

# Productivity Improvement through Green Productivity

**Dr. Anil Kumar Saxena**

## 1.0 Introduction

**Productivity** is one of the factors considered for economic development of any nation. The increase in the production was considered as productivity improvement by increasing the inputs. Labour productivity was considered by economists while discussing about productivity as the amount of product produced by each unit of labour. Later on, it was realised that labour is not only the factor for productivity but also the other input resources are also important to improve the productivity. All inputs contribute to the productivity of a business which include labour, machinery, land, raw materials and human capital. In the earlier days, the natural resources were utilized liberally in view of easy availability resulting in fast depletion with the growing demand of ever-growing population. It may be noted that the natural resources are not unlimited and the businesses have to utilize these resources judiciously and take into account other resource inputs while calculating productivity.

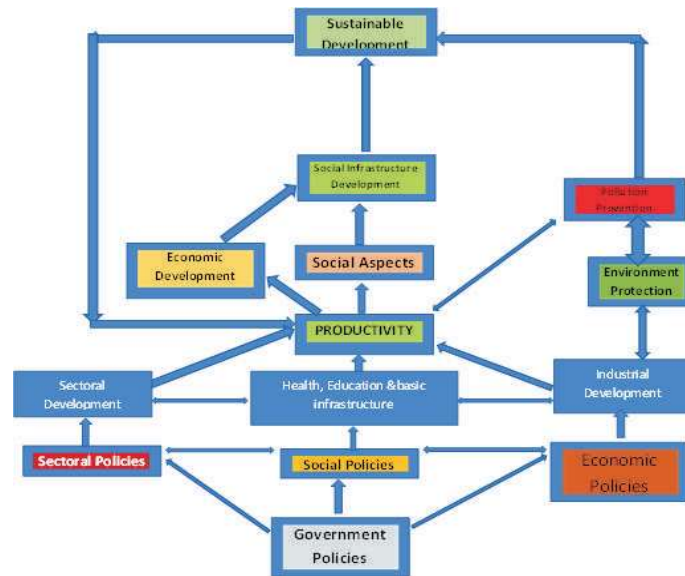
A country that has a higher level of productivity than another one is able to produce more with the same amount of inputs and is thus comparatively more competitive. In contrast, countries with higher productivity growth experience larger relative increases in their output than those with lower productivity growth rates. One can see that the contribution of different factors of production to growth varies across countries due to differences in inputs, such as labour and capital and total factor productivity (TFP). Economic growth can also take place when firms are able to increase levels of output by using existing inputs more efficiently and effectively. A nation that has a higher level of productivity is able to produce more with the same amount of inputs and is comparatively more competitive. Productivity, in a broad sense, is a measure of how efficiently and effectively resources are used as inputs to produce products and services needed by society.

Any form of economic activity, be it agriculture, industry or the services sector, involves use of natural resources which is increasing rapidly, coupled with population growth. The process of utilizing these resources results in degradation of the environment. It is now recognized fact that production and consumption patterns have become unsustainable which has led to severe, and in many cases, irreversible deterioration of the environment. There is a need to change strategy for economic activity in order to conserve the natural resources to protect the environment. Therefore, resource utilization needs to be made more efficient. Manufacturing processes, which consume maximum resources, result in pollution in the form of air emissions, wastewater and solid waste generation which will impact air, water, land and associated biota. Also, the use and disposal of products by consumers again results in pollution of air, water and land.

*Increasing awareness and growing public concern about the negative impacts of agriculture, industry and services on natural resources is forcing a rethinking of the strategy for growth and economic development.*

By the late 20th century, the concept of sustainable development became important for the growth of a nation. The sustainable development was discussed first at Rio Earth Summit in 1992 by the leaders and Agenda 21 was passed for sustainable development. It was decided that investing in sustainable development goal will foster productivity growth. There is a correlation between productivity improvement with sustainable development and government policies which directly and indirectly affects the economic growth of a nation. The social policies of the any nation contribute in expanding education, health and other basic infrastructure systems. On the other hand, economic and sectoral policies of government may strengthen productivity by promoting sustainable industrialization through reducing waste

generation at source by using pollution prevention, waste minimization, cleaner production and pollution control techniques & technologies. This would ultimately lead to sustainable development. Figure 1 shows relationship between Government policies with productivity and sustainable development.



**Figure - 1: Framework for Networking between Social, Economic, Productivity and Sustainable Development**

Economic liberalization in India has led to rapid growth in export-oriented industries, urbanization, construction boom in late nineties. From an economic perspective, both trade liberalization and environmental protection are inherently important and interlinked. There is a need to combine both these aspects to promote sustainable economic development

*"Environment and development are not separate challenges; they are inexorably linked. Development cannot subsist upon a deteriorating environmental resource base; the environment cannot be protected when growth leaves out of account the costs of environmental destruction. They are linked in a complex system of cause and effect."*

*The important point to be noted here is that the rate at which resources are extracted must be at slower rate than that the rate at which they are replenished by natural processes. This is the core or the essence of sustainable development. Our Common Future, The World Commission on Environment and Development,*

### 1.1 Importance of SMEs

Small & Medium Enterprises (SMEs) are the backbone of economic development and engine of growth, particularly in Asian countries. These industries constitute more than 50% of the total industrial sector output in China and India, and for 10% - 25% in most other Asian countries. The importance and dynamism of SMEs is one of the distinguishing features of the industrial sector in Asian countries. They are the important source of employment for low income earners, thus helping to alleviate poverty.

*Pollution is a form of a waste and a symptom of inefficiency in industrial production.*

SMEs on the contrary have limited resources at their disposal - both technical & financial and often find themselves unable to afford address the changes, in their system, necessary to meet fast changing environmental regulations and product quality. They pose difficult pollution abatement problems because of complexity of pollution potential. Though, they are not the major polluters in most sub-sectors, but generally their pollution potential is more per unit of output than large firms operating in the same sector.

## 1.2 Productivity and Environment Management

Industry is central to the economies of modern societies and an indispensable vehicle of growth for any nation. Industry has an impact on the natural resource base throughout the entire cycle, from raw material exploration and extraction to product use and disposal. These impacts may be both positive by enhancing the quality of life and also negative in the form of pollution and depletion/degradation of resources which may happen both during the manufacture of goods and services as well as during their use and disposal. In most of the nations, the excess fertilizers and pesticides are being used in agriculture sector. Thus, impacting the soil and water resources. The concept of economic development has to be looked differently in view of increasing awareness and growing public concern about the negative impacts of agriculture, industry and services on natural resources.

Earlier the society was market driven however after liberalization of industrial policy in nineties in India, it has become consumer driven due to availability of variety of competitive products. A knowledgeable consumer drives producer to be more responsible and accountable. In the changed scenario, communication plays a major role in driving development towards a sustainable path.

No business can long operate forever by depleting the natural environment. Hence in order to sustain growth for any nation, it is important to address both the quality product and environment conservation. The World Council of Environment and Development (WCED) addressed these issues and provided definition of "**Sustainable Development**" in his book entitled "Our Common Future" in 1987 as "*development that meets the needs of the present generation without compromising the ability of the future generations to meet their needs.*" World Business Council of Sustainable Development (WBCSD) coined the term "Eco-efficiency" and first introduced as a concept in 1992 in Changing Course at the Rio 'Earth Summit'. The trend of 'Environment Management' has changed since 1950's from ignorance to dilution (1960's) to pollution control & prevention (70's & 80's) and now to eco sustainability through Green Productivity.

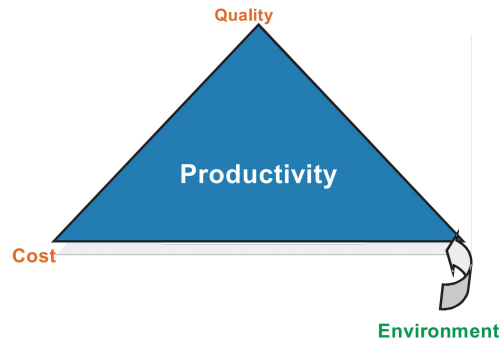
*"By considering pollution prevention separately from other manufacturing needs such as productivity and quality improvements, most pollution prevention programs fail to develop the vital synergies and working relationships with manufacturers that are essential to drive both pollution prevention and manufacturing competitiveness....."*

*Industry, Technology and the Environment -- Competitive Challenges and Business Opportunities. The US Congress, Office of Technology, January, 1994*

## 1.3 Integration of Environment and Productivity

Traditionally, productivity improvement focused on cost effectiveness through cost reduction. Therefore, to improve profitability or organizational effectiveness, the approach used was cost reduction. With the advent of "the quality" drive, productivity had to be measured by comparing the benefits accrued from a quality program (output) with the resources used within the programs (inputs). To some extent, productivity practices such as preventive maintenance and good housekeeping reduce the environmental burden. However, for total environment management, it is necessary to integrate these productivity improvement programs. Thus, the environment is the ultimate foundation for business and economic productivity. By the onset of early nineties, environment became one of the important factors while assessing the productivity. The integration of environment with productivity is shown in Figure 2.

*The total quality movement may be one vehicle through which environmental issues can be integrated into business as a whole.*



**Figure - 2: - Integration of Environment in Productivity**

## 2.0 Evolution of Green Productivity

No business can long operate without a profit. A business that loses money will eventually drain the resources of its society. No business can also not operate forever by degrading the natural environment. The environment is the ultimate foundation for business and economic productivity. The earth provides huge resource bank from where we can withdraw and spend. However, this resource bank is not unlimited. Everyone pays for earth's resources as per their cost of extraction and not their cost of creation. It takes millions of years to create resources however, it will not take time to deplete these resources, if not used judiciously. If it is not replenished, the ATM of resources bank will become bankrupt. It is therefore, businesses should track the environmental resources it consumes - and take responsibility for their replenishment.

*There are sufficient resources for the need of everyone however, not for the greed of person.*

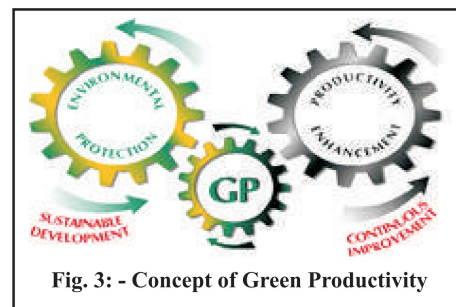
*Mahatma Gandhi*

The need to fundamentally change the approach to business by moving towards resource efficiency and taking a holistic life-cycle view of products was recognized in the 1990s. Resource efficiency not only leads to protection of natural resources, but also results in improved productivity. Therefore, if development is to be sustainable, there is a need to move beyond pollution prevention and ensure that both productivity improvement and environmental protection are achieved simultaneously.

Rio Earth Summit in 1992 addressed Sustainable Development to conserve natural resources. Asian Productivity Organization (APO) took the initiative and formalized the concept of integrating resource conservation with productivity and coined the term "Green Productivity" in 1994.

## 2.1 Concept of Green Productivity (GP)

Green Productivity (GP) reconciles two needs that are often in conflict that is the need for business to earn a profit and the need for everyone to protect the environment. **Green Productivity (GP) is a strategy for enhancing a business's productivity and environmental performance at the same time, for overall socio-economic development (Figure 3).** It is the application of appropriate techniques, technologies, and management systems to produce environmentally compatible goods and services. GP acts as a catalyst for moving two wheels of development i.e., productivity improvement and environment protection.



**Fig. 3: - Concept of Green Productivity**

GP has two "silver bullets" - Productivity Enhancement and Environment Protection. It enables us to do more and use

less. **"Doing more" is a function of innovation.** Designer William McDonough calls that eco-effectiveness. "Using less" is a function of efficiency - or what environmentalists call eco-efficiency. GP puts them together. Green Productivity is part of a much broader movement of change that goes by many names - natural capitalism, corporate sustainability, industrial ecology, and others. Green Productivity is a system popular in Asia that combines the tools of productivity enhancement with insights from nature to deliver gains in each. The productivity tools used are Just-in-time, inventory management, source reduction, dematerialization, and environmental design.

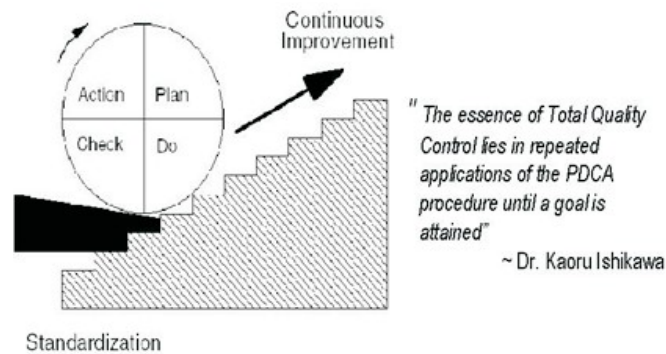
The goal of GP is to attain a higher level of productivity to serve the needs of society, and to protect and enhance the quality of environment - both locally and globally. GP and eco-efficiency share a common vision. GP, however, looks at environment and productivity in an integrated manner to form the foundation of sustainability, considering the harmony needed between production as well as consumption.

GP recognizes that all the pollution and waste generated are the wasted resources which is not able to convert resources into saleable products. From this perspective, pollution and waste are the inverse of corporate productivity. GP seeks to eliminate this process inefficiency - pollution and waste. It also sets out to promote innovations that create new valuable products or processes. In these two ways - reducing waste and increasing innovation - GP helps a company increase productivity.

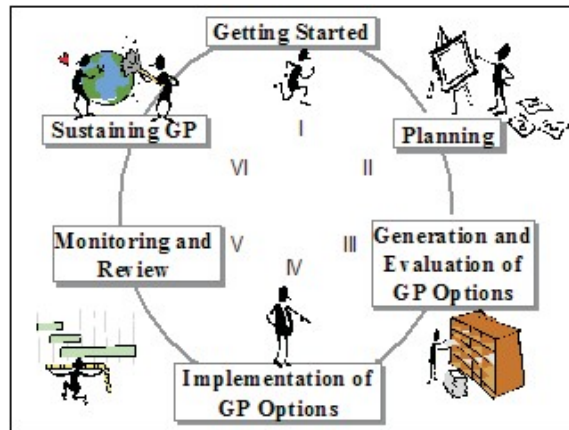
## 2.2 GP Methodology

There is a step-by-step problem-solving framework developed by the APO for GP. GP methodology was developed originally to solve environmental and technical problems in the manufacturing industry which is based on **Deming's Cycle** i.e., 'Plan-Do-Check-Act' (PDCA) as shown in Figure 4.

**Figure - 4: PDCA Cycle for Continual Improvement.**



GP methodology has three components i.e.; (1) the step-by-step problem solving framework, (2) the set of tools, techniques and methodologies used in conjunction with the frame-work, and (3) The social, economic, environmental and cultural principles and values that govern the choice of tools, techniques and technologies and the design of the GP process. The problem-solving framework, in one form or another, is widely used in many organizations and enterprises. APO implemented and tested this framework in a number of Green Productivity Demonstration Projects (GPDPs) in different APO member countries and developed a 6-step approach with 13 tasks (Figure 5). The methodology used in GP were none other than productivity tools & techniques.



### 6 Steps & 13 Tasks of GP Methodology

GP methodology consists of six major steps. A step can be completed by following certain tasks. The six steps of GP methodology consist of thirteen tasks.

#### Step I: Getting Started

- Task 1 Team formation
- Task 2 Walk through survey and information collection

#### Step II: Planning

- Task 3 Identification of problems and causes
- Task 4 Setting objectives and targets

#### Step III: Generation, Evaluation and Prioritization of GP Options

- Task 5 Generation of GP options
- Task 6 Screening, evaluation and prioritization of GP options
- Task 7 Formulation of GP implementation plan

#### Step IV: Implementation of GP Options

- Task 8 Implementation of selected options
- Task 9 Training, awareness building and developing competence

#### Step V: Monitoring and Review Task 10 Monitoring and evaluation of results

- Task 11 Management review

#### Step VI: Sustaining GP

- Task 12 Incorporating changes into organization's system of management
- Task 13 Identifying new/ additional problem areas for continuous improvement.

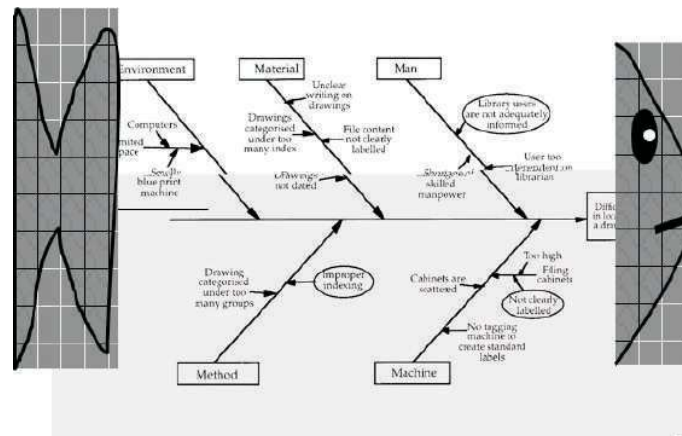
### 2.3 How to implement and measure Green Productivity?

The core metric of the industrial economy, where information multiplies resources of all kinds is total resource productivity: labour, capital, land, raw material, water and energy. That means all inputs into production have to be used with the aim of obtaining the greatest possible output with the least possible input use. There are many ways to measure resource productivity or key components of resource utilization/productivity. There are many ways to express resource productivity depending on the professional background and skill. It is important for any establishment be it a society, industry or service sector to find out the root cause of the problem of inefficiency leading to non-productivity.

There are a number of tools & techniques available to measure productivity. However, one of the important tools is a Cause-Effect diagram also called as Fish-bone diagram because of its appearance, where head of fish represents the core problem (Figure 6). This is also known as an Ishikawa diagram after the man who popularized it in Japan. The

principle of this cause-effect analysis is based on "**Four M**" indicating that any problem may happen because of Man, Material, Machine and Method. The Cause and Effect analysis helps one to:

- Focus attention on a specific problem.
- Organize and display theories about its root causes.
- Show the relationship of factors that influence a problem.
- Focus your team on causes, not symptoms.



**Figure - 6: Fish bone diagram for Problem Analysis.**

While doing cause and effect analysis one should remember to:

- identify causes and not solutions.
- causes that appear repeatedly.
- Identify and review each major cause category and highlight the most likely causes on the diagram.
- verify the most likely cause with data.

## 2.4 Prioritizing Problem Areas

Each organization has to develop criteria for prioritizing areas according to their business requirement. However, the primary criteria for prioritization could be:

- **Severity of the problem** - this refers to the scale and implications of the problem.
- **Frequency** - this indicates the recurrences of the problem. An insignificant problem repeating several times in a production cycle can cause greater damage than a severe problem once in five years.
- **Cost implications** - cost information of the possible solution is needed so as to check the affordability before setting an objective.
- Lastly, but most importantly, the **estimated cost of inaction** - this is the cost of not taking any action on a problem. This is estimated by costing the waste streams.

The scores can be decided by the mutual consensus of the group and a final score, based on the integration of the above parameters, would compare the problems on a macro-level and help in setting the objectives and targets. After identifying the problems and their causes, the next essential input for setting objectives and targets is costs of waste streams, including resources (raw materials / products/ by-products). In simple terms this cost is the cost of inaction.

The businessmen understand the financial aspects very easily. They can be made aware about environmental issues in

terms of costs. In order to determine the monetary losses due to the generation of wastes, it is important to assign costs to the waste stream. While the detailed analysis of the streams provides data for identification of problems that then leads to the cause analysis, the cost assignation provides a basis for generation of viable options.

Such a strategy helps in prioritizing which areas need to be tackled first and what types of options need to be looked at for not only resource conservation but also cost reduction which will ultimately lead to environment protection. The assigning cost to waste streams can be used at several points in the GP methodology viz.; identification and prioritization of problems, setting objectives and in monitoring/corrective action.

We often think of waste as Generally, the physical things like materials, water, electricity, etc. are considered as waste. However, in the context of productivity, waste is defined as any form of work which does not add value to the final output. Some of the companies in Japan for example The Toyota Production System has defined waste as 7 Wastes to include things like excessive stocks, waiting, movement or transport as below:

*The 7 Wastes can be used as a guide while identifying area for improvement.*

- **Waiting** : Leaving resources waiting during production;
- **Transporting** : Moving materials unnecessarily in the factory;
- **Processing** : Wastes inherent in the process or design itself;
- **Inventory** : keeping high inventory or work-in-process (WIP);
- **Motions** : Unnecessary movements of the worker during operation;
- **Defects** : Producing defective parts or poor service;
- **Overproduction** : Produce more than what is needed.

## 2.5 GP Barriers

First and the foremost requirement for implementing GP is the commitment. The top management plays a critical role in the success of the GP Program. It has to ensure that the GP program is established by incorporating appropriate changes into organization's system of management to enable continuous improvement. It may be noted that this is not a work of a single person and it is a team effort. There are many hurdles in implementing GP in any organization. There are a number of barriers for implementation which can be categorized as below:

- Attitudinal barriers;
- Information related barriers;
- Technical barriers; and
- Financial barriers.

Resistance to change is one of the most common attitudes observed at every stage, particularly among SMEs. Fear of the unknown and fear of failure are the primary reasons for such an attitude. In most of the family-run SMEs, good housekeeping and management of environmental issues are generally considered as a low priority as compared to the business operations. A common myth in most of the organizations is that efforts on environmental management are expensive with no accrual of financial benefits. However, it has been observed and demonstrated under GPDPs in various APO member countries that by just changing some housekeeping practices, may result in considerable resource conservation leading not only to environment conservation but also productivity improvement.

Good housekeeping refers to a number of practical measures based on common sense that organizations can undertake to improve their productivity, obtain cost savings and reduce the environmental impact of their operations. Good housekeeping is more of a habit than a technique which is aimed at:

- Rationalizing the use of raw materials, water and energy inputs;
  - Reducing the volume and/or toxicity of waste, wastewater and emissions related to production;
  - Conserving material and energy;
  - Improving working conditions and occupational safety.
- The good housekeeping practices normally do not require significant investment. It is mostly the application of common sense.

### 3.0 Journey of Green Productivity

The journey of Green Productivity started in 1994 with the establishment of Working Group on Productivity & Environment to conduct research in ten Asian countries. Initially, the focus was on application of cleaner production techniques which subsequently broaden to incorporate more productivity & environmental tools & techniques, including pollution control and target mostly on SMEs which was the backbone of economic development of developing nations. The concept was also extended to farms and community level for socio-economic development of villages, in Vietnam.

India in association with APO has been involved in GP movement since its beginning. National Productivity Council of India has been active in GP Demonstration Projects in industrial and service sector since 1995-96 and also capacity building on GP in various APO member countries.

Manila Declaration on GP was made during the World Conference on GP in 1996 at Manila. Realizing the knowledge base in Japan, APO founded the GPAC in 2003 in cooperation with leading Japanese companies. GP received wider publicity from the Eco-products International Fairs which was initiated in 2004. Since then, these fairs are being organized in APO member countries.

#### 3.1 The major milestones in GP journey are

- 1994: Establishment of Working Group on Productivity & Environment
- 1996: Manila Declaration
- 1996 & 2002: World Conference on Green Productivity
- 2002: Presented Achievements of GP activities in the World Summit on Sustainable Development in Johannesburg
- 2003: Establishment of GPAC
- 2004: Launched Eco-product International Fair & Publication of Eco-product Directory
- 2006: Launched E- learning program

#### 3.2 Achievements of GP

During the course of more than 25 years of launching of GP program by APO, the businesses, farms & community have contributed to the cause of Sustainable Development by improving their efficiencies and protecting the environment in Asia-Pacific region, with or without the support of APO. Some of the major highlights are given below:

- I) **Policy Intervention:** The countries like Malaysia, Thailand & Singapore have incorporated GP concept in their National Development Plans.

- ii) Malaysia established "**International Green Purchasing Network**" in collaboration with the Japanese Government.
- iii) **Capacity Building:** The capacity building programs, on various aspects of energy & environment, were initiated by APO to develop knowledge base not only amongst the business enterprises, administrators, professionals, regulatory bodies, etc. but also the NPOs through short term & long-term training programs, workshop-cum-seminar, GPDP, etc. More than 4500 professionals have been trained so far on GP.
- iv) **GPDP:** Seeing is the believing was the basis for GP demonstration projects. The demo projects have been the instrumental in accepting the GP concept by the industrial units and community. These demo projects resulted in cascading impacts on environment protection & productivity enhancement in a number of industries in the APO member countries.
- v) **EPIF:** About more than 500,000 people have benefited through the Eco-product International Fairs organized since 2004. APO has brought out eco-product directories based on the exhibitors display & their profiles.

#### 4.0 Way Forward:

GP is an umbrella concept covering a hierarchy of improvement opportunity. GP fosters the change process to help businesses not only to cater to the customer need for better environmentally safe products but also to improve their bottom line by conserving natural resources through improved production efficiency. With the growing concern of general public for the demand of "Green & Environmentally Friendly Goods & Services", the concept of GP can turn table round.

Green Productivity has brought substantial & tangible results during the course of its journey since 1994. The APO has contributed towards realizing the goals of Agenda 21 by bringing sustainability in the Asia-Pacific region by the application of GP. The APO will continue its efforts towards sustainable development not only in the Asia-Pacific region but also would like to extend other part of the World through international collaboration. The message is loud and clear, promote Green Productivity as a simple strategy to innovate sustainability for economical, environmental and social (triple bottom line) returns and poverty alleviation.

#### References:

1. Anil Kumar Saxena, The APO's Green Productivity journey and achievement; APO News, May, 2011.
2. Carson Rachel, Silent Spring, Boston, Houghton Mifflin Company, 1962.
3. GP Training Manual, Asian Productivity Organization, Tokyo, August, 2002.
4. Mechanical and Industrial Engineering, University of Massachusetts, 1999.
5. Robins N., Roberts., S, Changing Consumption and Production Patterns, Unlocking Trade Opportunities, HED, UK, 1997.
6. Training Manual on Green Productivity, Asian Productivity Organization, Tokyo, Japan,
7. U.S. Congress, Office of Technology Assessment, Industry, Technology and the Environment: Competitive Challenges and Business Opportunities, OTA-ITE-586 Washington, DC: US Government Printing Office, January 1994.
8. World Commission on Environment and Development, Our Common Future, Oxford University Press, Oxford, 1987.