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INVITATION OF PAPERS FOR PUBLICATION

Vanijya Manthan would endeavour to publish papers from leading academicians, researchers and practitioners on Commerce and on other disciplines of Social and Management Sciences. We also invite articles, Notes, and comments based on operational experiences and supported by relevant evidences, from policy-makers, practicing senior executives and management experts who would like to share their thought, ideas and views with others.

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INDIA: A CASE FOR A WELFARE STATE

* Dr. R. Prabhakar Rao

Abstract: Indian economy as at the current state should be a welfare state to a large extent. Open market forces in the agriculture sector may not be the best way to move forward. To unravel the reasons for this, a change in the accounting practices is required that includes the accounting for natural resource depletion.

Key Words: Gross National Product, Per Capita Income, Happiness Index, Human Development Index, Natural Resource Accounting

Introduction
India is an agriculture dependent country. In order to provide sustenance to small and marginal farmers, forest dependent communities, fisher folk, and small artisans it is important to not focus too much on Gross National Product as an indicator of development.

Objective of the present paper
The objective of the paper is to highlight the inadequacy of existing economic indicators to capture welfare reaching out to the common man.

Research Methodology
The paper is a theoretical framework based on literature survey about conditions of poor and marginalized sections of the Indian economy. Agriculture plays a vital role in the Indian economy. Over 70 per cent of the rural households depend on agriculture as their principal means of livelihood. Agriculture, along with fisheries and forestry, accounts for one-third of the nation's GDP and is its single largest contributor. Majority of the farmers are small and marginal and need the support of a welfare state. They are in no position to battle with open market forces. The population distribution in India in terms of rich poor divide also mandates a welfare state. The gap between the poor and the rich is growing in India, a UN-ESCAP report has said. Even in poverty, Indians have a sense of being satisfied under trying circumstances. Of course there is a limit beyond which this will not be true. When hunger, malnutrition and drinking water issues affect people, the situation becomes dire. An estimated 21.25 percent of the Indian population lives on less than 100 rupees per day. India is home to one-quarter of all undernourished people worldwide. Any global impact on hunger

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requires progress in food and nutrition security in India. India ranks 130th out of 188 countries in the 2015 UNDP Human Development Index (HDI) and 80 out of 104 countries in the Global Hunger Index. While per capita income in India has more than tripled in the last two decades, the minimum dietary intake fell during the same period. Levels of inequality and social exclusion are very high. The bottom 10 percent of the population accounts for only 3.6 percent of the total consumption expenditure and the top 10 percent accounts for 31 percent - the gap between rich and poor has increased during the period of high economic growth.

Growth indices like Gross National Product (GNP) and Per Capita Income (PCI) provide the overall picture that can mask ground realities. Human Development Index, Happiness Index etc. are attempts to highlight realities that GNP and PCI fail to reveal.

For a country like India where majority of population depend upon forests, agriculture and allied activities, we need indices that properly account for value additions to GNP. For instance when forest lands are diverted to agriculture, the extra food grain produced is added to the GNP but the loss of forests is not accounted anywhere. GNP is a flow concept. Business firms prepare a Profit and Loss Account and Balance Sheet to show their performance. If assets are sold, cash generated is shown but in the balance sheet the asset will be shown at a depleted figure. At the country level, no national balance sheet is prepared. So the effects of a rising GDP are not captured fully.

At a project level, cost benefit analysis may be supplemented by a social cost benefit analysis. But for the country as a whole, depletion of natural assets is not reflected. For instance when a dam is constructed resulting in submergence of large tracts of forested lands, the electricity that will be generated, the acreage that will be irrigated, the population getting water etc are shown as benefits of constructing the dam. The loss of forest and the resulting ecological damage is never quantified. Forest play a major role in regulating climate, recharging ground water, sediment control, flood control, preventing run off, sequestering carbon, and providing a habitat for to forest dwelling communities and wildlife. Forests are a store house of floral and faunal biodiversity. These factors are hard to quantify and so are left off without there losses being taken into account. That is why clearances given to large projects have become subject of litigation and tension between project proponents and state on the one hand and project affected people on the other. Displacing people from their ancestral homes completely disrupts their cultural and social life. Often they end up as refugees in their own country and are compelled to occupy marginal and degraded lands.

A national balance sheet has to be prepared that would reflect the true cost of natural asset depletion. Ignoring natural resource depletion can have grave
mandate to protect the country from external aggression. In a similar way the Ministry of Environment, Forests and Climate Change has the mandate to protect our natural wealth. If natural resources are handled recklessly, agriculture takes a downturn and the country is forced to import food grains. Our dependency on other countries for food makes our country vulnerable to outside pressures even if we have a strong defence force.

In order to provide welfare to all sections of the population, proper accounting of natural resources is essential. India being a signatory to the biological Diversity Convention is mandated to secure its biological wealth that is the property of the national government.

Similarly squandering of national natural resources will drive a country toward bankruptcy irrespective of the current level of development. Many countries that depleted their natural resources are now facing the problems of desertification, wars and terrorism. Refugee crisis is adding to the problems. In India, the Defence Ministry has the mandate to protect the country from external aggression. In a similar way the Ministry of Environment, Forests and Climate Change has the mandate to protect our natural wealth. If natural resources are handled recklessly, agriculture takes a downturn and the country is forced to import food grains. Our dependency on other countries for food makes our country vulnerable to outside pressures even if we have a strong defence force.

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ELECTRONIC HUMAN RESOURCE MANAGEMENT

* Dr. Reeta ** Mr. Bharat Bhatt

Abstract

Information technology is changing the way HR departments handle record keeping and information sharing. It decreases the paperwork substantially and allows easy access to voluminous data. The employee can also keep track of his/her achievements without having to go through litigious procedures. It uses intranet or other web technology channels. E-HRM is a Computerized Human Resource Information System (CHRIS) consisting of a fully integrated, organization-wide network of HR related data, information, services, databases, tools and transactions. E-HRM is the application of IT for HR practices which enables easy interactions within employee and employers. It stores information regarding payroll, employee personal data, performance management, training, recruitment and strategic orientation. With computer hardware, software and databases, organization can keep records and information better as well as retrieve them with greater ease. It aims at transforming the HR functions into one that is paperless, more flexible and resource efficient. The main objective of this paper is to discuss the scope, uses and tools of e-HRM.

Keywords: E-HRM, Information Technology, Employer and Employees, Efficiency,

Introduction

Before the advent and application of information technology all organizations depended on the administrative management for managing their human and other resources. The administrative staff had to manually perform its daily function. It not only was time consuming but it also required a number of staff to it carry out. Personal files, records had to be prepared, maintained and accessed manually leading to a lot of paperwork that also occupied a large space. The managers would have to rely on one another, move from one location to another or use other forms of communications that took a toll on both the human and monetary resources. Policy decisions, employer employee interaction and discussions required all to be assembled at one place which would affect the working of the organization. Strategies had to be devised to address all these problems. With the introduction of information technology in businesses and organizations the outlook of the whole
Research Methodology
For the purpose of this paper the secondary data has been collected from different books, journals and internet etc.

Concept of e-HRM
E-HRM (Electronic Human Resource Management) is an efficient, reliable and easy to use tool that is easily accessible simultaneously to a broad group of different users. E-HRM is a web-based tool to automate and support HR processes. The implementation of E-HRM provides an opportunity to delegate the data entry to the employee. E-HRM is an advance business solution which provides a complete on-line support in the management of all processes, activities, data and information required to manage human resources in a modern company. It provides a way of implementing HR strategies, policies, and practices in organizations through extensive use of web-technology based channels. It covers all aspects of human resource management like personnel administration, education and training, career development, corporate organization, job descriptions, hiring process, employee's personal pages, and annual interviews with employees.

According to Kettley and Reilly, E-HRM is a Computerized Human Resource Information System (CHRIS) consisting of a fully integrated, organization-wide network of HR related data, information, services, databases, tools and transactions.

Objective of the paper
The main objective of the paper is to discuss the concept of E-HRM, its uses, scope and various tools.

Scope of e-HRM
In this competitive world businesses look forward to having a system that not only improves the management of activities of
functions. Both managers and employees are allowed to have a direct access to HR and other workplace services. Efficiency in providing services is increased with the use of web-based tools. These tools are:

**E-Employee Profile:** This is a web application that provides a central point access to the employee contact information. Earlier the employee profile had to be maintained in paper form but with the use of E-HRM the information with regard to an employee is electronically stored and through this application it can be accessed easily and quickly. It lists the employee skills that make the management of HR easy and simple. Managers and employees use this application to get an overview of the information about an employee. Employees can use this application to display their own data and managers can display the profile of the employees in their team. The profile displays each and every characteristic of the employee like, certification, awards, work related information like experience, specialization, skills, competency, contact details, job information service details etc.

E-HRM Tools

Electronic Human Resource Management consists of the application of internet based tools to support HR functions. Both managers and employees are allowed to have a direct access to HR and other workplace services. Efficiency in providing services is increased with the use of web-based tools. These tools are:

**E-Employee Profile:** This is a web application that provides a central point access to the employee contact information. Earlier the employee profile had to be maintained in paper form but with the use of E-HRM the information with regard to an employee is electronically stored and through this application it can be accessed easily and quickly. It lists the employee skills that make the management of HR easy and simple. Managers and employees use this application to get an overview of the information about an employee. Employees can use this application to display their own data and managers can display the profile of the employees in their team. The profile displays each and every characteristic of the employee like, certification, awards, work related information like experience, specialization, skills, competency, contact details, job information service details etc.

The system is also connected to other data and information where an employee can manage them personally and completely such as making a leave request, in which an employee can see the exact number of leave days while being able to make a leave request directly via the computer. This can facilitate a manager to approve such leave request in an immediate manner as both the employee and the manager can view the details of leave request fully. The maintenance of the E-Profile lies with the individual employee, the manager and the database manager.
E-Recruitment: Before the application of computers or internet, jobs used to be advertised in papers or displayed on the notice boards. This was later replaced by advertising jobs on a bulletin board service with the use of computer. With the application of E-HRM some companies started accepting applications online. This method of recruitment became so popular and cost effective that, today, it is the choice of recruitment adopted by most companies. It came to be known by the name 'E-Recruitment'. This became so popular that today thousands of recruiting web sites are available on the net. Different job e-recruiting methods are presently available e.g. Job Boards, Professional/Career web sites, Employer websites etc. Some of these are naukri.com, monsterindia.com, careerindia.com, jobsahead.com, and many others. This also has increased the workload of the recruiters as the HR professionals have now a lot of data to go through.

E-Selection: Before going further it is good to be said there are two different orientations on company's website: recruiting-oriented which means the web site only publish information about the vacant positions for perspective applicants and screening-oriented which means the web site would collect information from applicants to be used for selection process and also company's may use both. So e-selection could be considered only when there is a set of collected data from applicants which requires screening-oriented for company's web site. Chapman and Webster (2003) divide various stages of recruitment and selection as (a) advertising positions, (b) receiving applications, (c) initial screening, (d) and final selection. So according to the first definition selection starts on third stage whereas according to the second one, initial screening is a pre-selection process. As a result generally we can say e-selection process is composed by two steps as pre-selection and the final selection which would be elaborated more by focusing on different methods of e-selection. Human resource professionals can find ways to maximize the staffing benefits of electronic, or "e-selection systems" and at the same time avoid potential pitfalls that could turn off qualified job candidates. E-selection systems can provide a substantial return on investment, but it requires spending a lot of effort setting it up, differentiating jobs and segments.

E-Learning: Before the application of information technology in organizations all modes of learning was done in a class room manner. There was limited access to educational material. One would have to leave his place of work to attend classes. But all this changed. Web based technology now became the medium of teaching and learning. E-learning is rapidly becoming an essential tool for employee training and business performance optimization. E-learning technologies can help your company to exponentially increase the effectiveness of its corporate employee training programs. E-learning is flexible and can be done in short periods to suit the individual's routine. One of the most unique and advantageous aspects of e-learning is that it permits a high degree of customization. This means that managers...
can work to align online employee training and development plans with the company's objectives as well as the requirements of different employee profiles. An effective implementation of this e-learning possibility will result in staff emerging from their online training programs equipped with the specific skills needed to most efficiently bring the company closer to its objectives. Another aspect is the Staff recruitment. Not only does e-learning increase the loyalty of existing employees, but they can also help companies with additional staff recruitment. In addition to obvious efficiency, e-learning equips employees with knowledge that is globally relevant and often, universally applicable. The existence of a multitude of different e-learning companies means that executives now have an extremely broad choice of possibilities when it comes to choosing the best training program for their employees. E-learning is economical and efficient. While conventional employee training has been associated with time away from work, e-learning methods can be flexibly incorporated into the busy schedules of both companies and their employees. E-learning allows staff to receive a wealth of specialized training means that employees can also become more actively involved in their company's vision, helping boost overall employee engagement in the organization. This will allow employees to feel like key online training and increasing the chances of staff retention. If implemented effectively, e-learning tools can be a great investment that brings companies significantly closer to their objectives while enhancing their employees' competencies, involvement and loyalty.

**E-Training:** Employee training and development is a broad term covering multiple kinds of employee learning. Training is a program that helps employees learn specific knowledge or skills to improve performance in their current roles. Development is more expansive and focuses on employee growth and future performance, rather than an immediate job role. Online training courses are designed to guide people through information and coursework, or help trainees to better perform in specific tasks. Hiring top talent takes time and money, and how you engage and develop that talent impacts retention and business growth. As companies grow and the war for talent intensifies, it is increasingly important that training and development programs are not only competitive, but are supporting the organization on its defined strategic path.” And it's not just about retention. Employee training and development programs directly impact your bottom line. Increased access, convenience and flexibility have improved the performance of those having undertaken online training.

**E-Performance System:** Performance Management is one of the functions overseen by the HRM. If the same is done electronically then it is called E-Performance Management and becomes the function of E-HRM. This web-based tool is designed to make performance reviews easier. Through E-Performance management the organization can ensure that the employees know and understand in what way they have contributed
towards the goals and objectives of the organization. It also helps the employee understand what is expected of him. Further it can ascertain whether the employees possess the necessary skills to fulfill what is expected of them. It helps facilitate a cordial and harmonious relationship between the individual employee and the manager. With effective implementation An effectively implemented e-performance management system can benefit the organization, managers and employees in several ways. The organization benefits through good performance, improved productivity, employee retention and loyalty. There is accountability for actions, good unhindered communication and lower cost that the organization benefits from. The managers, on the other hand, get an instant feedback, can review the performance quickly and take an immediate decision on the action to be taken. The previous data and the latest can be matched and a decision can be taken. All this information gets fed into the individual profile and development plan. The employee, by accessing information regarding his performance can make a self assessment, identify his deficiencies and initiate measures to correct them. He thus benefits from job satisfaction.

E-Compensation: It is essential that all companies must put in place a compensation plan. Compensation Planning is a process by which the managers calculate and allocate salary increases equitably across the organization within the allotted budget in a transparent manner. In contrast to earlier methods it is now possible to make use of the intranet and internet services in compensation planning. This is called e-compensation planning.

Advantages of e-HRM
The use of E-HRM provides the following benefits to the organization:

- Efficiency can be obtained by reducing the cycle times for meting out paper work, increasing data precision, and reducing excess HR.
- Amplified and easy access to HR data and ease in classifying and reclassifying data.
- It leads to a more transparent system.
- Considerable reduction of administrative burden.
- Provides Integral support for the management of human resources and all other basic and support processes within the company.
- A more forceful workflow in the business process, productivity and employee Satisfaction
- E-HRM can save costs while maintaining the quality of data.
- Ease of recruitment, selection and assessment.
- Decentralization of HR tasks.

Conclusion
E-HRM helps in conveying any kind of HR policies, training program, and pay slip sheets easily. Electronic Recruitment has made the job much easier for both the companies and the job seekers and here the credit goes to the Software, IT Professionals, Internet, Computer and
many other people who are working back-end. E-Recruitment is an easiest and convincing way to hire people from any part of the world and promotes opportunity; it benefits the company to be recognized globally. E-HRM is based on more systematic & technology theorem, which helps the HR department to scrutinize employee performance carefully & accurately.

References


★★★★
GOODS AND SERVICE TAX (GST) IN INDIA
AND ITS IMPACT ON INDIAN ECONOMY

* Prof. Dr. Suresh Kumar Dhameja   ** Deepak Kumar   *** ManikaDhameja

Abstract
In this study an attempted to the impact of Goods and Services Tax (GST) on Indian Economy. GST is a comprehensive tax levy on manufacture, sale and consumption of goods and services at a national level. The Government GST regime seeks to replace excise duty, import duties, VAT and service tax regulations, along with other cess and surcharges, with three separate legislations namely CGST, SGST and IGST. GST would be applicable to all transactions of goods and service, and it to be paid to the accounts of the Centre and the States separately. The biggest advantage of GST is economic unification of India. It has potential to end the longstanding distortions arising out of the differential treatment of the manufacturing and service sectors. The GST reform is expected to bring in a lot of changes in Indian economy. The present structure of Indirect Taxes is very complex in India. There are so many types of taxes that are levied by the Central and State Governments on Goods & Services. This paper studies the impact of GST on Indian Economy.

Keywords: Goods and services tax, import duty, excise duty, economic growth Internet.

INTRODUCTION
In this study an attempted to the impact of Goods and Services Tax (GST) on Indian Economy. GST is a comprehensive tax levy on manufacture, sale and consumption of goods and services at a national level. The Government GST regime seeks to replace excise duty, import duties, VAT and service tax regulations, along with other cess and surcharges, with three separate legislations namely CGST(central GST, collected by the central government), SGST(state GST, collected by the state government) and IGST(integrated GST, collected by the central government). GST would be applicable to all transactions of goods and service, and it to be paid to the accounts of the Centre and the States separately. The biggest advantage of GST is economic unification of India. It has potential to end the longstanding distortions arising out of the differential treatment of the manufacturing and
service sectors. The GST reform is expected to bring in a lot of changes in Indian economy. The present structure of Indirect Taxes is very complex in India. There are so many types of taxes that are levied by the Central and State Governments on Goods & Services. This paper studies the impact of GST on Indian Economy.

Given the passage of the Constitution Amendment Bill for Goods and Services Tax (GST) in the Rajya Sabha on 3 August 2016, the Government of India seems committed to replace all the indirect taxes levied on goods and services by the Centre and States and implement GST by April 2017. With GST, it is anticipated that the tax base will be comprehensive, as virtually all goods and services will be taxable, with minimum exemptions.

GST the game changer: GST will be a game changing reform for Indian economy by developing a common Indian market and reducing the cascading effect of tax on the cost of goods and services. It will impact the Tax Structure, Tax Incidence, Tax Computation, Tax Payment, Compliance, Credit Utilization and Reporting leading to a complete overhaul of the current indirect tax system.

GST will have a far reaching impact on almost all the aspects of the business operations in the country, for instance, pricing of products and services; supply chain optimization; IT, accounting and tax compliance systems.

OBJECTIVES OF THE STUDY

1. To study the various aspects of Goods and Services Tax system in India.
2. To analyze the Impact of Goods and Services Tax (GST) on Indian Economy.
3. To understand the Structure of Goods and Services Tax in India

REVIEW OF LITERATURE

Girish Garg, (2014) Studied “Basic Concepts and Features of Good and Service Tax in India”, and found that GST is the most logical steps towards the comprehensive indirect tax reform in our country since independence. GST will create a single, unified Indian market to make the economy stronger. Experts say that GST is likely to improve tax collections and Boost India's economic development by breaking tax barriers between States and integrating India through a uniform tax rate. Under GST, the taxation burden will be divided equitably between manufacturing and services, through a lower tax rate by increasing the tax base and minimizing exemptions.

Dr. R. Vasanthagopal, (2011) Studied “GST in India: A Big Leap in the Indirect Taxation System”, and found that the positive impacts are dependent on a neutral and rational design of the GST, balancing the conflicting interests of various stakeholders, full political commitment for a fundamental tax reform with a constitutional amendment, the switchover to a flawless” GST would be a big leap in the indirect taxation system and also give a new impetus to India’s economic change. It is also noted that, buoyed by the success of GST, more than 140 countries have introduced GST in some form to other and is fast becoming the preferred form of indirect tax in the Asia Pacific region.
RESEARCH METHODOLOGY
This study is intended to identify the impact of GST on Indian economy. The study is descriptive in nature, based on secondary data. The study focuses on an extensive study of Secondary data collected from books, National & International Journals, government reports, publications from various websites which focused on various aspects of Goods and Service tax and Commercial Taxes Department.

WORKING OF GST AND ITS IMPACT ON ECONOMY

The present structure of Indirect Taxes is very complex in India. There are so many types of taxes that are levied by the Central and State Governments on Goods & Services. We have to pay 'Entertainment Tax' for watching a movie. We have to pay Value Added Tax (VAT) on purchasing goods & services. And there are Excise duties, Import Duties, Luxury Tax, Central Sales Tax, Service Tax.

GST is collected on value-added goods and services at each stage of sale or purchase in the supply chain. GST paid on the procurement of goods and services can be set off against that payable on the supply of goods or services. The manufacturer or wholesaler or retailer will pay the applicable GST rate but will claim back through tax credit mechanism. The GST is an indirect tax which means that the tax is passed on till the last stage wherein it is the customer of the goods and services who bears the tax. This is the case even today for all indirect taxes but the difference under the GST is that with streamlining of the multiple taxes the final cost to the customer will come out to be lower on the elimination of double charging in the system.

Economic union of India: The debate about India as one republic union versus a federation of states will be put to rest. Goods can easily move across the country with diffused state boundaries and that will encourage businesses to focus on pan-India operations.

Simpler tax structure: By merging all levies on goods and services into one, GST acquires a very simple and transparent character with less paperwork and reduction in accounting complexities. A simple taxation regime can make the manufacturing sector more competitive and save both money and time.
Uniform tax regime: With only one or two tax rates across the supply chain as against multiple tax structure at present, state specific advantages/disadvantages are gone. This provides a fair play ground for all stakeholders and focus can be brought in to efficiency rather than vantage points.

**Greater tax revenues:** A simpler tax structure can bring about greater compliance, thus increasing the number of tax payers and in turn tax revenues for the government. By removing cascading effect, layers of taxes and simplifying structures, the GST would encourage compliance, which is also expected to widen the tax base.

**Competitive pricing:** A cursory look at the retail price of any product manufactured in India reveals that the total tax component is roughly 25-30% of the cost of the product. GST will effectively mean that the tax paid by the final consumer will come down in most cases and will help in boosting consumption, which is again beneficial to companies.

**Push to exports:** With fall in production cost in domestic market, the competitiveness of Indian goods in international market will increase. This bodes well for exporters, who compete with global manufacturers which operate on very different cost structures.

**CONCLUSION**

Goods and Services Tax (GST) is a comprehensive tax levy on manufacture, sale and consumption of goods and services at a national level. One of the biggest taxation reforms in India the GST is all set to integrate State economies and boost overall economic growth. India is a centralized democratic and therefore the GST will be implemented parallel by the central and state governments as CGST and SGST respectively. Goods and Services Tax, if implemented, will replace most of the existing indirect taxes. GST is also different in the way it is levied – at the final point of consumption and not at the manufacturing stage. Once GST is implemented, all these taxes would cease to exist. There would be only one tax, that too at the national level, monitored by the central government. GST is also different in the way it is levied - at the final point of consumption and not at the manufacturing stage. At present, separate tax rates are applied to goods and services. Under GST, there would be only one tax rate for both goods and services. The goods and services Tax will indeed be a further significant improvement towards a comprehensive indirect tax reforms in the country. Integration of goods and services taxation would give India a world class tax system and improve tax collections. It would end distortions of differential treatments of manufacturing and service sector.
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GOVERNMENT EXPENDITURE AND SUSTAINABLE HEALTH:  
A STUDY OF INDIAN STATES DURING POST ELEVENTH PERIOD

* Shipra Bansal

Introduction
Agenda 21 and Rio Declaration on Environment and Development states that “Human beings are at the centre of concerns for sustainable development”. Health is one of the vital measure reflecting the quality of life. The dream of sustainable development cannot be achieved without proper Health of the people because goals of sustainable development cannot be achieved till the population health cannot be maintained. Only healthy people are better able to learn and work efficiently. Hence they contribute positively to their economies and societies. If there is inequitable and poor quality of health services in the state then it leads to insufficient health status, which further result in to piddling development of human capital. This will lead to lower productivity and hence result into more poverty and less economic development of the nation. If the nation will not develop then it again will lead to less expenditure on social sector including health, and which will lead to poor quality of health infrastructure in the state. Hence health is an important input to sustainable development.

As per Human Development Index (HDI) 2010, India ranked only at 135th place in terms of health, wealth and education. To propel the process of structural transformation, rejuvenation of healthcare facilities is imperative which in turn calls for increased health expenditure. No doubt Government had taken huge steps to improve health condition in India. But still India seems to be lagging behind of Millennium Development Goals (MDGs) target values in terms of health attainments. According to the National Health Profile 2010 of Central Bureau of Health Intelligence, morbidity and associated mortality in terms of communicable and non-communicable diseases remains very high though the absolute number of cases and deaths seem to be declining. MMR also remains far above the ground. In such a situation, the role of public expenditure is imperative for India.

Various studies had been conducted on the health expenditure by various stakeholders, researchers and academicians under different times. Madhavi (2014) studies the Government Health Expenditure in India. Government
health expenditure as a percent of GDP shows a decline in government health spending over the period of 1999-2000 to 2004-05. As a percentage of the gross domestic product (GDP), expenditure decreased from 1.12 percent in 1999-2000 to 0.97 percent in 2004-05. It was found that however government health spending since April 2005 has increased significantly. Its share in GDP too increased from 0.97 percent in 1999-2000 to 1.10 percent in 2008-09. Arun and Kumar (2013) examined the trends of health expenditure in India over the last few decades. The analysis revealed that, levels of public spending on healthcare in India were amongst the lowest in the world. Further, the paper attempted to ascertain that the state had a significant role to play in the delivery of health services in India. The purpose of this paper was to study the rationale behind promoting regulated private expenditure for the development of effective health infrastructure. Overall, health expenditure was affected by host of structural deficiencies, most importantly the looming reliance on private sector investment and foreign donors. The paper aimed to suggest relevant measures to improve the role of government in providing world class health facilities to the needy at an affordable price including health insurance schemes and increased budgetary allocation at both national and state government levels. Chakraborty, Singh and Jacob (2013) analyzed the benefit incidence of health spending in the context of India. The results revealed that the public health system was “seemingly” more equitable in a few states, while regressivity in the pattern of public health-care utilization was observed in others. Both results were to be considered with caution, as the underdeveloped market for private inpatient care in some states might be factors in the disproportionate crowding-in of inpatients, making the public health-care system simply appear more equitable. However, patients “voting with their feet” and choosing better, private services seems evident only in the higher-income quintiles. Results also suggested that polarization was distinctly evident in the public provisioning of health-care services, though more related to inpatient, rather than ambulatory, services. Hooda (2013) analyzed the implications of changing pattern of government health expenditure in India during the last two and a half decade (1987-88 to 2011-12). This includes the impact of different policy (health and macroeconomic) changes on the change in level and compositional pattern of health expenditure. The data had been collected from Finance Account of the State Governments, Original Budget of the State Government, RBI-State Finances: A study of Center and State Budget, Ministry of Health and Family Welfare, National Rural Health Mission. The results showed that government health spending had remained almost constant during the period and hovered around one per cent of GDP, which is even lower than
most of the developing countries. The adverse macroeconomic conditions had resulted in declining in health expenditure both at centre and state level. The health policy change, particularly the National Rural Health Mission (NRHM), however had shown positive impact on health expenditure. The health expenditure shows increasing trend after the implementation of NRHM but remained lower (about 1.2% of GDP) than its ambitious commitment of 2–3 per cent of GDP. It had been concluded that the high spending however can be a necessary condition but not sufficient. Therefore, along with the high commitments of spending, it became important to ensure that allocated funds get spend effectively across states. Bhadra and Bhadra (2012) examined the factors that were affecting low public expenditure on health across states in India while the health related outcomes were far below than the MDGs target levels. In spite of massive economic growth, public spending on health for centre and states combined remains less than 1 per cent of gross domestic product. They observed that in majority of the states most of the existing own revenues were used up in meeting their committed liabilities which leaves very little room for the states to spend on health. In the last they made suggestion that centre to step in and provide additional financial resources to enhance public expenditure on health. Ghuman and Mehta (2009) examined the problems and prospects of health care services in India. Health sector had been accorded very low priority in terms of allocation of resources. Public expenditure on health was less than 1 per cent of GDP in India. The paper also witnessed decline during the post economic liberalization period. The meager resource allocation to health sector had adversely affected both access and quality of health services. The unequal access to health services was reported across strata, gender and location (i.e. urban and rural areas). With a view to improve access and quality of health services, government should enhance public spending on health sector in the vicinity of 3 per cent of GDP. Bhat and Jain (2004) examined the relationship between income and healthcare expenditures at state level. The findings suggested that at state level governments have target of allocating only about 0.43 per cent of SGDP to health and medical care. This does not include the allocations received under central sponsored programmes such as family welfare. Given this level of spending at current levels and fiscal position of state governments the goal of spending 2 to 3 per cent of GDP on health looks very ambitious task. The analysis also suggested that elasticity of health expenditure when SGDP changes in only 0.68 which suggest that for every one percent increase in state per capita income the public healthcare expenditure had increased by around 0.68 per cent. With the increasing important of health to sustainable development, need arises to examine the expenditure incurred by
Government on Health Sector during recent times. This paper attempts to examine the health expenditure in India among selected states during post eleventh period.

**Need of the study**
Health is one of the global issue and it has mostly agenda of all countries whether developing or developed. As per India context, no major changes and development took place in health sector, in spite of the fact that every year government spent a huge proportion in health sector in India. But the fact is that more than 20 percent population still lives in miserable condition. They have not even access to safe drinking water and suffers from malnutrition. The expenditure on health varied substantially between states. Moreover, inadequate allocation of public health resources and its unequal spread across different states have resulted in inequitable health status. Thus a need was emerged to study inter-state disparities in public health expenditure in India. This paper attempts to examine the health expenditure in India among selected states during post eleventh period.

**Objectives of the study**
- To measure the nature and level of inter-state disparities in health status in India
- To examine the relationship between health status and public health expenditure during post eleventh period.

**Data**
The data has been collected for each state. For the purpose of this study we have included 10 states in our analysis. Study covers the time period of 11th plan, i.e. from 2007-12. Data from various sources was collected for this purpose. Main sources are World bank and “Health Finance Indicator report 2013” of Health & Family Welfare Division, Planning Commission, Central Bureau of Health Intelligence (CBHI) and National Accounts Statistics, Government of India.

**Selected variables**
1. **Infant Mortality Rate (IMR):** It is the ratio of number of deaths among children less than one year old during a given year to number of live births during the same year.
2. **Crude Birth Rate (CBR):** It is defined as total number of births per year per 1000 of population. It is calculated as under:
   \[ \frac{B}{P} \times 1000 \]
   Where \( B \) is number of births
   \( P \) is mid year population
3. **Crude Death Rate (CDR):** It is defined as total number of deaths per year per 1000 people. It is calculated as under:
   \[ \frac{D}{P} \times 1000 \]
   Where \( D \) is number of deaths
   \( P \) is mid year population
4. Per capita public health expenditure at constant prices.
Sample
High HDI States

<table>
<thead>
<tr>
<th>S. No</th>
<th>State/Union Territory</th>
<th>Consumption based HDI (2007–08)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Kerala</td>
<td>0.790</td>
</tr>
<tr>
<td>2.</td>
<td>Delhi</td>
<td>0.750</td>
</tr>
<tr>
<td>3.</td>
<td>Himachal Pradesh</td>
<td>0.652</td>
</tr>
<tr>
<td>4.</td>
<td>Goa</td>
<td>0.617</td>
</tr>
<tr>
<td>5.</td>
<td>Punjab</td>
<td>0.605</td>
</tr>
</tbody>
</table>

Low HDI States

<table>
<thead>
<tr>
<th>S. No</th>
<th>State/Union Territory</th>
<th>Consumption based HDI (2007–08)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Jharkhand</td>
<td>0.376</td>
</tr>
<tr>
<td>2.</td>
<td>Madhya Pradesh</td>
<td>0.375</td>
</tr>
<tr>
<td>3.</td>
<td>Bihar</td>
<td>0.367</td>
</tr>
<tr>
<td>4.</td>
<td>Orissa</td>
<td>0.362</td>
</tr>
<tr>
<td>5.</td>
<td>Chattisgarh</td>
<td>0.358</td>
</tr>
</tbody>
</table>

Methodology
Following techniques has been applied to analyze the data for achieving the desired objectives. These techniques are discussed below:

Growth Rates
Annual growth rates was computed for respective states over the period of time. Growth rates are calculated by the following formulae:

\[ Y = AB^t \]

Where Y is the value of dependant variable
t is time period

Regression Analysis
Simple regression analysis has been applied to determine the relative contribution of different explanatory variables on dependant variable. The results of simple regression between health indicators as dependant variable and per capita public health expenditure (PCHE) as independent variable are given in the following regression equations.

Regression Equations
1. IMR = \( \alpha + \beta \) PCHE + e
2. CDR = \( \alpha + \beta \) PCHE + e
3. CBR = \( \alpha + \beta \) PCHE + e

In the given regression equation:
PCHE = Per Capita Health Expenditure
IMR = Infant Mortality Rate
CDR = Crude Death Rate per '000 of population
CBR = Crude Birth Rate per '000 of population

Data Analysis and Interpretation
Public Health Expenditure

Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. Health expenditure; public (% of total health expenditure) in India was last measured at 33% in 2012, according to the World Bank.

Status of Health Expenditure in India

Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation (WHO 2010). Total healthcare expenditure in India was 4% of GDP in 2012 despite India being one of the most privatized healthcare systems in the world. The low levels of spending will have an adverse impact on the creation of a preventative health infrastructure.

Table 1: State/UT wise Budgetary Allocation Under Health Sector during 11th Plan (2007-12)

<table>
<thead>
<tr>
<th>State/UT</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
<th>2010-11</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerala</td>
<td>842.62</td>
<td>1019.44</td>
<td>1384.29</td>
<td>1713.15</td>
<td>2.110439</td>
</tr>
<tr>
<td>Delhi</td>
<td>10637.35</td>
<td>1096.08</td>
<td>1130.86</td>
<td>1475.44</td>
<td>1.106484</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>2248.81</td>
<td>2177.27</td>
<td>2159.06</td>
<td>2347.16</td>
<td>0.26696</td>
</tr>
<tr>
<td>Goa</td>
<td>458.75</td>
<td>509.09</td>
<td>510.84</td>
<td>592.24</td>
<td>1.729601</td>
</tr>
<tr>
<td>Puducherry</td>
<td>334.4</td>
<td>462.74</td>
<td>455.31</td>
<td>478.15</td>
<td>0.19535</td>
</tr>
<tr>
<td>Bihar</td>
<td>3540.99</td>
<td>3491.63</td>
<td>3572.98</td>
<td>3754.79</td>
<td>2.889552</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>19436</td>
<td>33000.01</td>
<td>16550</td>
<td>27694</td>
<td>0.955135</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>16990.39</td>
<td>20491.63</td>
<td>27592.98</td>
<td>37594.9</td>
<td>2.889552</td>
</tr>
<tr>
<td>Chhattisgarh</td>
<td>24180.7</td>
<td>28273.87</td>
<td>43040.85</td>
<td>41161.78</td>
<td>2.45478</td>
</tr>
<tr>
<td>Punjab</td>
<td>324.4</td>
<td>462.74</td>
<td>455.31</td>
<td>478.15</td>
<td>0.19535</td>
</tr>
<tr>
<td>Bihar</td>
<td>3540.99</td>
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</tr>
</tbody>
</table>

Table 1: Status/UT wise Budgetary Allocation Under Health Sector during 11th Plan (2007-12)
health will improve the quality of life of people and hence they will have high HDI rank. Thus every state has to incur on health to improve their status/ rank in HDI.

**Relationship between public health Expenditure and health status in India**

The results of simple regression between health status indicators as dependant variable and per capita public health expenditure (PCHE at constant prices) as independent variable for the year 2007-12 are given in table 2

**Regression Equations**

1. IMR = α + β PCHE + e
2. CDR = α + β PCHE + e
3. CBR = α + β PCHE + e

In the given regression equation:

PCHE = Per Capita Health Expenditure  
IMR = Infant Mortality Rate  
CDR = Crude Death Rate per ’000 of population  
CBR = Crude Birth Rate per ’000 of population

**Results of Simple Regression**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Constant</th>
<th>Regression Coefficient</th>
<th>R²</th>
<th>F-ratio</th>
<th>Significance Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBR</td>
<td>26.451</td>
<td>-.035</td>
<td>.93</td>
<td>41.938</td>
<td>.07</td>
</tr>
<tr>
<td>CDR</td>
<td>8.602</td>
<td>-.012</td>
<td>.958</td>
<td>92.918</td>
<td>.002</td>
</tr>
<tr>
<td>IMR</td>
<td>86.004</td>
<td>-.319</td>
<td>.922</td>
<td>48.147</td>
<td>.006</td>
</tr>
</tbody>
</table>

Table 2: Results of simple regression
From the table 2 it is observed that the variables Infant Mortality Rate (IMR), Crude Death Rate per '000 of population (CDR) and Crude Birth Rate per '000 of population (CBR) were individually found to be negatively significantly influencing Per Capita Health Expenditure (PCHE) in the states of India. All the three variables show a high degree of coefficient correlation. Moreover Value of F-ratio is also significant as p value is less than .05.

The negative relation of PCHE with all the three variables shows that with the increase in Per Capita Health Expenditure there is a decrease in all the three variables, i.e. IMR, CDR and CBR. It brings home the fact that our country status in regard to health has been improving. The money allocate to health expenditure has been used by states in efficient way and thus we found the negative regression coefficient of the three variables, i.e. IMR, CDR and CBR.

Conclusion
Health is an important variable of sustainable Health. Without the healthy population the goal of sustainable development cannot be achieved. The World Development Report 2003 also notes that one of the initiatives to promote sustainable development in a dynamic world is to empower underprivileged sections of population by increasing their access to education and health. In line with this thinking, it is necessary that the Government's must have to increase their expenditure on both health and education. The present paper aims to identify the expenditure incurred by government on health across states. In order to achieve the goal of 2-3 per cent of GDP, it suggests that large and sustainable increases in government health spending will require more focus on the states own spending as well as improving the capacities of states and districts to use resources for health effectively. It was found that state expenditure on health every year goes on rising except for Himachal Pradesh. The highest growth in health expenditure is seen in Punjab state. There is wide variation in health expenditure across state.

Results of simple regression shows that the variables Infant Mortality Rate (IMR), Crude Death Rate per '000 of population (CDR) and Crude Birth Rate per '000 of population (CBR) were individually found to be negatively significantly influencing Per Capita Health Expenditure (PCHE). Thus with the increase in Per Capita Health Expenditure there is a decrease in all the three variables, i.e. IMR, CDR and CBR. It brings home the fact that our country status in regard to health has been improving.
References


GREEN INFORMATION TECHNOLOGY
FOR A SUSTAINABLE FUTURE

* Er. Amardev Singh  ** Dr. Harsh Vardhan Samalia  *** Dr. Hergovind Singh

Abstract

The present era of human development round the globe is characterized by technological innovations completely driving the today's modern society. The Information and Communication Technologies (ICTs) also forms a part to the same and has made a life a lot easier and comfortable through the click of a button thereby impacting the human society in a very significant manner, but irrespective of the varied advantages offered by the ICT, it has a darker side to it too. It is impossible to avoid its adverse impact on environment due to fast paced penetration of the ICT peripherals in our homes as well as the organizations i.e. society as a whole. Therefore, it is need of the hour to go for Green Information Technology (Green IT) for a Sustainable Future.

The authors, through this paper, attempt to look at several aspects of Green IT in relation to the choices and decisions one makes pertaining to ICT and related peripherals in relation to our natural environment. This paper offers a broad sketch of the terms relevant in context of Green IT, with an attempt to define each of them and also providing the insights into the usage of terminology as captured by various researchers operational in the domain(s) of environmental sustainability and/or IT. This work also attempts to explore the various perspectives of 'Green IT' along with an effort to highlight 'Green IT' potential and link it to Information Technology Product Lifecycle. This paper also views IT Product Lifecycle from a green lens thereby attempting to enlist some of the important technologies/practices/policies and the potential regulations that may directly or indirectly contribute to greening of different phases of the IT Product Lifecycle.

Keywords: Green Information Technology, Green IT, Sustainable, Terminology, Information Technology Product Lifecycle.

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1. **INTRODUCTION**

Given the penetration of ICT peripherals in our homes and the organizations at an incredible pace, its negative impact on the environment cannot be evaded (Singh et al., 2012, March). As per Hanne (2011), two main problems related to IT includes (i) high energy consumption for IT particularly if we consider the total life cycle of IT products and datacentres' power utilization, (ii) the problem of e-waste arising out when the IT devices are discarded. Having said all these, there is positive side of IT also. IT at an advanced level can play a crucial role in promoting environmental sustainability (Corbett, 2010; Watson et al., 2010). Also, as advocated by Widjaja (2011), IT is perceived as enabler to address to the issues of global warming, energy and resource constraints, and provide for greater efficiency. Thus, there are two aspects to IT (i) energy conservation of IT and (ii) energy conservation by IT.

Roughly 3 percent of global electricity usage (Ruth, 2009) and about 2% of total world-wide greenhouse gas emissions (Shah et al., 2009; Zhong & Liu, 2010) is attributed/accounted to information and communications technology (ICT) infrastructure. Therefore, it is the need of the hour to call for Green Information Technology and Green Information System as with exponential increase in the adoption of ICT in developing countries; its impact on the environment over the next 10-15 years will increase substantially (Zhong & Liu, 2010). Also, the biosphere's carrying capacity face the threat of being overburdened by the growing risk of climate change, the continued depletion of natural resources, and the rapid generation of non-biodegradable waste (Shah et al., 2009). Therefore, to deal with environmental problems we are called upon to innovatively use IT and make IT systems and work practices greener (Murugesan, 2010).

The authors in this paper advocate the Murugesan (2010) assertion that “there are several Green IT areas that demand further research and development: technology adoption, environmental impact assessment, standards and regulation, and harnessing IT for environmental sustainability” (p. 5). Also, the researchers have considered the 'energy conservation of IT' aspect as base for this paper and accordingly, the theme of viewing each phase of IT product lifecycle from a green lens has been covered in one of the following sections.
2. TERMINOLOGY
The several important terms along with their brief description/definitions emerging from the literature reviewed by the authors that the researchers must know/be familiar with to comprehensively grasp the different aspects of Green IT are given as below:

Green: refers to a product's or property's physical attributes in context of eco-friendliness and/or energy efficiency/carbon footprint (Minoli, 2010; Galley Eco Capital LLC, 2008; Saeger & Leppo, 2008).

Greening: refers to reducing energy consumption, maximising energy usage efficiency and whenever possible, opting for renewable energy sources. The use of components and consumables that are eco-friendly also plays a role (Minoli, 2010; Galley Eco Capital LLC, 2008; Saeger & Leppo, 2008).

Sustainable: refers to business processes, values, ethics and social justice in addition to green physical attributes of a product or property (as in a building) (Minoli, 2010; Galley Eco Capital LLC, 2008; Saeger & Leppo, 2008).

Sustainability: There exist in the literature, many overlapping definitions for the term sustainability. A definition that may be considered apt is given by the World Commission on Environment and Development (1987), defining sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (as cited in Marrone et al., 2011). Molla et al. (2009a) signified that to solve both IT and non-IT (by using IT) related sustainability problems, there is need to incorporate the sustainability issues with in the IT technical infrastructure, human and managerial dimensions of the IT infrastructure. Further, a direct link of sustainability to Green IT (Marrone et al., 2011) can be easily seen from the Watson et al. (2010) assertion that “IT investments are growing, and sustainability requires a reduction in computer related energy consumption” (p. 32).

Sustainable design: refers to “system design where the objective is to create places, products and services in a way that reduces use of non-renewable resources, minimises environmental impact and relates people to the natural environment (Galley Eco Capital LLC, 2008; Saeger & Leppo, 2008)” (as cited in Minoli, 2010, p. 19).
**Triple bottom line:** A reckoning of social, environmental and financial performance often referred to as 'people, planet, and profit'. This calculation method is distinct from the traditional business bottom line, which only considers profits (Minoli, 2010; Galley Eco Capital LLC, 2008; Saeger & Leppo, 2008).

**Energy efficiency:** refers to designing a system, a building, a data centre, or a network node, to **consume less energy in comparison to conventional approaches**, for the same or higher performance. It is important to note that all data centre sub systems, **network subsystems and building systems** (e.g. HVAC, lighting, and so on) possess the potential to contribute towards higher energy efficiency (Minoli, 2010; Galley Eco Capital LLC, 2008; Saeger & Leppo, 2008).

**Corporate Social Responsibility:** As put by Hiatt et al. (2009) CSR “**refers to a company's performance on a range of social and environmental issues over time**” (as cited in Marrone et al., 2011). From a positivist perspective, Scherer and Palazzo (2007) also observe power games between the firm and its stakeholders resulting to what is referred to as CSR (Marrone et al., 2011). As per Campbell (2007) CSR are “**actions taken by a firm that are intended to further social welfare beyond the direct economic, technical, and legal interests of the firm**” (as cited in Marrone et al., 2011). Further, emphasizing on IT, Molla et al. (2009) advocate the development to extend CSR and environmental sustainability to IT too (Marrone et al., 2011).

**Eco-Goals:** As identified by Dyllick and Hockerts (2002) there are three main goals of sustainability: eco-efficiency, eco-equity, and eco-effectiveness.

**Eco-efficiency** is “**the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle to a level at least in line with the earth’s carrying capacity**” (DeSimone et al., 1997; as cited in Marrone et al., 2011). Further, emphasizing on IT, Molla et al. (2009) advocate the development to extend CSR and environmental sustainability to IT too (Marrone et al., 2011).

**Eco-equity** refers to the “**equity between peoples and generations**
and, in particular, the equal rights of all peoples to environmental resources” (Gray & Bebbington, 2000; as cited in Marrone et al., 2011; as cited in Watson et al., 2010, p. 28). The conviction that there should be a fair sharing of resources both within and across generations is at the heart of almost all sustainability goals (Gladwin et al., 1995; Watson et al., 2010). Watson et al. (2010) propounds that the eco-equity focuses on our social responsibility towards future generations who will bear the penalty of disproportionate utilization of scarce resources and environmental dilapidation. Therefore, they express the need for all of us to develop collectively social and corporate norms that support eco-equity for now and tomorrow.

**Eco-effectiveness** The concept of eco-effectiveness was introduced by McDonough and Braungart (1998) without explicit definition in 1998 (Watson et al., 2010), but later explained by McDonough et al. (2003) as “working on the right things—on the right products and services and systems—instead of making the wrong things less bad” (as cited in Marrone et al., 2011).

**Environment:** “The environment can be seen as an important part of sustain ability” (Marrone et al., 2011), and as per Molla et al. (2009a) it is defined as “one of the three pillars of sustain ability” (as cited in Marrone et al., 2011)

**Stakeholder:** According to Freeman (1984), a stakeholder is "any group or individual who can affect or is affected by the achievement of the organization's objectives" (as cited in Marrone et al., 2011). The three most important stake holders in a typical energy supply/demand system in context of Green IT comprise: suppliers, consumers, and governments (Marrone et al., 2011; Watson et al., 2010)

**“Greenwashing”** “Greenwashing” is a term derived from “white washing.” The term “whitewashing” is defined as “a coordinated attempt to hide unpleasant facts, especially in a political context” (Creative Commons, 2010, p. 189). In an environmental context, based on the same premise is the term Green washing. Some refers to it as whitewashing, but with a green brush. The definition from Corp Watch of green*wash: (gr en-wosh) - washers, -washing, -washed is “1) The phenomenon of socially and environmentally destructive corporations attempting to preserve and expand their markets by posing as friends of the environment and leaders in the struggle to eradicate poverty. 2) Environmental
Green IT (Green Information Technology): As per Molla et al. (2009), “Green IT is organisations' ability to systematically apply environmental sustainability criteria to the design, production, sourcing, use and disposal of the IT technical infrastructure as well as within the human and managerial components of the IT infrastructure” (p.5). The soft business practices in acquiring, using and disposing IT in addition to the hard technological solutions comes under the span of Green IT (Marrone et al., 2011; Molla et al., 2009a). Molla et al. (2009a) further advocates that the Green IT refers “not only to Greening the IT artefact but also to using IT to achieve sustainability in business and supply chain processes” (as cited in Marrone et al., 2011). In the words of Murugesan (2010), “Green IT, also known as Green Computing, refers to the study and practice of designing, manufacturing, and using computer hardware, software, and communication systems efficiently and effectively with no or minimal impact on the environment; Green IT is also about using IT to support, assist, and leverage other environmental initiatives and to help in creating green awareness” (p.4).

3. GREEN IT PERSPECTIVES

As per Molla (2008), approaching Green IT from an IT activity chain perspective – from sourcing to end of IT life management is one useful way to navigate the different conceptualisation of Green IT and is consistent to notions of the pollution prevention, product stewardship, and clean technology – the three main goals of eco-sustainability (Hart, 1997). Therefore the authors have considered the definition of Green IT provided by Molla (2009) as base for this paper. The referred definition can further be split into and captures the four different but interrelated perspectives of Green IT – sourcing, operations, services and end of IT life management (Molla, 2008), briefly described as below:

3.1 Green IT Sourcing

“From a sourcing perspective, Green IT implies the practice of environmentally preferable IT purchasing” (Molla, 2008, p. 661). This includes the adoption of sourcing practices such as green supplier selection (Molla, 2009; Molla et al., 2009), selecting more energy-efficient environment friendly equipment (Aronson, 2008;
Barbour, 2010; Murgesan, 2008). Putting due consideration on recycling & up gradation (Aronson, 2008) options at the time of purchasing can also contribute to Green IT Sourcing. Preference to the use of Green energy (Molla, 2009; Murgesan, 2008) and the selection of vendors with leasing or take back arrangement (Aronson, 2008; Molla et al., 2009) are few other practices comprising of sourcing perspective. Organizations can also opt for purchasing laptops as alternative to desktops (Barbour, 2010) as it also helps in reducing the power consumption. The companies willing to go for Green sourcing of IT peripherals can also give due weightages to Green labelling certification obtained by vendors before making their IT purchases from them (Wilbanks, 2008).

3.2 Green IT Operations

“From an operation perspective, Green IT implies improving energy efficiency in powering and also cooling corporate IT assets thereby reducing IT induced greenhouse gas emissions” (Molla, 2008, p. 661). The significant techniques that constitute Greening IT Operations include server virtualization and consolidation (Cameron, 2010; Watson, 2008; Wilbanks, 2008), desktop virtualization (Ruth, 2009) and data de duplication (Pernici et al., 2008, Watson, 2008). Practicing techniques for print optimization and avoidance (Barbour, 2010; Watson, 2008) whenever possible and by storage optimization (Molla, 2009) the firms can achieve greening of their IT operations to a large extent. The practices toward reducing energy consumption such as equipment & light turning off policy when not in use (Barbour, 2010; Hazelton, 2009; Wilbanks, 2008), choosing more efficient power supplies & hardware (Cameron, 2010; Murugesan, 2008), use of DC power (Molla, 2009; Watson, 2008) also contributes to Greening of organizational IT operations. Further, the IT infrastructure design related considerations that comprises of Green IT operations perspective such as rightsizing core IT and supporting systems (Aronson, 2008; Molla, 2009), optimal temperature maintenance (Molla, 2009; Murugesan, 2008), design innovations for efficiency optimization (Aronson, 2008; Murugesan, 2010; Watson, 2008) and liquid/water cooling arrangement for IT equipments (Murugesan, 2008, Watson, 2008) are major ones among the many such design issues. Some more technologies such as spam filtering, cloud computing, use of heat pumps, solar energy, combined heat-and-power (cogeneration) plants can also
3.3 **Green IT Services**

“From a service perspective, Green IT refers to the role of IT in supporting a business's overall sustainability initiatives. Adopting a Green IT from a services perspective therefore includes adoption of analytical tools for green supply chain management, environmental management and carbon footprint analysis” (Molla, 2008, p. 662). Illustratively, the use of high definition video conferencing services for distance learning, internal and external client meetings, and diagnostic capability (Barbour, 2010) amount to the Green IT services perspective. The service perspective also span practices such as thin provisioning (Murugesan, 2008; Ruth, 2009), use of power management tools (Barbour, 2010; Wilbanks, 2008), adoption of time based usage policies (Barbour, 2010), powering down of idle systems (Watson, 2008), retiring old inefficient equipments (Molla, et al., 2009; Watson, 2008), and implementation of go green policies or incentives for employees (Murugesan, 2008).

3.4 **End of IT Life Management**

“From end of IT life management perspective, Green IT refers to practices in reusing, recycling and disposing IT hardware” (Molla, 2008, p. 662) in an environmentally responsible way. The practices constituting this perspective of Green IT include environmental friendly disposal provisions (Molla et al., 2009), responsible recycling (Barbour, 2010; Hazelton, 2009; Watson, 2008), reusing for waste reduction (“IT goes green”, 2004; Murugesan, 2008), refurbishment initiatives (Watson, 2008), and transfer or donation of old equipments (“IT goes green”, 2004).

4. **HIGHLIGHTING 'GREEN IT' POTENTIAL AND LINKING TO IT PRODUCT LIFE CYCLE**

Widjaja (2011) perceives Green IT as an exact fit to link both the corporate innovation and environmental integration, and advocates that in the present time Green IT concerns have evolved from just a trend to being a priority, especially for the government which strives to realize significant reductions in carbon emissions and enhanced cost savings. Singh et al. (2012, March) propound Green IT as a strong probable remedy in prognosis of the problem of adverse impact of IT on the environment. Corbett (2010) also seeks support in favour of suggestions that Green IT has the potential for widespread impacts at multiple levels.
As put by Hedwig et al. (2009), Green IT “denotes all activities and efforts incorporating ecologically friendly technologies and processes into the entire life cycle of information and communication technology” (as cited in Marrone et al., 2011). Widjaja (2011) also, asserts that “Green IT can be included in each of the four phases of the product life cycle” (p. 1):

1) The Development phase embraces using green material and seeking energy efficiency consumption to design environmentally friendly systems and computers (Widjaja, 2011).

2) The Production phase focuses on energy saving to realize cost savings and the reduction of carbon emissions to lessen the impact on the environment. Producing at lower costs aims to lessen energy use, while reducing the CO2 emission tends to use subsidized energy sources such as solar panels (Widjaja, 2011).

3) The Usage phase refers “to the organization itself, employee behaviour, equipment and infrastructure. To implement a Green IT strategy, the management needs to draw up a new process and implement new standards not only in terms of IT infrastructure but also in terms of individual usage” (as cited in Widjaja, 2011, pp. 1-2).

4) The Disposal phase is the most crucial phase as it primarily depends on the government's involvement in the enforcement of regulations and motivating the companies to invest in products which can have a second life (Widjaja, 2011).

5. VIEWING EACH PHASE OF IT (INFORMATION TECHNOLOGY) PRODUCT LIFECYCLE FROM A GREEN LENS

In this section the authors of this paper attempt to enlist some of the important technologies/practices/policies and the potential regulations that may directly or indirectly contribute to greening of the just described phases of the IT Product Life cycle.

5.1 Greening and the IT development phase

The key concern for greening the IT development phase is the removal of toxins from products. Toxic substances are used in the development and packaging of IT hardware and software products (Hanne, 2011). As per Velte et al. (2008), “Lead, mercury, cadmium and polybrominated flame retardants are examples of toxic substances used in desktop computers” (as cited in Hanne, 2011, p. 425). As per Microelectronics and Computer Engineering
Technology Corporation (1996), lead represents up to 6.3% of a typical computer which is the equivalent of 2 kg (Hanne, 2011). The government of a country can have legislation related to electrical and electronic equipment. For example, restriction of the use of certain Hazardous Substances in Electrical and Electronic equipment (RoHS) directives with aim to eliminate the hazardous substances these products contain (Creative Commons, 2010). As per Hanne (2011), the first legislation in the world restricting the use of hazardous substances in electrical and electronic equipment is considered to be the RoHS legislation (directive 2002/95/EC), which came into force since February 13, 2003; there by restricting six toxic substances viz. a viz. lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDEs). Further, with the exception for cadmium's maximum concentration value to 0.01%, the value of these substances should not exceed 0.1% (Hanne, 2011).

5.2 Greening and the IT production phase
One of the alternatives for greening the IT production involves the use of green power such as solar thermal, solar photovoltaic, wind, thermal energy, hydro, renewable heating and clean coal among others (Minoli, 2010).

As per EPA green power products are of three types: renewable electricity, renewable energy certificates and on-site renewable generation (Minoli, 2010). “Renewable electricity is generated using renewable energy resources and delivered through the utility grid; renewable energy certificates (RECs) represent the environmental, social and other positive attributes of power generated by renewable resources; and on-site renewable generation is electricity generated using renewable energy resources at the end-user's facility” (Minoli, 2010, p.20)

5.3 Greening and the IT usage phase
There is a comprehensive list of techniques/practices/policies for greening the IT usage phase, as captured from the literature in their work by Singh et al. (2012). The enumeration includes: selecting a green supplier (Molla, 2009; Molla et al., 2009), more energy-efficient eco-friendly equipment (Aronson, 2008; Barbour, 2010; Murugesan, 2008), laptops as alternatives to desktops (Barbour, 2010), server virtualization and consolidation (Cameron, 2010; Watson, 2008; Wilbanks, 2008), desktop
virtualization (Ruth, 2009), print optimization and avoidance (Barbour, 2010; Watson, 2008), storage optimization (Molla, 2009), equipment & light turning off policy when not in use (Barbour, 2010; Hazelton, 2009; Wilbanks, 2008), choosing more efficient power supplies & hardware (Cameron, 2010; Murugesan, 2008), rightsizing core IT and supporting systems (Aronson, 2008; Molla, 2009), optimal temperature maintenance (Molla, 2009; Murugesan, 2008), design innovations for efficiency optimization (Aronson, 2008; Murugesan, 2010; Watson, 2008) and liquid/water cooling arrangement for IT equipments (Murugesan, 2008; Watson, 2008), techniques such as spam filtering and cloud computing(Ruth, 2009; Watson, 2008), telecom muting and teleconferencing (Herrick & Ritschard, 2009), particularly the use of high definition video conferencing services for distance learning, internal and external client meetings, and diagnostic capability (Barbour, 2010), thin provisioning (Murugesan, 2008; Ruth, 2009), use of power management tools (Barbour, 2010; Wilbanks, 2008), adoption of time based usage policies (Barbour, 2010), powering down of idle systems (Watson, 2008), retiring old inefficient equipment (Molla, et al., 2009; Watson, 2008), and implementation of go green policies or incentives for employees (Murugesan, 2008).

Further, the document named “Code of Conduct on Datacenters Energy Efficiency”, includes the recommendations made by European Union (EU, 2008; Hanne, 2011) that can be referred to by the data centres operators and owners for improving their data centre's energy efficiency. Also, the Green Grid consortium - a global consortium of companies dedicated to developing and promoting standards, measurement methods, processes and new technologies can be a guiding post in enhancing the energy efficiency in data centres(The Green Grid, 2010; Hanne, 2011).

Also for purchasing computer systems and peripherals the organizations can assess the trade-offs of cost versus performance across a broad range of devices from EPEAT (CGI, 2010). Electronic Product Environmental Assessment Tool (EPEAT) - a product registry in United States, is a federally sponsored initiative that uses 51 environmental product compliance requirements developed through an industry group led by the Institute of Electrical and Electronic Engineers (IEEE) (CGI, 2010).
5.4 Greening the IT disposal phase

The practices that may be used for greening the IT disposal include: reduction of computer resources (both in number and amounts) necessary to accomplish the same tasks (Herrick & Ritschard, 2009), environmental friendly disposal provisions (Molla et al., 2009), reusing for waste reduction (“IT goes green”, 2004; Murugesan, 2008) and increasing the product lifespan (Herrick & Ritschard, 2009), responsible recycling (Barbour, 2010; Hazelton, 2009; Watson, 2008), refurbishment initiatives (Watson, 2008), and transfer or donation of old equipments (“IT goes green”, 2004). Also, regarding disposal of ICT e-waste in an environment friendly manner, there exist Waste Electrical and Electronic Equipment (WEEE) directive that requires EU member countries to have recycling systems for WEEE in place, with the aim to substantially reduce the amount of electrical and electronic equipment entering incinerators and landfills (Creative Commons, 2010).

The WEEE legislation (directive 2002/96/EC) came into force on February 13, 2003 and is about collection, recovery and recycling of electrical goods (Hanne, 2011). “It defines take-back systems where consumers return their used products free of charge and producers have the responsibility to manage properly this e-waste” (as cited in Hanne, 2011, p. 425). Further, as per the directive, there are different requirements for handling and disposing of materials in 10 WEEE categories ranging from small household appliances to medical equipment and large automatic dispensers (Creative Commons, 2010). The organizations can refer to the WEEE directive guidelines for establishing socially responsible recycling and disposal practices.

6. CONCLUSION

The main contributions of this piece of research are (i) It provides a broad outline of the terms relevant in context of Green IT, with an attempt to define each of them and also bringing forth the insights into usage of the terminology as captured by several researchers working in the area of environmental sustainability and/or IS/IT. This work can act as a good reference for the starters in the field of Green IT RESEARCH and in other research areas allied to sustainability theme, thereby enabling them to better comprehend the basics. (ii) This work enlists some of the important technologies/ practices/ policies and the potential regulations that may directly or indirectly contribute to greening of different phases of the IT Product Life cycle,
that enables the researchers and the practitioners in the Green IT and sustainability domain to have an advanced window view of the important aspects related with greening IT life cycle.

The future researchers are encouraged to review, select, describe and add to the list, further terms from the literature that may be relevant to the theme of 'Sustain ability in context of IT' /Green IT. Also, the enlist of technologies/practices/ policies appearing under each phase of IT Product Life cycle especially under the development and the production phase can further be worked upon to provide for a more enriched view.

Also, it can be explored by future researchers that whether the 'Green IT' potentials as highlighted in this research paper will actually convert to economic and social realities, or will turn to be “myths” (Fuchs, 2008) only.

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