hypertension and their prevention.

Key words: Hypertension, Risk Factors and Pregnant Women.



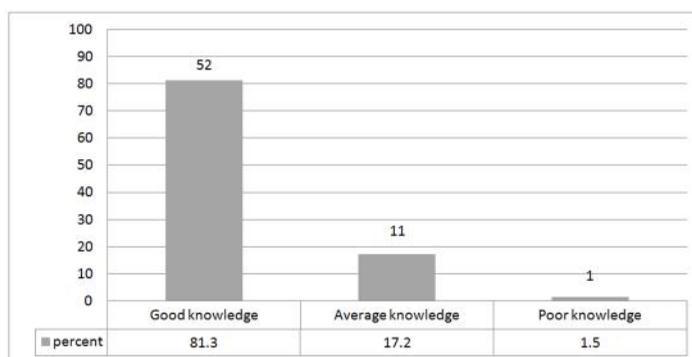
Introduction:

Hypertension is one of the common complications met with in pregnancy and contributes significantly to maternal and prenatal morbidity and mortality. The identification of this clinical existing and effective management play a significant role in the outcome of pregnancy both for the mother and the baby. Some of the risk factors of hypertension are prim gravida, family history of Hypertension, preeclampsia and placental abnormalities, like poor placenta (placenta not formed properly). Hyperplacentalosis, placental ischemia, molar pregnancies, any immunological factors like thrombophilia. Clinical features of hypertension symptoms are slight swelling ankles which persist raising from bed & tightness of ring, gradually swelling extends to face abdominal wall, vulva and whole body, described sled dismissed urine output, epigastric pain , sign are abnormal weight gain with in short spasm of time before visible edema , edema, pulmonary edema, scanty, liquor. In India, hypertension is the leading non -communicable disease risk and estimated to be attributable for nearly for 10 percentages of all deaths.

According to WHO health statistics 2012, the prevalence of hypertension in India was 23.1% in men and 22.6% in women in equal or more than 25 years age. The raised blood pressure was a high risk condition that caused approximately 51% of death from strokes and 45% from coronary artery disease. It was considered directly responsible for 7.5 million deaths in 2004, about 12.8 percent of the total of all global deaths. Prevalence of hypertension is high among lower and middle class population set in India. This is mainly attributed to smoking, high alcohol consumption and stress in this set of population.

Results:

Knowledge on risk factors of hypertension among pregnant women



The results of the study reveals that majority 52(81.3%) of the pregnant women has good knowledge, most of the sample 11(17.2%) have average



knowledge & 1(1.5%) has poor knowledge regarding risk factors of hypertension.

- **Association between level of knowledge regarding the risk factors of hypertension and demographic variables.**

In this present study tested that there was no statistically significant association found between pregnant women knowledge regarding the risk factors of hypertension and selected demographic variables such as age ($p=0.36$), education ($p=0.30$), residence ($p=0.75$), Menarche at age ($p=0.02$), Family history of hypertension ($p=0.63$), Pregnancy type ($p=0.66$), Oral contraceptive use ($p=0.65$), Diabetes mellitus ($p=0.16$), Occupation ($p=0.80$), Abortion (0.81) and Anemia ($=0.65$). There is significant association between level of the knowledge regarding risk factors of hypertension with Menarche at age ($p=0.02^*$).

Discussion:

In this present study majority of the pregnant women 54.70% have 23-34 years age, 39.1% had secondary education, 64% are from rural, 82.8% age at menarche are <15 years, 53.1% have family history of hypertension, 81.3% are single type of pregnancy, 60.9% have not used the oral contraceptive, 80% are not having diabetes mellitus, 76.6% are housewife, 78.1% doesn't not have history of abortion, 60.9% are anemic at visit. The majority of the pregnant 52(81.3%) have Good knowledge, 11(17.2%) of pregnant women have average knowledge and 1(1.5%) of pregnant women have poor knowledge. The result is that, there is significant association between the variables.

Conclusion:

This study shown that the majority of knowledge about risk factors of hypertension is 52(81.3%) have Good knowledge, 11(17.2%) of pregnant women have average knowledge and 1(1.5%) of pregnant women have poor knowledge. And there is one significant association between the variable.

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చేతనావర్తన కవిత్వం - మానవతావాదం

డా.గుండిమెడ శ్రీనివాసరావు

ఎం. ఏ, ఎం.ఫిల్, పిహెచ్.డి

లెక్చరర్ ఇన్ తెలుగు

ఆంధ్ర ముస్లిం కళాశాల, గుంటూరు

మానవుడే అన్నింటికీ మూలం అనే భావన క్రీస్తుపూర్వం 5 వ శతాబ్దంలోనే పొడసూపినప్పటికీ, అ భావన ఒక వాదంగా రూపుదిద్దుకుంది మాత్రం ఆధునిక యుగంలోనే. మధ్యయుగం, ఆధునిక యుగం సంధికాలంలో యూరప్ దేశాలలో వచ్చిన పునరుజ్జీవనం (Renaissance) వాదాలకు, ధోరణులకు తెరలేపింది. వాటిలో భాగంగా వచ్చిందే ఈ మానవతావాదం. ఈ వాదం కొత్తదైనప్పటికీ 'మానవత' అనే భావన మనిషి పుట్టినప్పటి నుండి ఉంది. మధ్యయుగం నటి సామాజిక పరిస్థితులన్ని మతవిశ్వాసాలకు, కట్టుబాట్లకు లోబడి ఉన్నవే. మనిషిని కేంద్రంగా సమాజాన్ని నిర్మించాలన్న అవసరాన్ని గుర్తుచేస్తూ ఈ వాదాన్ని బలంగా ముందుకు తెచ్చారు. ఈ సిద్ధాంతాలు తర్వాత కాలంలో యూరప్ నుండి ప్రపంచమంతటికీ విస్తరించాయి. సామజిక స్పృహతో రచనలు చేసిన రచయితలందరూ ఈ వాదాన్ని ఒక వస్తువుగా స్వీకరించి రచనలు చేస్తున్నారు.

ప్రాచీన కాలంలో భారతదేశం భూస్వామ్య సంబంధాలతో దేవుడు కేంద్రంగా, ఆధ్యాత్మిక చింతన పేరుతో, సనాతన ధర్మం పేరుతో గల ఆచారాలు, సంప్రదాయాలు ఉనికిలో వుండేవి. సామాన్య మానవుడు ఒక ఉత్పత్తి సాధనమే తప్ప సామజిక, రాజకీయ వ్యవహారాలతో అతనికి ఎటువంటి సంబంధం లేదు. పాలనా వ్యవహారాలు, సాహిత్యం వంటి మానవీయ అంశాలన్నీ కులీన, ఉన్నత కులాల పరిధిలో మాత్రమే ఉండేవి. సామాన్య మానవుడి ఉద్ధరణ ఒక ఆదర్శంగా యూరప్ సమాజాల్లో ఉండేది. అది మన సమాజంలో కొరవడింది.

ఆంగ్లేయుల పాలనలో వున్నా భారత దేశం యూరప్ దేశాల్లో వచ్చిన సామజిక సాహిత్య మార్పులన్నింటినీ స్వీకరించింది. ముద్రణా యంత్రాల అభివృద్ధి, ఆంగ్ల విద్య వీటికి దోహదం చేశాయి. ఆవిధంగా మానవతావాదం కూడా ఒక ప్రత్యేక ధోరణిగా సాహిత్యంలో చోటుచేసుకుంది. తెలుగు సాహిత్యం



అందుకు మినహాయింపు కాదు. అయితే నన్నయ కాలం నుండే తెలుగు సాహిత్యంలో మానవతా భావన విరివిగా కనిపించినప్పటికీ ఒక వాదంగా బలపడింది మాత్రం ఆధునిక యుగంలోనే.

మానవతావాదం

మానవతావాదాన్ని ఆంగ్ల భాషలో HUMANISM అంటారు. ఈ ఆంగ్ల శబ్దానికి మాతృక లాటిన్ భాషలోని HUMANITAS అనే పదం. (LATIN – ENGLISH : HOMO – MAN; HOMINES – MANKIND ; HUMANUS – HUMAN; HUMANITAS - HUMANISM).

HUMANISM అనే పదాన్ని మొట్ట మొదటిసారిగా ఆక్స్ ఫర్డ్ యూనివర్సిటీకి చెందిన ఎఫ్. సి. యస్. పిల్లర్ సమకూర్చారు. పిల్లర్ ప్రతిపాదించిన వ్యావహారికవాద (pragmatism) రూపాంతరమే మానవతావాదంగా భావించబడింది.

మానవతావాదం లక్షణాలు :

1. మానవుడే అన్నింటికీ ప్రమాణం, లక్ష్యం
2. జీవకోటిలో పవిత్రుడు, అత్యుత్తముడు మానవుడే.
3. విశ్వరహస్య సంవేది, సంఘ సౌభాగ్య కారిణి మానవునిది విలసనమే.
4. భౌతిక , వైజ్ఞానిక ఆధ్యాత్మిక కళా రంగాల్లోని అభ్యున్నతికి మానవుడే కారణం.
5. మానవుని మేధను, సర్వశక్తులను మానవాభ్యుదయం కోసం నిర్దేశించేదే మానవతావాదం.
6. వ్యక్తి స్వాతంత్ర్య పూర్వకమైన మానవ ప్రేమే మానవతావాద లక్ష్యం.
7. వ్యక్తిపరిస్థితులకు, వైయక్తిక స్థితిగతులకు సంబంధించినవి సర్వసమత్వాన్ని, సౌకర్యాలను, న్యాయాన్ని అందించడమే మానవతావాద లక్ష్యం.
8. భౌతిక సుఖాన్ని అభిలషించే అర్హతను అందరికీ అందించేదే మానవతావాదం.
9. సాంప్రదాయక మత సిద్ధాంతాలకు, అతిమానవ శక్తులకు అతీత మైనదే మానవతావాదం.



10. వసుదైక కుటుంబమే మానవతా ధ్యేయం.

11 . మానవతావాదం పరిణామశీలం.” (వసునందన్ రావికంటి :1990 : పుట – 15,16)

మానవతావాదం రకాలు

వివిధ పరిణామా పరిస్థితులననుసరించి మానవతావాదంలో గల విభాగాలను పరిశీలించినట్లయితే...

1. దార్శనిక మానవతావాదం
2. సామాజిక మానవతావాదం
3. ప్రాకృతిక మానవతావాదం
4. పరిమాణాత్మక మానవతావాదం
5. వైజ్ఞానిక మానవతావాదం
6. మౌలిక మానవతావాదం
7. సాహిత్య మానవతావాదం
8. హేతుపూర్వక మానవతావాదం
9. అతీత మానవతావాదం
10. సృజనాత్మక మానవతావాదం
11. విశ్వజనీన మానవతావాదం
12. సమగ్ర మానవతావాదం
13. ఆధ్యాత్మిక మానవతావాదం
14. నైతిక మానవతావాదం
15. పునరుజ్జీవన మానవతావాదం
16. చారిత్రక మానవతావాదం” (వసునందన్ రావికంటి : 1990 : పుట – 18,19)

నిర్వచనాలు (Definitions)

“A Movement of the 15th century which aspired to restore the universally human values of classical antiquity has opposed to be based scholasticism of the late middle ages, by reviving the languages, philosophy and literature of ancient Greece and Rome. Any of several movements purporting to advocate the universally human as against utilization since, religious



dogma, uncontrolled passion(Eg- Romanticism).” (the new wasters dictionary of English language : 1987 : p-471)

ప్రకృతిలో మానవ ప్రాధాన్యతని గుర్తించి, మానవుల క్షేమాన్ని ఆశిస్తూ, మానవ విలువలను గౌరవించే తాత్విక చింతన. మానవాతీతమైన దైవశక్తి కి ప్రాధాన్యతనిచ్చే మానవులకు విలువనివ్వని మధ్యయుగాల ఆలోచనా ధోరణికి వ్యతిరేకంగా 14,15 శతాబ్దాలలో ఐరోపాలో మానవతావాదం ప్రారంభమైంది. మానవుడు ఇహలోక, భౌతిక వాంఛలతో ముగిసిన, దారుణమైన పాపి అని దాని నుంచి ఆటను విముక్తి కావలసి ఉందని మధ్యయుగాల నటి క్రైస్తవ ఋషుల అవగాహన. ఈ అవగాహనకి భిన్నంగా మానవుడిలో అనేకమైన ఉత్తమ శక్తి సామర్థ్యాలు ఉన్నాయని, భౌతిక ఆధ్యాత్మిక నైతిక మేధోపరమైన అంశాలన్నింటి మధ్య సమతౌల్యాన్ని సాధించగలడని పునరుజ్జీవన కాలపు మానవతావాదులు భావించారు. ఆధ్యాత్మిక జీవితము, శాస్త్రోత్తము వంటి భావనలను వదిలి, భౌతిక ప్రపంచంలోనే ఉన్న మానవ జీవితాన్ని పరిపూర్ణమైనదిగా మార్చుకోవాలని చెప్పే దృక్పథం. ఈ వాదం 14,15 శతాబ్దాలలో బీజ రూపంలో ఉన్నా 16 వ శతాబ్దంలోనే ఒక సాహిత్య రూపంగా రచనలలో ప్రతిబింబించడం ప్రారంభమైంది. ఐరోపా ఖండంలో పునరుజ్జీవన ఉద్యమ కాలపు విలువలను, ఆదర్శాలను మానవతావాదం పేరుతో 19 వ శతాబ్దంలో పిలవటం ప్రారంభించారు. (నళిని ఎస్ .ఎస్ : 1999: పుట-141)

“ఆధునిక తెలుగు సాహిత్యానికి తల్లివేరు మానవత్వం . తెలుగులోని ఆధునిక సాహిత్యం అంతా మనవ సాహిత్యమే. మానవసంబంధ సాహిత్యం, మనవ సంబంధం లేని సాహిత్యం సాహిత్యం కూడా ఉంది కానీ తక్కువగా ఉంది. సాహిత్యం ఆధునిక కాలంలో మనిషిని మనిషిగా చూడటానికి అలవాటుపడింది. మనిషిని గౌరవించడం చూపింది. మనిషి ఉన్నతని కాంక్షించింది. మనిషి అధోగతిని నిరసించింది. మానవ విలువల పరిరక్షణకు పట్టుకొమ్మగా నిలిచింది. ఆధునిక సాహితీ వృక్షం ఎన్ని శాఖలను, ఉపశాఖలను, రెమ్మలను, ఆకులను, పువ్వులను వివిధ సాహిత్య వాదాలు, ధోరణుల రూపంలో రూపొందినా అన్నింటా దాల్చిన ఈ సాహితీ వృక్షాన్ని కాపాడుతుంది తల్లివేరైన మానవత్వమే”. ఈ ధోరణిలో నుండే ఈ చేతనావర్తన కవిత్యం వెలువడింది.

మానవతావాదాన్ని బలంగా, వాడిగా , వేడిగా ఒక ఉద్యమ స్థాయికి తీసుకెళ్ళి తెలుగు కవితా రంగాన సంచలనం కలిగించిన వాళ్ళు చేతనా వర్తన కవులు. వీళ్ళు నలుగురు. సుప్రసన్న, వే.నరసింహారెడ్డి, పేర్వారం జగన్నాథం, సంపత్కూమార. ఈ నలుగురు కలిసి చేతనావర్తనం అనే రెండు సంపుటాలను వరుసగా 1967, 1970 లలో ప్రచురించారు. ఇది దేశంలోని కవి పండితుల్ని, యువకుల్ని ఎంతగానో ఆకర్షించింది.



అప్పుడప్పుడే తెలుగు కవిత్వంలో ప్రవేశిస్తున్న శూన్యవాదాన్ని, అరాజకత్వాన్ని చేతనావర్తనం నిర్ణయంగా ఖండించి సాహిత్యపు విలువల్ని పునరుద్ధరించారు.చేతనావర్తనం మొదటి సంపుటానికి రాసిన పీఠికలో వీళ్ళు ఈ విధంగా ప్రకటించుకున్నారు.

“మానవ జీవితం ఐహిక లోకం, భావ లోకం, ఆధ్యాత్మిక లోకం అనీ మూడు విధాలుగా విభజించవచ్చు. సమగ్రమైన మానవ వికాసానికి అన్ని రంగాల సమన్వితమైన వికాసం అవసరం, పాక్షిక దృష్టి అభివృద్ధి హేతుకం కాదు. ఈ సమన్వితం కోసం ఈ కవులు భావి దర్శనం చేస్తున్నారు. ఈ దర్శనం వీళ్ళను కవితా రూపాన బంధిస్తూ ఉన్న ఏకీకృతి జీవితం నుండి పలాయనం చేయడం వర్తమానాన్ని తిరస్కరించడం మాత్రం వీళ్ళు చేయరు. మానవ జీవితంలోని పురోగతి, సుదూరాకాశాల స్ఫురించే దివ్య జీవన శిఖరం అధిరోహించడం వీళ్ళు భావిస్తున్నారు. కాలం వీళ్ళను అనంతమైన అఖండమైన ప్రవాహం భావియుగంలోని ప్రేమామంజులమైన దివ్యభావ చైతన్యావరణ ప్రభాత వేళలోని స్వర్ణ కిరీటాలను వీళ్ళు దర్శిస్తున్నారు”(చేతనావర్తనం, మొదటి కవితా సంపుటి కి రాసిన పీఠిక)

“గతంలోంచి అనుభవాలను పిండి మనిషిలోని నిగూడ మానవతను జాగృతం చేయడమే ఈ కవిత్వం’ అన్నారు చేతనావర్తనం కవులు అని అంటాడు.(శివ ప్రసాద్ ముదిగొండ: 2003: పుట-205)

వీరు ఏ కవితా వాదానికి లొంగకుండా మానవ జీవిత పురోగతిని కాంక్షించి రచనలు చేయడమే వీరి ధ్యేయంగా కనిపిస్తుంది.

పీర్వారం జగన్నాథం

మనిషిలోని మంచితనానికి నీరాజనం పట్టి మనిషిపై మనిషికి భరోసా కలిగించడం తన కవితా లక్ష్యంగా ప్రకటించుకున్నాడు. జగన్నాథం గారి కవిత్వం పరిపూర్ణ మానవతా చైతన్యం అంతఃసూత్రంగా కలిగి సంఘ సంక్షేమాన్ని దేశ కళ్యాణాన్ని ధ్వనింప చేస్తుంది.(జగన్నాథం పీర్వారం : 1987 : పుట-69)

అభ్యుదయ సాహిత్య ఉద్యమం పతనం కావడానికి గల కారణాలను వ్యక్తం చేస్తూ పీర్వారం జగన్నాథం అధిక్షేపణ ధోరణిలో ఇలా అంటాడు...

“మానవతను మట్టిలో పారేసి

మంచితనాన్ని మరుభూమిలో పాతేసి



అభ్యుదయం తెస్తామనడం

ప్రజావంచనకు మెత్తని మార్గం

వానలేకుండా వట్టి పిడుగులు రాలటం” అది ఏ ఉద్యమ మైనప్పటికీ మానవతా దృక్పథం పరిధిలో పనిచేసినప్పుడే దానికి జీవన శక్తి ఉంటుంది. మానవత్వాన్ని విస్మరిస్తే అది తప్పనిసరిగా జీవనశక్తి కోల్పోతుందనే సత్యాన్ని పేర్వారం జగన్నాథం వ్యక్తం చేశాడు.(వీరాచారి డి. : 1993 : పుట-242)

జగన్నాథం మంచికైనా చెడుకైనా మానవుడే కేంద్రబిందువనే మానవతా దృక్పథాన్ని వెల్లడించాడు. మనిషిలో మానవత వికసించాలని, మంచితనం చిగురించాలని ఆశించాడు.

“” మానవతను మట్టిలో పారేసి

మంచితనాన్ని మరు భూమిలో పాతేసి

అభ్యుదయం తెస్తామనడం/ ఆకాశాన్ని కోస్తామనడం

ప్రజావంచనకు మెత్తని మార్గం “(జగన్నాథం పేర్వారం :1992 :పుట -207) అని అంటాడు.

సుప్రసన్న

“ సుప్రసన్న కవిత్యంలో మానవత కొరకు, శాంతి కొరకు, విశ్వ మానవ ప్రేమ కొరకు నిరంతరాన్వేషణ , అనంతమగు ఆవేదన గోచరించును”(నాగయ్య జి : 2004 : పుట – 726)

“”ఎవడికి వాడు ఒక వెలుగుల సంపుటి

ప్రపంచమంతా చైతన్య కల్లోల సంవర్షావృత్తి

ప్రతి ఒక్కడు ఒక దీప శిఖ / ఎవడి మనస్సు వాడికే ఆవిష్కార శాఖ

కాని ఒకటే ప్రాణ స్తోత్రస్సు అంతటికి

అదే జీవధార” ఈనాటి దారిద్యం నుండి, దుఃఖం నుండి, పిడివాదం నుండి, చీకటి నుండి, అజ్ఞానం నుండి, మృత్యువు నుండి విముక్తి కోసం దిగి వచ్చిన స్వర్గం కోసం మానవుడు సాధించే



సర్వతోముఖ ప్రయత్నాల్లో ఉన్నత మనస్సు నుంచి ప్రసరించే వెలుగుల్ని పదిల పరచేది సుప్రసన్న గారి కవిత" అని అనుమాంధ భూమయ్య అంటాడు.(జగన్నాథం పీర్వారం : (సంపా) 1987: పుట -67)

సంపత్కుమార

దేశకాల సమాజాల కన్నీటికి మానవుడే కేంద్రమని భావిస్తున్నాడు. ఈ భావన మానవతావాదానికి పునాది. ఈ భావనను సంపత్కుమార కింది కవితలో తెలియజేస్తున్నాడు.

“వ్యక్తికీ వ్యక్తికీ మధ్యగల సంబంధాన్ని

నిర్దాక్షిణ్యంగా విచ్చిన్నం చేస్తు

వసుదైక కుటుంబ సంయోజనకు/ సగర్వంగా పాటుపడుతున్న

నాకు తెలుసు , ఇది ఆదర్శం మాత్రమేనని

నాకు తెలుసు ఇది ఆచరణలో అసంభవమని “(వసుదైక కుటుంబకుడు : 1992 : పుట- 143) ఒక వ్యక్తికీ మరొక వ్యక్తికీ మధ్య ఉన్న సంబంధాన్ని మానవుడే విచ్చిన్నం చేస్తున్నాడు. ఆ మానవుడే దేశ సమైక్యత అని వసుదైక కుటుంబమని నినాదాలు పలుకుతున్నాడు. ఈ నినాదం ఆదర్శవంతమైనదే కాని ఆచరణ యోగ్యమైనది కాదని ఏనాడూ సఫలం కాని సిద్ధాంతం అని భావించాడు.

వే నరసింహారెడ్డి

వే నరసింహారెడ్డి ఈ దేశాన్ని అఖండంగా తప్ప చూడలేదు. ఇక్కడ వేర్వేరు జాతులు లేవు.భారత జాతి ఒక్కటే. ఇక్కడ పేరుకున్న అవ్యవస్థను, రాజుకుంటున్న అరాచకతను, కుళ్ళు రాజకీయాలను, కులగోత్రాలను, మూడ విశ్వాసాల గోడలను, ఆకలిని, అంతకన్నా భయంకరమైన అవమానాన్ని తొలగించుకోవాలని ఈ కవి ఆవేదన చెందాడు.

“ కులం పేర, మతం పేర/ భాష పేర, ప్రాంతం పేర

నిన్ను విభజించి, చించి / నీ కళ్ళలో దుమ్ము చల్లి

నీ గాయం మీద కారం చల్లి/ రేచుల్లాగ త్రాచుల్లాగ



లేవుతారు, ప్రేవుతారు/నీలో పశువుని" (నీ కాళ్ళ మీద నువ్వు : 1992 :పుట-173) మనిషిలో మంచితనాన్ని తట్టిలేపి మానవునిగా తీర్చిదిద్దాలి తప్ప పశుత్వాన్ని ప్రేపించి మానవ సమాజాన్ని మంట గలపకూడదు. మనిషి తన బాధ్యతలను గుర్తెరిగి కొత్త తరానికి ద్వారాలు తెరిచే ఆలోచనలు చేయగలిగితే అతణ్ణి మించిన బలవంతుడు లేడు అని అంటాడు.

ఈవిధంగా సమాజానికి కేంద్ర బిందువు వ్యక్తి అని, వ్యక్తి చైతన్యం సమాజ చైతన్యంగా రూపొందాలని ఆశించే వారు చేతనావర్తన కవులు.

ఉపయుక్తగ్రంథ సూచి :

1. అనంతరామశాస్త్రి నేతి : ఆధునిక తెలుగు సాహిత్యంపై లౌకిక విలువల ప్రభావం, అరుణ పబ్లికేషన్స్, గుంటూరు, 2006.
2. అరుణ కుమారి జి : ఆధునిక తెలుగు కవిత్వంలో మానవతావాదం - విభిన్న ధోరణులు, ఈస్ట్ వెస్ట్ రీసెర్చ్ సెంటర్, హైదరాబాదు, 1987.
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6. నారాయణరెడ్డి సి. : ఆధునికాంధ్ర కవిత్వము - సంప్రదాయములు - ప్రయోగములు , సికింద్రాబాదు, 1977
7. వసునందన్ రావికంటి : ఆధునికాంధ్ర కవిత్వంలో మానవతా వాదం - విశ్వంభర విలక్షణత , జగదాంబ ప్రచురణలు, హైదరాబాదు, 1990
8. శ్రీనివాసరావు గుడిమెడ : సమకాలీన తెలుగు కవిత్వంలో మానవతావాదం , పిహెచ్.డి సిద్ధాంతగ్రంథం హైదరాబాదు విశ్వవిద్యాలయం , 2001



संस्कृत काव्य परम्परा में गुण विवेचन

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संस्कृत काव्यशास्त्र में शास्त्र परम्परा के लेखन के आरम्भ से ही विभिन्न काव्यांगों के ऊपर चर्चा देखने को मिलती है। भरतमुनि से लेकर जगन्नाथ तक सभी ने अपने-अपने अनुसार किसी न किसी विशिष्ट काव्यांगों को प्रधान रूप से निरूपित करने तथा अन्य को गौण भाव से प्रस्तुत करने की परम्परा रही। इसी के परिणाम स्वरूप संस्कृत में प्रमुखतया षट् सम्प्रदाय की परम्परा देखने को परिलक्षित होता है। विभिन्न मतों के आधार पर हम छः सम्प्रदायों को निम्नलिखित दृष्टियों से विभक्त कर सकते हैं—

1. भाषा तथा रचना कौशल की दृष्टि गुण, रीति तथा काव्य दोष।
2. विधान की दृष्टि से – अलंकार तथा वक्रोक्ति।
3. कवि शिक्षा एवं काव्य प्रयोग – कवि शिक्षा, औचित्य।
4. पाठक की दृष्टि से – रस विवेचन।
5. अभिनय विज्ञान की दृष्टि से – नाटक को आधार बनाकर रचित ग्रंथ विशेष दशरूपक, नाट्यशास्त्र नाट्य दर्पण आदि।

साहित्य शास्त्रीय परम्परा के शैशवकाल से ही गुण तथा अलंकारों का निरूपण काव्य के शोभादायक तत्व से रूप में किया जाता रहा है। गुण तथा अलंकार काव्य में किस प्रकार से काव्य को उत्कर्षित करते हैं, इस विषय को लेकर संस्कृत आचार्यों में एकरूपता का दिग्दर्शन मुस्किल से ही हो पाता है। कतिपय आचार्य गुणों को काव्य का महत्तम शोभादायक तत्व सिद्ध करते नहीं थकते तो कोई अलंकारों को। आचार्य भामह कहते हैं कि—

न कस्तामपि निर्भूषणम् विभाति वनितामुखम्।¹

अर्थात् सौन्दर्य से रहित रहने पर नायिका का मुख भी सौन्दर्यता को धारित नहीं कर सकता। अग्नि पुराणकार ने गुण के महत्व का वर्णन इस प्रकार किया है

अलंकृतमपि प्रीत्यै न काव्यं निर्गुण भवेत्।

वपुष्यललिते स्त्रीणां हारो भारायते परम्।²



अर्थात् यदि काव्य अलंकार युक्त हो किन्तु गुणरहित हो तो वह काव्य प्रीतिजनक नहीं हो सकता जैसे कोई कुरूपा स्त्री के हारादि आभूषण केवल उसके भारत के लिए होते हैं। संक्षेप में हम संस्कृत आचार्यों के मत में गुण विवेचन को समझने का प्रयास करेंगे।

संस्कृत काव्य परम्परा में गुण वर्णन : शास्त्रीय दृष्टि से गुणों का सर्वप्रथम वर्णन आचार्य भरत ने नाट्यशास्त्र के 17वें अध्याय में किया है। उन्होंने 10 गुण माने हैं जो श्लेष, प्रसाद, समता, समाधि, माधुरि, ओज, पदसौकुर्मायता, अर्थव्यक्ति, उदारता कान्ति हैं।³ इनके अनुसार गुणों का कार्य है काव्य को सौन्दर्यमण्डल करना—

अलंकारैश्चमगुणश्चैव बहुभिः समलंकृतः।⁴

भरत मुनि की अवधारणा का अनुशीलन करने पर हम निम्न निष्कर्ष प्राप्त कर सकते हैं—

1. भरत मुनि ने नाट्यशास्त्र में दस गुणों का वर्णन किया है, परन्तु वे गुणों को सर्वथा स्पष्ट परिभाषित नहीं किया।
2. आचार्य भरत ने गुणों को अभावात्मक तत्व माना है। उनकी दृष्टि में दोषों की सत्ता का अभाव ही गुण है। जो रसाधीन रहते हैं।

अतः एव विपर्यस्ता गुणाः काव्येषु कीर्तिता⁵

3. भरत मुनि गुण तथा अलंकार दोनों को ही काव्य का भूषण स्वीकार करते हैं। अर्थात् गुण और अलंकार की रचनात्मक प्रवृत्ति तथा कोटि एक ही है।

भामह : भामह ने काव्यालंकार के दूसरे अध्याय में गुणों का वर्णन किया है। वे काव्य में अलंकार को महत्ता देते हैं तथा अलंकार को सौन्दर्य सिद्धि का हेतु मानते हैं। उनकी दृष्टि में गुणों का शोभादायकत्व अलंकार से हीन है। भामह ने गुणों की संख्या तीन मानी है वह भरत के दस गुणों को नहीं स्वीकार करते। जिसका आधार वे रचना या रीति पर आधारित स्वीकार करते हैं। वे गुणों तथा अलंकार के मध्य विभाजक रेखा खींचने का प्रयास किया वे कहते हैं कि अलंकार जहाँ काव्य के आत्मीय तत्व है वहीं गुण मात्र स्थूलतत्व। वह कहते हैं कि काव्यगत समासाधिक्य होने पर ओजगुण, काव्यश्रवण, सुखद तथा अल्प समाजयुक्त हो तो



माधुर्य तथा जिसका अर्थ विद्वान स्त्री बच्चे सभी समझ ले वहाँ प्रसाद गुण होता है।⁶

दण्डी : आचार्य दण्डी अलंकार और गुण दोनों की एक जैसी परिभाषा देते हैं। वे अलंकार को परिभाषित करते हुए कहते हैं—

काव्यशोभाकरान् धर्मान् अलंकरान् प्रचक्षते।⁷

काव्य के शोभा विधायक धर्म का नाम अलंकार है। मूलतः गुण का कार्य है—रचना के सौन्दर्य का विधान करना है। दण्डी ने अलंकार के विषय में विचार करते हुए ही गुण के संबंध में अपना मत प्रकट किया, वह कहते हैं—

दोषा विपत्तये तत्र गुणा सम्पत्तये यथा।⁸

अर्थात् दोष यदि काव्य की शोभा को नष्ट करने वाला है तो गुण शोभा को बढ़ाने वाले। उन्होंने तो सन्ध्यांगो को भी अलंकार में समविष्ट कर दिया। दण्डी के गुण विषयक विशेष तथ्य—

1. आचार्य दण्डी भरत मुनि प्रणीत दस गुणों को स्वीकार करते हैं।
2. वे सभी शोभादायक तत्वों को जो काव्य में उपस्थित रहते हैं, उनको अलंकार माना हो।
3. वे गुणों को भी साक्षात् रूप से काव्य के उत्कर्षक स्वीकार करते हैं, अर्थात् रस आश्रित गुणों की सत्ता को वह नहीं मानते।

वामन : वामन के पूर्ववर्ती के सभी आचार्य काव्य के शोभादायक तत्व के रूप में गुण तथा अलंकार का पृथक्त्व मानते हैं। वामन ने गुणों के महत्त्व को स्पष्ट करते हुए इसकी तुलना स्त्री के स्वभाविक सौन्दर्य से की है—

युवतेरिव रूपमंगकाव्यं स्वदते शुद्धगुणं तदप्यतीव।

विहितप्रणयं निरन्तराभिः सदलंकारविकल्पकल्पनाभिः।।

यदि भवति वचश्च्युतं गुणेभ्यो वपुरिव यौवनवन्ध्यगंगनायाः।

अपि जनदयितानि दुर्भगत्वं नियतमलंकरणानि संश्रयन्ते।।⁹

अर्थात् कोई भी काव्य माधुर्य आदि गुणों के अभाव में, अलंकारों से युक्त होने पर भी इस प्रकार सौन्दर्य रहित प्रतीत होते हैं, जैसे स्वाभाविक सुन्दरता के अभाव में स्त्री के शरीर पर आभूषण सुशोभित नहीं होते हैं। मगर किसी ने भी इन दोनों



के मध्य विभानक रेखा खीचने का प्रयास नहीं किया। वामन प्रथमतः आचार्य हो, जिन्होंने गुण तथा अलंकारों का पृथक निर्देश किया। वामन कहते हैं—

काव्यशोभायाः कर्तारो धर्मागुणाः। तदतिशय हेतवस्वलंकाराः।¹⁰

अर्थात् गुण काव्य शोभा के विधायक धर्म है। जबकि अलंकार काव्य के मात्र शोभादायक तत्व। इस प्रकार हम सकते हैं कि—

1. गुण काव्य में वे तत्व हैं जो पाठक को आनन्दानुभूति कराते हैं। ये काव्य के नित्य धर्म होते हैं जबकि अलंकार मात्र रमणीयता को उत्पन्न करने वाले कष्ट आदि के समान अनित्य धर्म।
2. अलंकारत्व के अनित्य तथा गुणों को नित्य शोभादायक की यह कल्पना वामन की काव्यशास्त्र में नूतन कल्पना है।
3. गुण शब्द तथा अर्थ के धर्म हैं। इन्होंने इसी को आधार बनाकर शब्द तथा अर्थ के आधार पर 10-10 भागों में विभाजित करके गुणों की संख्या 20 पहुँचा दी।
4. गुणों की सत्ता नित्य होने के साथ ही साथ काव्य के प्राणपद धर्म मानते हैं। जिस प्रकार "यौवन रहित देह को अलंकार शोभित नहीं करता उसी प्रकार गुणरहित काव्य लोक प्रसिद्ध अलंकारों से युक्त होने पर भी शोभिता नहीं होते हैं।"

पूर्व मुणाः नित्याः तैर्विना काव्य शोभानुपपन्ते।¹¹

5. गुण काव्य के शोभादायक तत्व हैं जबकि अलंकार सौन्दर्यवर्धक तत्व है।
6. गुणों का काव्य के लिए अनिवार्य तत्व है जबकि अलंकारों की सत्ता काव्य में अनिवार्यता नहीं होती।

आनन्दवर्धन : ध्वनि सिद्धांत के प्रतिष्ठापक आनन्दवर्धन तथा लोचनकार अभिनवगुप्त के समय तक महत्व तथा स्थिति दोनों की दृष्टि से गुण का सम्पूर्ण ढाँचा बदल गया। उन्होंने वामन प्रतिपादित 20 गुणों का अन्तर्भाव केवल तीन गुणों—माधुर्य, ओज तथा प्रसाद में कर दिया। उनके अनुसार शृंगार तथा करुण में माधुर्य, रौद्रादि ओज तथा प्रसाद सभी रसों में अवस्थित रहता है। इनके अनुसार—

ते तमर्थ रसवित्क्षणमङ्गिनं सन्तमवलम्बन्ते ते गुणा शौर्यादिवत्।¹²



अर्थात् माधुर्य आदि गुण शब्दार्थ अर्थात् शब्द विन्यास के धर्म नहीं हैं अपितु ये काव्य की आत्मा अर्थात् रस के धर्म है। वे पुनः कहते हैं—

तमर्धमवलम्बन्ते येऽङ्गिनिं ते गुणा स्मृताः।

भङ्गाश्रितास्त्वलङ्कारा मतव्या कारकदिवत्।¹³

अर्थात् जो प्रधानीभूत (रस) के आश्रित रहने वाले (माधुर्यादि) हैं उनको गुण कहते हैं और जो उसके अङ्ग के आश्रित रहते हैं। उनको अलङ्कार कहते हैं। आनन्दवर्धन के मतों का सार—

1. आनन्दवर्धन की दृष्टि में गुण रसाश्रित रहते हैं तथा अलङ्कार काव्य के बाह्य शोभा को प्रतिबिम्बित करने वाले हैं।
2. गुणों को उन्होंने शौचीदि के समान काव्य का नित्य धर्म माना जबकि धारदि के समान अलङ्कार अनित्य धर्म है।
3. गुण रसाश्रित रहते हैं जबकि अलङ्कार शब्दार्थ आश्रित।
4. रसों के गुण सदैव उत्कर्षित करते हैं जबकि अलङ्कार सदैव नहीं।

भामह प्रतिपादित तीन गुणों को ही स्वीकार किया। जिससे गुणों की बढ़ती संख्या के विकास की पद्धति अवरूद्ध हो गई। परवर्ती सभी आचार्यों ने आनन्दवर्धन के त्रैगुणवाद को ही स्वीकार किया।

राजा भोज : गुणों के विषय में भोज कहते हैं कि—

अलङ्कृतमपि श्रव्यं न काव्यं गुण वर्जितम्¹⁴

काव्य में अलङ्कार चाहें हो या न हो, मगर गुण अवश्य होना चाहिए। भोज ने गुणों को 3 श्रेणियों में विभक्त किया—(बाह्य) शब्द गुण, आभ्यान्तर (अर्थगुण) वैशेषिक गुण (दोषगुण)—जो दोष होते हुए भी विभिन्न परिस्थितियों में गुण बन जाते हैं। भोज गुण तथा अलङ्कार को काव्य का अविच्छेद्य तत्त्व मानते हुए भी दोनों में भेद स्वीकार किया है। गुण के महत्त्व के संबंध में वे कहते हैं कि—

गुणयोगस्तयोमुख्यो गुणालङ्कारयोगयोः।¹⁵

कुन्तक : गुणों की संख्या तथा स्वरूप को लेकर कुन्तक का मत कुछ भिन्न है। कवि स्वभाव के आधार पर तीनमार्ग होते हैं—सुकुमार, विचित्र और मध्यम। फिर ये तीनों मार्गों के दो-दो गुण होते हैं—



विशिष्ट : मार्धुय, प्रसाद, लावण्य, अभिजात्य

साधारण : औचित्य, सौभाग्य

मम्मट : मम्मट काव्य में गुण विवेचन की परम्परा में आनन्दवर्धन तथा अभिनवगुप्त की ही परिपाटी को स्वीकार किया। उन्होंने वामन तथा उद्भट सम्मत गुणों का जमकर खण्डन किया। उनकी दृष्टि में—

ये रसस्पङ्गिनो धर्मः शौयीदयः इवात्मनः।

उत्कर्ष हेतवस्ते समुचलस्थितियोः गुणा।¹⁶

अर्थात् काव्य के प्रधानभूत (अंगी तत्त्व) रस के आश्रित धर्म हैं जो आत्मा के शौर्यादि धर्मों की भाँति हैं, अचल भाव से उसमें वर्तमान होकर उस (रस) के उत्कर्ष का साधन बनते हैं, वे गुण कहलाते हैं। मम्मट के अनुसार गुण के तीन तत्वों की ओर उल्लेख किया है—

1. गुण शौर्यादि अन्तरंग धर्म की भाँति काव्य के नित्य रूप से उत्कर्ष के साधन बनते हैं। जबकि अलंकार काव्य में शब्द को आधार बनाकर उत्कर्ष की वृद्धि करते हैं। अर्थात् गुण रस के अपरिहार्य उत्कर्ष की वृद्धि करते हैं। अर्थात् गुण रस के अपरिहार्य उत्कर्षाधायक गुण है जबकि अलंकार कभी कभार रस को उत्कर्षित करने वाले गुण धर्म।
2. काव्य में रस अंगी धर्म है जबकि गुण उसके सहायक।
3. ये सहायक धर्म सनातन हैं।
4. इन सहायक सनातन धर्मों का कार्य है, उस को उत्कर्षित करते रहना।

ये रसश्च...कारिका में गुण का स्वरूप विवेचन करते हुए उसका अलंकार से वैधर्म्य भी दिखाया गया है। यहाँ उत्कर्ष हेतवः गुणाः से गुण का स्वरूप निर्दिष्ट किया गया है जबकि 'आङ्गिनः रसस्य धर्माः तथा अचलस्पितयः' इन विशेषणों के प्रयोग से अलंकार का गुण भेदक प्रदर्शित होता है। भाव यह है कि जिस प्रकार शरीर में शौर्यादि धर्म चेतन प्राणी के गुण धर्म होते हैं न कि शरीर के उसी, प्रकार गुण भी रस के धर्म हैं न कि शब्दार्थ युगल के। इस प्रकार "वे रसोत्कर्षक गुण हैं" जो रस के धर्म हैं इससे गुण का अलंकार से भेदक लक्ष्य हो जाता है। इसी प्रकार रस के साथ गुणों की जो स्थिति है, वह अचल है। अर्थात् निश्चित रूप से पायी जाती है। अर्थात् गुण बिना रस के नहीं पाये जाते हैं तथा रस के साथ ही रहते



हुए ही वे रस के उपकारक सिद्ध होते हैं। जबकि अलंकार न तो नियम से रस के साथ ही रहते हैं और नहीं नियम से उपकारक ही रहते हैं।

विश्वनाथ : विश्वनाथ ने गुण के विवेचन आनन्दवर्धन मत को ही आधार बनाया। फिर भी उनका सिद्धान्त मम्मट का अनुसरण मात्र प्रतीत होता है। उन्होंने भी गुणों को रसाश्रित ही माना है तथा अलंकार को शब्दार्थ का अस्थिर गुण धर्म के रूप में स्वीकार किया है। गुण के संबंध में कहते हैं कि—जिस प्रकार शौर्यादि आत्मा के धर्म हैं उसी प्रकार गुण भी अंगी रस के धर्म हैं।

रसस्पङ्गिगत्मातस्पधर्मा शौर्यादयो यथा गुणाः।

शब्दार्थयोरस्थिरा ये धर्माः शोभामिशापियः।¹⁷

रसादीनुपकुर्वन्तोऽङ्गदिवत्।¹⁸

साहित्य दर्पणकार ने गुणों तथा अलंकार के मध्य विभाजन के सम्बंध में कहते हैं कि—उत्कर्षदेतवः प्रोवन्ता गुणालङ्काररीतयः।¹⁹ विश्वनाथ मम्मट के समान ही 3 गुणों की सत्ता को स्वीकार करते हैं—

जगन्नाथ : जगन्नाथ गुणों के संबंध में मम्मट प्रतिपादित मतों से पूर्णतः सहमत नजर नहीं हैं। उनका मानना है कि गुण काव्य के नित्य धर्म है इसमें कोई संदेह नहीं है किन्तु गुण को केवल रस का धर्म स्वीकार करना उचित नहीं है अपितु रस के साथ ही साथ शब्द, अर्थ तथा रचना को भी गुणों को प्रयोजक माना है।¹⁹ उनका विचार था कि गुण रस तथा शब्दार्थ की प्रयोजकता के साथ सम्बद्ध रहता है इसका अनुमान लौकिक उदाहरणों से लगाया जा सकता है। यथा रस मधुर है, शब्द मधुर है, रचना मधुर है आदि। इसके अतिरिक्त जगन्नाथ गुणों के सम्बंध में एक विशेष विचार प्रस्तुत किया। उन्होंने माना कि द्रुति, दीपित तथा विकास नामक चित्तवृत्तियाँ की क्रमशः माधुर्य, ओज तथा प्रसाद गुणों से ज्ञात होता है। जो कि श्रंगार आदि के प्रयोजक है। इतना होने पर भी गुणत्रयी की सत्ता को जगन्नाथ भी स्वीकार करते हैं। गुण विवेचन के आधार पर संस्कृत आचार्यों को हम चार भागों में बाँट सकते हैं—

प्रथम वर्ग : भरत को आधार मानने वाले आचार्य—दण्डी, वामन, वाग्भट्ट—I,
वाग्भट्ट—II, जयदेव।



द्वितीय वर्ग : आनन्दवर्धन को आधार मानने वाले आचार्य—मम्मट, अभिनवगुप्त,
हेमचन्द्र विश्वनाथ, विद्याधर, जगन्नाथ ।

तृतीय वर्ग : कुन्तक

चतुर्थ वर्ग : भोज तथा विद्यानाथ—इन्होंने 24 भेद स्वीकार किये हैं ।

उपर्युक्त विवेचन के आलोक में हम कह सकते हैं कि काव्य में गुण की उपादेयता स्वतः सिद्ध है। गुणों के अभाव में काव्य की कल्पना अत्यन्त दुरुह है। जिस प्रकार बिना शौर्यादि गुणों के मानव का जीवन पत्थर की मूर्ति के समान होता है। उसी प्रकार गुणों के अभाव में काव्य की स्थिति होती है। रसाग्रित होने पर भी बिना गुणों के रस की सत्ता को स्वीकार नहीं किया जा सकता है।

काव्य में गुणों की महत्ता को स्पष्ट करते हुए भोजने कविता के मौखिक शब्द तथा अर्थ गुण की चर्चा विस्तारपूर्वक की है। गुण को परिभाषित करते हुए वे बताते हैं कि— अलंकृतमपि श्रव्यं न काव्यं मुणविवर्जितम् ।

गुणयोग तपोमुख्यो गुणालकार योगयते:।²⁰

कविता अलंकृत होती हुई भी गुणयोग से समादृत होती है, वह इसलिए की वह (गुण) उसका अन्तिम तथा अपरिहार्य धर्म है। गुण से विवर्जित काव्य का कोई अस्तित्व नहीं है। इस प्रकार गुण काव्य रचना का अनिवार्य धर्म है। यह मुख्यतः उसकी भाषिक तथा अर्थगत प्रकृति का विधायक होने के कारण उससे अनिवार्यता जुड़ा है और अपनी विशिष्ट परिस्थितियों के कारण पाठक में रसास्वादन का वातावरण सृजित करता है। आचार्य कुन्तक ने काव्य रचना की समग्र सौन्दर्य सम्पदा को गुण की संज्ञा प्रदान की है।

असमस्त मनो हारि पद विन्यास जीवितम् ।

माधुर्य सुकुमारस्य मार्गस्य प्रथमो गुणाः ।।

अभिजात्य प्रमृतस्यः पूर्वमार्गोदिता गुणाः।²¹

अन्ना तिश्थात्मायान्ति जनिताहाय सम्पदः।²²

अलंकारवादियों की अपेक्षा ध्वनिवादि आचार्यों ने गुणों की संख्या सीमित करके त्रैगुण्यवाद की सत्ता को स्थापित अलंकारवादियों के बतलाये सभी गुण इसी में अनर्तनिहित हो जाते हैं। ध्वनिवादी आचार्यों के द्वारा प्रतिपादित गुणों की परम्परा को ही सर्वमान्य रूप में स्वीकार किया गया है।



संदर्भ ग्रंथ

1. भामह काव्यालंकार – 1/13
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3. भरत नाट्यशास्त्र 17/95
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