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ANALYTICAL APROACH FOR MEASUREMENT OF GREEN SUPPLY CHAIN

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ABSTRACT

Green Supply Chain Management (GSCM) is one of the recent innovations for the enhancement of capabilities of Supply Chain Management. In this research, we aim to study the various activities of the Supply Chain processes of the various Indian Manufacturing Industries i.e. both SME" s {Small Manufacturing Enterprises} & Large Scale Industries & finds how much eco-friendly they are (i.e. how much % of the green factor are involved in their supply chain activities from the procurement of the raw material to the transportation of the final product) for the purpose of metering the performance of the manufacturing sectors has been studied. The major six activities of the supply chain; namely Green Sourcing & Procurement, Green Manufacturing, Green Warehousing, Green Distribution, Green Packaging, Green Transportation are being covered throughout the research. From these above process activities we measured the performance of the various Indian manufacturing industries with the help of various crucial performance indicators & their sub-indicator's.

The research outcome based on the survey will identify the important result that's causes impact on the environment caused by the manufacturing sectors based upon the appropriate methodology we applied for research purpose. We can also analyze by comparing various sectors with each other & finds out the leading and lagging sectors based upon the existing way of processes. In the end also discussed wide future scope for the further research.

In this paper we discussed the various environment factors affecting in the manufacturing sectors .we designed a GSCM Index having 17 Indicators & 33 Sub-Indicators & with the help of survey questioner which has to be filled by the various multiple manufacturing sectors from that effort we can finds out the performance the various manufacturing sectors towards Green future

Keywords: Green Supply Chain management (GSCM) **; Green Sourcing & Procurement , Green Manufacturing , Green Warehousing , Green Distribution, Green Packaging ,Green Transportation.**

I. INTRODUCTION

An environmentally conscious supply chain, also called a green supply chain, is a new concept appearing in recent literatures. Although this environmental issue has been realized very important for business, its introduction to supply chain management has only been developed recently. The literature about environmentally conscious supply chain is very limited."Sustainable Development" was the key concept of the 1992 Earth Summit in Rio, as governments and international organizations committed themselves to take action

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to protect the environment as in integral part of long-term economic development. Environmentally-responsible consumption and production is seen as an essential part of the strategy to improve environmental quality, reduce poverty and bring about economic growth, with resultant improvements in health, working conditions, and sustainability, and is today's highlighted Agenda. In particular, organizations were called upon to exercise leadership in the promotion of environmentally sound goods and services.Qinghua Zhu in 2006 studied Green supply chain management: pressures, practices and performance within the Chinese automobile industry in which they observed that Increasing pressures from a variety of directions have caused the Chinese automobile supply chain managers to consider and initiate implementation of green supply chain management (GSCM) practices to improve both their economic and environmental performance. Expanding on some earlier work investigating general GSCM practices in China, authors explores the GSCM pressures/drivers (Motivators), initiatives and performance of the automotive supply chain using an empirical analysis of 89 automotive enterprises within China [5].

Chung-Hsiao in 2008 studied the Green supply chain management in the electronic industry in which they mentioned that there are various approaches for implementing green supply chain management practices has been proposed and recognized in previous literatures according to the author, but there is yet no investigation that identified the reliability and validity of such approaches particularly in electronic industry. Author used the fuzzy analytic hierarchy process method to prioritize the relative importance of four dimensions and twenty approaches among nine enterprises in electronic industry. The findings indicate that these enterprises would emphasize on supplier management performance in the crucial role of implementing green supply chain management [19].

Fengfei Zhou in 2009 Study on the Implementation of Green Supply Chain Management in Textile Enterprises in which according to the author The green supply chain management is a sort of modern management mode which could comprehensively consider the environmental influence and resource utilization efficiency in the whole supply chain and how to implement the green supply chain management in special industrial operation at present has become into one of hotspot problems [8].

In another study Ninlawan & Tossapol in 2010 works on the Implementation of Green Supply Chain Management Practices in Electronics Industry in which they aims to survey current green activities in computer parts‟ manufacturers in Thailand to evaluate green supply chain management and they survey current green activities in computer parts‟ manufacturers in Thailand, 11 manufacturers are case studies who provide in-depth interview about green procurement, green manufacturing, green distribution, and/or reverse logistics. To evaluate green supply chain management, the questionnaire related to investigate GSCM practices, measure GSCM performance, and explore GSCM pressure/ driver within Thai electronics industry is used to obtain survey results. Then suggestions to develop GSCM in electronics industry are presented in the end [20].

Robert & Benjamin in 2010 Introducing Green Transportation Costs in Supply Chain Modeling in which they thinks that Escalating environmental concerns with prevalent transportation modes has lead to an increased interest in the adoption of "green", sustainable practices in the area of supply chain management. As a part of an overall green supply chain strategy, the amount of carbon emissions resulting from the transportation element of a supply chain is a growing concern for supply chain managers and corporate executives alike. In which authors tries to review methods for quantifying carbon emissions and estimating the cost of going green in a select set of

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supply chain optimization models [21].

It is not surprising that GSCM finds its definition in the supply chain management. Adding the green component to supply chain management involves addressing the influence and relationships of supply chain management to the natural environment.

GSCM = Green purchasing + Green manufacturing/materials management + Green Distribution / marketing + Reverse logistics.

The green sourcing wave has begun to roll with an increasing number of companies beginning to catch on and ride the wave in an effort to proactively manage a new era of customer needs, environmental regulations and competitive realities that will ultimately impact the business. Companies that want to get ahead of the curve and stay there need to begin thinking green now and develop an approach to sourcing and supply chain management that factors this new reality into their plans. One of the ways to know where your organization stands by carbon footprint study or an assessment of your organization's "green" status. "How to improve end – of – life of product management & how your organization is going to get there plan"?

II. SCM AND INDUSTRIAL CLUSTER

There are various types of industrial clusters in Asia. Cluster policy is mainly undertaken, not by central governments as national policy, but by local governments as regional policy, partly because economies all over the world are decentralizing. One important question is whether cluster policy can be effective in forming a cluster. Also needs to understand clearly the relationship between clusters and supply chain management especially for those managers who are considering relocation of physical facilities or are exploring ways to build competitive advantage in their firm's present location.

Clusters theories, in effect, builds on the advantages of inter firm cooperation propounded by supply chain theorists. Supply chain management (SCM) integrates processes and builds long-term relationships among firms involved in the flow of products and services from the source to end-users. All firms in the supply chain can benefit through achieving lower costs, improved customer value and satisfaction, and greater competitive advantage [1].

Supply chain is defined as integrated net structure where the core enterprises control the flows of information, materials, and capital from the supplier, manufacturer, distributor, and retailer. Supply chain management is the integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customers and other stakeholders [2].

However, supply chain enterprises are not necessarily in the same geographical area, if there are no local suppliers to supply raw materials to local automobile manufacturers, and local auto manufacturers have to purchase raw materials from suppliers of the outer area. In that way, undoubtedly, this long-distance transport increased the costs of entire supply chain. If manufacturers can find suppliers for raw materials in local with the same quality and price, they can save a lot of money. In other words, it not only can save cost and increase the residual value for supply chain, but also insure enterprises in supply chain gain the profit and competitive advantage by enterprises clustering. So it is necessary to make a study on the clusters.

Industrial clusters provide a model for enterprises to realize short distance business combination, which is benefit to long distance business alliance. Because industrial clusters will shorten the geographical distance

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among enterprises, reduce the difficult and cost as they reasonable select the united objects, understand each other's situation and take part in business contact. So business combination in the same region is more conducive to realize internal scale economies than the long distance business alliance.

However, if there is no supply chain management in clusters to reasonably manage the whole enterprises in clusters, well then these enterprises will be likely to focus on their individual behavior and neglect of the linkages between enterprises themselves, as well as linkages between function and value of supply chain, more severely, enterprises within clusters may also generate vicious competition. As a result, they fail to reduce transaction costs, decrease the efficiency of themselves and block clusters enterprises‟ innovation, thus weak the competitiveness of the clusters.In the world, there are some representative automobile industrial clusters, such as America, Japan. Detroit auto industrial clusters in America are the first and largest clusters in the world, and it is also the seat of General, Ford and Chrysler Headquarters. Automobile manufacture is the core of departments and related steels, plastic, glass, tire and engine, etc. components production are relatively developed with high degree of specialization and intensiveness [3]. Auto industrial clusters brought about the development of other industries, such as metal and non-metal materials industry, electronic and IT industry, textile industry, petroleum chemical industry, equipment manufacturing industry, finance and insurance industry and sales and service industry, and so on.

III. TRADITIONAL AND GREEN SUPPLY CHAIN

In a traditional supply chain, the flow of materials and information is linear and from one end to the other. There is a limited collaboration and visibility. Each supply chain partner has limited information regarding, for example, the carbon footprint and greenhouse gas emission of the other partners. Hence, each player may be concerned about his own footprint and may try to reduce this, irrespective of the impact on upstream and downstream supply chain. There may be some focus on end-to-end supply chain costs but due to limitations of information sharing, the costs are far from optimized in most cases.

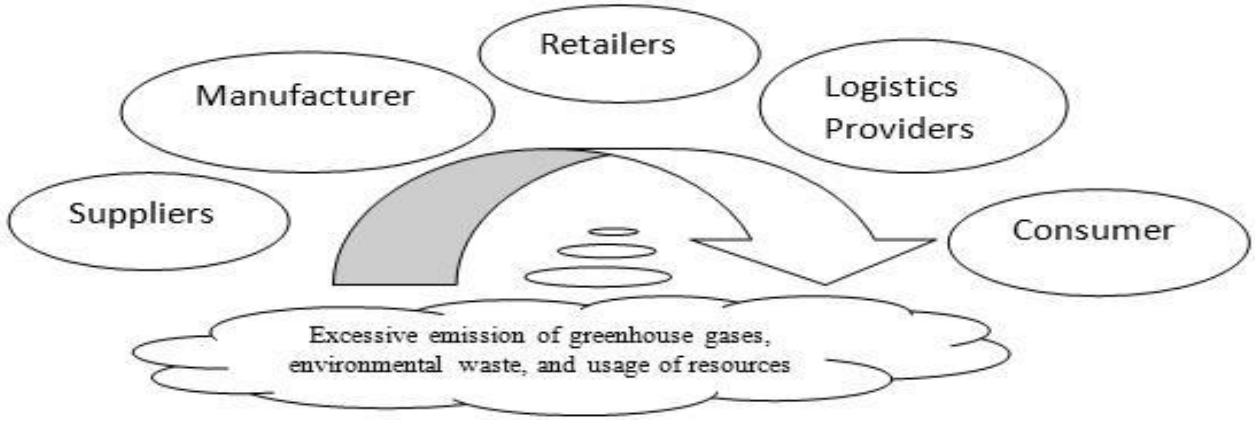

Figure 1-1 Traditional supply chain

An example follows in Figure 1-1 self constructed. In contrast, Green Supply Chains consider the environmental effects of all processes of supply chain from the extraction of raw materials to the final disposal of goods. Within the Green Supply Chain (see Figure 1-2 self constructed too), each player motivates other players to go Green and provides the necessary information, support, and guidance, for example, through supplier’s development programs or customer support. Environment objectives and performance measurement are then

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integrated with financial and operational objectives.

With this integration, the Green Supply Chains then will strive to achieve what any individual organization on its own could not possibly achieve: minimized waste, minimized environmental impact while assuring maximized consumer satisfaction, and healthy profits.

As consumers have become more aware of environmental issues, such as global warming, they have now started asking questions about the products they are purchasing. Nowadays, organizations routinely face queries about how Green their manufacturing processes and supply chain are, how wide the carbon footprint is, how wasteful their packaging is, and how they will recycle.

Some organizations have been able to convert the public`s interest in Green issues into increased profits. A number of projects within organizations have shown that there is a clear link between improved environmental performance and financial gains. Organizations that have looked to their supply chain have discovered areas where operational and environmental improvements can produce profits.

For example, General Motors was reported to reduce disposal costs by $12 million by establishing a reusable container program with their suppliers. While the motivation for this project may have been a desire to reduce costs, GM found that the environmental cleanup that resulted was actually a very marketable message for the public and policy makers.

IV. REASEARCH BACKGROUND

It is generally accepted that environmental consciousness is now changing to being more proactive, as organizations are discovering that it makes good commercial sense. Boards are asking managers to review their policies related to environmental norms, not only to bolster their corporate social responsibility aims, but also because consumers are increasingly asking for it. It is also widely agreed that consumers will increasingly prefer to buy more, and even pay more, for products or services provided in environmentally sound manner.

There are five fundamental questions that every environmentally pro-active leaders and managers needs to ask about their Supply Chains that **“How Green is their Supply Chain?”**

A recent analysis has however revealed the following key additional points. Companies are still primarily focused only on having environmentally conscious internal production. For example, any company can become totally carbon neutral by outsourcing all its production, however, shifting the carbon producing activity up or down the supply chains does nothing more than hide the dirt under someone else’s carpet. A holistic approach to carbon management is required, and this is provided by adoption of a Green Supply Chain methodology.

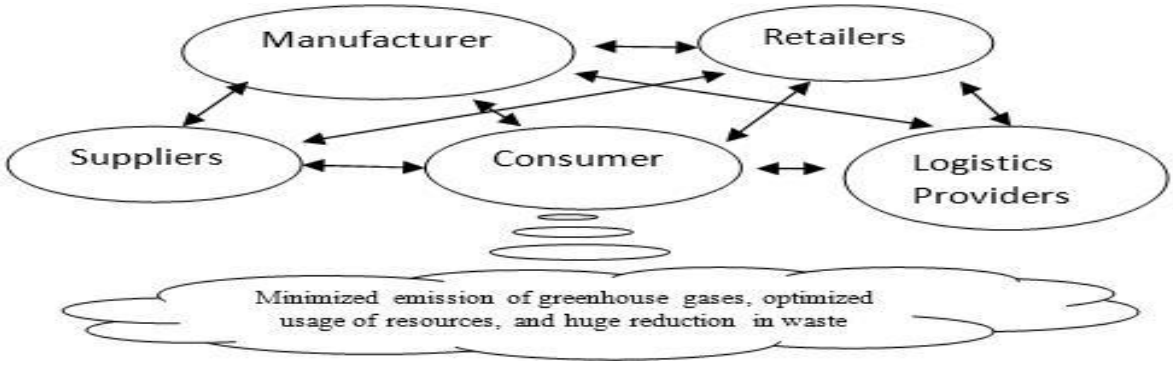

Figure 1-2 Green supply chain

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Environmental pro-activism is generally assumed to come at an additional cost to the corporations. It is widely thought that going green is expensive. Background of the research and modeling indicates that adoption of Green supply Chain methodology should result in overall cost reduction, providing this is done in a thorough and logical manner.

Most business models are focused on growing the volume of their current offerings of goods or services to increase profits. A change in this focus towards providing customer end outcomes will, not only, reduce the impact on the environment, but also secure and/or increase market share whilst improving profitability. So it is clear that a move to Green Supply Chains is not only necessary for sound environmental management, but it is also profitable and makes sound financial management. How therefore can companies start making the move?

From the previous research and practical work in this area, they believe the following five fundamental questions really help to focus the discussion and crystallize action plans:

1. What are the tangible and intangible benefits of moving towards a Green Supply Chain?

In our experience these benefits are frequently neither fully explored, nor adequately quantified. Even where a robust analysis is carried out, analysts can either ignore some of the potential benefits, or find it hard to analyze the full impact on the business. As a result, the overall benefits do not get adequate attention at the board level and therefore do not generate enough interest to release the necessary finance to create the transformation.

In one company we know (a large global industrial and building products company with revenues in excess of $5 Billion) the task of exploring opportunities in Green Supply Chains was handed over a senior executive as an additional job over and above his regular job, without any funding, clear direction or expectations. In a situation like this (which is all too common), the potential benefits cannot be fully understood or be agreed by the key stakeholders, resulting in understaffed projects, and poor implementation.

Their analysis has also found that without any new technologies being utilized, just a move to a Green Supply Chain can reduce costs by 5-20%. The adoption of new technologies, however, can take cost reductions to a whole new level. In addition, by raising their Green credentials amongst customers, employees, government authorities and other stakeholders, organizations also move rapidly towards ensuring a sustainable and successful future.

2. What are the costs, both direct, and indirect?

This is the flip side of the question above. For the same reasons, while companies have vague ideas of the costs, these are rarely fully explored and analyzed. In their experience, these are also frequently exaggerated because of uncertainty surrounding many of the costs. While all future costs have a certain amount of uncertainty, and there is general tendency to allow a buffer; our analysis finds that costs of going green are generally more uncertain, but the buffers allowed are made to be disproportionately higher.

The indirect costs are generally the source of most complications. It is really hard to estimate costs of process changes, disassembly lines planning and set up, waste collection and recycling modeling, additional research and development, inventory reduction and green supply chain modeling etc. Once each one of these systems are fully functional, the costs will follow a predictable experience or learning curve pattern, but it is indeed, difficult to predict the transitional costs, and this makes the analysis complicated and perhaps insurmountable for many project teams. Their research indicates that direct and indirect costs associated with Green Supply Chains are substantial but however they can be fully funded and more than offset by the benefits they generate

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3. What influence do we have over our suppliers, their suppliers and our customers (especially the party with the most power in the supply chain) that would allow us to jointly work together and move the supply chain towards a green supply chain?

This question is easier to answer as many pragmatic managers have a good idea of the relative power balance in their customer supplier relationships. While occasionally the influence is wrongly estimated, in general, they find that just asking this question helps to focus action in the right direction.

Some organizations now do think in terms of the end-to-end supply chains. However, there are still many more organizations that need to do this. Thinking holistically outside the boundaries of the organization, when applied to Green Supply Chain methodology, can yield some outstanding results. Under this primary question, a few additional secondary questions will help sharpen the focus even further to create the clarity, impetus and momentum towards positive plan and action.

Clearly, the organization which has the most influence over an end-to-end supply chain is best positioned to create the clarity and impetus towards the Green Supply Chains. For example in the retail sector, companies such as Tesco (UK) or Wal-Mart (USA) are best positioned to exercise this type of influence. However with the automobile sector, retailers have far less influence and the influence comes more from the manufacturers.

It is perhaps also clear why this crucial third question can only be answered after we answer the first two questions. Once the benefits, costs and influences are clearly expressed, defined and analyzed, then it much easier to have an informed discussion with the party that „controls" the supply chain.

4. How will we communicate and measure our progress towards the green supply chain to the key stakeholders? How will we engage them?

A new road needs new milestones. Traditional supply chain or financial measurements will not suffice in this case. We know of several organizations who started to make some progress towards vague environmental goals and defined this in terms of carbon impact reduction but without any clear definition of 4 or 5 key measurements that relate to supply chains at all levels.

A typical Green Supply Chain project has far more stakeholders than any other transformational projects inside an organization. Besides internal staff, key suppliers, customers, and even the public; media, regulators and government are also stakeholders in a green supply chain transformation. Therefore, a well thought out stakeholder engagement strategy, diligently executed, that includes clear and regular communication; is essential to success.

5. What barriers to Green Supply Chains can be expected and how can these be overcome?

There several categories of barriers to Green Supply Chains and these include legislation conflicts, inadequate or misaligned stakeholder incentives, lack of environmental norms and tools, lack of resources, and the high costs of implementation and technology.

Like in any other change initiative, barriers can be overcome through a properly structured, comprehensive and phased migration strategy. A "Big-Bang" approach is not to be recommended. Rather, each major project stream is dealt with by a series of phases that cover detailed analysis, design and implementation, and organization change management. Time and care should be taken on the first phase to ensure its success and the ability to leverage subsequent phases.

In summary, those organizations that wish to start on Green Supply Chain projects must ask some fundamental

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questions. The answers will then help to illuminate their way towards innovation, profitability and sustainability.

V. SUSTAINABLE MANUFACTURING AND GREEN MANU-FACTURING

Brundt land states that "Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." It is not obvious how to apply this directly to manufacturing but we could consider several categories of "sustainability." These categories depend on whether or not the resource consumed, or impact, is renewable or the impact can be accommodated by the environment. Materials and other resources extracted from the earth, like coal and oil, are not usually considered to be "renewable". So electricity generated from these resources is not renewable. Solar and wind based energy would be considered renewable. Impacts can be sustainable if the environment can "absorb" the impact as part of the natural processes. Hence, there is a limit to the amount of CO2 (and other green house gases (GHG)) or other contaminants put into the atmosphere based on the atmosphere's ability to accommodate this input. Exceeding this level is not a sustainable situation. Some resources may appear to be sustainably used but are scarce. For example, water is "renewable" in a specific area if not used beyond the ability of the aquifer or water sources to replenish that taken from the system. So, recycling water used in an industrial process may be a sustainable solution. Of course, one needs to consider the energy and material used in treating the water as part of any recovery system [6].

The manufacturing industry has been proactive in improving processes and systems to reduce energy and material use and the process impacts. This started with the natural attempts to reduce the cost of ownership in any way possible for processes that use exceptionally expensive materials (solid, liquid and gas) in production either as process chemicals or for cleaning and control. In addition, many of these materials are harmful and environmental health and safety programs have been aggressively developed.

There are a number of approaches to achieving sustainable manufacturing, or at a minimum, green manufacturing (Allwood) [24] lists five basic options as:

- Use less material and energy
- Substitute input materials: non-toxic for toxic, renewable for non-renewable
- Reduce unwanted outputs: cleaner production, industrial symbiosis
- Convert outputs to inputs: recycling and all its variants, and
- Changed structures of ownership and production: product service systems and supply chain structure

The benefits of going to Green manufacturing

Going green has become the newest item in the mission statement of several manufacturing companies. The controversy surrounding global warming and manufacturing companies tends to often dominate conversations between environmentalists and manufacturing companies. In order to reduce waste, several manufacturing companies have begun going green. This leaves the question, "What are the benefits of going green in your manufacturing company?"

Manufacturing equipment is made to be fast, reliable, and energy efficient. One example of going green is the energy-efficient light bulb. These bulbs use almost half the energy as a standard light bulb and yet they still produce a good amount of light. Manufacturing companies are using this example and re-designing their machines. Going green can benefit your manufacturing company in many ways. Not only will it benefit the

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environment, but it will impact your consumer, the shareholders, and the company perception in the market.

The first benefit to going green is the impact it will have on the environment. Insurance companies are actually giving better rates to manufacturing companies that are taking steps to go green. The government is even offering tax breaks for manufacturers that have gone green

The second benefit to going green is the money it will save. Manufacturers can look for machinery that is earth friendly. Wind and solar energy can save your company thousands of dollars and it is a very simple way to go green. The reality is that if you can save money on energy, your product costs can go down and your customers will not need to pay as much. In addition you can always maintain the same costs and turn a great profit on your products, helping out your shareholders.

The third benefit to gong green is the help it will provide to the community at large. Renewable energy sources are considered to be one of the fastest growing job markets. New manufacturing plants that are opening with renewable energy sources are offering many more jobs to their communities, giving them a larger respect in their market. Studies show that manufacturing companies that have gone green are expected to employ almost 70 percent of the new jobs in the future; the runner-up is jobs in information technology.

It is important to understand that even though going green has its benefits; it will be a large investment. There are also safety concerns that come with going green, especially if you are re-designing a facility that is currently in use. You may need to shut down parts of the facility while you install new equipment and transform your power source to renewable energy. Although the costs can be high initially, the benefits will far outweigh them. Both the manufacturing company and the environment will benefit greatly from going green.It has been shown that employees that work for companies that have gone green highly value the company and they often have a higher performance level than other company's employees. Going green can also produces a better air quality for the employees and the community. Better air quality may be one of the biggest benefits of going green. With the public awareness surrounding going green, it is also important to go green to keep your manufacturing company competitive. Some customers have begun making purchasing decisions based on products that are manufactured at facilities that have gone green and they boycott the other companies that do not have green manufacturing plants. Comparison table is constructed by us based upon the very useful & meaningful factors are shown below. The current damage to the earth has many concerned about global warming and the air quality. Going green is not only important for your employees and your community, but can be better for the bottom line.

Lean production: - Lean production, which is often known simply as Lean, is a competitive practice that reduces costs, improves environment and quality, and improves the bottom line. Lean production is aimed at the elimination of waste in every area of production. Here any expenditure that does not create a value for the customer is a waste and must be eliminated. This could include activities from various processes such as customer relations, product design, and supplier networks to factory management. Its goal is to incorporate less human effort, less inventory, less time to develop products, and less space whilst being highly responsive to customer demand and, at the same time, producing top quality products in the most efficient, environmentally responsible, and economical manner possible.

Lean production is closely associated with Green Production as there is an overlap between the goals and drivers for both processes. A key component of Lean principles is just-in-time (JIT) inventory strategy. It focuses on

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reducing inventory and provides material, energy, and space savings.

JIT Manufacturing: Purpose of JIT is Reduction of cost and Quality improvement.

ISO 9000 AND ISO 14000: Purpose of ISO 9000 and 14000 is to recognize quality standards are followed by the companies and Changes the motivation.

Zero Emission Strategy: Purpose of zero emission strategy is to Environmentally damaging production products are eliminated.16% of companies are actively following zero emission.85% of companies are following reduced emission strategies.

Six Sigma: - Six Sigma is another management methodology which became very popular. It supports Green Production by primarily eliminating defects from manufacturing processes and, hence, cutting waste. Through exercising greater care and management control minor investment defects are caught as early as possible through the process. As a result, significant savings can be made by reducing the number of defects, rework, and spending time on defective pieces.

Factors	Lean manufacturing			Green manufacturing
	JIT	Six sigma	ISO 9000 & 14000	
Eliminates defects	✓	✓		✓
Reduction of cost	✓	✓		✓
Quality improvement.	✓	✓		✓
Quality standards			✓	
Improve efficiency	✓	✓		✓
customers satisfaction	✓	✓		✓
Reduced resource consumption		✓		✓
Reducing emissions in manufacturing processes				✓
Recycling programs for raw materials				✓
Recycling programs for reusable components parts				✓
Remanufacturing programs				✓

It was originally developed to eliminate defects from manufacturing processes it has also been adapted for a variety of other business processes. Six Sigma projects involve the utilization of statistics based on quality management tools, to train a group of people within the organization who become experts in these methods.

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Six Sigma projects have quantifiable financial targets to make more money and, at the same time, satisfy customers and improve efficiency. They focus on customer requirements, error elimination, cycle time reductions, and cost reductions. Elimination of defects or errors from products or services being delivered has, therefore, a direct impact on the bottom line of the business. Six Sigma projects aim to cut out the waste of fixing the errors or defects by rework or disposal which wastes a significant amount of an organizations resource.

VI.THE ENVIRONMENTAL EFFECT ON GREEN SUPPLY CHAIN

The supply chain structure was changed due to the introduction of environmental concerns. Traditionally, a supply chain may be consists only of its suppliers, manufacturers, retailers, customers. With more and more concern about the environment, recycling, reuse, and remanufacturing were involved in the supply chain. The forward flow of the material through the supply chain now is obviously not enough because a back channel exists depicts the new structure of the supply chain. How to effectively integrate the new players into the traditional supply chain and how to manage the back flow of the used products in the supply chain became the supply chains new problems Supply chain strategy is to figure out what is the best way to improve the supply chain's performance and how to satisfy the customer. It is critical for a firm's success. As we examine the supply chain, we can see there are a lot of activities in the supply chain can affect the environment, so the supply chain managers need to reconsider the strategies used in every stage of the supply chain to eliminate or reduce the environmental impact the firm could possibly do environment.

VII. EVALUATE THE ENVIRONMENTALLY CONCIOUS SUPPLY

Chain

An important component in supply chain design and analysis is the establishment of appropriate performance measures. A performance measure, or a set of performance measure, is used to evaluate the efficiency or effectiveness of an existing system, or to compare competing alterative systems. Those performance measures also can be used when design proposed systems, by determining the values of the decision variables that yield the most desirable levels of performance.

(A) Traditional supply chain performance measures

The following are some evaluation performance measure found important in the traditional supply chain evaluation. The measures can be categorized as qualitative or quantitative.

(A-I) Qualitative performance measures

Qualitative measures are those measures for which there is no single direct numerical measurement, although some aspects of them may be quantified.

- **Customer satisfaction**: the degree to which customers are satisfied with the product and/or service received, and may apply to internal customers or external customers. It may be comprised of three elements [37]:

I.**Pre-transaction satisfaction:** satisfaction associated with service elements occurprior to product purchase.

II. **Transaction satisfaction**: satisfaction associated with service elements directly involved in the physical

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distribution of products.

III. **Post-transaction satisfaction**: satisfaction associated with support provided for products while in use.

- **Flexibility:** the degree to which the supply chain can respond to random fluctuation in the demand pattern.
- **Supplier performance**: the consistency the supplier delivers to the customer on time and in good condition.
- **Information and material flow integration**: the extent to which all functions within the supply chain communicates information and transport materials.[39]
- **Effective risk management**: all of the relationships within the supply chain contain inherent risk. Effective risk management describes the degree to which the effect of these risks is minimized.[40]

(A-II) Quantitative performance measures

A quantitative performance measure means those measures that can be mathematically expressed. It can be categorized by different objectives: (1) objectives that are based on cost or profit and (2) objectives that are based on some measure of customer responsiveness.

Measures based on cost

- **Cost minimization**: the most widely used objective. Cost is typically minimized for an entire Supply chain (total cost), or is minimized for particular business units or stage
- **Sales maximization**: Maximize the amount of sales dollars or unit sold.[41]
- **Profit maximization**: maximize revenues less costs.
- **Inventory investment Minimization**: Minimize the amount of inventory costs (Including products costs and holding costs).[38]
- **Return on investment maximization**: Maximize the ratio of net profit to Capital that was employed to produce that profit.[37]

Measures based on customer responsiveness

- **Fill rate maximization**: Maximize the fraction of customer orders filled on time.
- **Product lateness minimization**: Minimize the amount of time between the promised product delivery date and the actual product delivery date.
- **Customer response time minimization**: Minimize the amount of time required form the time an order is placed until the time the order is received by the customer. Usually refers to external customers only.
- **Lead time minimization**: Minimize the amount of time required from the time a product has begun its manufacture until the time it is completely processed.
- **Function duplication minimization**: Minimize the number of business functions that are provided by more than one business entity.[39]

VIII. EVALUATE THE ENVIRONMENTAL EFFECT

With the emergence of environmental problems, people have been keeping trying to find appropriate measurements for environment. However, up to date, environmental performance measurement is still a difficult task. It cannot be solved using simple mathematical model or calculation because sometimes environmental impact is not estimable. For example, in a manufacturing process of environmental problem). This global

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warming in a long run maybe will cause extreme weather conditions, loss of ecosystems etc. However, the value of the damage from

simple example is enough to illustrate the difficulty that environmental scientists are facing. However, scientists are keeping trying to find an effective way to evaluate the damage to the environment.

In general, the impact to environment always came from the following:

- Waste (all forms, for example solid waste, all kinds of emissions, wastewater etc.),
- Resource consumption,
- Energy consumption.

So, the direct way to evaluate environmental impact should be to measure these wastes and emissions for different process which is defined by different purpose.

Such kind of measurement can only be used to evaluate some aspects of the product's or processes environmental performance. The total environmental impact still cannot be indicated using these measurements. So the value of these measurements is very limited and sometimes is not appropriate. There is a tremendous need to identify the challenges and opportunities they face in their performance from a system perspective.

The following are some quantitative measurements, which can be used in environmental performance evaluation.

(B-I) Logistics Performance Index (LPI)

The Logistics Performance Index is a benchmarking tool developed by the World Bank that measures performance along the logistics supply chain within a country. Allowing for comparisons across 155 countries, the index can help countries identify challenges and opportunities and improve their logistics performance. The LPI survey was designed and implemented by the World Bank International Trade and Transport Departments .The World Bank conducts the survey every two years.

The capacity of countries to efficiently move goods and connect manufacturers and consumers with international markets is improving around the world, but much more is needed to spur faster economic growth and help firms benefit from trade recovery, according to a new World Bank Group survey on trade logistics.*"Global Trade Logistics Improving, but more Needed to Boost Recovery" [34]*

(B-II) Environmental Performance Index (EPI)

It measures the effectiveness of national environmental protection efforts in 163 countries. Reflecting our belief that on-the-ground results are the best way to track policy effectiveness, EPI indicators focus on measurable outcomes such as emissions or deforestation rates rather than policy inputs, such as program budget expenditures. Each indicator can be linked to well-established policy targets. The 2010 EPI relies on 25 indicators that capture the best worldwide environmental data available on a country scale. ***Iceland Ranks at Top of 2010 Environmental Performance Index***

Iceland leads the world in addressing pollution control and natural resource management challenges, according to the 2010 Environmental Performance Index (EPI) produced by a team of environmental experts. This is the third edition of the EPI, which has been revisited biannually since 2006. The EPI ranks 163 countries on their performance across 25 metrics aggregated into ten categories including: environmental health, air quality, water resource management, biodiversity and habitat, forestry, fisheries, agriculture, and climate change.

Iceland's top-notch performance derives from its high scores on environmental public health, controlling

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greenhouse gas emissions, and reforestation. Other top performers include Switzerland, Costa Rica, Sweden, and Norway – all of which have made substantial investments in environmental infrastructure, pollution control, and policies designed to move toward long-term sustainability. Occupying the bottom five positions are Togo, Angola, Mauritania, the Central African Republic, and Sierra Leone –impoverished countries that lack basic environmental amenities and policy capacity.[35]

The United States places 61st in the 2010 EPI, with strong results on some issues, such as provision of safe drinking water and forest sustainability, and weak performance on other issues including greenhouse gas emissions and several aspects of local air pollution. This ranking puts the United States significantly behind other industrialized nations like the United Kingdom (14th), Germany (17th), and Japan (20th). Over 20 members of the EuropeanUnion outrank the United States‟ ranking does not reflect the recent policy activities of the Obama Administration, as the 2010 EPI builds on data from before 2009.

Of the newly industrialized nations, China and India rank 121st and 123rd respectively – reflecting the strain rapid economic growth imposes on the environment. However, Brazil and Russia rank 62nd and 69th, suggesting that the level of development is just one of many factors affecting placement in the rankings.

Analysis of the policy drivers underlying the 2010 rankings suggests that income is a major determinant of environmental success. At every level of development, however, some countries achieve results that exceed what would be anticipated, demonstrating that policy choices also affect performance. For example, Chile, where

substantial investments in environmental protection have been made, ranks 16th, while its neighbor, Argentina, which has done much less to improve its pollution control and natural resource management, lags in 70th place. Regulatory rigor, the rule of law and good governance, and the absence of corruption also show strong correlations with high EPI scores. [35]

"The 2010 EPI shows the potential for a much more analytically rigorous approach to environmental decision making, but substantial investments in indicators that are systematically tracked and transparently displayed will be needed."

The 2010 EPI represents a "work in progress." It aims not only to inform but also to stimulate debate on defining the appropriate metrics and methodologies for evaluating environmental performance.

(B-III) Environmental Sustainability Index (ESI) 2009 for Indian States

Environment Sustainability Index (ESI) gives you an in-depth state-wise ranking of India through the various performance indicators based on which this ranking has been arrived at. More-over ranking, also able to do a comparative study by selecting the states of your choice. ESI is a comparative analysis of environmental achievements, challenges and priorities among Indian states. It is designed to sensitize, inform and empower citizens and policy makers. It aggregates quantitative data on states‟ initial endowment and resource use trajectory, magnitude of pollution and its impact on human health & ecosystem vitality, policy & societal response to maintain and improve present environmental conditions into a composite index that provides the overall picture of state-level sustainability. [36]

ESI is developed based on the Driving Force-Pressure-State-Impact-Response framework. Thus the chain of causal links starting with „driving forces‟ (Anthropogenic activities) through „pressures‟ (pollution& waste) to „states‟ (air quality, water quality) and „impacts‟ on human health, eventually leading to political

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„responses" (conservation, emission reduction) is reflected in the results.

(B-IV) Green performance index (GPI) 2011

Green performance Index (GPI) 2011 is a direct measure of the negative environmental impact based on Performance assessment developed by us. It expresses the total environmental load of a product or process. For sectors without their own environmental monitoring systems, the Green performance Index (GPI) 2011 can be useful for working out where there is a need for action in environmental policy making. Each indicator can be linked to well-established policy targets. The 2011 GPI relies on 33 indicators that capture the best possible data Green performance Index (GPI) 2011 gives you an in-depth sector-wise ranking of Indian manufacturing industries through the various performance indicators based on which this ranking has been arrived at. More-over ranking, also able to do a comparative study by selecting the sectors of your choice. GPI is a comparative analysis of environmental achievements, challenges and priorities among Indian manufacturing sectors.

So based on the cost and profit we drive a factors responsible for green supply chain profitability. Using these factors we developed a Green performance index (GPI) 2011. This index is useful to evaluate the performance of the organization based upon these factors. Also to know status of the organization that how sustained their organization towards green future. From that we can easily figure out the lagging factors of the organizations.

We can also able to compare the performance of the various manufacturing sectors with each other and also we can compare the performance of the various manufacturing sectors with the retail sector, education sectors and other forms of sectors. From that we can able to analyze the leading sectors and of course lagging sectors towards green future and so that finally we can ranked them accordingly.

As is the case with all ground breaking endeavors, the first mover advantage is enormous, as are the challenges. The given below index that prepared by us effort indicates the mapping of GSCM objectives and describes various level of performance measurement.

Table 1-2 Green performance index (GPI) 2011

Index	Objectives (Level 0)	Indicators (Level 1)	Sub – indicators (Level 2)
Green Performance index (GPI) 2011	(A) Green sourcing & procurement	(A1) Substitute for hazardous material	(A11) Employ green friendly design and product lifecycle management in sourcing strategy
		(A2) Improved quality & Minimal usage of raw material	(A21) Use of electronic processes to create efficiencies
		(A3) Supplier development	(A31) Embed "sustainability" into supplier relationships (A32) Work with suppliers on green SCM guidelines (A33) Audit suppliers for green SCM compliance
		(A4) Reduced resource consumption	(A41) Reduce use of paper in contracts (A42) Localised sourcing for JIT (A43) Others
	(B) Green production & manufacturing	(B1) Process design	(B11) Recycling programs for raw materials (B12) Recycling programs for reusable components parts (B13) Implementing ongoing assessment to measure and ensure Green SCM

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			□	compliance (B14) Reducing in manufacturing processes
		(B2) Product design	□	(B21) Including recycling in new product design
			□	(B22) Increasing product robustness in product design
		(B3) Higher efficiency	□	(B31) Measuring your company's carbon footprint
			✓	(B32) Applying carbon off-setting
			✓	(B33) utilization of fuel efficient tools & machines
			✓	(B34) Other
		(B4) Employee satisfaction	✓	(B41) Improved Labour management
	(C) Green warehousing	(C1) Reduction of energy consumption	✓	(C11) Reducing energy consumption through solar panels and green roofing options
			✓	(C12) Reducing inventory and handling of product
	(D) Green distribution	(D1) Distribution considerations	✓	(D11) Optimizing location of distribution hubs
			✓	(D12) Using reusable containers /storage equipment
			✓	(D13) Implementing order consolidation (decreasing unused space on trucks)
	(E) Green packaging	(E1) packaging material selection and reduce consumption	✓	(E11) Selection of recyclable packaging materials
			✓	(E12) Reduction in packaging materials
	(F) Green transportation	(F1) Alternative fuels	✓	(F11) Replacing diesel-powered trucks with alternatives flues
			✓	(F12) Switching to more fuel efficient modes like boat or rail
		(F2) Logistics optimization	✓	(F21) Reducing expedited shipping
			✓	(reducing air freight)
			✓	(F22) Route optimization (reducing empty miles)
			✓	(F23) Reducing truck idle time
		(F3) Vehicle maintenance	✓	(F31) Periodically Services of the vehicles at service stations
		(F4) Optimized truck load	✓	(F41) Increasing cube utilization
		(F5) Employee satisfaction	✓	(F51) Improved labor management
		(F6) Longer life of vehicles	✓	(F61) Migration to more aerodynamic trucks

IX. IMPORTANT FINDINGS & SURVEY RESULT:-

Sample target of the 100 various multiple manufacturing industries with a total of more 200 respondents, out of which 35 % of respondents indicates them self as a top priority of the organization & rest of the percentage value are like supervisors & various other's co-workers of the manufacturing unit. We collect the data from all forms of the sectors like micro & small scale are of [45%] and [55%] are from the medium and large scale enterprises[both government and private oriented manufacturing unit].

INDUSTRY FOCUS: - Respondents to the survey came from a variety of industry sectors {Micro, Small, and Medium & Large Enterprises}. Major Categories we covered are Railway's locomotive Manufacturer's , & Auto Parts Manuf. [25%], Hand Tools & Cutting Tools Manuf.[30%], Industrial Equipments (Agro ,Electrical

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& Safety) ,Machinery, Components/ Parts Manuf.,[27%] & various Others Manuf.,{ Like Food Products & Beverages Manuf., Paint manuf., Pipe manuf., Paper, Rubber & Plastic products manuf., Soap & chemical manuf., Packaging products manuf. [18%] ;

1. Key Environmental Issues Facing in Indian Manufacturing Sectors

With India's rapid growth, it's no secret concerns such as

CSR (Corporate Social Responsibility) and green best practices were put on the back burner. As a result, there is a perception that companies need more information about environmental sustainability. According to the individuals surveyed, the most important issue facing manufacturing sectors in India is the lack of awareness about environmental issues [51%] followed by waste disposal [40%] . Others issues such as conserving natural resources and green buying preferences were also some concern. The challenge of complying with government regulations came out as the least important issue, although it was still cited by one in five respondents as important.

Open ended responses raised additional pertinent issues. One being the need to ensure that the standards and protocols of retail customers in the Indian market are clearly communicated in India with partner factories and their management. Other concerns included overproduction of goods, green packaging, green energy and complying with chemical & hazardous materials regulations.

The bright side to a lack of awareness about environmental issues is that it can easily be addressed through education. The general signs are optimistic that Indian manufacturing sector moving in this direction.

2. Timeline for Implementing Green Initiatives

Another positive indicator about Green supply chain management (SCM) in India is that close to one in six [14%] of the industries surveyed said they would be implementing green SCM initiatives in the next six months. Another third [31%] plan to implement green initiatives within the next six months to two years. Of some concern is the fact that more than one in five [24%]of industries have no initiatives planned and another one in five [24%] are not sure about their company's plans.

3. Green sourcing & procurement focused initiatives

Using electronic processes to create efficiencies in sourcing and procurement was top initiative cited to half [40%] of the survey respondents. Other initiatives such as employing green friendly design and product lifecycle management and working with suppliers on sustainability and green SCM guidelines were almost equally planned and implemented initiatives in manufacturing sectors of India. Training and development of internal staff and suppliers and clients were also cited as important initiatives.

Reducing paper in contract and auditing suppliers were the least commonly implemented initiatives (both cited by less than a 3rd of respondents). The indicators here are positive and suggest that as technology improves and supply chains become more efficient, green practices will become more prevalent.

4. Green productions & manufacturing focused initiatives

Given that recycling is a concept that has had time and support to be successfully adopted by consumers and the broader society, even in Indian manufacturing sector, it's not surprising that utilization of fuel efficient tools & machine initiatives are a priority for companies. Recycling programs for raw materials and for reusable component parts were the most common green production and manufacturing focused initiatives.

Applying carbon off-setting was a distant priority. Carbon offsetting is a relatively new and abstract concept

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which will take time to adopt. Other green production and manufacturing initiatives that Indian manufacturing companies are implementing include the introduction of "returnable and reusable" packaging, reducing the usage of solvent based chemicals and choosing compliant factory and supplier partners.

5. Green warehousing & distribution focused initiatives

Most companies seem to be quite advanced in the implementation of green warehousing and distribution initiatives, most likely because these initiatives often also mean added efficiency. Companies appear to be most ahead in green practices in their inventory reduction and product handling [53%] have already implemented initiatives; and their ability to consolidate orders [44%] have already implemented these initiatives; and usage of reusable containers and storage equipment , where [57%] have already implemented these initiatives.

When it comes to reducing energy consumption through the use of solar panels or green roofing options, surprisingly [14 %] of companies have already adopted such initiatives. Similarly around [22%] of companies report that they have already optimized the location of their distribution hubs. While these types of initiatives show direct cost and efficiency benefits, the up-front cost associated with them may be why more companies have not adopted them.

6. Green transportation focused initiatives

Manufacturing Companies in India are also fairly well advanced in the types of green transportation focused initiatives they have adopted. Similar to their production and warehousing initiatives, there is a crossover between implementation of green and levels of efficiency. Almost half of companies surveyed are already periodically services of the vehicles at service stations along reducing empty miles, truck idle time and increasing cube utilization to create efficiency.

Adoption of more sophisticated green transportation measures which have less direct relation to efficiency and cost savings are not in wide practice. These more advanced green transportation measure such as using more aerodynamic trucks [9%] and more alternative fuel powered trucks are all adopted by [11%] or less of companies.

7. Collaboration with suppliers and/or customers on Green

Supply chain is by nature a collaborative field, so it makes sense that creating green supply chains requires buy-in from all links in the chain. Working with suppliers was identified throughout the survey as a key issue to improving the awareness and practice of Green SCM in Indian manufacturing sector. Specifically almost a third of the respondents reported having "active discussions" regarding collaborating on reducing environmental impact [32%].

A third of the individuals surveyed are either sharing sustainability policies or enforcing supplier specific mandates for change. What should be of some concern is that almost a third [31%] of respondents is not currently collaborating with their extended supply chain. It seems without collaboration throughout the chain, the real impact of Green SCM will be negligible.

8. Use of electronic tools to support company – wide Green SCM initiatives

E-tools to support green initiatives in companies are mostly used in logistics and materials management processes [36%], information integration [35%] and forecasting [24%] and are least likely to be used in customs management [10%]. What is telling here is that almost half of the companies surveyed are not using e-tools extensively across their company's supply chain. This might present an opportunity for greater use and adoption

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of e-tools to support green SCM practices.

9. Criteria for selection a vendor to support your Green initiatives

One of the top criteria for choosing a vendor to support green initiatives is that they are committed to environmental protection [36%]. Experience in supply chain integration along with knowledge regarding global environmental initiatives [23%] is also rated as important criteria. Robust infrastructure and a global footprint were the lowest rated criteria for selecting vendors to support green initiatives. The implication here is that for vendor selection, know-how about technology is less essential than its commitment to environmental initiatives and experience in supply chain integration and automation.

10. Barriers to adopting Green SCM practices biggest perceived barrier to adopting Green SCM is that it is cos Costs are ultimately a big factor in companies" strategies and practices in green supply chain management. The biggest perceived barrier [26% of respondents] to adopting Green SCM practices is that it is cost prohibitive, followed closely by it being too complicated to implement [25% of respondents]. Almost a third of the companies surveyed [17%] felt that there were no financial incentives to justify adopting Green SCM. Lack of executive support was not felt to be a significant barrier. Insufficient technology was only perceived by one in five respondents as a barrier. The message seems clear that if green SCM makes financial sense and is easy to implement, chances for adoption are much higher.

11. Incentives for implementing Green practices

Being perceived as a green company is obviously still very important to many companies. Brand building was listed as one of the top incentives [43% of companies] for implementing green practices, along with compliance with company goals on sustainability [40%] and increasing supply chain efficiency/reducing waste [42%]. Other incentives for implementing green practices include cost savings, efficiency and a perception that being green will bring a competitive advantage. On the positive side, very few companies felt that there is no motivation for applying green practices. Clearly, companies perceive significant value in implementing green practices.

X. SUMMARY AND DISCUSSIONS

1. [40%] of Indian manufacturing sectors Use electronic processes to create efficiencies in sourcing and procurement
2. Cost and complexity are perceived as the biggest barriers to implementing Green SCM, which highlights the need for cost effective and easy to implement solutions.
3. Brand building is one of the top incentives for green SCM, highlighting the importance of public perception of how companies operate.
4. Recycling of raw materials and component parts are the top green manufacturing and production focused initiatives
5. Adoption of green practices is highest in those areas of the supply chain where there is a direct relation to cost savings and efficiency, for example in inventory reduction, recycling of raw materials.
6. Almost a third of respondents are not collaborating with their extended supply chain on green practices.
7. 64 % of companies are not using e-tools extensively to support their supply chain operations, suggesting an opportunity to explore greater usage of electronic tools to facilitate green practices among the other half.

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Most of the Indian manufacturing small and medium enterprises like cutting & hand tools & auto parts & spare parts & industrial equipments and machinery manufacturer & various other products manufacturer are seem to be quite advanced in the implementation of green warehousing and distribution initiatives, most likely because these initiatives often also mean added efficiency. Those enterprises appear to be most ahead in green practices in their inventory reduction and product handling [53%] have already implemented initiatives; and their ability to consolidate orders [44%] have already implemented these initiatives; and usage of reusable containers and storage equipment, where [57%] have already implemented these initiatives.

When it comes to reducing energy consumption through the use of solar panels or green roofing options, surprisingly [14%] of companies have already adopted such initiatives. Similarly around [22%] of companies report that they have already optimized the location of their distribution hubs. While these types of initiatives show direct cost and efficiency benefits, the up-front cost associated with them may be why more companies have not adopted them.

XI. FUTURE SCOPE FOR FURTHER RESEARCH:

As like above techniques and methods we can developed more quantitative techniques to measure the performance & we can also calculate the carbon emissions of any particular process, product or any organizations etc by simple mathematical calculations work . we can also take any particular case study of any bigger organization to do more work efficiently in cast effective and cost benefit way towards green supply chain future .

REFERENCES

[1] J. T. Mentzer, W. DeWitt, J. S. Keebler, N. W. Nix, C. D. Smith and Z. G. Zacharia, "Defining supply chain management," Business Logistics, vol. 22, no. 2, pp. 1-25, 2001.

[2] D. M. Lambert and M. C. Cooper, "Issues in supply chain management," 2003

[3] H. Chunfeng, "The Mode of international automobile cluster of enterprises and which mode should Guangzhou automobile cluster of enterprises choose," Jinan University Master Degree Thesis, 2005.

[4] Qinghua Zhu & Joseph Sarkis, "Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises," (2004)

[5] Qinghua Zhu, Joseph Sarkis & Kee-hung Lai , "Green supply chain management: pressures, practices and performance within the Chinese automobile industry ," (2006)

[6] Helen Walker' Lucio Di Sisto and Darian McBain,"Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors ," (2008)

[7] Jamal Fortes, "Green Supply Chain Management: A Literature Review," (2008)

[8] Fengfei Zhou, "Study on the Implementation of Green Supply Chain Management in Textile Enterprises," (2009)

[9] Dornfeld, David, UC Berkeley, "Opportunities and Challenges to Sustainable Manufacturing and Chemical Mechanical Planarization (CMP) ," (2009)

[10] Reich-Weiser, Corinne, Uc Berkeley Vijayaraghavan, Athulan, UC Berkeley, "Appropriate use of

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

Green Manufacturing Frameworks," (2010)

[11] Joseph Sarkis a, QinghuaZhu b, Kee-hungLai c, "An organizational theoretic review of green supply chain management Literature," (2010)

[12] L. K. Toke, R. C. Gupta, Milind Dandekar, "Green Supply Chain Management; Critical Research and Practices, " 2010)

[13] Zhi Tao, Alfred L. Guiffrida, Marvin D. Troutt, "A Green Cost Based Economic Production/Order Quantity Model," " (2010)

[14] Frank Teuteberg, David Wittstruck , "A Systematic Review of Sustainable Supply Chain Management Research," " (2010)

[15] Ninlawan C, Seksan P, Tossapol K and Pilada W, "The Implementation of Green Supply Chain Management Practices in Electronics Industry," " (2010)

[16] Benjamin D. Reed , " Introducing Green Transportation Costs in Supply Chain Modeling," " (2010)

[17] Hokey Min, "Measuring the effectiveness of the country" s green supply chain from a macro perspective," " (2010)

[18] Jinesh Jain, G. S. Dangayach, G. Agarwal, Soumya Banerjee, " Supply Chain Management: Literature Review and Some Issues," " (2010)

[19] Chung-Hsiao, "The Green supply chain management in the electronic industry" (2008)

[20] Ninlawan & Tossapol , "The Implementation of Green Supply Chain Management Practices in ElectronicsIndustry"(2010)

[21] Robert & Benjamin,"Introducing Green Transportation Costs in Supply Chain Modeling".(2010)

[22] M.A. Salam, "Green procurement adoption in manufacturing supply chain," Proceedings of the 9th Asia Pasific Industrial Engineering & Management Systems Conference (APIEMS2008), Indonesia, pp.1253-1260. 3-5 December (2008)

[23] M. Atlas & R.Florida "Green manufacturing," Handbook of Technology Management (2008)

[24] Brundtland Commission Report, UN, 1987.8. Allwood,J., "What is Sustainable Manufacturing?," Lecture, Cambridge University,February (2005).

[25] Chopra, S. Lakshmi , "Turning Over a New Leaf", Indian Management, Vol-64, April-(2007)

[26] J.A. Ottman, , "Avoiding Green Marketing Myopia", Environment, Vol-48, June- (2006)

[29] Miss. P. Pirakatheeswari " Green Marketing – Opportunities & Challenge " (2009)

[30] Saurabh Gupta, Thesis, "To study the effect of various strategies adopted by different companies to implement Green Marketing" Submitted on: 24 February, (2010).

[31] Hiroyuki Sato, Executive Director Green Purchasing Network (GPN), Japan, "Greening Supply Chain and Green Purchasing" (2003).

[32] McKinnon Alan, Cullinane Sharon, Browne Michael, Whiteing Anthony, "Green Logistics: Improving the environmental sustainability of logistics" " , (2009)

[33] Sally Vivian & Estelle Morgan, URS Corporation Ltd Mannual (2010)

[34] Logistics Performance Index (LPI) Survey report, (2010)

[35] Environmental Performance Index (EPI) Survey report, (2010)

[36] Environmental Sustainability Index (ESI) for Indian States Survey report, (2009)

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

[37] Christopher, M. (1994). Logistics and supply chain management. New York: Richard D. Irwin, Inc.

[38] Lee, H. L., & Billington, C. (1993). Material management in decentralized supply chain. Operations Research, 4 (5), 835-847.

[39] Nicoll, A. D. (1994). Integrating logistics strategies. Annual International conference proceedings, American Production and Inventory Control Society, 590-594.

[40] Johnson, J. B., & Randolph, S. (1995). Brief: making alliances work-using a computer based management system to integrate the supply chain. Joumal of Petroleum Technology, 47 (6), 512-513.

[41] Hammel, T. R. (1993). Tightening the supply chain. Production and Inventory Management Joumal, 34 (2), 63-70.