

# A Study on Computer peripherals, Mining extraction and Health Sector towards Sustainability

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**Abstract:** - The importance of preserving the environment has been grabbing attention in the latter part of the century. This includes the subject of executing plans made by the authorities to successfully curb the adversity. Thus, green supply chain management is an important step towards sustainable development and the conserving the environment. This paper discusses the concept of green supply chain management (GSCM) and its implementation in three areas, namely mining sector, healthcare and computer parts. It also throws light on the different approaches made to analyze the implementation of GSCM in the above mentioned areas.

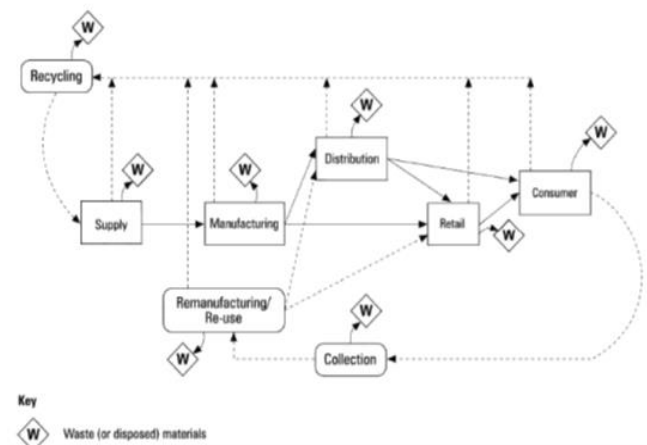
**Keywords:** *Supply chain management, fuzzy modelling approach, mixed integer programming model, stochastic models, hybrid model.*

## I. INTRODUCTION

The deteriorating environment has become a global issue of debate and discussion in the recent years of which the topic of global warming and its effects on mankind has been the most significant. This phenomenon arises due to the increasing number of industries, factories which has in turn led to generation of a huge amount of greenhouses released into the atmosphere. Before industrialization 280 ppm of CO<sub>2</sub> had a hike upto 450 ppm after the industrial revolution which in turn led to an increase of 2 degrees centigrade of earth's temperature. Thus many countries have passed laws compelling industries substitute conventional energy with renewable energy [1].

In every industry, there is supply chain management being followed. It is a process where raw elements are transformed into end products and are supplied to the customer [2]. This paper discusses the concept of green supply chain management and three of its practical applications. This concept is an environmentally conscious effort that aims at achieving sustainable development. It conserves the natural resources and also achieves good quality products. Walton, Handfield and Melynyk [3] even claim that "increasing government regulation and stronger public mandates for environmental accountability have brought these issues into the executive suites, and onto strategic planning agendas".

**Figure 1: Green Supply Chain Management**



The main question remains, why shift to green supply chain management. Many entrepreneurs believe that it is the right thing to do for the environment that will directly or indirectly affect the whole of mankind at some point of time. But there are some industrialists accept this concept due to that fact that it is more profitable and economical. It also helps in reduction of waste and advertising. Zhu and Sarkis agreed upon the fact that this concept was a "win- win relationships on environmental and economic performance"[4].

## II. LITERATURE REVIEW

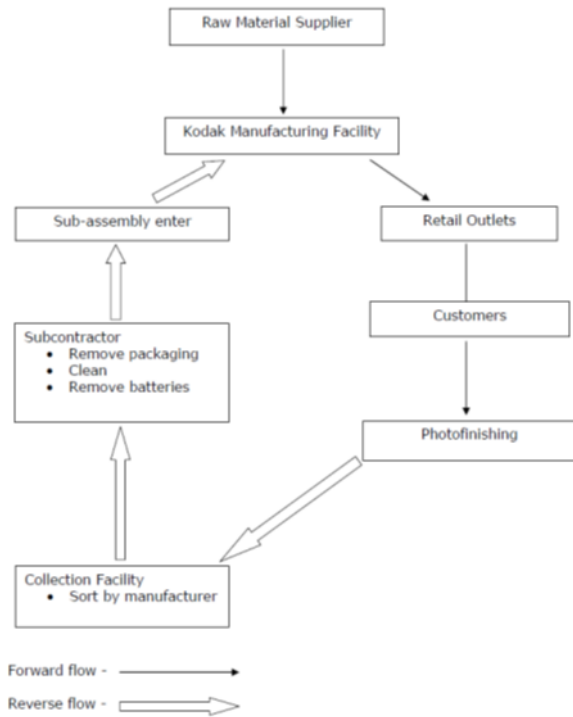
According to Hervani, Helms and Sarkis green supply chain management is "the sum of green procurement, green manufacturing, green distribution and reverse logistics"[6]. GSCM plays a role of utmost significance when it comes to influencing the environmental impacts of any firm thus contributing to the sustainability performance enhancement [7]. The following are application of this concept.

### A. MINING

Mining plays a vital role in the development of any economy especially in the developing nations. India ranks among the top five nations in the generation of fossil, ferrous, nonferrous and industrial ores. Just after independence India had the total production capacity of 24 types of minerals with a value of US\$23 million [8]. At present the value has gone upto \$30 billion with a total generation of 90 minerals [9]. This industry

contributes 2.2-2.5% but when the GDP of the total industrial sector is considered it comes to about 10-11% [10].

Figure 2: Kodak's Green Remanufacturing Line



Mining has a significant impact on the ecosystem we live in. The major negative impacts are air pollution, water pollution, noise and vibration and ecological impacts. Mining contributes to global warming because it leads to the emission of hazardous gases like carbon di oxide, methane, carbon monoxide, sulphur di oxide and oxides of nitrogen which also become the source of acid rain [11]. It is also a major contributor to water pollution due to the fact that the coolants are released into the water bodies without treatment. Further, mining activities like blasting and drilling generates a lot of noise that can cause permanent hearing damage. Hence, mining can be the reason several acres of vegetative lands get converted to waste lands and eventually leads to destruction of ecosystem [12].

Mining like every other industry also experiences many hurdles. The locals rebel and are wary of advanced technologies because it will reduce employment rates. The NGOs and other environmentally conscious groups do not pressurize these industries to opt for GSCM. The factories need to educate their staff and workers to adopt environment friendly working methods [12].

In this scenario, the implementation of green supply chain management is essential. The STOP approach is one of the methods by which sustainable management of resources can be achieved [10]. The citizens of the country have been getting more and more environmentally conscious in the latter part of the decade. The following are some instances in which awareness became a mode of executing GSCM.

1) The gram sabha (village council) rejected the extraction of bauxite form the Niyamgiri hills by the joint venture of state-run Orissa Mining Corporation (OMC) and Vedanta Aluminium Ltd, a unit of billionaire Anil Agarwal's London-listed mining giant Vedanta Resources Plc. The gram sabha's verdict is not the last word, but it will definitely influence the central government's decision.

2) The bauxite mine and alumina plant in the Kshipur region of Odisha was rejected by the locals as it would cause them to leave their homes and lose their source of livelihood as the Bramhani river flows in that area. [13]

A case study includes the mining done in the iron, coal and manganese sector and SWOT analysis done in respective industries. The implementation was done in accordance with the following factors:

- (i) Dust control practices
- (ii) Minimization of greenhouse gases emitted
- (iii) Proper utilization of energy
- (iv) Methods to control noise
- (v) Proper utilization of water
- (vi) Managing waste suitably
- (vii) Suitable management of waste
- (viii) Stabilization of dump

SWOT analysis is basically the process of analyzing the strength, weakness, opportunities and threats related to a specific sector.

After careful analysis of the three sectors with respect to the factors stated above we can safely conclude that coal mining industries are public sector units and offer more opportunities. They can effectively arrange human resource, funds and generate the required infrastructure.

The industries that practice iron ore mining are private sector and thus are less environmentally conscious when compared to the coal mining sector. The GSM technologies are important to them as they are a source of guidance and advanced technologies. In spite of this the factors like the usage of open cast mining and on road transport inhibit the adoption of GSM technologies.

Many iron ore mining industries use manganese as an associated metal. Thus the extraction of manganese being a supplier of these industries can adopt to GSM without any hinderance [20].

**B. THE MINIMIZATION OF GENERATION OF WASTES IN HEALTH SECTOR**

This makes the implementation of green supply chain demand an absolute necessity. The execution of this waste minimization program will lead to the conservation of the environment, the advancement of occupational safety and will be economical [14].

The Ministry of Environment and Forests, Government of India made rules regarding Biomedical wastes which came into effect on 20th July 1998 [15]. Despite this, the barriers to this concept are as follows:

- 1) No segregation practices followed.
- 2) The strategy of waste management followed is incorrect.
- 3) There is inadequate support from governmental organizations.
- 4) There is a deficiency of green procurement policy.
- 5) There is always an unsanctioned re usage of health care waste.
- 6) There is a lack of facilities and high quality management.
- 7) Financial factor. [16]

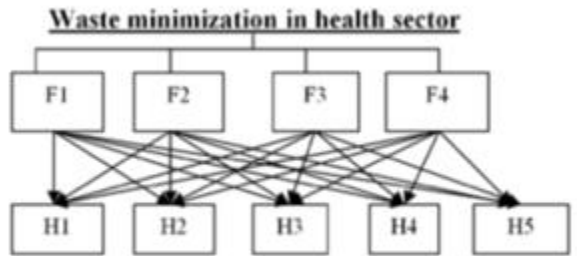
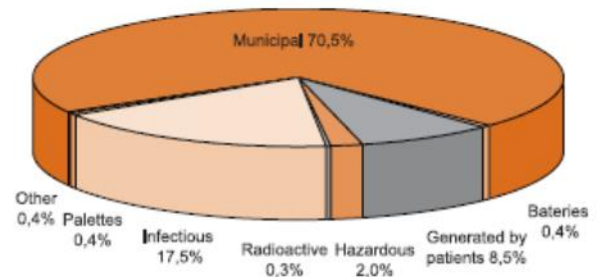
The daily activity of any hospital is acutely governed by four factors. They are:

- (i). Awareness programs conducted by the authorities for the betterment of the employees.
- (ii). Segregation of wastes; especially recycling plastics and the implementation of eco design service.
- (iii). The stakeholders of the institution should be a very strong team.
- (iv). Waste management can be greatly improved by using the life cycle analysis.

Considering a case of five different hospitals of which the first is privately owned cum a medical college, the second is owned by the state, the third is state owned cum a medical college, the fourth is privately owned and the last one is privately owned cum a medical college. This study was made using the AHP (Analytical Hierarchical Process) and concluded that the first hospital was the best when the above mentioned factors were taken into consideration [19].

The hospital wastes range from infectious to radioactive but are generally non-hazardous municipal wastes that can be easily segregated and disposed off. But the lack of proper management leads to costly procedures that process all the wastes generated I the exact same way.

**Graph 1. Typical breakdown of the overall health-care waste stream in Europe.<sup>1</sup>**



**Fig. 1: Network Diagram Showing the Relationship Between Hospitals and Factors**

**C. COMPUTER AND ITS PERIPHERALS**

The concept of GSCM has been acknowledged as one of the most revolutionary in the hardware and software industries. Major multinational companies like IBM, Sony, Panasonic, and Hitachi make use of directives like EuP and RoHS that make the proper disposal and handling of the electronic equipment an absolute necessity. Computer and its peripherals contain a huge amount of hazardous wastes like hexavalent Chromium and heavy metals like mercury and lead. A household PC may contain up to 23% of plastic, 15% of glass, 18% and 32% of non-ferrous and ferrous materials respectively [17].

The following are examples of companies who have taken the initiative to limit the hazardous wastes generated by electronics and implement GSCM:

1) Wipro Infotech is the first company to make peripherals which are ecofriendly. It is also known as Wipro green ware in the Indian markets which are made using ROHS (Restriction of Hazardous Substances).

2) Samsung launched ecofriendly mobile handsets in the Indian markets specifically W510 and F268. [18]

The interpretative structural modeling is a methodology by which a contextual relation can be defined between the elements identified. It does not essentially require the measurable on ratio scales unlike the other quantitative modeling approaches. Thus it is a modeling language to simplify structural complexity. This particular methodology consists of the following steps:

- (i) Putting together a structural self-interaction matrix
- (ii) Developing a reachability matrix
- (iii) Constructing level partitions
- (iv) Classifying out the factors
- (v) Development of interpretative structural model.

ISM model of factors for implementing GSCM in Indian computer and its peripheral industries



V. FUTURE SCOPE OF RESEARCH AND CONCLUSION

More and more methods need to be researched for computing the amount of greenhouse emissions by simple mathematical calculations. Case studies need to be taken up for a more efficient and cost effective analysis of the implementation of green supply chain management.

As the saying goes, when the last tree falls so shall the last man, we need to be environmentally aware and strive for sustainable development and management of resources. The green supply chain management is one of the most significant step in that direction. Better socio-economic rewards can be reaped if the senior management committee of any organization decides to increase transparency and attain a level of trust and coordination between the stakeholders. This concept should align with the requirements of the end consumers as this is important to given sector of the economy.

REFERENCES

- [1]. Johnny C Ho, Maurice K, Tzu Liang Tseng, David S Ang (2009), Opportunities in green supply chain management The Coastal Business Journal Spring 2009: Volume 8, Number 1.
- [2]. Beamon, B. (1999), Designing the green supply chain. Logistics information management 12(4), 332-342.
- [3]. Walton, S., Handfield, R. , & Melynk, S. (1998). The green supply chain: Integrating supplies into environmental management processes. International Journal of Purchasing and Material management, 34(2), 2-11.
- [4]. Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. Journal of Operations Management, 22, 265-289.
- [5]. Guide, V. D. R., Jayaraman, V., & Linton, J. D. (2003). Building contingency planning for close-loop supply chains with product recovery. Journal of Operations Management, 21, 259-279.
- [6]. Hervani A. A., Helms M. M., & Sarkis J., (2005) "Performance measurement for green supply chain management," Benchmarking: An International Journal, vol. 12, no. 4, pp. 330-353.
- [7]. James Adu Peprah, Isaac Opoku-Fofie and Kwabena Nduro, (2016), Factors Affecting Green Supply Chain In The Mining Sector In Ghana, European Journal of Logistics, Purchasing and Supply Chain Management Vol.4, No.1, pp.32-50, February 2016.
- [8]. S. Khatua and S. Stanley, Integrated Rural Development of Weaker Sections in India, Ecological debt: A case study from Orissa. India. 2008, [http://www.ecologicaldebt.org/publicaciones/Chapter5\(125-168\).pdf](http://www.ecologicaldebt.org/publicaciones/Chapter5(125-168).pdf).
- [9]. G. Singh, "Environmental issues with best management practices of responsible mining," presented at the 20th National Convention of Mining Engineers, Neyveli Local Centre:India, Jan 30- Feb 1, 2009.
- [10]. Dr. Sushanta Tripathy, STOP Approaches of Green Issues in Indian Mining Industries Towards Sustainability Development: A Critical Future Issue, IJRMET Vol. 5, Issue 1, Spl - 1 November 2014 - April 2015.
- [11]. G. Singh, "Environmental issues with best management practices of responsible mining," presented at the 20th National Convention of Mining Engineers, Neyveli Local Centre:India, Jan 30- Feb 1, 2009.
- [12]. K. Muduli and A. Barve, Role of Green Issues of Mining Supply Chain on Sustainable Development, International Journal of Innovation, Management and Technology, Vol. 2, No. 6, December 2011.
- [13]. [www.wikipedia.org](http://www.wikipedia.org)
- [14]. [www.noharm.org](http://www.noharm.org)
- [15]. S. Gupta, R. Boojh, A. Mishra, and H. Chandra. Rules and management of biomedical waste at Vivekananda Polyclinic: A case study. Waste Management. 2009, 29: 812-819.
- [16]. K. Muduli and A. Barve, Barriers to Green Practices in Health Care Waste Sector: An Indian Perspective, International Journal of Environmental Science and Development, Vol. 3, No. 4, August 2012.

- [17].Kannan, G., Sasikumar, P. and Devika, K. (2010) 'A genetic algorithm approach for solving a closed loop supply chain model: a case of battery recycling', Applied Mathematical Modeling, Vol. 34, No. 3, pp.655–670.
- [18].Bhamini Garg, (2014) Green Marketing: Buzzword for New Age Marketers in India, The International Journal Of Business & Management (ISSN 2321 – 8916).
- [19].Rosalin Sahoo, Jayshree Patnaik, Sushanta Tripathy, Waste Minimization in Health Sector: An AHP Approach, IJRMET Vol. 4, Issue 2 Spl-1, May - Oct 2014.
- [20].Kamalakanta Muduli, Akhilesh Barve, Jitendra Narayana Biswal, Green practices adopted by the mining supply chains in India: a case study, Int. J. Environment and Sustainable Development,xxxxxxx
- [21].Satyabrata Aich and Sushanta Tripathy, An interpretive structural model of green supply chain management in Indian computer and its peripheral industries, Int. J. Procurement Management, Vol. 7, No. 3, 2014.

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