

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

**AN IMPACT OF NANOTECHNOLOGY ON GREEN INNOVATION IN INDIA:
EMERGING CHALLENGES FOR SUSTAINING AN ECO ENVIRONMENT**

¹ Prof. (Dr.) Ramesh Chandra Rath.

¹Professor-Cum-Dean (R&D), Research Cell, Einstein Academy of Technology and Management, Bhubaneswar, Affiliated to BPUT, Rourkela ,Odisha and Approved by AICTE ,Govt. of India ,New Delhi , ramesh.ch.rath@gmail.com

² Mrs. Suchismita Mohapatra

² Associate Professor in Department of, Electronics & Communication Engineering ,Sprintronic Technology of Advanced Technology (STAR),Bhubaneswar Approved by AICTE Govt. of India New Delhi and affiliated to BPUT Rourkela , smita.mohapatra015@gmail.com

³ Er. Aruna Kumar Rout

³ Assistant Professor at the Department of Electrical & Electronics Engineering, Einstein Academy of Technology & Management, Approved by AICTE Govt. of India New Delhi and affiliated to BPUT Rourkela, arunkumarrou2012@gmail.com

⁴ Er. Samarendra kumar Pradhan

⁴ Assistant Professor in Department of Electrical & Electronics Engineering, Einstein Academy of Technology & Management, Approved by AICTE Govt. of India New Delhi and affiliated to BPUT Rourkela , chintupradhan@gmail.com

ABSTRACT

The world is becoming too closer due to development of science & technology. By this, it connects the people all around the globe. Nanotechnology is one of the emerging technologies of the 21st century. It is an interdisciplinary science domain with potential applications in biotechnology, computer science, electronics, communication, medical and food, energy production and new materials. It has generated a wide interest and its impact on society is expected to be huge. Innovative aspects of such new technology have important

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

implications for the Economic Growth of the Nation. It has received much global interest and many national governments are making large investments in nanotechnology research and development (R&D) activities. The present paper is an attempt to explore the “Impact of Nanotechnology on Green Innovation in India: Emerging Challenges for sustaining an Eco-environment” is purely an innovative, original and research oriented topic for the people in order to suggest, guided & instructed them to make the environment how more clean for getting pure air for sure maintenance of their day-to-day life as well as sustaining eco-environment. Here, the authors have focussed its Research & Development (R&D) work in the area of energy, water, health, and food and agriculture sector in India. It also highlights the outcome of nanotechnology in the publications and patent numbers, institutional players in nanotechnology policy in India and the environmental, health and safety issues of this emerging technology for sustaining an eco-friendly environment for ever.

Keywords: Nanotechnology (NT) Green Innovation (GI) Research & Development (R&D) Eco-Environment (EE), Sustainable Environment (SE)

1. INTRODUCTION

Nanotechnology is considered as an emerging and converging technology (Roco and Bainbridge, 2002) that is said to be one of the key technologies of the 21st century. It is a young domain and encompasses disciplines such as applied physics, materials science, physical chemistry, physics of condensed matter, bio-chemistry and molecular biology, and polymer science and engineering (Heinze and Bauer, 2007). It is a scale of technology, not a type, and it has applications in every economic sector, such as medicine, energy, industrial applications, materials science, engineering, electronics, communications, cosmetics, additives, coatings, food science, water purification, and agriculture. A nanometre (or nm) is one billionth of a meter and its scale generally represents between 1 and 100m.

Global investments in science, technology and innovation are estimated at \$1.2 trillion as of 2009. India's R&D investment is less than 2.5% of this and is currently under 1% of the Gross Domestic Product (GDP) (GOI, 2013). The gross domestic product in India expanded 4.7% in the fourth quarter of 2013 (Trading Economics, 2014). Increasing Gross Expenditure on Research and Development (GERD) to 2% from the present 1% of the GDP in this decade by

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

encouraging enhanced private sector contribution. The Union Cabinet of India has approved the Science, Technology and Innovation Policy (STIP) 2013 and the policy goal is to accelerate the pace of discovery, diffusion and delivery of science led solutions for serving the operational goals of India for faster, sustainable and inclusive growth. In this backdrop, the present paper has attempted to analyse the opportunities and challenges in the nanotechnology applications in the area of energy, water, health, and food and agriculture development in India

2. LITERATURE REVIEW

In the section of literature review , we the researcher have trying to our best finding in anticipation of the research titled ,**An Impact of Nano Technology on Green Innovation in India: Emerging challenges for Sustaining an Eco –Environment”** in order to find out the its reliable and authenticated causes & resources ,which are liable to enhancing the green innovation in India by producing more and more Nano products from the Indian industries .The researcher have taken two variables with followed by two hypothesis i.e in variable one ,Nano technology has an highly impact on Green innovation for sustaining an eco- environment (H_0) . The second variable has refers , Production of Green product as well as its more and more utilization by the users has an emerging value for green innovation ,if we shows our conscientious activities in our day- to -day life (H_e). Here, the researchers were taken many industries, health status & economical condition, regarding their green product production & its promotion in India in order to know its impact.

In connection with, Nano Mission aims to create the necessary innovation climate for nanotechnology in the country by strengthening basic research through funding support, creating centres of excellence, fund application oriented R&D projects, foster public private partnerships, organize international collaboration, education and training to researchers and professionals. Several other government funding agencies are engaged in, supporting nanotechnology in the national arena. Department of Biotechnology (DBT) is one of the key stakeholders in nanotechnology and issued projects related to nanotechnology in the fields of agriculture, including nutrition and mitigating soil pollution, biology, Nano-biotechnology, drug delivery systems and medicine for both fundamental research and technology development. Council for Scientific and Industrial Research (CSIR) is a network of 39 laboratories that engages in scientific and industrial R&D in nanotechnology in diverse areas. Department of Electronics and Information Technology (Deity) under the Ministry of Information and Communication

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

Technology as well as the Indian Council of Medical Research (ICMR) under the Ministry of Health and Family Welfare is also supporting the expansion of nanotechnology in the areas of electronics and health respectively. The Ministry of New and Renewable Energy (MNRE) is supporting Nano-science and technology in India to utilize its potential in developing renewable energy sources like photovoltaic and fuel cells etc. finally , the researchers have recommended that, if the people of India, industries are well conscious to produce and consume more and more greenery product , un doubt , we have got and sustain an eco- friendly environment for ever which gives us clean air for breathing , hygienic atmosphere for health and beautiful surroundings for maintaining a luxurious life forever.

3. AIM & OBJECTIVES OF RESEARCH

In this invited article, we the researcher set the following objectives for observing the impact of nanotechnology for sustaining an ecology through the green innovation with low level of monitoring of nanotechnology .The main theme of this report is to provide a comprehensive overview of nanotechnology developments globally through a systematic and also critical analysis of already available and comparable indicators and statistic. In particular, the report aims to assess the following questions:

- What is nanotechnology and how has this field developed?
- Which are the expected socio-economic impacts of nanotechnology?
- What are the extent, nature and distribution of nanotechnology R&D activities?
- Which are the main, emerging, application fields of nanotechnology?
- How are countries positioned and specialised in nanotechnology application fields?
- How are companies responding, which are the main challenges in commercialisation?

4. CHARACTERISTICS OF A GENERAL PURPOSE TECHNOLOGY

1. Should provide *rapid and significant scope for improvements over existing technologies in economic terms.*
- This characteristic is intended to reflect the performance of some function that is vital to the functioning of a large segment of existing or potential products and production systems. For example, “continuous rotary motion” and “binary logic” can be considered to embody these characteristics of steam power and ICT respectively as key examples of previous general purpose technologies.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

2. Should have a *widening variety of uses in a widening number of application areas and industries.*
 - This characteristic is intended to reflect the enabling and generic nature of general purpose technologies that support its widespread adoption through industries and economies. The widespread adoption may not only be a consequence of the scope of improvements of a technology, it also relates to a variety of actors, and co-ordinating beliefs about the promise of the technology.
3. Should also both *generate, and depend for its widespread use on, the development of range of other complementary technologies or innovations.*
 - These technologies and innovations may not only relate to *e.g.* supporting production Methods, components and other intermediaries. They may also relate to new organisations of companies and industries, different types of business models or changes in the overall business environment of companies.

5. RESEARCH PROBLEM

(a)Formulation of problem:

Generally a research problem refers to some difficulty, in which a researcher has experiences in the context of either theoretical or practical situation where the researcher wants to solve the same followed by some conditions i.e

(i)If the employees performance of an organization or group ,treat it title as 'I' to whom the problem can attributed, then the surroundings of that organization or group is called 'N' which is called uncontrolled variable Y_j

(ii)There are two courses of action like C_1 and C_2 i.e manufacturing of Nano Products and a sustaining of Green Innovation Environment which are controlled variable, for example produce more and more Nano products from the companies it leads to green ecology.

(iii) Here, the researcher have expect two out comes i.e O_1 and O_2 of the course of action, out of one is probable comes which is known as research objective.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

(iv)The course of action or function, must provides some chance of obtaining the objectives of research work, beyond that it is not possible to adopt the same chance. Otherwise chance is not a matter i.e

Problem 'P'=O₁/I, C₁, N) =P (O₁/ C₂, N)

Thus, we can say the choices of Nano product production must have unequal for the desired out comes. Here, the researcher have taken number of problem to observe their effectiveness in the process of green innovation for sustaining an eco-environment by following frame works for enhancing the research objectives i.e

(b)Analytical Framework:

As a theoretical framework, this study is based on the idea of innovation system. Invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out in practice ((Fagerberg, 2005). The innovation system permits to study activities, actors, norms, rules, relationships, and other factors which influence innovation .The elements of the innovation system are focused upon universities, research institutions, technological institutes, and R&D laboratories (Lundvall and Borrás, 2005). In context of this, the Indian Nanotechnology innovation system can be assumed that it consists of three broad segments which enable the journey of an idea from human mind to market. The first phase is called the 'Birth Phase', where commercially viable idea gets converted into a workable process. The next phase is called the 'Survival Phase' wherein up-scaling of the process to the pre-commercial stage is done. The third phase is called the 'Growth Phase' wherein the pilot production is up-scaled to commercial production (Gupta and Dutta, 2005). A model of the Indian Nanotechnology Innovation System is illustrated in number of ways i.e production of Nano products by using Nano Methodology, in various fields of industry, health, sanitation, transportation, education etc.

6. THE ORIGIN AND DEVELOPMENT OF NANOTECHNOLOGY

The relevance of what later became known as nanotechnology was first highlighted by the physicist Richard Feynman in his seminal talk in 1959 at the meeting of the American Physical Society, at the Californian Institute of Technology, entitled "There is plenty of room at the bottom". In this talk he anticipated the possibility of controlling matter at a very small scale and

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

thus introduced the scientific community to a new field of enquiry. The term “nanotechnology” was first introduced in 1974 by Norio Tangichi from the Tokyo University of Science, while the basic idea of this technology was explored in greater detail by Eric Drexler in his much-cited book “Engines of Creation – The Coming Era of Nanotechnology” from 1986.

6.1 What you get from Nano Technology?

- Market Research
- Industry Trends Analysis
- Technologies Analysis
- Business Intelligence
- Top Companies Database
- Business Leaders and Corporate Executives
- Industry Associations Database
- Export Tools - Build Mailing Lists

6.2 An Overview of Nanotechnology:

No doubt, we can say ‘Nanotechnology’ is a relatively new materials science that is slowly beginning to revolutionize many sectors of manufacturing .The long term outlook is exceptionally promising. Only a small number of consumers or business executives realize the extent to which nanotech is going to change the materials they use every day As of 2015, so much progress has been made in nanotech research and development that commercialization is accelerating broadly. One factor boosting the adoption of nanotechnology is an increase in the manufacture and availability of carbon Nano tubes, a basic Nano material that can be used in a wide variety of manufactured goods. These Nano tubes have been shown to have highly valuable qualities, including incredible strength, extremely light weight and high conductivity of electricity .As Nano tube supplies increase and costs drop, use will increase significantly. Investment in nanotechnology research and the market for nanotech products have expanded steadily.

6.3 Nanotechnology Development in India

The Nano science and Technology Mission (NSTM) was established by The Department of Science and Technology (DST) during the 10th plan period (2002- 2007) with an allocation of

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

Rs. 60 crores (about 12 million USD) (GOI, 2002). During the 11th plan period (2007-2012) this program was upgraded through another major initiative known as ‘Nano Mission’ with a budgetary allocation of Rs. 1000 crore (about 250 million USD) for 5 years (GOI, 2007). The Union Cabinet has approved for the second phase of the Nano mission in the 12th plan period (2012-2017) at a total cost of Rs. 650 crores (GOI, 2012). The researcher have studies various Nano products and its centres for testing the research work i.e



Nano Products in phone Model (Fig.01)



Nano Centre way to USA (Fig.02)

Defense Research and Development Organization (DRDO) a network of 50 laboratories under the Ministry of Defense as well as the Department of Atomic Energy (DAE) directly under the Government of India is contributing to the expansion of nanotechnology and Indian Council of Agriculture Research (ICAR) under the Ministry of Agriculture as well as the Ministry of Commerce and Industry has shown interest in engaging with nanotechnology in India. Associated Chambers of Commerce and Industry in India (ASSOCHAM), Federation of Indian Chambers of Commerce and Industry (FICCI) and the Confederation of Indian Industry (CII) are three major industrial associations involved in the promotion of nanotechnology in India. CII started its own nanotechnology initiative in 2002 to create a supporting environment for industry through knowledge exchange missions, awareness programs, workshops, market research and other range of services. Figure 2 exhibits the overview of projects supported by the Nano mission from 2002-2014.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

7. WHAT IS GREEN TECHNOLOGY?

The term "technology" refers to the application of knowledge for practical purposes .The field of "green technology" encompasses a continuously evolving group of methods and materials, from techniques for generating energy to non-toxic cleaning products .The present expectation is that this field will bring innovation and changes in daily life of similar magnitude to the "information technology" explosion over the last two decades. In these early stages, it is impossible to predict what "green technology" may eventually encompass .the following components are enhancing the green field .i.e

8. SALIENT FEATURE OF GREEN TECHNOLOGY

- It is an Environmental Friendly Technology
- It conserve natural resources & the environment Sustainable Development
- It focuses a radical thinking to change
- It is an innovation technology.
- Goals of Green Technology:

The Green technology having a specific aim to achieve number of goals like

- **Re-Thinking:**

It focuses radical Things of fundamental Changes.

- **Recycling :**

It is an aggregate & concrete, paper, plastic, Can, Batteries, clothing etc.

- **Renewing :**

- It consists of renewing energy, wind power, water power, solar Energy, Bio-fuel, waste water etc.

- **Reducing:**

Fuels, waste, Energy, Consumption etc.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

- **Responsibility:**

It emphasized for one world & one dream.

9. TYPES OF GREEN TECHNOLOGY

As the types of green Technology Concerned, it has classified in to the followings i.e

a)Green Energy b)Green Building c)Green Purchasing d)Green Chemistry e)Green Nano Technology etc. let us come to discuss in briefly as follows

9.1Green Energy:

Perhaps the most urgent issue for green technology, this includes the development of alternative fuels, new means of generating energy and energy efficiency.

- It is one type of energy which collects from the natural resources used in the energy generation process is on the decline.
- Increasing pollution caused by the Non-Renewable sources

9.2Green building:

Green building encompasses everything from the choice of building materials to where a

- High initial cost of setting up the projects.
- Emerging technology, so risks involve
- Does not cater to the promoter's short term interest of profit.

9.3Advantages:

Green Technology has certain advantages by which we make the world pollution free & expected a sustainable eco-environment. .i.e

- It helps to reduce the cost of operation in the long term.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

- It focuses about consumer's more consciousness regarding a green environment.

9.4 Green purchasing:

The government innovation involves the search for products whose contents and methods of production have the smallest possible impact on the environment, and mandates that these be the preferred products for government purchasing.

9.5 Product:

A product has a need satisfying entity which will be satisfying the needs, desires, and wants of customer due to its tangibility and intangibility characters or nature. In other words a product may be treated as:

- A product dimension includes providing & using engineering with market drives, Trends for green Product attributes such as energy savings ,organic, clothing ,low volatile organic compounds etc.
- Greener selection & use of resources results in savings from less waste, less chemicals & less processing.
- Walmart has made tremendous strides in greening their transportation, Energy usages, facility design and adoption of some greener products, such as organic clothes etc.

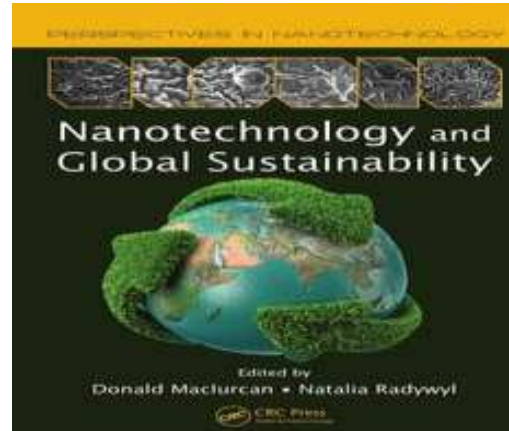
9.6 Green chemistry:

The invention, design and application of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances.

- Its design of process to maximise the amount of raw material that ends up in the product.
- Use of safe, environment –benign, substances including solvents, whenever possible.
- Design of energy efficient processes.
- Best form of waste disposal not to create it in the first place.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

9.7 Green Nanotechnology:



[Nano Technology & Global Sustainability Model & Books]

Nanotechnology involves the manipulation of materials at the scale of the nanometre, one billionth of a meter. Some scientists believe that mastery of this subject is forthcoming that will transform the way that everything in the world is manufactured. "Green nanotechnology" is the application of green chemistry and green engineering principles to this field building is located .i.e

- It refers to the use of Nano-technology to enhancing the environmental Sustainability of processes, currently producing negative externalities.
- It aims to minimise potential environmental & human health risks associated with the manufacturer and use of Nano-Technology Products and to encourage replacement of existing products with new Nano-Products that are more environmentally, friendly throughout their life cycle.

10. SUSTAINABILITY OF GREEN TECHNOLOGY

In order to meeting the needs of society in ways that can continue indefinitely into the future without damaging or depleting natural resources. In short, meeting present needs without compromising the ability of future generations to meet their own needs.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

10.1 "Cradle to cradle" design:-

Ending the "cradle to grave" cycle of manufactured products, by creating products that can be fully reclaimed or re-used.

10.2 Source reduction:-

It reducing waste and pollution by changing patterns of production and consumption.

10.3 Innovation:

It developing alternatives to technologies - whether fossil fuel or chemical intensive agriculture - that have been demonstrated to damage health and the environment.

10.4 Viability:

It creating a centre of economic activity around technologies and products that benefit the environment, speeding their implementation and creating new careers that truly protect the planet.

11. APPLICATIONS OF GREEN TECHNOLOGY

The application of green technology is a wide spread in every sector of human & environmental life, which can be applied in the following sectors i.e

- The use of green technology can reduce the amount of waste & pollution & provide early warning, message that is caused that's created during production, consumption & impact of natural disaster.
- This issue /suggestion provide an international forum for scientists, research scholars, investigators, Environmentalist, ecologist and professors for an open discussion. Besides that technocrats, engineers and academician for consolidating research activities and findings in all experimental, theoretical & practical aspects of green science, technology & engineering in to single & unique reference source.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

12. HYPOTHESIS TESTING

In this section, for testing the hypothesis, we the researcher have trying in our level best to collect more and more authentic data from various companies of India who are producing green products in various sector .i.e The researcher have taken two variables with followed by two hypothesis i.e in variable one, Nano technology has an highly impact on Green innovation for sustaining an eco- environment (H_0). The second variable is refers , Production of Green product as well as its more and more utilization by the users has an emerging value for green innovation ,if we shows our conscientious activities in our day- to -day life (H_0). Here, the researchers have taken 100 Manufacturing Nano products industries, in various sector such as health , Sanitation , education, transportation ,Communication Agriculture & economical sector, regarding impact of green product production & its promotion in India .Finally ,the researchers observed that use of More and More Nano products by the people having a positive impact for enhancing & sustaining an enriched eco-environment. (Please see the methodology of problem formulation & its solution as per followings)

13. METHOD OF STUDY

In the method of study, the researchers have taken both the primary and secondary method of data collection, but most of data collection through the means of empirical studies and have collected 100 companies of Asian continent and their data's are given below

[Statistical data of Nano Product Users for sustaining an Eco- Environment]

| Year | Country | Manufacturing Company | Number of Percentage | Remarks |
|------|--------------|-----------------------|----------------------|----------|
| 2016 | India | 82 | 08 | Positive |
| 2015 | China | 201 | 24 | Positive |
| 2014 | Finland | 125 | 10 | Positive |
| 2013 | Saudi Arabia | 18 | 00 | Positive |

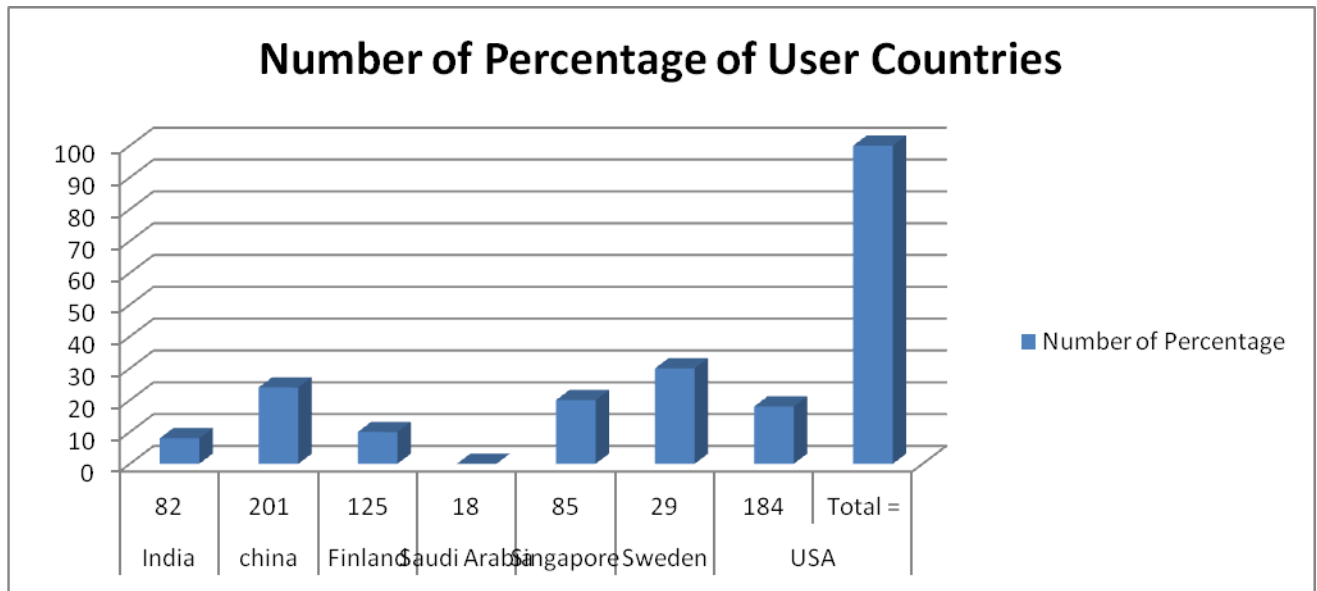
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

| | | | | |
|-------|-----------|-----|-----|----------|
| 2012 | Singapore | 85 | 20 | Positive |
| 2011 | Sweden | 29 | 30 | Positive |
| 2010 | USA | 184 | 18 | Positive |
| Total | | 724 | 100 | Positive |

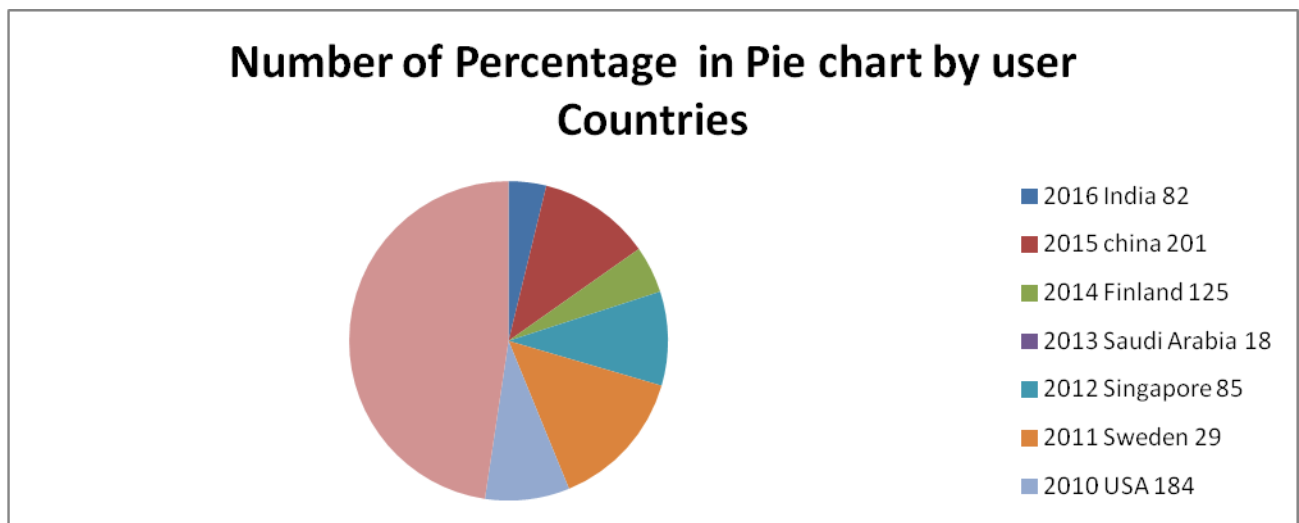
14. CALCULATION OF RATIO VALUE

14.1 Method of Correlation Co-efficient:

To testing the relationship in between the two hypothesized variable, the researcher have adopted method of co-relation coefficient in order to calculate its ration value i.e the calculated value of coefficient is 0.96 and the table value at 0.01 level and 0.05 level is .83 and the table value .94 on the degree of freedom (df)n-1=06 df .thus , we observed that ,the taken hypothesis has an significant role in both the condition of variable ,which enhancing a sustainable eco-environment.



[Statistical Model in Pie Chart of Nano Product Users]



International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

15. RESEARCH FINDINGS

Finally, from the above research analysis, the researchers have got the following findings and recommend it for the optimum development & welfare of the people of the globe in accordance their inhabitant environment becomes more healthy & hygienic and eco-sustainability.

16. WHAT WE DO & WHAT WE DON'T DO FOR GREEN ECOLOGY?

For a sustainable of Green logy, we should have responsible to the followings i.e

- We responsible for create a good environment
- Responsible for re- thinking the way we live.
- Reducing exhaustion.
- Re-Cycling waste
- Renewing energy etc.

ACKNOWLEDGEMENT

The Researchers have tender their hearty gratitude to the almighty, for giving this opportunity to do this valuable job. Besides that, I express my deepest thanks & regards to the following dignitaries who are helping us a lot for doing this work successfully that:

Firstly, we are very much thankful & grateful to the Dean (R&D) Research Cell (EATM), Bhubaneswar, affiliated to Bijupatnaik University of technology for giving us this opportunity. In connection with we are so much grateful to our esteemed guide **Prof. (Dr.) Ramesh Chandra Rath(India)**, who supported a lot ,from time to time to complete it successfully.

Secondly, we express our deepest regards to our parents, teachers, friends who encouraged me to prepare this article & finally, We extremely thankful to the honourable Chairman **Mr. Basant Kumar Bisoi, Principal Prof. (Dr.) Suvendhu Prasad Sahu** of EATM & its Centre of Excellency for providing golden opportunity and supported as well as motivated us to complete this assigned task .without their support, it is not possible to reach this stage.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

CONCLUSION

In sum , the above summations are summarizing that “Nano Technology ”is an excellent Material Science & Technology for modern manufacturing System ,by which , various difficult works are solving easily , with a high ration of product production & controlling all activities of manufacturing Industries ,market position.. Thus, in concluding paragraph of the said titled, we may conclude the followings that:

- Green technology has some defects; everything done should have both positive & negative impact in world.
- Global warming & energy cross cannot be solved with one & two years.
- It really requires our determination & continues effort in improving the situation.
- Green technology, will definitely to the solution to gets the potential for helping us to solve those problems & improve our environment,

REFERENCE

- National renewable Energy laboratories (NREL) <http://www.nrel.gov>.
- US green Building Council <http://www.usgbc.org>
- USEPP: Environmentally Preferable Purchasing <http://www.epa.gov/epp/>
- Project on Emerging Nano Technologies <http://nanotechnologyproject.org/>
- USEPA: Green Chemistry Program http://www.epa.gov/green_chemistry/
- OECD (2007), *OECD Science, Technology and Industry Scoreboard 2007*.
- OECD (2008), Nanotechnology innovation – An overview, (secretariat working document, not unclassified).
- Palmberg, C. and Nikulainen, T. (2008), “Nanotechnology and industrial renewal in Finland. A synthesis of key findings.” ETLA, Finland.
- Perez, Charlota (2002), *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*. Edward Elgar.
- Porter, A., Youtie, J., Shapira, P. and Schoeneck, J. (2006). “Refining Search Terms for nanotechnology.” Briefing Paper. Georgia Insititute of Technology, Atlanta, United States.

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

- Rafols, Ismael and Meyer, Martin (2007), “How cross-disciplinary is bio nanotechnology? Explanations in the speciality of molecular motors.” *Scientometrics*, vol. 70, no.3.
- Rafols, I and Porter, A. (2008), Mapping nanotechnology (1991-2007). Manuscript.
- Leydersdorff, L. and Rafols, I. (2008), “A Global Map of Science Based on the ISI Subject categories.”
- *Journal of American Society for Information Science and Technology* (under review, forthcoming)
- Robinson, D. Rip, A. and Mangematin, V. (2007), “Technological agglomeration and the emergence of clusters and networks in nanotechnology.” *Research policy* 36.
- Roco, M.C. and Bainbridge, W (eds.). 2001. Converging Technologies for Improving Human Performance. NSF Report, Arlington, VA
- Roco, M. 2003. Broader Societal Issues of Nanotechnology. *Journal for Nano particle Research*, vol. 5, Nos.3-4.

Author Profile: 01



[Prof. (Dr.) Ramesh Chandra Rath]

He is an Eminent Professor & academician of an international repute in the field of Management Education (Mkt. &HR) since last 22 years. He had obtained his PG in Psychology from Sambalpur University, Concurrred his MBA Degree from Delhi University in 1996, PhD, Degree Department of Management Studies “Birla Institute of Technology , Meshra , Ranchi” in 2000 on the area of **Green Marketing &Supply Chain Management** (Marketing Management specialization) and Concurrred his Post -Doctorate Degree from Patna University in 2003,on the area of “**Advanced physiology and Criminology** ”He has joined as a HR Manager in Pradhan Steels and Mines, Limited ,Athagarda from January 1998 to July 2001 .He has served as a faculty of NMIT for three years , Associate Professor at ICFAI, Berhumpur Centre, from June 2004 to May 2005, Professor in at Centre of Management Studies (OEC)form 2nd June 2005 to

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016

30th June 2007, and he had also served as a professor in Management studies in Ravenshaw University from July 2007 to June 2008, Principal of Presidency College, Berhampur (Odisha) from Sept.2009 to June 2012, Head of the Department of Management Studies (MBA) in Gandhi Engineering College, Bhubaneswar from the 2nd July 2012 to May 2014. He has presently working as a Professor-Cum-Dean at Research and Development Cell, EATM Bhubaneswar. Dr. Rath has guided four PhD research scholars on area of Green Marketing & supply Chain Management, Consumer Behaviour, and Organizational Behaviour, Production & Operational Management etc. There are 12 International journals and 16 National Journals & two books of (Management) publication in his credit by reputed publishers in India and abroad.

Author Profile No: 02



Er. (Mrs.) Suchismita Mohapatra

Er. (Mrs.) Suchismita Mohapatra is a well known research scholar in the field of Nano-Technology, Net-Working System of Cloud Computing, Technology of Manufacturing, etc. She has completed her M.Tech Degree from the College of Engineering Bhubaneswar (CEB), Bhubaneswar, and B.Tech. Degree from Jagannath Institute of Engineering & Technology (JIET), Cuttack, Odisha under Approved by AICTE, Govt. of India New Delhi & Affiliated to University of BPUT, Rourkela. Odisha. Throughout her career she has stood in first position from her inception of her education. She has more than 10 years of experience in the field of Academia and Industry. Presently she is working as Associate professor in the department of Electronics and Communication Engineering (ECE) at Sprintronic Technology of Advanced Research (STAR), Bhubaneswar under the Bijupatnaik University of Technology, Rourkela Odisha.

Author Profile No: 03

International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 11, February 2016



He is an excellent teacher in the field of Electrical & Electronics Engineering, in the area of Net work Theory and power system & Control since last three years. He was completed his Diploma & B.Tech Degree from Indus College of Technology, Bhubaneswar and affiliated to BPUT Rourkela, Odisha. Besides that, .He has four years of working experience in the department of Electrical Engineering, Presently he is working as an assistant professor, at the Department of Electrical Engineering, EATM, Bhubaneswar, and Odisha.

Author Profile No: 04



Er. Samarendra Kumar Pradhan

He is an excellent teacher in the field of Electrical Engineering & Technology, at the area of Net work Theory and Electrical Machine Design since last three years. He was completed his Bachelor's degree from Utkal University, Vanivihar , Bhubaneswar, Odisha and completed his B.Tech Degree from the Indus College of Technology , affiliated to BPUT ,Rourkela Bhubaneswar, Odisha. Besides that, he has also concurred diploma and ITI degree from the reputed institutions of Odisha .He has three years of working experience in the department of Electrical Engineering, Presently he is working as an assistant professor, in the Department of Electrical Engineering, EATM, Bhubaneswar, and Odisha.