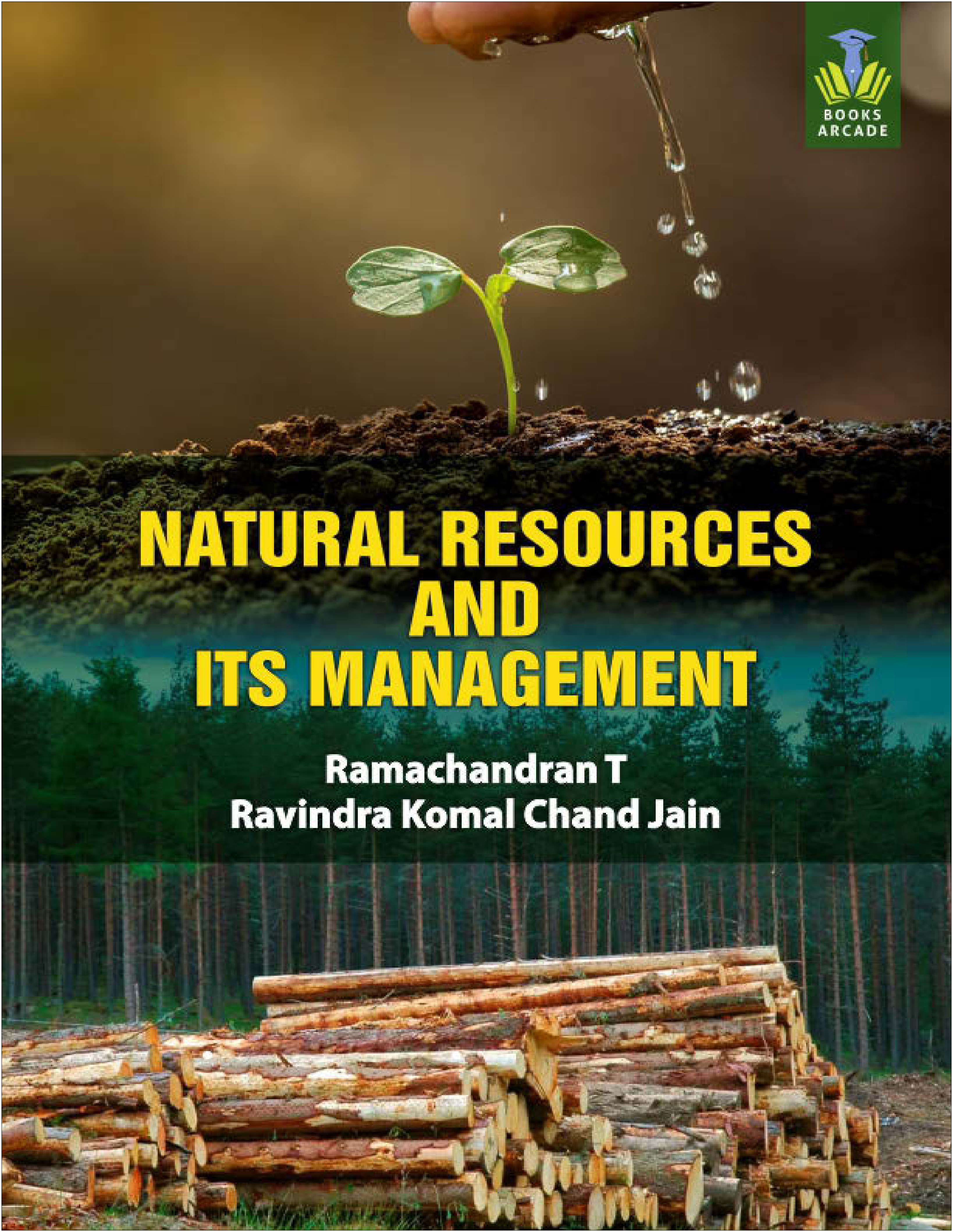

NATURAL RESOURCES AND ITS MANAGEMENT

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BOOKS ARCADE

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CONTENTS

CHAPTER 1

ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS

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ABSTRACT:

Demands for control of their use have arisen as a result of awareness of the world's diminishing reserves of minerals, forests, and other exhaustible resources. The conservation movement has its roots in the belief that these products are currently too inexpensive for the benefit of future generations, that they are being exploited selfishly at an excessive rate, and that as a result of their excessive affordability, they are being produced and consumed wastefully.

KEYWORDS:

Environmental, Inefficiency, Natural Resource, Pollution, Sustainability.

INTRODUCTION

The three main concepts of this work are sustainability, optimality, and efficiency. We briefly discuss these issues in this chapter before examining how the discipline of study known as economic analysis of natural resources and the environment came to be. We next list some of the salient characteristics of that area of study and point out the passages in the book where the issues highlighted here are covered in greater detail [1]. Economic analysis employs the ideas of efficiency and optimality in particular ways. We will go into further detail on this. Therefore, a succinct straightforward explanation will be helpful here. One approach to consider efficiency is in terms of the possibilities that are lost. When resources are used inefficiently, opportunities are lost, and reducing waste or inefficiency may benefit certain individuals more than others. Energy inefficiency is one instance.

It is sometimes stated that a great deal of energy is generated or utilized inefficiently and that, if other procedures were adopted, considerable resource savings might be achieved without sacrificing ultimate production. Often, an argument of this kind alludes to some sort of physical or technological inefficiency. Typically, economists ignore this kind of inefficiency and concentrate on allocative inefficiencies. Net advantages are sometimes wasted, even though resources are employed technically efficiently. Imagine, for instance, that electricity may be produced in technically efficient ways by burning either a fossil fuel that emits a lot of pollution, like coal, or a less-polluting alternative fossil fuel, like gas. As the former fuel is less expensive, profit-maximizing power companies choose to utilize it. Yet, pollution causes damages that call for spending on medical treatment and cleanup efforts. These costs, which are not covered by the power provider, may outweigh the cost savings that coal-based electricity producers experience.

If this occurs, even in situations where there are no technological inefficiencies, there is inefficiency as a consequence of resource allocation decisions. The choice of the less polluting option would result in positive net benefits for society as a whole. We demonstrate throughout the book how such allocative inefficiencies will be widespread in the usage of environmental and natural resources in pure market economies. How economies could prevent inefficiencies in the distribution and use of natural and environmental resources constitutes a significant portion of environmental economics. While connected to efficiency, the second idea, optimality, is separate from it. To comprehend the concept of optimality, we must consider the following:

Some overarching goal that this civilization has, and in terms of which we might gauge the degree to which any resource-use choice is beneficial from that society's point of view. If a resource use decision maximizes that goal while taking into account any relevant limitations that could be in place, it is said to be socially optimum. Efficiency and optimality are connected because it turns out that a resource allocation cannot be optimal without being efficient, as we will demonstrate. In other words, efficiency is a prerequisite for optimality.

It should be intuitively clear that if society wastes chances, it cannot maximize its goal (whatever that might be). Efficiency, however, is not a prerequisite for optimality; in other words, even if a resource allocation is effective, it could not be the best option for society. This occurs because there are always a variety of effective resource allocations, but only one of them will be seen to be "best" from a social standpoint. It should come as no surprise that the concept of optimality is important in economic analysis. Sustainability is the third main idea. For the time being, we may state that sustainability entails protecting future generations. In the next chapter, we'll go through why this is something that has to be taken into account in the context of resource and environmental economics.

When initially considering this, you could assume that a term like sustainability is unnecessary given optimality. Surely, if a resource allocation is sustainable, it must also be socially optimal? If sustainability is important, it should be included among society's goals and taken into consideration while aiming for perfection. It's not nearly as simple as it seems. The pursuit of optimality as it is often understood in economics will not always adequately care for future generations. If protecting future generations is seen as a moral imperative, then a sustainability constraint will need to be imposed on the pursuit of optimality as it is often defined by economists [2].

Resource and environmental economics's emergence. We now take a quick look at how resource and environmental economics have evolved since the European industrial revolution. Classical economics: Smith, Malthus, Ricardo, and Mill's contributions to the growth of natural resource economics While interest in the content of natural resource and environmental concerns has far older antecedents, the development of natural resource and environmental economics as a separate sub-discipline is a comparatively new development. For instance, it is clear from the works of the classical economics, for whom it was a top priority. The term "classical" refers to a group of economists active in the eighteenth and nineteenth centuries, when both the industrial revolution and a sharp rise in agricultural output were occurring, at least in large portions of Europe and North America. The proper institutional setups for the growth and development of commerce were a recurrent topic of political-economic discussion [3].

The issue of what influenced living standards and economic progress was a major focus of classical economics. Natural resources were thought to have a significant role in determining national prosperity and its expansion. The availability of land, which is sometimes used to refer to all natural resources, was thought to be limited. The early classical economists got to the conclusion that economic growth would be a fleeting aspect of history when these assumptions were combined with the ones that land was a required input to production and that it had declining returns. They recognized the likelihood of a future stagnant condition in which the bulk of people's chances for a high level of life were dim. This argument is most firmly linked with Thomas Malthus (1766–1844), who made it in his Essay on the Principle of Population (1798), which gave birth to the term "neo-Malthusian" to refer to people who today doubt the viability of sustaining long-term economic expansion. Malthus believed that productivity per capita would tend to decline over time because of a fixed amount of land, an anticipated propensity for continuous positive population increase, and declining returns in agriculture. According to Malthus, there was a long-term trend for the majority of people's living conditions to be lowered to a subsistence level. The population would be able to simply reproduce itself at subsistence wage levels, and the economy would reach a stable state with a fixed population number and constant, subsistence-level living conditions [4].

DISCUSSION

Neoclassical Economics: Value and Marginal Theory

The transition from classical economics to what is now known as "neoclassical economics" was sparked by a number of significant books that were published in the 1870s. This led to a shift in how value was explicated, among other things. According to classical economics, value results from the labor force that is (directly and indirectly) embodied in production. Karl Marx's writings are the best example of this theory in its entirety. Value, according to neoclassical economists, is established via trade and hence reflects preferences and production costs. Price and value as separate notions ceased to exist. A concept of relative scarcity has also taken the role of earlier ideas of absolute scarcity and value, with relative values (prices) being determined by supply and demand. This shift in focus prepared the way for welfare economics, which will be covered momentarily. The approach of marginal analysis was adopted at the methodological level, enabling prior theories of decreasing returns to be given a formal foundation in terms of declining marginal productivity within the setting of an explicit production function. The theory of consumer preferences was formalized by Jevons (1835–1882) and Menger (1840–1921) using the concepts of utility and demand theory. Neoclassical economic analysis evolved to place more focus on the structure and allocative effectiveness of economic activity than on the overall volume of economic activity [5].

As we said previously, the development of neoclassical economics primarily disregarded concerns about the amount (and increase) of economic activity. John Maynard Keynes (1883–1946) developed his theory of income and production determination against the backdrop of the interwar economic crisis in the industrialized nations. The Keynesian agenda shifted focus to overall supply and demand as well as the reasons why market economies would not be able to reach levels of activity that incorporate the utilization of all production inputs. Keynes was concerned with identifying the causes of the recession's persistently high unemployment rates and offering solutions. The establishment of resource and environmental economics was not much impacted by this direction of growth in conventional economics. The creation of a neoclassical theory of economic growth and the rebirth of interest in growth theory in the middle of the 20th century, however, were indirectly influenced by Keynesian "macroeconomics" as opposed to the microeconomics of neoclassical economics. The lack of land or any other natural resources from the production function utilized in early neoclassical growth models is notable. Early neoclassical growth modeling did not take into account traditional limits-to-growth arguments based on a fixed land input.

Social Economics

The emergence of a rigorous welfare economics theory is the last advancement in mainstream economic theory that has to be briefly discussed here. As you'll see in Chapter 5, welfare economics makes an effort to provide a framework within which normative decisions may be made about various configurations of economic activity. It specifically tries to pinpoint the conditions that allow one resource allocation to be justified as being superior (in some way) to another. It turns out that such rankings are only conceivable if one is willing to accept some ethical standard, which is not unexpected. The utilitarian moral theory, which was created by David Hume, Jeremy Bentham, and John Stuart Mill, is the source of the ethical standard that is most often applied by classical and neoclassical economists. This ethical framework is examined in Chapter 3. It is sufficient to remark at this point that according to utilitarianism, social welfare consists of a weighted average of the total utility levels experienced by everyone in society. In order to offer recommendations about how to allocate resources, economists have tried to develop a system for rating various countries that does not rely heavily on ethical standards or social welfare functions. They have invented the idea of economic efficiency, often known as allocative efficiency or Pareto optimality (since it was created by Vilfredo Pareto in 1897). Chapter 5 goes in-depth on these concepts. It may be shown that an economy set up as a competitive market economy would achieve a state of economic efficiency under certain relatively strict requirements. This is Adam Smith's tale of the helpful role of the invisible hand in current, scientific terms. Market failure is the term used to describe a situation in which markets fail to allocate resources efficiently. The problem of "externalities" is one example of market failure. There are instances when connections between economic actors are not always mediated through markets due to the nature of property rights [6].

The function of the environment as a provider of recreational and amenity services is also a focus of environmental economics, and this role may be examined using ideas and techniques that are comparable to those that are used when analyzing pollution issues. It covers this area of contemporary environmental economics. It use cost-benefit analysis extensively, a method that was developed in the 1950s and 1960s as a useful tool for applied welfare economics and policy guidance. Chapter 11 discusses the fundamental framework and methods of cost-benefit analysis, expanding on Chapter 5's examination of market failure and state policy. The present subfields of environmental economics and natural resource economics have substantially separate origins in the core of contemporary mainstream economics. The former was primarily influenced by neoclassical growth economics, whereas the latter was influenced by welfare economics and the study of market failure. Both may be said to have their roots in the early 1970s, while older contributions are undoubtedly there.

Ecological Economics

A relatively young, multidisciplinary area is ecological economics. In the 1980s, a number of economists and natural scientists came to the opinion that multidisciplinary research was important to better understand and manage environmental issues. 1989 saw the founding of the International Society for Ecological Economics. The fact that ecologists made up the majority of the natural scientists involved may have had an impact on the exact name chosen for this society, but what was more significant was the perception that economics and ecology were the two fields most closely related to sustainability, which was seen as the primary issue. Ecology is the study of animal and plant abundance and distribution [7]. An ecosystem, which is an interdependent group of plant and animal populations and their abiotic, non-living surroundings, is a key point of interest.

The term "eco" in both economics and ecology comes from the Greek word "oikos," which is also the basis for both words. Oikos, which translates to "household," might be used to describe both economics and ecology as the study of home management in general. Hence, ecological economics may be defined as the study of the interactions between these two sets of data. As we said before in this chapter, sustainability entails caring for future generations. The majority of those who want to be referred to as "ecological economists" are worried that the size of human housekeeping is now posing a danger to the sustainability of nature's housekeeping in ways that will negatively impact human future generations. The defining feature of ecological economics is that it uses the economic system's integration with the planet's overall system as its point of departure and guiding organizing principle. It begins by recognizing the interdependence of the economic and environmental systems, and then examines the combined economy and environmental system in the context of natural scientific concepts, especially those related to thermodynamics and ecology. We will quickly go over these topics in the next chapter, which is titled "The Origins of the Sustainability Problem," since it is the interconnection of economic and ecological systems that gives birth to the sustainability challenge [8].

This book will mostly reflect that the influence of ecological economics on the approach to the natural environment that evolved from conventional economics has been fairly restricted so far. The next two chapters do explicitly address the issue of sustainability, however for the purposes of this chapter, we will mostly be discussing conventional resource and environmental economics. While sustainability is a recurring subject throughout the book, which mostly discuss the mainstream approach do not make this idea particularly clear. Nonetheless, we do briefly discuss how adopting an ecological economics approach might alter analysis and policy at several points in those chapters. The topic of sustainability is brought up once again in the book's last chapter, when the chances for improving sustainability via improved economic accounting are discussed.

Basic problems with the economic strategy for addressing resource and environmental concerns. Four characteristics of the economic approach to resource and environmental challenges that will be explored in this book are briefly sketched out below. Property rights, effectiveness, and governmental involvement [9]. Allocative efficiency is a key issue in resource and environmental economics, as we've previously said. The examination of this subject revolves upon the function of markets and pricing. As we've already said, a fundamental tenet of contemporary economics is that, given the right circumstances, markets will lead to efficient resource allocation. One of the requirements is clear-cut private property rights that can be enforced. Many natural resources lack property rights or have unclear definitions, making it difficult for markets to distribute such resources effectively. Price signals don't accurately represent the full societal costs and benefits in such situations, and there is a strong argument for government policy action to increase efficiency. As we will see throughout the remainder of this book, the decision-making process at the core of resource and environmental economics is where and how to intervene. Chapter 5 lays the groundwork for the economic approach to policy analysis, which is then implemented in the following chapters. Certain environmental issues transcend national borders and should be handled as global issues. In these situations, there is no global government with the power to address the issue in the same way that a nation state's government may be expected to address an issue inside its boundaries [10].

Irreversibility and Substitutability

Thinking about policy in connection to the natural environment involves crucial and related questions of substitutability and irreversibility. The pace at which a resource is depleted certainly has significant effects on sustainability if the depletion of the resource stock is irreversible and there is no close alternative for the services it offers. There is less reason for worry about the pace of resource usage to the degree that depletion is not irreversible and close replacements exist. Issues relating to substitutability fall into two categories. The first concern is whether or not one natural resource can be completely replaced by another. Can fossil fuels be replaced on a massive scale, say, by solar power? As we shall see, this is a particularly crucial question given that the burning of fossil fuels not only results in the depletion of non-renewable resources but also contributes to a number of serious environmental pollution issues, such as the so-called greenhouse effect, which raises the possibility of a change in the planet's climate [11], [12].

CONCLUSION

All economists working on issues relating to natural resources and the environment do not use the same technique. Ecological economists have stated that we should strive for a more comprehensive field that integrates economic and natural-scientific concepts. Some ecological economics contend further that the solution to the sustainability issue must include both a fundamental shift in societal norms and a reorientation of science. Even while there has been considerable progress in the direction of multidisciplinary collaboration, most analysis is still far from being fully integrated. On the opposite end of the methodology spectrum are economists who emphasize the need of creating a more comprehensive set of quasi-market incentives to encourage efficient behavior but see no need to go beyond applying neoclassical principles to environmental concerns. Such economists reject the notion that societal norms should be questioned, and many have tremendous confidence in the capacity of ongoing technological advancement to address resource scarcity issues and advance sustainability. The degree to which technological advancement can solve the issues resulting from the interconnection of economic and environmental systems tends to raise additional doubts in the minds of ecological economists. Yet, there is a great deal of agreement among economists working in the field, and in this book we primarily concentrate on this. Nobody who has conducted thorough research on the subject holds the view that the interaction between the economy and the environment can be completely left to market forces. Nowadays, almost anybody still contends that the link between the two doesn't include market-like incentives. In terms of policy, the debates center on how much the government should be doing and the relative efficacy of various tools. This book's objective is to explore the economic analysis pertinent to these sorts of concerns and to teach readers about the resource and environmental issues these questions raise. The overall interconnection of the economic and environmental systems, as well as the sustainability problems that have resulted from this, are covered in the first section of the next chapter.

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CHAPTER 2

THE CAUSES OF THE ISSUE WITH SUSTAINABILITY

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ABSTRACT:

It is obviously challenging to provide for billions of people, and it is challenging for each individual to provide for their own family. However, the fact that the population has grown over millennia from a few thousand or millions of individuals living below the poverty line to billions of individuals living well above the poverty line is a very good indication that the problem of sustenance has become less difficult rather than harder. By itself, the trend of population expansion ought to portend hope rather than despair.

KEYWORDS:

Atmosphere, Natural Resources, Non-Renewable, Renewable Resources, Sustainability.

INTRODUCTION

The human population has increased significantly over the previous century and is expected to almost double in the next century in the planet we live in. Despite the fact that many people living today are in abject poverty, the ordinary person's material needs have been rising quickly. Economic expansion has often been seen as the answer to the poverty issue since the 1950s and 1960s. Without economic development, reducing poverty requires transfer from the wealthy to the poor, which is met with opposition by the wealthy. In any event, there may be so many impoverished people in comparison to the size of the better-off group that a redistributive solution to the issue of poverty is just impractical no matter how thinly the pieces are sliced, the cake is too little to feed everyone. The size of the cake grows as the economy expands. Without having to diminish the size of the bigger pieces, if there were enough of it, it may be feasible to offer everyone at least a respectable slice. Yet, the world's supply of resources is finite and made up of a complex web of interconnected ecosystems that are presently showing symptoms of instability. The ability of the global economic system to expand without jeopardizing the natural systems that serve as its ultimate support is being questioned more and more [1].

This collection of problems is what we refer to as "the sustainability challenge” how to reduce poverty without harming the environment and jeopardizing future economic opportunities. We lay forth the rationale for thinking that there is such an issue in this chapter. The structure of this chapter is as follows. We begin by examining the relationship between the economy and the environment and provide a quick outline of some fundamental concepts in environmental science that are pertinent to this. The second portion takes into account the immediate causes of the economy's effects on the environment. Data on the current level of human development in connection to the issues of poverty and inequality are presented in the third part of the chapter.

In this part, we draw attention to economists' support for economic expansion as a means of eradicating poverty. We examine growth constraints in the section after that. The last section of the chapter examines how the concept of sustainable development growth that doesn't harm the environment emerged in the 1980s and the steps taken to make it a reality. The system that is the earth and its atmosphere is where economic activity occurs and is a component of that system. This system we name 'the natural environment', or more succinctly 'the environment'. The remainder of the cosmos serves as this system's habitat [2].

DISCUSSION

The environment, which is a thermodynamically closed system since it exchanges energy but not matter, is represented by the outside, heavy, black-lined box with its surroundings. Solar radiation is a source of input for the environment. When being absorbed, some of the radiation stimulates environmental activities. Part of it is reflected into space again. The arrows that cross the thick black line at the top of the image stand in for this. The thick black line is not crossed by matter. The global climate system's operation depends on the equilibrium between energy absorption and reflection. Three boxes, which stand for three of the roles the environment performs in connection to economic activity, are traversed by the energy in and out arrows. The provision of life-support services and those functions that keep the whole functional system together makes up the fourth function, which is symbolized by the hefty black box with black lines on it. Take note of how the thick black line cuts across all three of the boxes and how they intersect one another. This is a sign that the four functions work in concert, as will be explained later.

The solid lines within the heavily drawn box represent economic activity that is situated inside the environment and involves both production and consumption, both of which depend on environmental services. Not all of the output is used up. A portion of the output from production is added to the stock of human-made, repeatable capital, whose services are employed in production together with labor services. An example of production employing a third kind of input, resources taken from the environment. Wastes are created during production and released into the environment. Consumption also. Without the need of intermediary productive activity, consumption also utilizes a flow of amenity services from the environment to persons. We now go into further depth about these four environmental roles and how they interact with one another [3].

The benefits that come from the environment

Natural resources employed in manufacturing come in a variety of forms, as was mentioned in the previous chapter. Whether a resource exists as a stock or a flow is one defining feature. The distinction is whether or not the degree of present consumption will impact future supply. There is no correlation between present availability and future utilization of river resources. A roof with a solar water heater is an excellent example of a flow resource since how much water is heated today has no bearing on how much can be heated tomorrow. Other flow resources include wave and wind energy. Stock resources are those whose future availability is affected by their degree of usage now.

The nature of the connection between present usage and future availability within the category of stock resources is the subject of a second standard differentiation. The biotic populations of flora and wildlife are renewable resources. Minerals are non-renewable resources, and this includes fossil fuels. In the first scenario, the stock that is present at a given moment has the capacity to increase via natural reproduction. The size of the stock increases if the resource's utilization is less than its rate of natural expansion. It is possible to utilize a resource eternally if usage or harvesting always proceeds at the same rate as natural growth. A "sustainable yield" is what is often used to describe such a harvest rate. When harvest rates exceed sustainable yield, stock size is said to be falling. There is no natural reproduction of non-renewable resources, except on geological periods. So, higher usage now always indicates decreased use down the future. The difference between fossil fuels and the other minerals under the category of non-renewables is crucial. First, it may be argued that one of the key features that sets industrial economies apart is the widespread usage of fossil fuels. Second, burning fossil fuels is an irreversible process since there is no method to even partly recover the input fuel after combustion. Coal, oil, and gas cannot be recycled since they are utilized to generate heat rather than as ingredients in chemical reactions. Mineral inputs used in manufacturing may be recycled. This indicates that, in contrast to fossil fuels, minerals do not have the option of postponing the date of depletion of a given starting supply at a given rate of usage. Finally, burning fossil fuels is a significant contributor to a variety of waste emissions, particularly into the atmosphere.

Numerous industrial and consumption-related activities result in trash or residuals that must be released into the environment. Moreover, these introductions into the environment are a necessary consequence of the removal of material resources from it, as we will see when we explore the materials balance concept. Pollution is the term used in economics to refer to issues including the effects of waste discharge into the environment. Economists claim that there is a pollution issue if and only if waste release results in issues that are noticed by people. There are two ways to conceptualize pollution issues. One view, which is popular among economists, considers pollution to be a stock of material that resides in the environment. The alternative, which is more popular among ecologists, views pollution as a flow that has an impact on the ecosystem. In the first scenario, pollution is regarded just like a stock resource, with the exception that the stock has a negative value. The stock is increased and decreased by residual fluxes into the environment and natural decomposition processes. In pollution modeled in this manner. The environment is treated in the flow model as having an "assimilative capacity," which is expressed in terms of a residual flow rate. If the residual flow rate exceeds the assimilative capacity, pollution will develop. If the residual flow rate is the same as or less than the assimilative capacity, there is no pollution [4].

If the residual flow rate consistently exceeds the assimilative capacity, the latter may ultimately reach zero and start to deteriorate. The direct transfer of amenity services from the environment to people. Humans may enjoy recreational opportunities and other types of entertainment and stimulation thanks to the environment. For instance, one does not have to engage in constructive work to turn swimming from an ocean beach into a source of human joy. Absence of other human activities is the defining characteristic of wilderness recreation. Some folks prefer to just relax outside in the sunlight. Imagine yourself as the inhabitants of a space spacecraft, and you can see the significance of the natural environment in terms of amenity services. In many circumstances, the provision of amenity services to persons does not directly include any movement of consumptive materials. Although it may incorporate this in the use of wood for fires, the capture of wildlife for food, and other instances, wilderness recreation, for instance, is not mainly about exploiting the resources in the wilderness environment. Spending a day at the beach does not entail any beach consumption in the same way that using oil does. This is not to argue that the physical effects of amenity service flows on the environment are never present. A beach area's nature may alter as a result of excessive usage, as shown with the erosion of sand dunes after human presence led to the removal of flora.

It is challenging to convey the fourth environmental function, in a clear and straightforward manner. In addition to acting as a resource basis, waste sink, and amenity base, the biosphere today fulfills the essential tasks of human life support. There are limitations to what is bearable, despite the fact that humans have a wider range of environmental tolerances than the majority of other animals. For instance, our criteria for breathing air are fairly strict. We can survive at a large range of temperatures compared to those on Earth, but not as vast as those on other worlds in the solar system. Humans need a minimum amount of water to survive. The current state of the environment allows for human existence [5].

There are many and intricate relationships between economic activity and the environment. The complexity is heightened by the presence of environmental processes, which means that the four Environmental service categories all communicate with one another. The three boxes' intersection with one another and the strong black line, which stands for the life-support function, serve as visual cues for this. The example that follows may be used to demonstrate what is involved. Due to the presence of a commercial fishery, it acts as a resource foundation for the local economy. Urban sewage is dumped into it, acting as a waste sink. It is utilized for leisure activities including boating and swimming as a source of amenity services. Insofar as it serves as a breeding habitat for marine species that are not economically exploited but are important to the functioning of the marine environment, it contributes to life-support functions. All four functions may coexist when sewage discharge rates are at or below the estuary's assimilative capacity.

Nevertheless, the other estuarine processes are hampered in addition to a pollution issue emerging if the rate of sewage discharge exceeds assimilative capacity. The ability of the economically fished fish populations to reproduce will be hampered by pollution, which might result in the closure of the fishery. Its biological extinction is not always the result of this. The public health risk might justify closing the fisheries. Pollution will lessen the estuary's ability to sustain recreational activities, and in certain cases, like swimming, it may even make it impossible. The non-commercial marine species will also be affected by pollution and might go extinct, which would have an influence on how well the marine ecosystem functions. An illustration of how environmental services are connected globally and how economic activity affects interconnected environmental processes is offered by the issue of global climate change, which is covered in further detail below [6].

Environmental Services Replacement

Thus far, we've spoken about the solid lines. There are a few dashed lines as well. These indicate potential environmental service replacements. First, think about recycling. This entails intercepting the waste stream before it harms the environment and returning a portion of it to manufacturing. Recycling serves as a two-fold alternative for environmental duties. First of all, it lessens the demands placed on the operation of the waste sink. Second, it lessens the demands placed on the resource base function inasmuch as recycled materials take the place of environmental extractions.

The thick black line denoting environmental functions and four dashed lines from the capital box extending to the three boxes. The potential for replacing environmental services with services provided by replicable capital are shown by these lines. Some economists refer to the collective of environmental assets as "natural capital" because they see the environment as an asset class that generates flows of services. The dashed lines in that language indicate to options for replacing natural capital services with reproducible capital services. Think about the sewage discharge into a river estuary once again as an illustration of the waste sink function. It is feasible to treat sewage at different levels before releasing it into a river. At a particular volume of sewage, the demand placed on the estuary's assimilative capacity is decreased based on the degree of treatment. Depending on the amount of treatment the plant offers, capital in the form of a sewage treatment plant partially replaces the natural environmental role of a waste sink.

The replacement of capital for resource base functions is shown using a case study from the area of energy conservation. By installing insulation and control systems, a home may consume less energy for a given degree of human comfort. They increase the overall capital stock by adding to the portion of the capital equipment stock that consists of the home and all of its fixtures. But keep in mind that the insulation and control systems are physical objects whose manufacture necessitates the extraction of resources from the environment, including energy.

In productive tasks, similar fuel-saving substitute options exist. The following instances pertain to amenity services. Anybody who enjoys swimming may do it in a river, lake, from a beach overlooking the ocean, or in a constructed swimming pool. While the experiences in question are not exact duplicates, they are near equivalents in certain ways. Similar to this, seeing a natural area no longer requires entering there to enjoy it. Without leaving the city, it is now able to see natural flora and animals thanks to the capital equipment in the entertainment sector. A lot of the feelings associated with being in a natural area can reportedly be experienced without really being there because to computer technology and virtual reality gadgets [7].

Many scientists seem to see the replacement options as being the most constrained in the context of the life support function. Yet, it is not quite evident that this is the case from a strictly technical standpoint. Humans have already been able to live outside of the biosphere in small numbers and for a finite amount of time thanks to the development of artificial settings that are capable of maintaining human existence. With an adequate energy source, it would seem conceivable, if costly, to establish circumstances conducive to human habitation on the moon. Nonetheless, it would seem that there would be a very limited amount of human life that could be preserved in the absence of natural life-supporting mechanisms. These tasks are not totally impossible to replace, but on the scale that they are performed, they are. The second factor is related to living quality. Although human existence on a biologically dead planet is theoretically possible, it would not be at all desirable, according to a reasonable point of view.

Capital equipment has been used to discuss the potential alternatives to natural capital's functions. When the result of current production is not used immediately, capital accumulates. Reproducible capital includes machines, buildings, roads, and other structures in addition to equipment in today's manufacturing. Technical change is based on "human capital," which is raised when present output is utilized to grow the body of knowledge. Although the development of human capital is unquestionably crucial in addressing environmental issues, new equipment is often needed for technological change to have an influence on economic activity. Unless knowledge is integrated into machinery that replaces environmental functions, it does not truly alleviate the demands placed on such functions.

The only kind of substitution relevant to the linkages between the economy and the environment is capital for the replacement of environmental services. The flow of information between the economy and the environment as a single line. Of course, each line reflects a variety of possible flows, not just one. Substitutions between components of the flow are feasible for each of the aggregate flows and these replacements have an impact on the demands placed on environmental services. Each particular substitute may have effects that go beyond the immediately impacted environmental function. For instance, switching from fossil fuels to hydroelectric power minimizes the waste produced while burning fossil fuels, as well as the flow of amenity services inasmuch as a natural leisure area is inundated [8].

Involved when matter undergoes structural, physical, chemical, or spatial changes. It's important to understand the nature of the system being considered in thermodynamics. An "open". A system is one that interacts with its surroundings to exchange matter and energy. A human person, for instance, is a singular organism and an open system. An environment and a "closed" system exchange energy but not matter. The atmosphere of the planet earth is a closed system. A system that is "isolated" from its surroundings does not exchange either energy or matter. An isolated system is an ideal, an abstraction, apart from the cosmos as a whole.

According to the first rule of thermodynamics, energy can only be changed from one form to another and cannot be generated or destroyed. Many individuals who care about the environment seek to promote "energy conservation" among humans.

Yet according to the first rule, no matter what individuals do, there is always 100% energy conservation. There isn't really a conflict here; rather, the proponents of "energy conservation" are using language inexactly. They truly want to promote people continuing to do the same things they now do, but in ways that demand less heat and/or labour and, thus, less energy conversion. The entropy law is another name for the second law of thermodynamics. It claims that heat cannot be converted into work with a perfect efficiency since heat naturally transfers from a hotter to a colder body. Hence, all energy transformations from one form to another are not fully efficient. While it seems to do so, this does not violate the first law[9]. The key idea is that certain energy stores, like fossil fuels, may not have all of their energy accessible for conversion.

The percentage of an energy store's energy that is accessible for conversion varies. Entropy is a measure of energy that is not accessible. An isolated system's entropy is increased by every energy conversion. Any energy conversion that is less than 100% efficient is irreversible since it signifies that the work needed to return the system to its initial condition is not present in the transformed state. As the burning of fossil fuels is irreversible, it automatically increases the entropy of the system, which is the setting for economic activity. Yet, since it is a closed system that is constantly receiving energy inputs from its surroundings, such as solar radiation, it is not an isolated system.

It's challenging for non-specialists to comprehend thermodynamics. As will be seen below, there has been discussion about it even within physics in the past. There are several widespread misconceptions about thermodynamics and its applications. For instance, it is often said that entropy constantly rises. Only an isolated system can say that. The study of equilibrium systems was part of classical thermodynamics, but the open and closed systems that directly affect economic activity are far from being in equilibrium. These systems draw energy from their surroundings. A living thing is an open system that is out of balance, as was already said. It requires some energy input to maintain its structure and avoid becoming disorganized, or dead.

It is obvious how important thermodynamics is to understanding the causes of the sustainability issue. Nicholas Georgescu-Roegen, an economist who began his academic career as a physicist and did the most to attempt to educate his peers about the laws of thermodynamics and its consequences, referred to the second law as the "taproot of economic scarcity". To illustrate his thesis, he used the analogy that one lump of coal would last forever if energy conversion processes were 100% efficient. Energy is needed because material changes take labour. There is a maximum amount of work that can be done with solar energy when it is received at a fixed rate. Both the population size and the rate of material consumption were constrained during the most of human history. This restriction is lifted by the use of fossil fuels. The fossil fuels are gathered from previously used solar energy, first changed into living tissue, and then stored by geological processes. Considering its origin, the supply of fossil fuels must inevitably be limited. As a result, there would eventually be a return to the energy situation of the pre-industrial era of human history, which involved complete reliance on solar radiation and other flow sources of energy, if there were not an abundant alternative energy source with characteristics similar to those of fossil fuels, such as nuclear fusion.

Recycling

Most people interpret the rules of thermodynamics to indicate that, in theory, any transformations of matter are feasible when there is sufficient energy available. On the basis of this knowledge, it has also commonly been accepted that total material recycling is theoretically feasible. Thus, the energy available negates the need for resource shortages to limit economic growth. Recycling could be used to restore previous extractions. The second rule of thermodynamics is the ultimate cause of scarcity in this view. Mineral scarcity is unnecessary when there is enough energy available. This is what sparks interest in nuclear energy, particularly nuclear fusion, which may hold the promise of a pure, almost limitless energy source.

The economist Nicholas Georgescu-Roegen, who is credited with developing the concept of the second rule as the fundamental justification for economic scarcity, later criticized the viewpoint just described as "the energetic orthodoxy" and claimed that "matter mattered" as well. He maintained that, even with enough energy, it is theoretically impossible to completely recycle matter. The validity of this so-called "fourth rule of thermodynamics," which states, for example, "Complete recycling is physically achievable provided sufficient energy is supplied," has been contested. This refusal is justified by the fact that the fourth rule would conflict with the second. There are two reasons why this debate over a fundamental scientific concept is noteworthy. First off, it is obvious that many matters that are important to sustainability include ambiguity if trained scientists can differ on such a basic topic. Second, regardless of the amount of energy available, all sides of this debate would agree that 100% recycling is practically unattainable. Hence, right after the argument against the fourth rule stated above, it is stated that: "The difficulty is that such energy consumption would imply a massive rise in the entropy of the environment, which would not be sustainable for the biosphere."

The idea of material equilibrium

The rule of conservation of mass, which asserts that matter cannot be generated or destroyed, is sometimes referred to as "the materials balance principle" by economics. An early explanation of the idea as it relates to business. The most basic meaning of the materials balance principle in terms of economics is that economic activity fundamentally entails changing matter taken from the environment. In a material sense, economic activity cannot produce anything. It does, of course, include altering environmental stuff such that it is more useful to people. Yet, there is also the additional connotation that all of the materials taken from the environment must ultimately be returned to it, although in a different form. The word "eventually" is essential since part of the harvested material remains in the economy for a very long time and is used in things like machines, buildings, and roads [10].

The physical connections that the idea of material balance implies. It removes the delays in the cyclical flow of matter brought on by economic capital accumulation. The image of material removals from and insertions into the environment is enhanced. Environmental enterprises utilise primary inputs ore, liquids, and gases from the environment to create usable goods basic fuel, food, and raw materials. These outputs may go directly to homes or are used as inputs in later manufacturing processes shown as a product flow to non-environmental businesses. Also, households obtain finished goods from the non-environmental business sector.

Biodiversity

Biodiversity is defined as the quantity, diversity, and variability of all living things found in terrestrial, marine, and other aquatic environments, as well as the ecological systems of which they are a part. This definition makes it clear that biodiversity is meant to include two dimensions: first, the quantity of living things and, second, their variety. There are three levels at which biodiversity may be considered:

1. **Population:** We may quantify biodiversity in terms of the number of populations because genetic variation among the populations that make up a species is significant since it impacts the evolutionary and adaptive capabilities of the species.
2. **Species:** Instead of counting the number of species, we could want to count the number of different species that exist in a certain area, the degree to which a species is endemic (exclusive to a certain area), or both.
3. **Ecosystems:** The variety of ecosystems is, in many respects, the most significant indicator of biodiversity; however, there is no generally accepted standard for either defining or quantifying biodiversity at this level.

For the sake of this level-based categorization, a species may be thought of as a collection of unique creatures with the ability to reproduce, while a population can be thought of as a collection that actually does so. The subset of a species that is reproductively isolated is called a population. Species are often used to describe biodiversity, and one measure of biodiversity is frequently the number of unique species. There are issues with this policy. For instance, every species will exhibit a significant amount of genetic diversity within a single population. Let's say a program for collecting people in that demographic that have a certain trait such as large size.

The genetic diversity of the remaining population is decreased by the harvesting program since the target individuals are likely to have genetic material that favors that attribute. Hence, managed harvesting programs may cause biodiversity loss even when the total number of existing species remains stable [11].

In a variety of ways, biodiversity is crucial to the delivery of environmental services to support economic activity. Diverse ecological systems enable environmental processes including carbon cycling, soil fertility maintenance, climate and surface temperature management, and watershed flows in order to provide life-supporting services. We get amenity services from the environment thanks to the variety of flora and animals in ecosystems. In terms of production inputs, those plants and animals provide a variety of valuable goods, including medicines, meals, and fibers. The genes they carry also serve as the foundation for future advances in biotechnology. Agriculture's reliance on biodiversity to create novel kinds and increase crop and animal variety. In terms of the evolutionary potential and resilience of ecosystems, ecologists see biodiversity as having the greatest long-term significance. Diverse gene pools serve as a type of protection against ecological collapse because they increase the ability of organisms to adapt to shocks and to maintain the organization and functionality of their ecosystems.

CONCLUSION

Our goals in writing this chapter were to provide an overview of the present stage of human evolution as well as the basic physical and biological framework within which it must proceed in the future. Humans have also looked at a few effects that human activity has on the environment now and might have in the future. Our debate has shown that the natural environment as well as the human economy are interdependent, despite the fact that it was not exhaustive.

Instead, a complicated web of connections has brought them into close proximity. The environment is impacted by economic activity, which impacts the environment. Whatever the term "sustainability" may imply, our research here makes it obvious that one need for an economy to be sustainable is that its natural environment should be preserved in order to continue providing a variety of services.

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CHAPTER 3

AGRICULTURAL RESOURCES AND ECONOMIC SUSTAINABILITY

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ABSTRACT:

Agricultural resources play a central role in economic development, food security, and environmental sustainability. This chapter examines the economic dimensions of agriculture with a focus on land, water, labor, and biological resources. It analyzes how agricultural productivity, market structures, policy interventions, and resource management practices influence sustainable growth. Emphasis is placed on balancing economic efficiency with ecological conservation to ensure long-term viability of agricultural systems amid population pressure, climate change, and resource scarcity.

KEYWORDS:

Agricultural Economics, Resource Management, Food Security, Sustainable Agriculture, Rural Development, Land Use, Water Economics, Policy Intervention.

INTRODUCTION

The biobased economy can be to the 21st century what the fossil-based economy was to the 20th century. Agriculture has the potential to be central to this economy, providing source materials for commodity items such as liquid fuels and value-added products (chemicals and materials). At the same time, agriculture will continue to provide food and feed that are healthful and safe, which may give rise to some situations of trade-offs.

The use of agricultural raw material in a biobased economy is not new. However, now agriculture has to compete with alternative land uses in order to claim the status of socially responsible entrepreneurship. Conservation of valuable landscapes, habitats, biodiversity have come to the forefront of some policy makers' agenda. The public-good benefits that could accrue from the biobased economy are compelling. They include increased security in some countries, economic advantages to farmers, industry, rural communities, and society, environmental benefits at the global, regional, and local levels, and other benefits to society in terms of human health and safety.

Definition of biobased economy

As an alternative, researchers working in the agriculture, forestry, and fisheries sectors recognize the use of biobased products for competing with the fossil-based industry, commonly referred to as the 'biobased economy'. This economy uses renewable bio-resources, biological tools, eco-efficient processes that contribute to GHG emission reductions to produce sustainable bioproducts for medical treatments, diagnostics, and more-nutritional foods, energy, chemicals and materials while improving the quality of the environment and standard of living. Biobased resources are materials derived from a range of plant systems, and may include starch, sugar, wood, cellulose, lignin, proteins etc. These resources are produced from different sources such as, biomass, crop residue, dedicated crops and crop processing by-product.

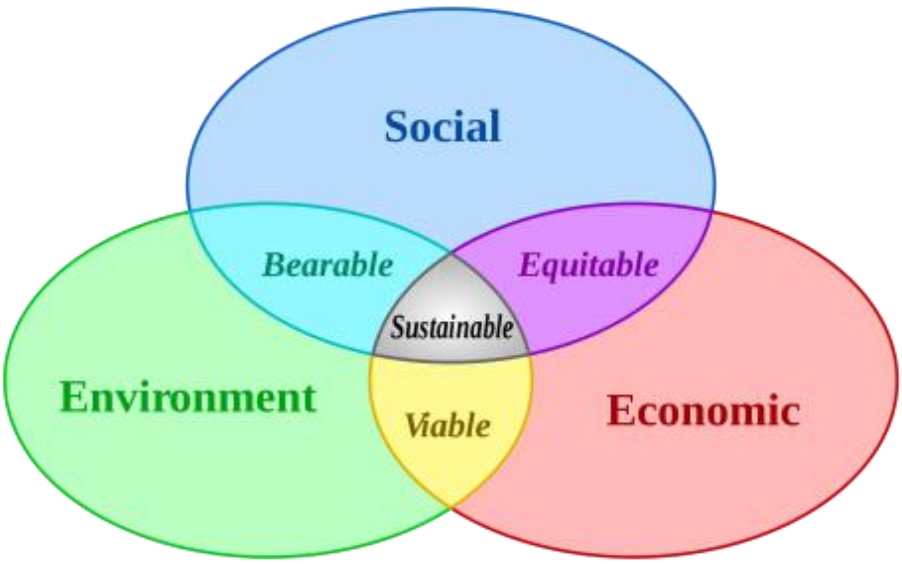
The major commodity produced in the biobased economy is energy, in the form of liquid fuels (ethanol and biodiesel) and biogas. The types of energy generated from these products include uses in transportation, heating, electric appliances etc. Agricultural and forest products are generally used in the production of the above biofuels.

Generally, agricultural activity generates a variety of feedstocks for the production of bio-products, particularly bioenergy. Main feedstocks of agricultural activity are from crop biomass including crop residues and livestock waste. Canada, possessing about 67.5 M ha of agricultural farmland, has the potential to offer feedstocks for bioenergy (including biofuels). Of this area, 31.87 M ha are planted each year to grow starch (wheat, barley, corn and oat), oil (rapeseed, soybean and flaxseed) and forage crops, with a total carbon content of about 33.5 Mt C/yr, and an energy content of about 2 exajoules (EJ) yr-1 or 2 times 1018 J yr-1 . Additionally, agricultural crop residues were estimated to contain about 56 Mt C/year. Although some of this residue may be incorporated into the soil to maintain soil fertility and carbon content, the recoverable portion contains 14.6 Mt C/yr and has an energy potential of 0.52 EJ/yr. To this estimate, one can add livestock wastes in Canada, which could produce over 3 billion m3 of biogas which is equivalent to energy of 0.065 EJ/yr.

Definition of sustainability

What is sustainability?

Sustainability is inherently about durability and endurance. The World Commission on Environment and Development defines it as "the capacity to meet the needs of the present without compromising the ability of future generations to meet their own needs". It emphasizes strategies that promote economic and social development to meet human needs in ways that avoid environmental degradation, overexploitation or pollution. At the 2005 World Summit it was noted that this requires the reconciliation of economic, environmental and social demands - the "three pillars" of sustainability. The concept of sustainability is shown in Figure.



Framework for Assessment of Sustainability

Figure shows that an economy would be sustainable if it is:

1. Economically viable (uses natural, financial and human capital to create value, wealth and profits);
2. Environmentally compatible (uses cleaner, more eco-efficient products and processes to prevent pollution, depletion of natural resources as well as loss of biodiversity and wildlife habitat), and minimizes damage to the ecosystem services that provide many ecological goods and services to the society; and
3. Socially responsible (behaves in an ethical manner and manages the various impacts of its production through initiatives).

Sustainability in the context of biobased economy

The biobased economy can contribute to a more sustainable society, not only because it leads to an economy no longer primarily dependent on fossil fuels for energy and industrial raw materials, but also by generating less waste, by a lower energy consumption and by using less water. In addition, the biobased economy provides also for the established industries the opportunity for further growth in a sustainable way. However, does it mean that the production and use of bioenergy is intrinsically sustainable? The Environmental Audit Committee (EAC) found that although biofuels can reduce GHG emissions from road transport, most first generation biofuels have a detrimental impact on the environment overall. In addition, most biofuels are often not an effective use of bioenergy resources, in terms either of cutting GHG emissions or value-for-money. Stoeglehner & Narodoslawsky (2009) answered this question from an ecological footprint perspective. They found, by comparing different technologies, that biofuels are considerably more sustainable than fossil options presently in use. Yet, to what extent biofuel use is sustainable remains open as this can only be answered in a regional context taking other land use demands, visions and values into account.

Major utilitarian frameworks define and identify sustainable choices as those that maximize per capita utility subject to an ethical constraint that per capita utility will not decline over time. The utilitarian framework can be applied to derive sustainable outcomes in the context of biofuels, and in particular to identify which biofuels to produce and to what extent, by assuming that utility is derived from the consumption of food, fuel (fossil fuel and biofuel) and other private goods and is maximized subject to budget constraints, land availability and various sustainability constraints. Biofuels would be considered a sustainable substitute if they can compete with fossil fuels in a free market setting at prices that internalize all environmental costs of production, minimize damages to the environment and allow food and other goods and services to be available such that overall utility is non-decreasing over time. The production of any type of biofuel is likely to involve trade-offs among these multi-dimensional aspects of sustainability. The degree to which biofuels can accommodate the three pillars of sustainability, taking account of potential tradeoffs among these pillars, needs to be evaluated

Economic sustainability:

The economic sustainability of biofuels depends on the costs of production and market price of supply. The sustainability of the corn ethanol industry depends on its ability to deal with volatility in both gasoline and corn prices. Variability in the price of corn could lead to cycles of boom and bust for the biofuel industry with the impact of supply shocks being exacerbated when inventories are low. The oil price, commercially viable technology to produce cellulosic biofuels, and trade barriers also affect economic viability of the biofuel industry. The rising oil price has contributed to higher corn prices because of increased cost of production of corn, in addition to its demand. Besides the supply-side considerations, the demand for ethanol and the availability of infrastructure to deliver the ethanol produced to the blenders are the driving forces behind the biofuel industry sustain expansion.

Environmental sustainability:

Biofuels are occasionally claimed as being carbon neutral and fossil-fuel free, but serious concerns about the carbon benefits of current biofuels have been raised. Actually, biofuels consume a significant amount of energy that is derived from fossil fuels. Equally important is the fact that production of biofuels has other environmental impacts, such as soil erosion due to tilling, eutrophication due to fertilizer runoffs, impacts of exposure to pesticides, habitat, and biodiversity loss due to land-use change, etc., which have not received the same attention as GHG emissions. Conversely, the grain used for ethanol feedstock production is often the poor quality, impure grains which are mostly unsuitable for either human or livestock, and which also do not require as much pesticide. In contrast to grain-based ethanol, cellulosic biofuels from perennial grasses (such as switchgrass) have the potential to produce more biofuel per hectare of land and thus have smaller indirect land use effects. While, the environmental benefits of cellulosic biofuels depend on the mix of feedstocks use, the location and management practices used to grow them are equally important. There might also be some trade-offs between environmental benefits and most profitable methods of producing cellulosic feedstocks.

Social sustainability:

Khanna et al. (2009) consider that the social sustainability of biofuel depends on the distribution of biofuel costs and benefits across countries, income groups, and rural and urban areas. One should keep in mind that human rights, health and equity are also important issues that are related to social sustainability. Higher crop prices in response to increased demand of biofuel will improve farm incomes. However, the higher commodity price may be capitalized into land rent and prices of inputs, which will reduce the future benefit to farmers. Cost of food to consumers may also increase, which may create a heavy burden on the urban poors. The development of biofuel production may also bring to the forefront equity and gender-related issues, such as labour conditions on plantations, constraints faced by small holders and the disadvantaged position of female farmers. All of these could affect the welfare of the society and sustainability.

The criteria and indicators for assessing the sustainability of bioenergy development

An indicator can be used to quantify a specific impact of bioenergy production (e.g. the rate of soil erosion). Ideally, to evaluate the sustainability of bioenergy use, the impacts of bioenergy production, conversion and trade must be analysed using an integrated approach, taking account of the three dimensions of sustainable development: people (social well-being; the social impacts), planet (maintaining environmental quality; the environmental impact), and profit (economic viability of bioenergy production and its welfare impacts; and other economic impacts). The production and use of bioenergy can only be deemed sustainable if the net impact is positive. Practically applicable criteria and/or indicators are required to monitor and assess the sustainability of bioenergy production and use.

Various ongoing initiatives aim to ensure the sustainability of bioenergy production and use through certification, a form of communication that assures the buyer of bioenergy that the supplier complies with specific sustainability criteria. The European Union and several individual countries, most notably the UK and The Netherlands, are currently developing certification systems. Other countries, for example Brazil, are linking biofuel certification with tax reductions and other incentives to stimulate sustainable bioenergy use. Also, various non-governmental organisations are formulating sustainability criteria.

Smeets (2008) analysed to what extent implementing a sustainability certification system affects the management system (costs) of bioenergy production and availability (quantity) of land for energy plantations. The certification system takes account of twelve sustainability criteria and accompanying indicators. However, this certification system lacks the important criterion of “GHG emissions”. A project group “Sustainable Production of Biomass” was established in 2006 by the Interdepartmental Programme Management Energy Transition to develop a system for biomass sustainability criteria for the Netherlands for the production and conversion of biomass for energy, fuels and chemistry. A set of generic sustainability criteria and corresponding sustainability indicators was formulated.

The need to secure the sustainability of biomass production and trade in a fast-growing market is widely acknowledged by many stakeholder groups and setting standards and establishing certification schemes are recognized as possible strategies that help ensure sustainable biomass production and trade. McBridge et al. (2011) have developed a selection criteria framework for bioenergy sustainability.

There seems to be a general agreement that it is important to include economic, social and environmental criteria in the development of a biomass certification system. However, mutual differences are also visible in the strictness, extent and level of detail of these criteria, due to various interests and priorities and geographic constraints. The development of biomass certification systems is still in its infancy and largely in development. Therefore, it is worthwhile to consider in this preliminary phase which ways can be followed if the strategy to be taken in the development of a reliable and efficient biomass certification system.

DISCUSSION

Environmental impacts of biobased economy

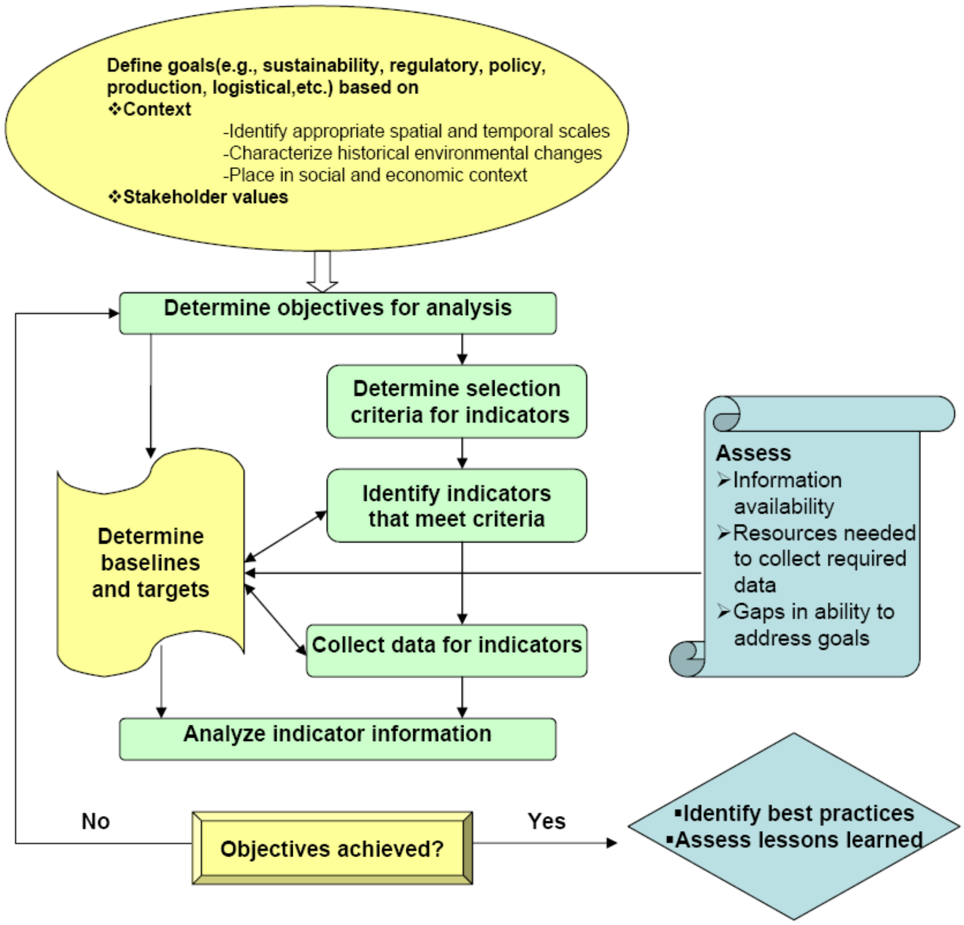
Agriculture involves a large human manipulation of the biosphere that impacts the environment. For all the impacts considered, Engstrom et al., noted that agriculture affects the environment through: eutrophication of water resources, GHG emissions, and loss of biodiversity. On a life cycle analysis basis the impacts are even larger but much of that environmental harm is associated with fossil fuel use. In addition to direct fossil fuel use for agriculture, agriculture production involves further fossil fuel use for energy-intensive inputs like N fertilizers and for transportation of inputs to the farm and products from farm to market.

Bioenergy production is an important existing bioeconomy initiative whose current and potential environmental impacts have been studied extensively. Bioenergy production may cause eutrophication of water, increases ecosystem and human exposure to toxins, causes loss of biodiversity, degrades air quality, and increases acidification of the ecosystem.

Informed decisions by society require comparative studies of environmental impact of alternatives. For agriculture, the most useful information for decision–makers is not the damage from agriculture to the environment but the comparative measures of environmental harm between food types, production practices, and/or geographical situations. This information facilitates making choices that best balance food need with acceptable environment damage. A similar situation exists for bioenergy. The comparative values of environmental impact between energy sources are required to make sound choices in bionergy. Thus, the problem becomes a multi-objective, albeit limited, optimization across the considered alternate energy sources or across considered alternative ways to provide energy-related functions, such as km of passenger travel.

Greenhouse gas emissions

Reducing GHG emissions compared to fossil-fuel alternative is often considered the environmental value of biofuels. Several standards require that biofuels provides GHG emission reductions at least 60% lower than those for competing fossil fuel.



Framework for Selecting Sustainability Indicators for Bioenergy

The estimated GHG benefits of bioenergy are complex, variable, and controversial. Most biofuel production systems provide GHG benefits, typically at least 30% less than fossil fuels. Some favourable systems such as biodiesel from palm oil and ethanol from sugarcane in Brazil can achieve life-cycle reduction of 50% to 90%. Second generation biofuels using biomass crops and crop residues have been estimated to achieve GHG reductions greater than 50%.

However, some studies argue that the GHG emissions associated with bioenergy production are underestimated and that there is no net GHG savings for many biofuels.

Considering changes in soil carbon associated with crop production can reduce GHG emissions. Where there is an increase in land carbon stocks this reduces net GHG emissions and, if the carbon stock change is sufficient, GHG emission can become negative, i.e. a net removal.

Searchinger et al. (2008) included indirect land-use change (ILUC) from major increases in ethanol production from US corn. There are large GHG emissions from the land use change, particularly from clearing of forests. They calculated that it would take 150 years of biofuel production before the aggregate GHG emission reductions from ethanol compared to fossil-fuel gasoline are larger than the GHG emission from biofuel-induced ILUC. Fargione et al. (2008) estimated that the GHG effects of ILUC increases the GHG emission for ethanol from US corn by 17 to 420 times. However, the analysis of Searchinger et al. (2008) has attracted criticism that it oversimplifies trade effects, neglects the effect of increases in yield over time, and the use of alternatives pathways to ethanol from feedstock other than corn.

Kløverpris et al. (2010) used a global trade model to show that land use impact is complex and depends on where feedstock production is taking place. Gains in productivity are more feasible in some regions than others. For example, Denmark has high yield and restrictions on use of fertilizer and pesticides so opportunity for increased production is lower than countries with lower initial yield and fewer restrictions on farming activities. Feasible increases in yield of crops can overcome the ILUC associated with bioenergy. Schmidt et al. (2009) determined that selection of location for sourcing food to replace that lost from bioenergy is important to ILUC effects. For example, exports of Canadian rapeseed oil to Europe would displace palm oil from tropical countries where palm plantations threaten the rain forests in those countries. Similarly, by strengthening the market demand for field crops in the Canadian Prairies, the demand for biofuel feedstock will increase the area seeded to crops, rather than left fallow, a practice that is known to increase wind erosion.

Land use and biodiversity:

Gomiero et al. (2010) have argued that agreed limits to human appropriation of ecosystem services and global net primary productivity are needed. The world will not be able to support biofuels and food production when loss of agricultural land for transportation, industry, and settlements are considered. Appropriation of net primary productivity beyond the current 50% is unsustainable. They point out that the area impact of biofuel is already much larger than that of fossil fuels considering their relative impacts on energy supply. Fibre and bioenergy needs will exacerbate the pressure on global biodiversity from conventional food production. Bioenergy is a tradeoff between GHG reductions and biodiversity.

Land use impact is not only how much land but also what land and how land is used. Dale et al. (2010) present a potential scenario of increases in biofuel production with increases in biodiversity, mostly through increase production of perennial biomass crops included vegetation mixtures more similar to natural prairies. Solid biofuels for commercial and industrial applications could be an effective and sustainable way to grow the bioeconomy. The use of biomass pellets – which can be produced from wood, switchgrass or straw, would not only create new market oppourtunities for the forest and agricultural industries, it would reduce dependence on coal as well as the GHG emissions associated with coal use. Sophisticated geographical analysis involving land use, habitats, and sensitive ecosystems allows for design of bioenergy production that minimizes potential biodiversity impact. However, Gomiero et al. (2010) note that efficient biofuel production requires monoculture and mechanization for land near the biofuel plants to achieve maximum efficiency. Such production practices could be detrimental to biodiversity.

Bioenergy feedstock production will affect land use which can impact biodiversity to varying degrees, depending on the crop type and the region. Growing grain crops probably has the greatest detrimental impact on biodiversity if these crops are managed more intensively, with increased inputs and fewer rotations. Growing perennial herbaceous crops on marginal land can often reduce biodiversity loss compared to using the land for row crops such as corn. However, Dyer et al. (2011) found that if the marginal land is natural grassland, such as much of the rangeland in Western Canada, rather than the result of land degradation, even a perennial feedstock crop (such as switchgrass) could result in the loss of extensive areas of natural habitat. When cattle are displaced by feedstock crops (ILUC), they may be grazed at unsustainable stocking rates or in rangeland not previously used for grazing. Good geographic planning of bioenergy development can protect high-carbon high-biodiversity compared to letting market forces determine land use.

Sustaining land productivity:

Crop residues are an attractive feedstock for bioenergy since they do not reduce food production, are available in large quantities, and are relatively low cost. However, crop residue protects the soil from erosion and maintains soil organic matter.

The removal of 20-30% of crop residue is probably sustainable although residue removal will eventually require additional fertilizer to replace nutrients removed. The balance between the residue removal rate and long-term soil health is a challenge.

Soil erosion is affected by crop type and its production practices. Generally, increased bioenergy production increases erosion risk. The choice of crops is important, especially if maize replaces grass and forages. Production practices, such as winter cover crops where appropriate, can mitigate erosion risk.

Eutrophication:

Nutrient loss through runoff leads to eutrophication of water bodies. This is largely a consequence of fertilizing crops for bioenergy feedstock. Consequently, bioenergy can increase eutrophication compared to fossil fuels even in highly optimized production systems. The use of perennial biomass crops for bioenergy feedstocks can decrease contamination of water with nutrients compared to annual crops. Similarly, removal of crop residue can increase nutrient contamination from surface runoff.

Economic impacts of biobased economy

The economics of biofuels critically depend on the price of fossil fuels, price of feedstocks, the cost of conversion and the revenues generated by the by-products. Storage, transport and logistic costs also need to be included. Two major sources of revenue from biofuel production are sale of the fuel, and sale of by-products, which may include dry distiller’s grain and sollubles (DDGS), glycerine and carbon dioxide, as well as rapeseed or soybean meal.

Investigations by (S+T)2 & Edna Lam Consulting (2005) for ethanol and biodiesel production suggest that these products cannot compete with fossil-based products without a subsidy. The impact of biofuel production on various sectors of the society is also very different. Benefits are realized by the ethanol industry, but at the cost of state revenues, and consumer expenditures. But with new markets that respond differently than conventional food markets, the rural economy is enhanced. Society as a whole benefits from the country's reduced reliance on crude oil imports and reduced economic costs for mitigating GHG emissions.

Job creation and rural development:

Brazil is one of the examples of successful job creation from bioenergy industry. The bioenergy industry offers direct or indirect employment opportunities.

Direct employment refers to the creation of employment opportunities from increased biofuel feedstocks production, transportation and construction and operation, maintenance of conversion processing plants. Indirect employment is jobs created through the supporting industries, for example, marketing and distribution of end products from biofuel industries.

Employment generation from a biofuel plant differs between the two stages: construction stage and operations stage. During the construction phase, employment impacts are large but temporary in nature. Plant operation generates fewer but permanent jobs. For example, Haig (2006) estimated that the impact of producing 2 billion litres of ethanol on the rural economy would generate 6,645 jobs in rural Canada.

Urbanchuk (2006) has found that local ownership of biofuel plants maximizes the rural development potential. He estimates that the full contribution to the local economy of a farmer-owned co-operative ethanol plant is likely to be as much as 56 percent higher than the impact of an absentee-owned corporate plant. This is attributed to two main factors unique to farmer owned plants:

1. A larger share of operational expenditures is made in the local community; and
2. The distribution of dividend payments to farmer-owners of a co-operative ethanol plant represents additional income to farmers and their families.

Meanwhile, if a market for selling carbon credits could be established, this would provide another source of revenue to farmers.

Improved trade balance:

The activities associated with the biobased economy such as the expansion of biofuel would cause, in some cases, substantial increase in exports of agriculture commodities due to a diversified set of agricultural products. In addition, a biobased economy is economically viable in a longer term perspective. In a study of Thailand, although the costs of biofuel production may exceed the cost of importing equivalent petroleum, domestic production of biofuels allows virtually all of the money to stay within the country's economy, and thus, adds to the balance of payment for the country.

Establishment of new industries:

An increase in feedstock production for biobased industry results in an increased production of by-product and residues that are in turn utilized as raw materials for several other sectors, such as livestock production, cosmetics and pharmaceutical industries, among others. Input providing industries, such as agricultural equipment manufacturing firms and fertilizer industries, will expand to supply additional goods and services to support the increased biomass production activity. Byproducts and inputs can be important criteria for feedstock crop choices. For example, soybean-based biodiesel was shown to have a lower carbon footprint than rapeseed-based biodiesel due to both providing more livestock feed byproduct than rapeseed oil and being a legume that does not require N-fertilizer input.

The oil price plays an important role in determining the economics of biofuels. If the world oil price remain high, biofuels will be more financially viable even without government support. The remote areas (or countries) usually have the comparative advantage of labor, but due to poor facility and transportation system, prices of oil may be markedly higher than the international prices. In these cases, if biofuel production and processing are located near consumption centers or can be transported to them at relatively low costs, they can be competitive against imported fossil fuels.

Fiscal effects of biofuel development:

Biofuel development can affect several levels of governments through one or a combination of three pathways:

1. Provision of public subsidies;
2. Generation of new and different sources of government revenues; and
3. Change in government expenditures.

Under current fossil-based fuel prices, biofuels are not competitive. Many jurisdictions have accepted the need for public subsidies to enhance the public cause. However, biofuel support programs can act as a substitute for other agricultural program subsidies. For example, the U.S. ethanol tax credit, according to Gardner (2003), has served to displace some of the government deficiency payments related to corn. The financial impact on government is likely to include both positive and negative components. There is a cost to government for any incentives provided to the biofuel industry, but there will also be tax revenues that flow to government from the income generated by these operations. Intuitively, if subsidies are retired at some point in time, the benefits from the program would exceed costs to government.

In the case of an energy importing country, impact on the government would be through replacement of petroleum imports. However, this cost should be weighed against government spending to develop the biofuel industry. In some countries such as Brazil, development of the biofuel industry has resulted in a net benefit even after all government support expenditures are included.

Providing the balance to sustainability – trade-offs to be made

Biobased economy cannot provide all of society's material and energy needs. One therefore, needs to look at the value of displaced food production in social-economic context to know if trade-offs are worthwhile. Other possible trade-offs that may exist are:

1. Between economic and environmental goals of the society;
2. Between environmental and social objectives of the society; and
3. Between economic and social objectives.

Environment and economy:

Traditionally, there has been a view that investments for mitigation of environmental damage (environmental protection) is a cost that takes resources away from investments that would increase production efficiency. Consequently, there are trade-offs between environment and the economy. Many countries have developed (or proposed) policies for reducing GHG emissions, such as subsidies, carbon tax, import tariffs for biofuels, and mandates for quantities to be produced or blended. These policies may promote investments in environmental protection and related technology development, while they can also distort markets and are subject to political decisions that may make them unsustainable. At the same time, some policies strive at maximizing the economic benefit, but will cause environment degradation. An example of this is the U.S. volumetric tax credit for cellulosic biofuels, that does not differentiate across feedstocks and rewards monocultures of high-yielding biofuels per unit of land and are therefore unlikely to create incentives for maintaining biodiversity.

Climate change mitigation vs. energy security

Biofuels are attractive to governments which can diversify energy budget and reduce their exposure to international oil market to maintain economic sustainability. Corn-based ethanol in the United States and sugarcane-based ethanol in the Brazil have been built successfully with this objective in mind. While the well–to-wheel environmental benefits are different, such as sugarcane-based ethanol and cellulosic biofuels may achieve significant reduction of GHG, the corn-based ethanol performs poorly due to intensive fossil fuel input.

GHG vs. other environmental goods

Besides GHG emission reduction, there are many other environmental benefits associated with a biobased economy, such as decreasing soil erosion, water eutrophication, loss of biodiversity, that should be considered. Treating GHG emissions as the only environmental cost, with no concern for other environment threats, can probably result in the other environmental goods and services, such as soil, water and biodiversity, becoming the unintended casualties. Decision makers need to include the full range of desired environmental outcomes in the design of appropriate and robust biofuel policies.

Environment and society:

Emphasis on biofuels as renewable energy sources has developed globally. The use of food crops for biofuel production raises major nutritional and ethical concerns. As a result some trade-offs may exist. One such trade-offs is use of agricultural commodities for food vs. for fuel production.

The food versus fuel debate arises because increased use of land and water for bioenergy production reduces the availability of these resources to produce food for human consumption. The competition is direct in terms of first generation biofuel production that uses feedstocks of cereal grains (e.g. corn, wheat, etc.), oilseeds (e.g. rapeseed, soybean, palm oil), or other crops (e.g. sugar cane) that are conventionally used for food. However, even if the bioenergy feedstock crop is not suitable for food directly, it uses land that could be used for food production.

Secure and affordable food is basic to social sustainability. However, bioenergy may be at the origin of social benefits in providing better quality of life for rural population. It also has great potentials to mitigate environmental impacts. Therefore, if bioenergy is seen as a net environmental benefit, then the extent to which bioenergy production threatens the supply of secure and affordable food becomes an environment and society trade-off. However, if bioenergy is seen as environmental benefit, then the trade-off becomes between society and environment.

Economy and society:

Usually, it is hard to clearly distinguish between economic and social issues. While economic sustainability emphasizes the economic feasibility and viability, society sustainability focuses more on distribution, human health, human rights and equity. Some social conflicts hide behind the economic benefit maximization. For example, the smaller scale operations generally have higher cost. However, the social sustainability policy goals for biofuels include promotion rural development and inclusion of small farmers. This trade off is important as many commodity dependent developing countries are characterised by a high proportion of small producers.

If an industrialized form of bioenergy crop cultivation is practiced, then the land required will most probably be controlled by large land owners or national companies. From maximization of the economic profits, crop cultivation tends to be industrialized which in turn will affect small landowners and poor people's right and welfare. Land ownership should be equitable, and land-tenure conflicts should be avoided. This requires clearly defined, documented and legally established tenure rights. To avoid leakage effects, poor people should not be excluded from the land. Customary land-use rights and disputes should be identified. A conflict register might be useful in this context.

CONCLUSION

There exist significant opportunities and challenges with biobased economy. If done correctly, such developments can provide important environmental, economic, and social benefits. The challenge is to have desired outcomes well defined and then develop structures and policies to make those outcomes a reality.

The biobased economy is a major new opportunity for agriculture, which could enable to take it from its recurring overproduction for limited food, feed, and fiber markets to a more sustainable and profitable productions. But the benefits of this biobased economy will extend beyond agriculture to society as a whole, necessitating broad-based support in terms of public policy and investment.

Biobased economy, being located in rural areas, may provide many social benefits, including:

1. Increased employment opportunities in rural areas, resulting in reduced out-migration of local people;
2. Health and sustainable rural communities; and
3. Emergence of new investment opportunities for local entrepreneurs (e.g. trucking).

Many new challenges would also emerge as a result. Among these are included some of the economic challenges, such as:

1. Biomass crops have only one local market, making the local economy more sensitive to its price;

2. Cost of infrastructure improvement and maintenance;
3. Increased specialization;
4. Lack of local control (since heavily capitalized portions of business are less likely to be locally owned -- such as biorefineries to process corn into ethanol);
5. GHG mitigation could cause agricultural activities to be reduced (e.g. through decreases in livestock population which currently provide important incomes and employment);
6. Higher priced food (local, national, and international);
7. seasonal employment;
8. Many low-skill jobs, e.g. machinery operator, truck driver, etc.;
9. Road congestion, less safe highways due to truck traffic to transport biomass;
10. Potential competition for water between population and industry, affecting some social functions in the communities; and
11. Destruction of traditions, e.g. displacement of livestock, farmers into forest plantation managers, pastures into biomass grass.

To develop a sustainable biobased economy, two important needs must be addressed. First, it is essential to identify and implement mechanisms for the sustainable production of biomass as current practice of agriculture already facing challenges related to environment degradation and food security due to unsustainable practices. Policy incentives to adopt sustainable agriculture methods that help maintain soil cover, increase water use efficiency and reduce soil erosion are critical and, research focus on ecosystem services to provide the necessary information to make appropriate land management decisions is also required. Second, developing technologies in order to improve the efficiency of conversion of biomass to biofuels is essential. This not only improves the energy yield of bio-fuels but also reduces the overall environmental and economic burden and hopefully could provide sufficient quantities to satisfy the energy needs of the society.

Ultimately, in a short to medium term, the success of biofuels market completely dependent on the economic factors and not ecological aspects. However, Coelho argues that the full potential of biofuel industry is hindered currently because the fossil fuels do not reflect their real costs and risks. The externalities associated with fossil fuels, such as additional health and environmental costs, are not taken into consideration and the policies of biofuels are mostly focus on side effects, such as local agricultural and food effects.

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CHAPTER 4

ENVIRONMENT, ECONOMY AND ETHICS

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ABSTRACT:

The study of environmental ethics is a subfield of applied philosophy that focuses on the philosophical underpinnings of environmental values as well as more practical concerns about social attitudes, behaviors, and policies that aim to preserve and maintain ecological systems and biodiversity. The application of moral or political philosophy to important concerns in business organizations or the economy is known as economic ethics. The application of moral or political philosophy to important problems in the interaction between people and non-human environmental systems is known as environmental ethics.

KEYWORDS:

Environment, Ethics, Economy, Human Society, Natural Resources.

INTRODUCTION

The distribution, allocation, and use of natural resources are all topics covered by environmental and resource economics. These issues may be examined in a framework that doesn't need the endorsement of any certain ethical position to some degree. We may concentrate on responding to queries of the type "What are the consequences for Y if X occurs in a certain set of circumstances?" This kind of analysis is frequently referred to as "positive" economics. But, it is constricting to limit our scope to responding to inquiries of this kind. Many economists are interested in doing "normative" economics, which addresses issues of what ought to be done in a certain set of circumstances. Use of ethical standards developed from beliefs about how people should act is required in order to accomplish this. Economists often use standards drawn from utilitarian ethical theory while doing normative economics, also known as "welfare economics". The foundation of normative resource and environmental economics is primarily utilitarian ethics. This chapter's major goal is to introduce and summarize the utilitarian approach to ethics and to demonstrate how it influences normative economics. In order to set the stage and offer some perspective, the first two parts of this chapter briefly examine alternative approaches to ethics. The third half of the chapter then outlines the fundamental ideas of utilitarianism as a broad approach to the topic of how we should act as well as the specific applications of that general approach that welfare economics makes [1].

According to some other naturalist philosophers, the definition of sentience is excessively limited. Outside the category of other creatures that are capable of feeling pain and pleasure, we have duties to other people. The conclusion is that every living thing has rights that should be taken into account by any moral actor. In his opinion, "being in existence "rather than "being alive" confers the right to be taken into consideration by others. Hunt believes that all things, whether they are alive or not, animate or inanimate, have inherent rights. Although being succinct, our overview of naturalistic ideologies shows that the traditional humanist philosophy held by the majority of economists has been opposed. It seems that several ecological and environmentalist arguments have strong naturalistic ethical underpinnings. This may explain why it has been difficult for traditional economics and certain environmentalists to come to consensus. See the list of recommended readings at the conclusion of the chapter if you want to learn more about naturalistic moral philosophy than what has been covered in this chapter. A humanist moral philosophy, libertarianism. It bases its main tenet on the idea that each person's human rights are fundamentally inviolable. There are no rights other than those of individual humans, and the respect or lack thereof for those rights is measured in economic and social behavior. Individual rights violations cannot be justified by citing any ostensible increase in the state of social welfare. In order to ensure that each person's basic freedoms and rights are maintained and upheld, libertarianism claims that processes, procedures, and mechanisms come first. People have intrinsic rights, hence ideas like "community rights" or "social rights" are meaningless.

Early utilitarian authors coined the word "utility," which refers to the individual's pleasure or satisfaction. This word is still used in such fashion in contemporary economics. The social good, which in utilitarianism and, by extension, welfare economics, is some combination of individual utilities, is referred to as "welfare" in this context. According to utilitarians, doing things that improve wellbeing is good and doing things that harm it is bad [2].

According to utilitarianism, an action's moral value is purely based on its results or consequences, which is a consequentialist view of moral philosophy. This is where it differentiates from deontological theory, which holds that an action's intrinsic nature determines whether it is good or evil, and motivist theory, which holds that an action should be assessed according to its motive (Kant was a motivist). For a utilitarian, an action may be ethically permissible even if it is carried out for motives that are unworthy and has a character that may sometimes be deemed harmful. The objectives may justify the methods for a utilitarian.

Human-Centered Utilitarianism

Making a utilitarian judgment requires us to, among other things, choose the make-up of the set of entities over whose consequences matter. We must determine who should be taken into account when determining whether a certain conduct is good or wrong. The founders of utilitarianism believed that only distinct human beings were ethically significant, and that people were the only group of creatures over which consequences should be weighted. The same anthropocentric viewpoint is held by contemporary economists. In fact, they often further limit the morally significant set when doing applied welfare economics by taking solely the effects on the human citizens of a given country state. The limitation to people is not logically necessary. He contends that obtaining pleasure and avoiding suffering are the sources of utility, and because all sentient creatures (by definition) are able to feel either pleasure or pain, all may be seen as being able to take advantage of utility. Utility, therefore, is a quality of sentience in general, not only of mankind [3].

In his conclusion, Singer argues that it is ethically acceptable to judge decisions based on how they will affect utilities and, by extension, welfare, but he also argues that non-human utilities should be given consideration alongside human ones. It should be highlighted that disregarding the interests of non-human things does not necessarily follow from rejecting Singer's arguments for the expansion of moral considerability. Notwithstanding the fact that only human utilities matter, there are two ways that non-human interests could affect choices.

Utility-Based Preference-Satisfaction Theory

Assuming that we have established that the consequences for individual human beings should determine what is right and wrong. The solution for the utilitarianism that forms the cornerstone of normative economics is that the affected individuals make the decision.

According to the preference-satisfaction utilitarianism of welfare economics. This is sometimes referred to as "the concept of consumer sovereignty" and holds that consumer desires should control the economy [4].

It is illogical to conclude that anthropocentric utilitarianism entails consumer sovereignty. Instead of preference fulfillment, physical and mental health might be used to define individual usefulness. While this is theoretically correct, most people interpret utilitarianism to entail evaluating oneself in accordance with preferences due to terminological issues. The reason it's crucial to make it clear that an anthropocentric consequentialist theory of ethics does not entail consumer sovereignty is because this use is so pervasive. The version of consumer sovereignty and choice satisfaction used by economists does, as we will see, lend itself to formalization and quantification. Also, as we will show, it is true that the market, a kind of economic organization that has come to rule human society, is well-aligned with it. Yet, it has its detractors, some of whom are economists. After reviewing how (preference-satisfaction) utilitarianism approaches social welfare, we'll take a closer look at some of its criticisms.

Utilities and Welfare

Social welfare, according to utilitarianism and subsequently welfare economics, is a collection of individual utilities. According to utilitarians, doing things that improve wellbeing is good and doing things that harm it is bad. We now need to think about the exact route from utilities to welfare.

Utilities that are ordinal and cardinal

All utilitarians agree on one point: societal welfare, often known as well-being, is a function of the utility of all relevant individuals. We'll look at the possible formats for this function soon. Whatever the answer, we can only get such an aggregate metric if we treat people's individual utilities as similar [5]. According to economists who practice positive economics, preference orderings may be modeled by ordinal utility functions, from which the basic ideas of demand theory can be deduced. Change the order of this. Demand theory only requires ordinal measurements of usefulness rather than cardinal ones. Hence, there is no foundation for comparing interpersonal usefulness. We cannot accurately infer from A and B's actions and conditions that A is more useful than B, or vice versa.

Considering this, economists have spent considerable time attempting to come up with techniques to avoid having to draw interpersonal comparisons while doing normative economics. The term "compensation tests" refers to this branch of welfare economics. Here, we only outline the fundamentals. Assume that we are thinking about altering the economic structures in a way that affects how much A and B consume. Positive demand theory's basic tenets hold true if both are allowed to consume more of everything; hence, we do not need to compare them to one another to determine that the shift has enhanced welfare. These kinds of changes are unusual. Any suggested adjustment would often benefit A or B more than the other, increasing their utility, while harming the other, resulting in reduced utility. How can we determine whether the modification is desirable at this point? The logical course of action is to combine the utility changes, maybe using weights, and determine if the result is positive or negative. If the result is positive, we can infer that the change is beneficial. Yet, because comparisons of interpersonal utility are forbidden, we are unable to accomplish this. To get around this, you might state that the change is desirable that is, welfare-improving if it results in the gainer from the change being better off as a result and completely making up for the loser as a result of the change, in her estimation. A modification like this is referred to as a "Pareto enhancement" since it benefits at least one person without harming anybody else. Although this method does eliminate the necessity for interpersonal comparisons, it is not very practical. If economists were limited to providing policy recommendations based only on the Pareto improvement test, they would not have much to say. They would be limited in what they could say to modifications where either everyone won or the winners had to make up for the losers. Governments seldom ask for opinion on policy changes that include mandatory compensation [6], [7].

Economists developed the concept of the "possible Pareto improvement" test to broaden the potential application of recommendations. This suggests that a change is preferable if the winners could offset the losses and still come out ahead. Real payment is not necessary. Potential compensation tests do not provide a solution, as shown in Chapter 5, despite being frequently utilized in practical welfare economics. The use of cardinal utility functions is necessary for economists to aggregate over individual utilities and do interpersonal comparisons in order to find improvements that improve wellbeing [8].

DISCUSSION

Many of the topics we discuss in this work entail making decisions that have long-term repercussions. Such decisions are thought to have a "intertemporal" component. An "intratemporal" analysis is one in which we only consider the implications that are occurring right now. We have been examining utilitarianism as the moral foundation for intratemporal normative economics so far in this chapter. The majority of economists also take a utilitarian standpoint when addressing normative intertemporal concerns, as will be discussed in this section. Nonetheless, it should be highlighted that although there is much dispute over the precise implications for policy of the basic framework for analysis, there is rather broad consensus on that point [9].

The discussion here is more in the style of an introduction to intertemporal distribution problems. We will use a method that is often used in this branch of economics in order to make the analysis very straightforward and to retain intertemporal ethics as our main emphasis. We'll conceptualize time in terms of advancing human generations. We shall proceed under the assumption that the number of the human population remains constant throughout time and that each generation can be thought of in terms of a single representative member. Next, we consider how the present generation would act toward future generations if it adhered to the guidelines derived from a certain ethical perspective, in this case utilitarianism, on how to make decisions that have an impact on future generations [10].

The maximization of the function that converts utilities into welfare is evaluated in the intertemporal situation, just as it is in the intratemporal case, to determine the consequences of utilitarianism. As a result, we start by defining the intertemporal social welfare function. At first, we just take into account two generations. This will enable us to utilize the same basic notation as when examining two people simultaneously. Generation 0 is the current generation, while generation 1 is the one that will come after it [11], [12].

CONCLUSION

Regarding the goals of environmental policy, such as the acceptable amount of pollution, economists provide advice. Such advice comes from welfare economics, whose moral foundation is a kind of utilitarianism where the standard of what is good for a person is used. Many people who care about the natural environment have varying ethical stances. For instance, some people desire to give non-human beings moral status. The interests of non-human animals are only taken into consideration in the preference-based utilitarianism that forms the basis of welfare economics. Many of the choices that must be made about the usage of the services that the natural environment offers have long-term effects on human interests.

The next issue is whether future consequences in decision-making should be accorded the same weight as present-day effects. This is the discounting issue. It's crucial to understand the difference between discounting future consumption and future utility while considering this issue. Moreover, it must be understood that the effects of discounting depend on the conditions in which utility and consumption may be changed over time.

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CHAPTER 5

GROWTH IN THE ECONOMY AND ENVIRONMENTAL STABILITY

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ABSTRACT:

Throughout the last 20 years, there have been several approaches to the sustainability problem. If the concept of sustainable growth is given a quantitative understanding in neoclassical logic, the heterodox positions in recent years. Instead of focusing on the quantitative aspect of growth, economics, etc. Our major goal is to support the most recent conceptualization of sustainability, according to which the effective use of resources, the growth of employment, and the protection of the environment for future generations are fundamental components of the term.

KEYWORDS: Environmental, Economic Growth, Natural Resources, Preservation, Sustainability.

INTRODUCTION

It is hard to claim that effective resource allocation, employment, environmental preservation, etc., are consistent with an economic growth notion. Over a period of decades, both economics and ecology have evolved as disciplines with distinct goals, terminologies, and approaches. Compatibility is now almost a given. For instance, Commoner argues against the issues that technology as opposed to the significant rise in consumerism, population, etc. has presented to the environment. The separation of streams such as information society and sustainable development, according to the author, has led to significant issues like rebound effects. According to ecology talks more about ecosystems and their operating principles, whereas traditional science more closely resembles the science of parts.

This chapter's main goal is to demonstrate how economics see sustainability. We also take into account how ecologists approach sustainability. We won't be debating whether sustainability ought to be a goal of policy. Such kind of ethical dilemma was covered in the previous chapter. Here, we will assume that sustainability is desirable and that it is generally accepted that the present generation of humans should consider the interests of future generations. The second issue is how we safeguard their interests. There are two steps to this second query itself. The first step is to identify current policy goals that protect long-term interests. Creating policy tools to accomplish such goals is the second step. The major focus of this chapter is on how to connect the goals of present policy with the interests of future generations. It merely provides a very broad response to queries concerning instruments; the most of the next chapters focus on a more in-depth examination of these issues [1].

In order to analyze how the concept of sustainability as described above may be made more explicit, we define interests as consumption levels and consider comparisons of various temporal trajectories for consumption in the first portion of the chapter. This is the natural course of action for economists to take when analyzing the sustainability issue. For a subsequent debate, we also provide several methods to conceptualize the sustainability challenge in this chapter. The two parts that follow next examine sustainability from an economic and ecological perspective, respectively. We next go through a strategy that frames the issue largely in terms of social structures and institutions. These many conceptualizations of sustainability shouldn't be seen as rivalry or as mutually incompatible. Instead, they work in tandem, and the last portion of the chapter tries to derive some general policy implications from this. The study in this chapter will be based on the assumption that the size of the human population remains constant. This premise considerably simplifies the explanation without sacrificing any crucial insights. For instance, if we define sustainability as continuous consumption, it is obvious that considering per capita consumption is something we must do if we really care about the interests of future generations. When we speak about consumption increasing, decreasing, or remaining constant, we are referring to the nature of the time path for both per capita and aggregate consumption since we are assuming a constant population size. The consumption/utility that we refer to as belonging to some representative person, where all people are the same in all pertinent ways, may be treated in the same manner as in the preceding chapter [2].

Growth, development, sustainability, or the new development and sustainability paradigm. The main concern is how development functions in terms of quality when there are issues with increasing inclusion, producing more effective allocation, and separating all of these from energy use, non-renewable resource use, desertification, and unsustainable emissions. All of these issues appear to limit the economy's ability to contribute to the reduction of inequalities. For instance, authors like Neumayer fought against the issues brought on by ecological sustainability, economic progress, and expansion. The concepts of weak and strong sustainability are also quite important. These trends and ideas have been the focus of the whole discussion and the answers offered. The main challenge is striving to meet the requirements of the present without compromising the ability of future generations to meet their needs in an equal manner. Ecologists and economists continue to have various perspectives on how to tackle the problems of growth, development, and sustainability; there is no such thing as a sustainability concept that can be applied to varied circumstances.

The relationship between ideas like development, robust sustainability, sustainable regrowth, and adequate allotment the latter of which is strongly tied to the neoclassical tradition of economic growth is what we are attempting to demonstrate. While wealth per capita might increase when the GDP per capita increases, the rise of the Gross Domestic Product cannot be used as a measure of wellbeing. If growth is to address welfare or be environmentally friendly, it must be qualitative or focused on the issues of income, health, and education basic needs; there is evidence that, for instance, Japan's early massive investment in education and health had prepared it for the techno-economic leap after the war, and others show that economies with low GDP values can expose much higher levels on indicators such as mortality, poverty, etc. as compared to economies with higher GDP values. In these conditions, it is essential to develop an effective concept for eco-sustainable allocation because meeting needs necessitates the production of goods, which invariably interferes with the marginal allocation and distribution brought about by market and/or price dynamics. However, the economy cannot be eliminated in its entirety, including efficiency, growth, etc., but it can broaden its goals to include environmental protection and qualitative development or growth. Solutions can be found at the level of policies and paradigms from underutilized areas, such as sustainable regrowth, strong sustainable consumption, materialization of consumer lifestyles, etc.

DISCUSSION

The issue of allocation is unavoidable, particularly given the fact that without effective allocation, output would exceed the marginal cost, resulting in the loss of resources, energy, etc. We believe that allotment may be included into development and growth paradigms that are quite distinct from the tradition they are a part of. The extent of allocation and expansion is the challenging factor. Yet this results in a scenario where a limited environment, like the ecology of the planet, cannot support ongoing economic expansion, the introduction of new wants, etc.

What Chichilnisky refers to as the tragedy of the commons is the major problem with allotments. Most likely, the way the market operates in regard to the harmful externalizations it creates is what puts the economy and ecological in opposition to one another. The market has a propensity to internalize advantages while socializing externalities and costs. Chichilnisky offers a means of challenging this issue and representing the Kyoto Protocol's stance. Similar to how information is seen as a public benefit created in the private sector, emissions, deforestation, etc. If knowledge is universally accessible and/or non-competitive, particularly as a result of new information technology, then global CO2 emissions exhibit the same limitless expansibility. Different individuals create both knowledge and CO2. These are thus both public products produced in the private sector. The institutional and direct effects of this therapy raise questions of equity and development on an equal footing with the lessening of environmental harm [3].

Maybe the most significant action is the trading in public commodities. Since public commodities like CO2 emissions, several concepts and designs , which makes it possible for both the internalization of negative externalizations through a policy of rights and the possibility of reducing emissions as a result of a better costs-benefits alignment; the opening of economies to newer and more ecological forms of production ; and The concepts of efficiency and equity, which are differentiated in conventional markets with private products but are now correlated to public goods markets, are the factors that set the public goods markets apart from the private goods markets. Consequently, countries that are less polluting or that rely more heavily on natural resources while yet being less polluting than industrialized economies have more rights to pollute; economies that are more polluting have fewer rights to pollute but must pay more to get additional rights. These rules are outlined in the Kyoto Protocol of 2005, which turns them into an international law. Particularly when it comes to the private identification of public goods, the equitation and efficiency principles coincide. The market is not destroyed, but under the new institutional setup it creates greater equality, not simply efficiency, with regard to transactions and market allotment. In these conditions, according to Chichilnisky, the relationship between the North and the South, which is based primarily on utilizing comparative advantages, could be changed in the direction of better equity, efficiency, and sustainability, which appear to generally characterize knowledge- and information-based societies.

Because the concept of sustainable development is still relatively young and lacks a unified meaning, it is a phrase that is often used by politicians throughout the globe. Despite how crucial it is, the idea of sustainable development is continually being developed, and the term's meaning is often updated, expanded, and improved. When development "meets the requirements of the present without compromising the capacity of future generations to meet their own needs," it is sustainable, according to the traditional definition provided by the United Nations International Commission on Environment and Development in 1987. It is generally accepted that the lack of current social equality would make it difficult to attain this "intergenerational" justice if some groups of people's economic activities continued to endanger the well-being of people belonging to other groups or living in other regions of the globe. Suppose, for instance, that greenhouse gas emissions, which are mostly produced by highly industrialized nations, cause the flooding of certain low-lying islands, which causes whole island nations to be uprooted and rendered impoverished. Now think about the scenario where pharmaceutical firms make more profits at the expense of millions of underprivileged individuals who are unable to pay for the drugs they need to treat their life-threatening illnesses. "Sustainable" development is probably better described as "equitable and balanced," which means that in order for development to continue indefinitely, it must simultaneously balance the interests of various groups of people in the economic, social, and environmental realms in both the same generation as well as between generations. Hence, equity which is defined as equal possibilities for well-being as well as the comprehensiveness of goals are key to sustainable development [4].

It goes without saying that any government would find it very difficult to balance so many different development goals. How would you weigh the advantages of increased national security against the disadvantages of slower economic development? There is no purely scientific way to carry out these assessments and comparisons. But, governments have to make these types of judgments on a regular basis. Such choices must be made in the most democratic and inclusive manner possible if they are to represent the interests of the majority. Nevertheless, even under this scenario, there is a significant chance that the long-term interests of our children and grandchildren won't be taken into consideration since they won't be able to cast their own votes. Hence, our current values must be educated enough to represent their interests as well in order to guarantee that future generations inherit the circumstances essential to secure their own wellbeing.

The difficulty is made much more difficult by the fact that many facets of sustainable development are, in reality, international or even global in today's interconnected globe. On the one hand, a lot of choices made at the national or even local level really have global economic, social, and environmental repercussions. "Exporting unsustainability" is a term that is occasionally used to describe the scenario when these implications are detrimental. On the other hand, national policies are often insufficient to successfully address many sustainability-related concerns. As a result, international collaboration is essential to addressing the vast array of so-called transboundary and global issues related to sustainable development. Eliminating severe poverty is perhaps the most important issue with sustainable development in each nation as well as worldwide. This is so because poverty isn't only bad in and of itself. Moreover, it hinders the achievement of the majority of other development objectives, including personal freedom and a clean environment. The establishment and maintenance of peace in all nations and areas is a separate but closely linked global issue. All economic, social, and environmental development objectives are inevitably undermined by war and poverty [5].

In the end, sustainable development is about creating long-term circumstances for the multifaceted well-being of mankind. For instance, the famous Rio Declaration states that "Human beings are at the center of concern for sustainable development," which was approved at the United Nations Conference on Environment and Development in 1992. Individuals have the right to live a productive, healthy life in harmony with the environment. Living sustainably is providing for future generations with the resources they need to fulfill their requirements. Environmental, social, and economic sustainability are now seen as the three primary pillars of modern sustainability thought. They have been shown in many different ways, such as "pillars," concentric circles, and interlocking circles. The interconnecting rings model was used in the IUCN Programme 2005-8, which was established in 2005, to show that the three goals need to be better linked and that action has to be taken to restore the balance between sustainability components.

Economic growth and the sustainable use of the world's natural resources are the two main pillars of sustainable development. To put it another way, we must consume while aware that resources are limited and that it is part of our responsibility as humans to ensure that humans continue to inhabit this planet for an infinite amount of time. The Commission also advocated for what it referred to as "equity and the common interest" in this vision of the unlimited future. "Ecological interactions do not respect the borders of private ownership and governmental sovereignty," the Commission said. The development of ever-more-advanced technology has not restricted the local character of human interaction with the environment to just local environmental impacts “Production has expanded internationally due to rapid expansion, with implications for both politics and the economy. Towards the Commission "The lack of alignment between the political jurisdictional and impact regions sometimes makes it difficult to enforce shared interests [6].

Sustainable Development Facilitation

The world's countries urgently need sustainable development strategies due to the diminishing and exhaustible nature of their natural resources. In this article, strategies for attaining and promoting sustainability are examined. For a long time, developing nations have pushed for fundamental revisions to international economic agreements in order to make them more equal. This has been true especially for financial flows, trade, transnational investment, and technology transfer. Their ideas must now be revised to include the ecological factors that were previously routinely disregarded.

For the majority of developing nations, with the exception of the biggest, a new era of economic growth depends on effective and coordinated economic management among major industrialized nations. This management should be done in order to promote expansion, lower real interest rates, and prevent the emergence of protectionism. Longer term, significant adjustments are also necessary to keep consumption and production patterns viable in the face of faster global development. Increasing the Transfer of Resources to Developing Nations Our suggestions on financial flows are driven by two connected issues: one is the number of resource transfers to developing nations, and the other is the quality of those flows. One cannot avoid the need for extra resources. It is a terrible misconception to think that emerging nations would do better to live within their restricted resources. By alone, the governments of developing nations cannot end global poverty. Nonetheless, even if they are important, more financial support and help are insufficient. The design of projects and programs must promote sustainable development [7].

Boosting the Financial Flow

Regarding resource availability, the strictness of foreign financing has already aided in an intolerable drop in living standards in emerging nations. Together with those of low-income countries that depend on assistance, the patterns and demands of highly indebted nations that primarily rely on commercial borrowing have been detailed. Several impoverished nations, though, have achieved notable strides in recent years while continuing to confront significant challenges, not the least of which is halting environmental damage. Asia has a persistent need for significant sums of help, and most of the major receivers there have an excellent track record in aid management. Without such assistance, it will be harder to maintain the growth that, when combined with programs aimed at reducing poverty, might better the life of hundreds of millions of "absolutely poor" people. It is difficult to dispute the significance of ecological issues on a global scale. Coordinated efforts within each economy in the context of international collaboration will become more necessary for their effective resolution. Environmental issues are unparalleled in human history. The primary donors and lending institutions must reevaluate their practices in order to satisfy these demands [8].

Sustainable Development via Lending

Investments required to improve the environment and the productivity of the resource sectors should get a higher share of all development aid. Reforestation and the production of fuel wood, watershed preservation, soil conservation, agroforestry, irrigation project rehabilitation, small-scale agriculture, low-cost sanitation measures, as well as the conversion of crops into fuel are a few examples of such activities. Experience has shown that grassroots activities of this kind are most successful when they are modest and have the widest possible involvement. Thus, the programs that are most closely tied to the goal of sustainable development may have higher local costs, a higher ratio of recurring to capital expenses, and a larger reliance on local technology and experience.

A move toward these kinds of initiatives will need donors to reevaluate the substance of their aid programmes, especially with respect to commodity support, which has sometimes contributed to limit rather than expand the possibilities for sustainable development. The industrialized world's needs for raw resources, increased productivity, and material products have had a significant negative influence on the environment and come at a significant financial cost to both developed and developing nations. The issues are made worse by the current international trade, investment, and financial trends. In view of the potential effects these have on Third World underdevelopment and environmental degradation, we must all be ready to reassess our relationships in international commerce, investments, development aid, industry, and agriculture. We must even be prepared to take it a step further and use the tools required to combat these symptoms.

Sustainable development is very relevant to both national economic policy and international economic ties. A dynamic and supportive international economic environment as well as well-thought-out national policies are necessary for the reactivation and acceleration of growth. If none of these conditions are met, it will be frustrated. It is essential to have a favorable external economic environment. If there is instability, lack of dynamism, and lack of stability in the global economy, the development process will not gain speed. However, it won't gain traction if the developing nations' terms of trade and commodity prices continue to decline, development financing is insufficient, access to markets is restricted, and they are burdened by high levels of external debt. On all of these criteria, the 1980s had a really bad track record, which has to be changed. So, it is crucial to implement the policies and actions required to forge a global setting that firmly supports national development initiatives. If the world is to move toward sustainable development, international cooperation in this area has to be planned to enhance and support, not to replace, developed and developing country strong domestic economic policies.

Sustainable Development Promotion through Trade

All trading partners stand to gain from an open, equitable, secure, non-discriminatory, and predictable multilateral trading system that promotes sustainable development goals and results in the distribution of global production that is most advantageous for each trading partner's comparative advantage. Also, increased market access for exports from developing nations in combination with sensible macroeconomic and environmental policies would have a favorable environmental effect and therefore significantly advance sustainable development.

Experience has taught us that in order to achieve sustainable development, one must be dedicated to sound economic management and policies, as well as an efficient and predictable public administration, the inclusion of environmental issues in decision-making, and advancements toward democratic government, which permits full participation from all parties. Many emerging nations' economy are dominated by the commodity sector in terms of export revenue, employment, and production. The 1980s saw a significant decrease in commodity export revenues for many producing nations as a consequence of the preponderance of extremely low and decreasing real prices for the majority of commodities on international markets. This development, along with tariff and non-tariff barriers, such as tariff escalation, limiting their access to export markets, may make it more difficult for those countries to mobilize the resources required to finance the investments required for sustainable development through international trade. It is crucial to eliminate current trade-related distortions. In order to avoid causing significant losses to the more efficient producers, particularly in developing nations, the achievement of this goal specifically calls for a substantial and progressive reduction in the support and protection of agriculture, including internal regimes, market access, and export subsidies. So, there is room for measures targeted at trade liberalization and for policies to make output more responsive to environmental and development demands in agriculture, industry, and other sectors. Thus, trade liberalization across all economic sectors should be promoted globally in order to support sustainable growth. Many changes in the global commercial environment have led to new possibilities and challenges, as well as increased the significance of multilateral economic cooperation [9].

To achieve this, it is necessary to encourage an international commercial system that takes developing nations' demands into consideration. Governments should follow through on their past promises to stop, reverse, and broaden market access, especially in sectors of importance to developing nations.

It will be easier to enhance market access if developed nations make the necessary structural adjustments.

Developing nations should keep up the fundamental adjustments and improvements to their trade policies that they have already made. Therefore, it is crucial to improve market access conditions for commodities, particularly through the gradual removal of obstacles that limit imports of raw and processed commodities, especially from developing nations, as well as the significant and gradual reduction of support mechanisms that encourage uncompetitive production, such as production and export subsidies [10].

CONCLUSION

The topic of sustainability has undoubtedly been approached in a variety of ways throughout the last 20 years. Our fundamental goal was to promote a heteredox philosophical perspective of sustainability, where the intergenerational preservation of the natural environment and the effective use of resources are intrinsically compatible with the idea of sustainability. What we have discovered is the fragmented nature of research as well as environmental deterioration, both of which are the outcomes of the isolated growth of various purposes and methodology, as well as their need to modify their means and goals. Thus, it is without a doubt necessary to revise the conventional economic model of growth and development. The research on environmental damage reduction and the effectiveness of creating a worldwide market for pollution rights provide a fresh viewpoint on the argument for sustainability and environmental damage reduction.

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CHAPTER 6

ENVIRONMENTAL PROTECTION AND WELFARE ECONOMICS

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ABSTRACT:

If its tenets are followed, welfare economics may produce political ideas. Moreover, "environmental" welfare economics may aid decision-makers in their efforts to preserve the environment and natural resources. The ramifications of all of this for technical advancement and the system of pricing and wages that underpins technology are covered in this chapter. My main thesis is that ecologically friendly technology benefits wildlife conservation. In order to preserve nature in this manner, labor costs must be reasonable when compared to the cost of natural resources. The institutional challenge is to maintain as low a wage as feasible while, ironically, maintaining as high a wage earner's income.

KEYWORDS:

Environment, Microeconomics, Natural Resources, Positive Economics, Welfare Economics.

INTRODUCTION

A non-technical explanation of the connections between the environment and economics was offered in the preceding unit. The unit also made a suggestion on the rising significance of using economic analysis to solve environmental issues. We shall begin a more formal examination of the connections between the environment and economy with the current unit. We will specifically work to comprehend how economics contribute to the formulation of environmental policy. In other words, we will investigate the use of economic analysis techniques (by taking into account the ideas of welfare and microeconomics), in order to recognize environmental issues and link them to them in order to support the development of policies to address or mitigate them. We will use the words "welfare" and "well-being" interchangeably moving forward, but we will define "welfare" in more detail later in this course. Increasing social welfare is the goal of all economic policy in general and environmental policy in particular. So, a course in applied welfare economics may be seen as an environmental economics course. Given that background, we'll go on to this unit's discussion of welfare economics. The area of economic theory known as welfare economics looks at the nature of the policy suggestions that an economist would offer. Hence, while assessing environmental policy choices, a number of key findings from the area of welfare economics may be used [1].

Economics, Positive and Normal:

Distinction

There are two main functions for economics and economists. First, the "state of the world" or the events taking place around us may be explained using economic techniques. Positive economics is the application of economics to the 'what is' viewpoint of the current condition of the world. The ability to be tested using evidence is a crucial aspect of positive assertions. Economics may also be used to justify "what should be," or how we would want the economy to spend its resources differently to improve general welfare. Normative economics is the name given to this alternative viewpoint. In other words, "positive economics" is impartial in its approach and devoid of value judgments. On the other side, normative economics makes recommendations on how the economy ought to operate. So, establishing what may be the "optimal" strategy to do so is inevitable. It thus involves passing (often unjustifiable) value judgments. Normative statements may often be rephrased to become positive ones. For instance, "there should be a charge on pollution" may be rephrased as "imposing a pollution tax would result in cutting emissions". The resulting affirmative assertion may be put to the test using economic theory and instruments. As was already said, recognizing the issue and addressing environmental distortions are key components of environmental policy. Although identifying the issue is within the purview of positive economics (i.e., characterizing the issue), coming up with solutions belongs to the purview of normative economics or analysis. The latter is due to the fact that normative economics seeks to determine what form of government action would be necessary to ensure the problem's correction [2].

Although various economists would normally reach the same conclusion about the nature of the issue, they would have different viewpoints on what the best course of action should be, resulting in varying recommendations. In other words, whereas normative analysis determines what course of action should be taken to improve welfare, positive analysis aims to observe, quantify, and characterize the behavior of economic actors. An environmental issue may often be seen from both a normative and a positive perspective. For instance, quantifying the impact of climate change on different industries would be part of a constructive study of the problem (e.g. agriculture and fisheries). More specifically, it may make an effort to quantify the losses in agricultural production and fisheries output that have been documented as a result of climate change and also forecast potential scenarios for a value-neutral evaluation of the issue. On the other hand, a normative analysis of the problem would allow decision-makers to respond to issues like "what action should be done to mitigate the consequences of climate change," "when should the abatement measures be put into operation," and other similar ones. Hence, normative analysis is crucial in igniting policy discussions and assisting decision-makers in choosing their future course of action. Politicians eventually choose which policies to put into effect based on normative judgments (and, indirectly, the people who elect them to office). Table 1 below provides a few (hypothetical) examples of affirmative and normative statements related to environmental policy.

DISCUSSION

If no one can be made worse off without causing harm to at least one member of the economy, then the resource allocation is efficient. Simply put, an efficient allocation is a "no waste" allocation, meaning that all resources have been completely used and any reallocation will always result in at least one economic agent's position being worse. Efficiency in consumption, production, and product mix are characteristics of economic efficiency. These three criteria are covered in this portion of the course for a two agent instance since they allow for the graphical analysis that microeconomics often starts with. Using techniques like vector analysis, which we will leave outside the scope of the present unit, it might be extended to the situation of several agents [3].

Equity and Efficiency

A desired resource distribution should meet the need of equality in addition to efficiency. While there isn't a single, "universal" definition of equity, it is often defined as "fairness" since it is a normative term. A distribution is deemed fair in the context of consumption and trade if no agent favors the bundle of another agent, i.e. agent A does not "envy" agent B's bundle. Consider the two origins in the Edgeworth box for the most straightforward illustration. The efficiency of each of these assignments was previously discussed. The fact that one agent gets none of the two items at any of these two allocations makes it clear that these distributions are unfair. It should be noted that equity is not the same as equality, meaning that a resource distribution that is equally distributed between two people may not necessarily be fair unless their preferences are the same [4].

Optimality

We may acquire the idea of social optimality, or the maximization of society's welfare, by combining the two notions of efficiency and fairness. Consequently, in order to maximize social welfare, we must first determine the function that best captures the welfare of society. This is unmistakably the "aggregate social welfare function" that reflects the general desires of society. Although this cannot be accomplished owing to Arrow's impossibility finding, in order to go further we must make the assumption that such a preference aggregation is somehow feasible. With this supposition, the social welfare function may convert each member of society's utility level to a number in a way that offers greater utility values to the more socially acceptable functions (e.g. health and education).

Ecological Policy

It is ensured that allocations are made in line with the social welfare values by identifying the social welfare function (SWF) and the optimum allocations that satisfy the efficient requirements. A higher ranked allocation is selected over a lower ranked one. While having a strong theoretical foundation, this technique has practical issues. Secondly, as was already established, it is not simple to generate aggregate preferences. Moreover, since the selection of the particular form of the social welfare function is normative and driven by value judgments, one is more likely to apply techniques of alternative allocations without needing to consult an SWF. To put it another way, under these circumstances, we would want criteria for assessing alternate allocations. The next section covers two conditions in order to achieve this.

Pareto Improvement

Criterion the most well-known normative criteria to determine if a social reform "improves welfare," given by Italian economist Vilfredo Pareto, is derived from the idea of Pareto efficiency. Remember that in a Pareto efficient allocation, all opportunities for mutual benefit have been explored, meaning that no one can be made better off without making someone else worse off. So, a "Pareto improvement" is a modification that helps at least one person while having no negative effects on others. Pareto improvement since each of these moves benefits at least one agent without harming the utility of any other agents. This basic but limiting criterion's key flaw is that it is only marginally useful in real-world situations. Almost all planned reallocations would result in both winners and losers. A policy cannot often benefit everyone while harming no one. In other words, because there will always be "winners" and "losers," it is necessary to balance and analyze the relative profits and losses of these parties[5].

Social Economics

Neoclassical welfare economics examines the logical repercussions of diverse moral judgments on how societies are structured. Hence, welfare economics is normative and seeks to provide policy suggestions. It is difficult to experimentally examine the theory's implications since normative disciplines do not allow for this. The theory's validity can only be affirmed by critically analyzing all the premises it is predicated on and the reasoning behind how its implications are derived. So, each of these consequences depends on the underlying value judgments and the presumptive operation of the economy. In economics, it is typical to begin with a set of very generic value judgments in order to infer as many general implications as possible. The first such conclusion is that the end states, not the method by which they are selected, are what count.

The distribution of output among various people and the distribution of resources among various purposes are typical ways in which the end states are determined. So, the distribution of the resultant output among the members of society and the distribution of the factors of production among various production activities may be used to characterize a particular end state. Such a goal may be attained in a number of ways, such as by administrative choices or the results of market forces. The phrase "end states matter" refers to the idea that the methods to a goal are irrelevant. Of fact, it is not entirely reasonable to make the assumption that only end states are important. Even if it is the same bundle, it counts to me that I picked it rather than being forced to consume a set of commercial items that a dictator dictated. Given that environmental quality is a shared benefit, this statement appears to have particular force in relation to environmental issues. We'll revisit a short explanation of this assumption later on in this chapter. However this assumption allows for enough simplifications that examining its ramifications is warranted. Nevertheless, when the presumption that only end states matter is rejected, some of the most significant consequences are still valid [6].

The individualistic foundation of welfare economics is built upon these three premises. The preferences of the person, which are considered to be autonomous, are what matter. Of fact, there are several instances when even liberal societies object to a wholly individualistic approach, with drug regulation serving as possibly the finest illustration. Nonetheless, it seems that in Western democratic nations, these counterexamples are in no way widespread. Determining the effects of an individualistic perspective on environmental policy is thus of great importance. The notion of autonomous preferences is more troubling. It goes without saying that a person's whole environment, including his upbringing, education, culture, and even marketing, influences his tastes. 4 Any alteration to this environment may alter his preferences, which would alter how society viewed the change's acceptability. As significant as this issue may be, we shall get around it by presuming that people have stable, independent preferences for sets of manufactured products and environmental characteristics.

Limitations imposed by nature on the pricing system a rent payment might accompany land ownership for the owner. The rent that a renter pays is one well-known example. Moreover, other elements of nature, such as natural stocks, may be linked to property rights. A plant's location may have an impact on whether it is permitted to dispose of trash in the environment, which is another property right of nature. It will become apparent that the structure of rents from nature is influenced by urbanization factors and infrastructure construction. Planological policy, however, also has an impact on the latter structure. I use the word "planology" here in a wide sense. It contains all commands that define nature. Rules in the field of environmental policy are also covered, as are regulations governing the direction and area in which natural stocks should be used. Planology is a tool used in the effort to promote social welfare. This does not change the reality that, as a consequence of this policy, land values may decrease in certain circumstances and rents may even become negative during private interactions. Consider the exploitation of a mine and an area designated as a forest, both of which will be rather costly.

Under such circumstances, private expenses may exceed private income. Environmental welfare economics' job is to determine whether private costs and benefits are in line with those valued from a particular societal perspective. That is the issue with welfare economics internalizing nature. A Framework for Pricing Incentives inside Institutions Economic value is ultimately a political matter, especially where nature is a component. Broadly speaking, determining whether existing pricing are partially or completely socially acceptable is a political decision. It again depends on politics how and to what extent prices should be raised or lowered if they are seen to be either too high or too cheap. Nevertheless, this does not imply that nothing can be said about it. Prices may change in accordance with widely recognized political ideas. One of these ideas is that nature must remain in pristine shape in order to preserve its economic qualities. This idea is particularly appropriate for adoption in environmental welfare economics. The primary component of the pricing system's institutional architecture is its taxes and subsidies. The pricing structure is what ultimately determines how money is distributed in society. Beginning from the premise that a more equitable distribution is preferable to the one we now have, we are faced with the reality that, within some bounds, more equality puts pressure on social welfare by diminishing pricing incentives (including salary incentives) on economic activity.

If the institution system in issue is committed to achieving this social and economic ideal, then the concept makes sense. Yet, the issue is more complex in environmental welfare economics. To ensure that pricing incentives are strong enough to achieve the goal, the notion of nature conservation should be included into the optimization model. Thus, the issue of what standards apply to landowner subsidies emerges. Giving them a salary that matches the whole societal worth of the privately held piece of nature cannot be the solution. This political tenet has no substantial foundation. A more sensible course of action would be to provide subsidies to landowners up to the amount of revenue that permits them to carry out the government-mandated conservation measures. This is in line with the previously indicated political conservation of natural idea. Naturally, the concept of subsidizing is only applicable if the owner is not accountable for altering the natural feature. Nature's destroyers should be responsible for paying for the harm they inflict. This is equally true if they are the ones who own the land in question. Anybody, whether in private or public hands, has no right to waste the social worth of nature. Regarding taxes, it makes sense to say that, in line with the loss of social value of nature, the enterprise or organization whose operations result in a degeneration of nature should pay taxes. This is based on the conservation concept. Later on, we'll talk more about an environmental tax policy [7].

Technology's Effect on the Environment

This section aims to demonstrate that, in the industrial world, welfare is not only achieved via organizational prowess and inventiveness, but also through the progressive replacement of existing production methods with new ones that are increasingly more dependent on nature. Production expansion and natural resource depletion have historically gone hand in hand with economic development in the West. I have looked at the phenomena of substitutability between nature and labor in order to situate this process of development within a welfare theory framework. I then create the concept of "nature-sparing" technology with an eye toward how this development process may be modified to promote the preservation of nature. Nature and labor may be substituted for each other.

The replacement of labor by nature is of particular importance in the context of this research. As capital is a derived production element that includes labor and nature, it is not depicted as such. Capital may be seen as "liquid" in the long term and may be divided into the initial production elements. It is helpful to break down the element of nature into its constituent parts, such as arable land, fossil fuels, and natural resources. The substitution elasticity is very important in this context. This parameter shows the relative change in the ratio of the prices of two production components, for example, in relation to the ratio change in the ratio in which these elements are used. The flexibility between nature and labor is of particular importance in this research. The "translog" production function, used by a number of writers, has helped integrate the elasticity of substitution into economic modeling. Many research provide information on the size of the relevant elasticities. hence, labor and energy are suitable replacements. Natural resources and labor also seem to be key replacements. The price ratios determine whether or not a high substitution elasticity is advantageous for the preservation of nature. A low elasticity is preferred when nature is relatively inexpensive; a high elasticity is preferred when nature is a somewhat costly manufacturing element. So, the pricing structure should be taken into consideration while looking at the factor substitution component of conservation policy, particularly in concerns related to environmental technology[8].

Eco-Friendly Technology

Technology, which involves constantly rising productivity, is what is driving Western economic prosperity. Innovations allow for the achievement of a specific degree of welfare with fewer production elements. It should be noted, however, that until recently, the knowledge that more can be done with natural resources and energy has seldom been utilized to restricting their usage. The majority of the time, it is used to provide greater social welfare while using at least as many natural resources as previously. It is a good idea to attach factor-saving technology to the marginal rate of substitution, as Hicks did, since in this situation, the marginal productivity of the component in question grows more than the marginal productivity of the other production factor. This is valid when used in relation to the nature of the production element. It is quite confusing how technology advancement affects the economic system. With new pricing ratios and new marginal productivity ratios, new equilibriums develop. The interchangeability of manufacturing elements is important in this situation. Whether more or less of a certain production element is employed in the economic process as a whole relies on a variety of factors. A replacement effect is thus of relevance in addition to a factor-saving effect that reflects the impact of an increase in the marginal productivity of the production element in question [9].

Ecological Policy

The theoretical perspective on environmental policy is given in this article. The conservation policy premise is the center of attention. There are certain suggestions made about the institutional system's structure that depend on achieving the highest level of environmental welfare. Last but not least, a few traits of a comprehensive environmental policy are discussed.

Institutional Pricing Incentivizations

This manufacturing element must be made relatively costly in order to make the price structure serve the preservation of nature. In this approach, conservation of the environment is encouraged and environmental technology is turned on. Transferring taxes from the factor labor to the factor nature is an apparent strategy to bring about this condition. This is consistent with George's views. In George's view, there are two types of income: a private one from engaging in economic activity, and a collective one from paying fees for using natural resources. This tax change impacts both the environment's economics and the growth of the labor market.

Scenarios for Environmental Policy

Economic policy includes a large portion of pricing and pay incentives as a type of regulation. One prerequisite is that industrial policy interacts properly with planology (including resource policy and environmental policy). Pricing-based policy, or planning via the market mechanism, promotes pricing-based policy in the area of physical planning, and vice versa. According to the time frame in which the actions must be put into action, industrial strategy in relation to environmental conservation has three temporal dimensions. There are possibilities for short-, intermediate-, and long-term planning as a result. The length of time it takes for the majority of industrial plants to degrade affects the short-term planning. Realize that the following production factors will change in this scenario: (1) Since manufacturers cannot put short-term environmental directives into effect at reasonable prices, a number of factories will have to shut. (2) Some factories are able to continue operating because production installations may be modified to comply with environmental standards if necessary. (3) Both new and old facilities will encounter new possibilities that may be taken advantage of by new technology. A system of subsidies and tax breaks may be used to supplement and speed up this scenario of short-term industrial restructuring. The time during which sane assumptions may be made regarding potential advancements in the field of environmental technology determines the intermediate term. The assumption that the environmental restrictions are enhanced in the context of this situation is evident. Government may take a backseat if it seems that market incentives are sufficient to spur these advances. If these incentives are not strong enough, the government may support them by, for example, providing tax exemptions [10]. The government may also mandate research from specialized companies and public research institutions to promote the development of environmental technologies. The institutional system's rebuilding is the long-term scenario. It includes a strategy for transforming an institutional structure that harms nature into one that is more sympathetic to it. Thus, the government must make sure that prices reflect nature's scarcity in the long run. Hence, it is important to keep in mind that nature should be available to all people, not just a select few generations of a small portion of the global population. Second, the fiscal system has to be altered so that rather than encouraging nature usage, it discourages it [11], [12].

CONCLUSION

From this investigation, four key findings may be taken. First, the notion of relative scarcity of nature, its dynamics, and its institutional component all define environmental welfare economics as it is understood in this work. Second, the concept of laissez-faire is open to modification and renewal throughout time. Laissez-faire is a menace to nature in its outdated form; in its modern version, it is submissive to the preservation of nature. The third major finding is that in order to introduce an environmental technology with its impacts on protecting the environment, the cost of the production element nature must be relatively high while the cost of the production factor labor must be as low as feasible. The fourth conclusion is that institutional change is necessary for a social welfare ideal that is conditioned by the preservation of nature. The effectiveness of pricing and salaries should be the main emphasis of this change. Planology should complement other fields. The premise that best captures the results is: The pursuit of wellbeing and the preservation of nature can and must be harmonized, both in theory and in reality.

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CHAPTER 7

THE ECONOMIC APPROACH

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ABSTRACT:

The majority of the students who read this book will have previously studied valuation techniques in earlier courses. This chapter, which must include some mention of valuations, is meant to provide a comprehensive overview of the financial implications of development rather than to replace such studies. The quantities are assumed to be functions of the prices in the economic approach to index number theory, and the observable data is produced as a result of different economic optimization issues. The economic method often needs the CPI to be some kind of cost of living index in the context of the CPI.

KEYWORDS:

Environment, Economic System, Energy, Raw Materials, Resource.

INTRODUCTION

It is crucial that we build and define the economic approach so that we can have a sense of the big picture before delving into individual environmental issues and the policy solutions to them. Understanding the conceptual framework makes it simpler to deal with specific examples as well as, and perhaps more crucially, to understand how those cases fit into an all-encompassing strategy. The broad conceptual foundation for how economics approaches environmental concerns is developed in this chapter. We start by analyzing the connection between human behaviors as it is expressed in the economic system and its effects on the environment. Next, we may develop standards for evaluating whether the results of this connection are desirable. These standards serve as a framework for determining the nature and severity of environmental issues as well as for developing workable solutions. The economic point of view is compared with other points of view throughout this chapter. The economic approach is brought into clearer perspective by these differences, which also encourage more in-depth analysis and criticism of all potential options [1].

Connection between Humans and Environment

Environment as Resource The environment is seen as a composite asset in economics that offers a range of services. It certainly is a highly unique asset since it supplies the mechanisms that ensure our very survival, but it is still an asset. We want to increase the value of this asset, or at the very least stop it from depreciating excessively, so that it can continue to provide aesthetic and life-sustaining functions. The environment gives the economy the raw materials and energy needed for the manufacturing of goods that are then turned into consumer goods. This energy and raw materials eventually become garbage and are released back into the environment. Also, the environment offers customers immediate access to products and services. We benefit from the environment either directly or indirectly in that it provides us with the air we breathe, food and drink for sustenance, and shelter and clothes for protection. Ecosystem goods and services, a substantial subgroup of these, include the advantages gained directly from ecosystems, such as biodiversity, breathing air, wetlands, water quality, carbon sequestration, and leisure.

Anybody who has enjoyed the adrenaline rush of whitewater rafting, the complete peace of a wilderness hike, or the magnificent beauty of a sunset will understand that ecosystems provide us a range of amenities for which there is no alternative. The interaction between the environment and the economic system may be seen as a closed system if the term "environment" is used widely enough. For our purposes, a closed system is one that does not accept any inputs energy or matter from outside the system and does not send any outputs to the outside. In contrast, an open system is one that allows for the importation or exportation of both matter and energy. It is obvious that we do not have a closed system if we limit the interaction to our planet and its atmosphere. Most of our energy comes directly or indirectly from the sun. Also, we have launched spacecraft far beyond Earth's atmosphere. But, historically speaking, this system may be regarded as a closed system for material inputs and outputs excluding energy since the number of exports like abandoned spacecraft and imports like moon rocks are insignificant.

The extent to which space exploration makes the rest of our solar system accessible as a supply of raw materials will determine whether the system stays closed. The first rule of thermodynamics summarizes one essential result of seeing our planet and its immediate surroundings as a closed system: energy and matter cannot be generated or destroyed. According to the legislation, the vast majority of elements that enter the economy from the environment must either build up within it or be disposed of as trash. When accumulation ceases, the amount of materials entering the economy and the amount of garbage entering the environment are both of comparable size. Of However, excessive wastes may cause the asset to degrade; when they go beyond nature's ability to absorb them, wastes limit the services the asset can provide. Examples abound: smog destroys magnificent views, drinking water pollution causes cancer, air pollution damages respiratory systems, and climate change may result in coastal floods [2].

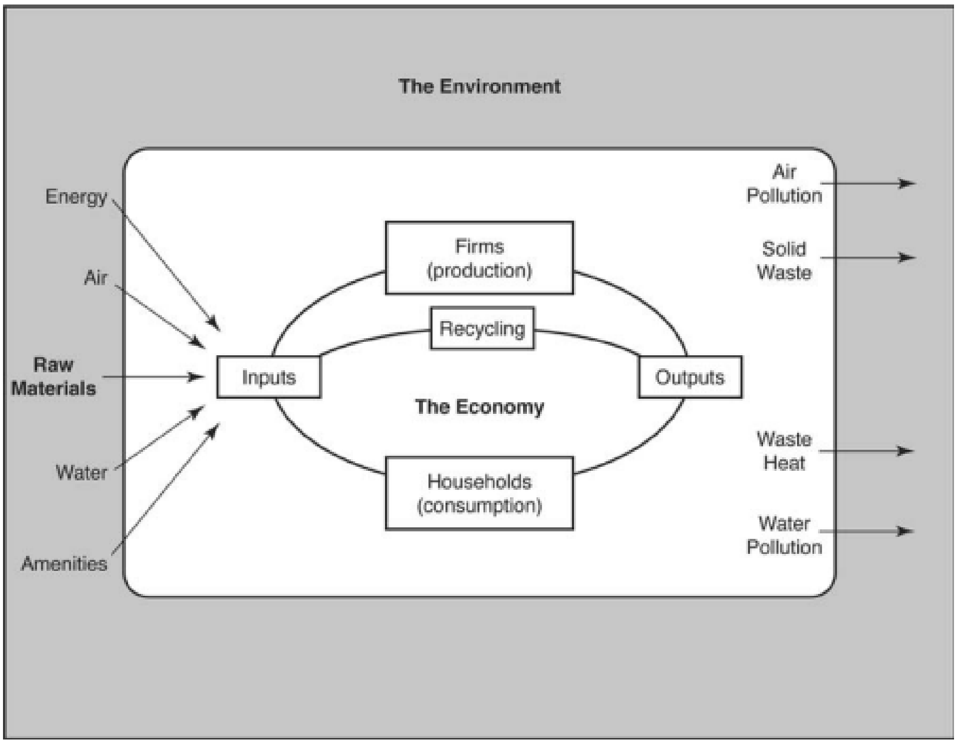

Figure 1: The Economic System and the Environment.

Another physical rule, the second law of thermodynamics, also influences how humans and the environment interact. This law, sometimes referred to as the entropy law, asserts that "entropy grows." The quantity of energy not accessible for work is known as entropy. This equation, when applied to energy systems, suggests that no energy transfer from one form to another is entirely efficient and that the process of using energy is irreversible. During conversion, some energy is always lost, and the remaining energy, once utilized, is useless for more effort. The second rule also indicates that every closed system must ultimately exhaust its available energy in the absence of additional energy inputs. Life ends when productive energy flows stop since energy is essential to life. We must keep in mind that our planet is not even close to being a closed system in terms of energy; rather, we get our energy from the sun. The entropy law does, however, serve as a reminder that there is a limit on the amount of accessible energy that can be maintained due to the flow of solar energy. The quantity of energy accessible for productive activity will only be governed by flow resources like solar, wind, and hydropower, as well as by the amount that can be stored when the stocks of stored energy (such as fossil fuels and nuclear energy) have been depleted (through dams, trees, and so on). As a result, the growth process will ultimately be constrained by the availability of these flow resources and our capacity to use them [3].

DISCUSSION

The Economic Strategy

To better comprehend the interaction between the economic system and the environment, we may use two distinct forms of economic analysis: Positive economics makes an effort to define what is, was, or will be. Comparatively, normative economics focuses on what should be. An appeal to the facts may often settle disputes within positive economics. Yet, normative differences include value assessments. Each branch has its uses. Let's say, for instance, that we wish to look at how commerce and the environment are related. The effects of trade on the economy and environment might be described in terms of positive economics. On the issue of whether trade was desirable, it was unable to provide any advice. The conclusion would need to be drawn from normative economics, which we discuss in more detail in the next section. Positive analysis is nevertheless relevant in the policy process even if it cannot establish whether a particular policy move is desirable on its own. When the options are more flexible, the environment for normative economics may change somewhat. We may inquire, for instance, about how much and how best to regulate greenhouse gas emissions which are a contributing factor in climate change. Conversely, how much of the different sorts of forests should be preserved? We must weigh all of the potential outcomes and choose the best or optimum one in order to respond to these questions. While the issue is significantly more challenging to answer than one that merely asks us to evaluate two predetermined possibilities, the fundamental foundation for normative analysis is the same in both situations [4].

Ecological issues and economic effectiveness Static Performance

Static efficiency, or simply efficiency, is the main normative economic criteria for selecting between distinct outcomes happening at the same moment. If an allocation of resources maximizes the economic surplus obtained from those resources, it is said to meet the static efficiency criteria. Consumer surplus and production surplus together make up economic surplus. The value that consumers gain from an allocation less the price they paid to acquire it is known as consumer surplus. The area under the demand curve less the consumer's cost is used to calculate consumer surplus. The cost to the customer is the region below the price line, which is constrained to the right by the amount of the commodity and to the left by the vertical axis. The consumer spending on this amount of the commodity is shown by the rectangle, which captures pricing time's quantity [5]. Effective Arrangements for Property Rights Let's start off by outlining the framework of property rights that might result in effective distributions in a healthy market economy. Three key traits define an effective structure:

1. **Exclusivity:** Either directly or indirectly via sales to others, the owner should get all advantages and expenses associated with possessing and utilizing the resources.
2. **Transferability:** All property rights must be able to be freely exchanged from one owner to another.
3. **Enforcement:** Property rights must be protected against arbitrary confiscation or intrusion by other parties.

An individual who owns a resource with a well-defined property right (one that displays all three features) has a strong motivation to utilize the resource effectively since a reduction in its value is seen as a personal loss. Landowners have an incentive to fertilize and irrigate their property since the increased output boosts their revenue. They also have an incentive to rotate crops when doing so increases their land's production. Efficiency is facilitated when clearly defined property rights are transferred, as in a market economy. We can demonstrate this idea by looking at the incentives that producers and consumers face in the presence of a clear-cut system of property rights. The buyer must make payment in order to get the goods since the seller has the right to stop the buyer from using it without payment. The consumer chooses how much to buy based on a market price by determining the quantity that would maximize his or her particular consumer surplus.

Is this distribution effective? Our concept of static efficiency makes it apparent that the answer is indeed affirmative. According to Figure 2.4, the market allocation maximizes economic surplus, which is equal to the total of consumer and producer surpluses (areas A + B). As a result, we have developed a method for determining efficiency as well as a way to explain how the excess is divided between customers and producers. This differentiation is of utmost importance. Since consumers and producers aim for efficiency, efficiency is not attained. They're not! In a system where property rights are well defined and there are vibrant marketplaces where they can be exchanged, both producers and consumers want to maximize their surpluses. So, the pricing system encourages those self-interested actors to make decisions that ultimately prove to be effective for society as a whole. It directs self-interested energy into socially beneficial endeavors [6].

Different Externality Classes

Externalities, often known as external impacts, may be either good or bad. External cost (external diseconomy) and external benefit (external economy) have historically been used to denote, respectively, situations in which the affected party suffers losses due to or gains advantages from the externality. The example of water contamination clearly illustrates an external cost. Nonetheless, it is not difficult to locate external advantages. As stated in the first line of this chapter, private persons who protect a particularly beautiful location benefit everyone who passes by. In general, the market will undersupply the resources when external advantages are available. It's vital to note another difference. Pecuniary externalities are a subclass of externalities that do not pose the same issues as pollution. As the external impact is passed on via changed pricing, financial externalities are created. Let's say a new business expands in a location, increasing the cost of renting land. This rise has a detrimental impact on everyone who pays rent, making it an external diseconomy. While there is a financial crisis, this does not result in a market failure since the higher rents that follow represent the real shortage of land. The land market offers a method for parties to bid on property, and the prices that are returned represent the worth of the land in its different applications. The price signals could not support an effective allocation in the absence of financial externalities. Since the impact is not passed on via pricing, the pollution example is not a financial externality. Prices in this illustration don't change to reflect the rising garbage load. The expenditures incurred by the steel company do not account for the harm to the water resource. In the case of pollution, a crucial feedback mechanism that is present for monetary externalities is absent [7].

The Swiss method of granting grazing rights is one effective example of a common-property regime. Grazing rights on Alpine meadows have historically been regarded as common property in Switzerland, despite the fact that agricultural land is often classified as private property. Certain regulations, implemented by a group of users, which provide a cap on the number of animals allowed on the meadow, prevent overgrazing. While rights and obligations were transferred from one generation to the next, the families on the association's membership list remained consistent throughout time. This consistency seems to have promoted reciprocity and confidence, laying the groundwork for ongoing adherence to the norms. Regrettably, given the demand from a growing population, such stability may be the exception rather than the norm. The experience of Mawelle, a tiny fishing community in Sri Lanka, might serve as an example of the more typical scenario. To provide fair access to the finest locations and times while safeguarding the fish populations, villagers first developed a complex but successful rotating system of fishing rights. Over time, overexploitation of the resource and decreasing earnings for all members resulted from population pressure, the influx of outsiders, and rising demand.

These factors also weakened the community's sense of unity. Res nullius property resources, the primary subject of this section, are exploitable on a first-come, first-served basis as no person or entity has the legal authority to impose access restrictions. What we will refer to as "open-access resources" have given birth to the "tragedy of the commons," as it is now often called. Recalling the demise of the American bison may help demonstrate the issues caused by open-access materials. Examples of "common-pool" resources include bison. Resources that are part of a common pool are shared resources that are nonexclusive and divideable. When a resource is nonexclusive, it may be used by anybody, however when it is divisible, it is taken away from the quantity that is accessible to the other groups when one group captures a portion of it. (Notice the distinction between public goods and common-pool resources; this is the topic of the next section.) Bison were common in the early history of the United States; open access to hunting was not an issue.

Frontier people could readily get whatever skins or meat they need; the aggressivity of one hunter had little bearing on the time and effort put forth by other hunters. Open access did not pose a threat to efficiency when there was no shortage. Yet as the years passed, bison's demand rose and their scarcity came into play. Every extra unit of hunting activity ultimately increased the amount of time and effort needed to generate an additional yield of bison as the number of hunters grew. Consider graphically how different property rights structures (and the resulting level of harvest) affect the scarcity rent, which is calculated as the difference between the revenues from the harvest and the costs associated with producing that harvest. In this case, the scarcity rent is equivalent to the economic surplus received by consumers and producers[8].

Executive and Legislative Regulation These treatments come in a variety of packages. No one may generate more steel or pollutants than Q*, according to the law. Therefore, in order to dissuade prospective offenders, this maxim can be supported by prison terms or penalties that are suitably severe. As an alternative, the government might levy a tax on steel or pollutants. It would be effective to impose a per-unit tax equal to the vertical distance between the two marginal cost curves. Moreover, lawmakers may create regulations that would allow for more freedom while simultaneously minimizing harm. For instance, zoning regulations might designate distinct regions for resorts and steel mills. This strategy is predicated on the idea that separating nonconforming usage will significantly limit harm.

They might also prohibit the use of a certain industrial ingredient or mandate the installation of specific pollution control devices (such as when autos were needed to have catalytic converters) (as when lead was removed from gasoline). In order to get an efficient result, they may control outputs, inputs, manufacturing processes, emissions, and even the site of production. In the next chapters, we'll look at the several alternatives available to policymakers, both to demonstrate how they may change ecologically harmful behavior and to determine how much they can increase efficiency. Of course, victims have other options as well for reducing pollution than payments. Consumer boycotts are conceivable when the polluters' goods are also consumed by the victims. Strikes or other forms of worker opposition are also feasible when the polluter employs the victims.

The asymmetric information issue may also be solved through legislation and/or regulation. The apparent answer entails supplying such information since the core issue is that one or more of the parties lacks adequate essential, reliable information. How should that data be delivered? One way to provide customers additional information is via labeling. Examples of food product labeling include warning customers about items containing genetically modified organisms, as well as specifying crops that were cultivated organically and fair trade goods. Recent evidence of customer willingness to pay more for organically farmed fruits and vegetables has been encouraging for organic farmers [9].

Government's Effective Role

Although while the economic approach argues that government intervention may be used to increase efficiency, it also contends that inefficiency alone is not a sufficient reason for involvement. Transaction costs are a part of any corrective mechanism. It is advisable to just put up with the inefficiency if these transaction costs are sufficiently high and the surplus gained by fixing the inefficiency is sufficiently little. Think about the issue of pollution, for instance. In the United States, wood-burning stoves were a common source of heat and cooking in the late 1800s. Despite this, there was no regulation because of how well the air could absorb the pollutants. In more recent times, however, tighter rules for wood-burning stove emissions have been implemented due to the increased demand for wood-burning stoves in cold areas with adjacent woods, which was partly prompted by high oil costs.

The volume of economic activity has grown throughout time, as have the accompanying emissions. Cities are suffering from serious issues with air and water pollution as a result of the concentration of activity [10]. The quantity of emissions per unit volume of air or water has grown due to both the growth in the number of emitters and the clustering of those emitters. Pollutant concentrations have thus led to noticeable issues with aesthetics, plant development, and human health. In the past, demand for leisure activities has increased along with rising earnings. Canoeing and hiking are two examples of leisure activities that often take place in distinctive, pure natural settings. The value of the remaining regions has grown as the number of these areas has decreased due to conversion to other uses [11].

CONCLUSION

The kind of entitlements inherent in the property rights controlling resource usage determines how producers and consumers utilize the resources that make up the environmental asset. The owner of a resource has a strong motivation to utilize it wisely when property rights systems are exclusive, transferrable, and enforced since doing otherwise results in a personal loss. Yet, effective allocations may not always be supported by the economic system. Externalities, inadequately specified property rights systems such as open-access resources and public goods), imperfect markets for selling the property rights to the resources (monopoly), and asymmetric knowledge are some specific situations that might result in inefficient allocations. Market allocations often do not optimize the surplus under these conditions. The political system may also result in inefficiencies due to the rent-seeking activities of special interest groups or the less-than-perfect execution of effective policies. Increasing a person's private surplus (via lobbying, for example) may come at the price of a reduced economic surplus for all consumers and producers due to voter ignorance on many subjects and the public-good character of any political outcomes. The efficiency criteria might help in identifying the situations when our political and economic systems mislead us. By enabling the development of legislative, judicial, or regulatory measures, it may also aid in the quest for remedies.

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CHAPTER 8

EVALUATING TRADE-OFFS

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ABSTRACT:

The measurement of value tradeoffs is a crucial aspect of applied decision analysis. That was an important interest for Jane Beattie as well, starting with her thesis and continuing through her work with Graham Loomes and others, which is recounted in the last chapter. As part of her thesis, Jane investigated the application of holistic rating evaluations of stimuli having two characteristics as a method to gauge the tradeoff between the two qualities. Complexity may have the unintended effect of making tradeoff judgments more fragile and vulnerable to outside forces. One kind of tradeoff assessment involves doing holistic desirability assessments of stimuli in a set of stimuli that vary in at least two dimensions, such as the cost of a purchase and the travel time necessary to execute it. It is feasible to assess trade-offs between two elements by calculating how much of one dimension must be lost to make up for a change in the other by evaluating the effect of these alterations on the rating. This measure of tradeoffs should take into account the effects of these changes on the goals that guide the decisions, such as the willingness to sacrifice time in order to save money. It shouldn't be affected by how the values on either dimension are distributed.

KEYWORDS:

Environment, Human Health, Natural Resource, Pollution, Recycling.

INTRODUCTION

Differentiating between policies that are rational and those that are not is made easier by the normative dimension. There are only so many projects that can be undertaken owing to resource limitations, therefore making decisions is inevitable. Normative analysis is useful in public policy under a number of different conditions. For example, it may be used to decide if a new pollution control regulation or a strategy to safeguard an area from development is beneficial. In these cases, the analysis aids in making suggestions about whether a program is desired prior to its implementation. It may also be used to evaluate how well a piece of software that has previously been implemented is performing in various situations. Was this in this instance a good use of the available resources? In this chapter, we present and use a variety of decision-making tools that might aid in evaluating our options. Normative Guidelines for Decision-Making Normative choices may be made in two circumstances. In the first case, all that is needed is to choose from a list of predetermined options, while in the second, we search for the best choice from all those that are accessible [1].

Weighing the advantages and disadvantages of certain alternatives. If you were asked to evaluate the merits of a certain course of action, you probably would start by attempting to identify both its advantages and disadvantages. If the benefits exceed the drawbacks, it seems logical to encourage the activity. The normative method to evaluating potential economic policy alternatives is built on this simple framework. Economists contend that there are benefits and costs to every action. If there are more benefits than drawbacks, the activity is preferred. If the disadvantages exceed the benefits, the activity is undesirable.

In the section before this one, we looked at the use of benefit-cost analysis to judge the appropriateness of certain activities. This section will examine how to use this approach to identify the "optimal," or best, techniques. In subsequent chapters that concentrate on particular environmental challenges, the normative analysis will be continued in three sections. We will begin by choosing the optimal outcome. In the second step, we'll strive to determine how closely our institutions adhere to ideal outcomes and, in the event that there are any disparities, what the underlying behavioral problems are. Finally, by comprehending the nature of the problems and the underlying behavioral reasons of those problems, we may develop successful policy solutions. Even while the application of these three procedures to each of the environmental problems must take into consideration the specifics of each situation, the overall framework that served as the foundation for that study remains unchanged. Two examples from environmental economics and natural resource economics will be given to demonstrate how this method is used in practical contexts.

These are just intended to serve as examples and to provide a broad idea of the argument; the details are saved for future chapters. For instance, a rising number of coastal fisheries are being exhausted. The biodiversity of the oceans as well as the lives of those who depend on the sea for a living and the communities whose economies depend on fishing are all threatened by depleted fisheries, which involve fish populations that have declined to the point where their continued existence as commercial fisheries is threatened. How would an economist approach and analyze this problem? The first step would be to determine the appropriate stock or the ideal rate of fish harvest. This level would be compared to the actual stock and harvest levels in the next phase. Using this economic paradigm makes it clear that overfishing is the root reason of many fisheries' stocks being much below their optimal levels. There are several solutions now that the nature of the problem has been identified [2].

DISCUSSION

Another problem is solid waste. What should be done if local landfill capacity is threatened by a rise in rubbish production? The first thing economists think about is how one would define the optimal degree of waste. Recycling and trash reduction must be included as desired outcomes in the definition. The analysis demonstrates that current waste levels are too high and also identifies some specific behavioral drivers of the problem. On the basis of this understanding, practical economic solutions have been developed and implemented. Communities that have adopted these measures often have lower waste generation and higher recycling rates. In the book's subsequent chapters, several other topics—including energy, minerals, water, pollution, and climate change—are examined using a similar technique. In each case, the economic analysis helps to shed light on viable remedies. To begin that process, we first need to establish what "optimal" means.

Efficiency and Optimization

According to the normative choice criteria outlined earlier in this chapter, the desired outcomes are those where the benefits exceed the costs. The ideal policies would thus be those that maximize total profits, it follows logically (benefits minus costs). A resource allocation is considered to fulfill the static efficiency requirements if it maximizes the economic surplus from using those resources. Remember that the net benefits area to be maximized in a "ideal outcome" for public policy is the same as the "economic surplus" that is maximized in an efficient allocation. Thus, productive outcomes are also desirable outcomes. Let's spend a moment illustrating how this concept may be used. In the past, we debated whether or not a certain action would save 4 miles of river. Sure, provided that doing so has positive net benefits. Do you get the rationale? For static efficiency, a new question must be answered about the optimal number of miles to be maintained. According to the definition, the optimal amount of preservation would maximize net profits. Does conserving 4 kilometers increase net gains? Is it the productive outcome? We can ascertain the answer to the aforementioned issue by figuring out if more or less of the river can be protected. It is obvious that sustaining 4 miles could not have maximized the net benefit and was thus inefficient. Perhaps reducing the number of miles traveled may increase the overall benefit. If this allocation works as intended, degrees of preservation over 5 must have a negative net benefit. Remember that the area under the marginal cost curve indicates that keeping the sixth unit will result in higher maintenance costs than it would save in additional benefits (the corresponding area under the demand curve). Hence, the triangle RTU shows the reduction in net benefit that occurs if 6 miles rather than 5 miles are maintained [3].

Cost and Benefit Comparison throughout Time

The research we've done so far is quite helpful when thinking about tasks when time isn't a key factor. But, a lot of the decisions made today will have long-term consequences. Time is a problem. Finite energy sources are lost after usage. Overfishing of resources that are naturally regenerable (such as fisheries or forests) may lead to lower and perhaps weaker populations for next generations. Persistent pollutants may accumulate over time. How can we determine what to do when benefits and expenses are attached to different times? To include time in the study, we need to go beyond the concepts we have already described. With this innovation, there is now a way to take into account both the duration of benefits and costs as well as their relative magnitude. In order to incorporate timing, the decision rule must provide a way to assess net benefits acquired across a range of time periods. The concept of present value is what makes this comparison possible. Before providing this improved decision rule, we must first identify current value.

Dynamic Function

The static efficiency criteria are very useful for assessing resource allocations when time is not a major concern. The word "dynamic efficiency" is used to define the traditional criteria used to identify an optimal allocation when time is a consideration. Dynamic efficiency is an extension of the previously established static efficiency idea. In this sense, the present-value criteria provide a way to compare the net advantages obtained at one point in time with those obtained at another. A resource allocation satisfies the dynamic efficiency requirements if it maximizes the present value of net benefits that may be obtained from all realistic allocation options throughout the course of the n time periods [4].

Issues with Benefit Estimation

The analyst entrusted with doing a benefit-cost analysis has a number of decision-making options. If we are to understand benefit-cost analysis, the nature of these judgments must be very apparent in our minds.

Primary vs. Secondary Effects

Environmental programs may have both immediate and long-term consequences. For example, increasing lake utilization for recreational purposes will be the major outcome of lake cleaning. This main effect will have subsequent effects on the services provided to the lake's expanding user population. Are these extra benefits taxable? The answer is depending on the conditions of the local labor market. If this increase in demand consumes up previously underused resources, such as labor, the value of the additional employment should be evaluated. Yet, if previously used resources are put to a different use to meet the increased demand, the situation changes. Generally speaking, in areas with high unemployment rates or where the specialized abilities necessary are underemployed at the beginning of the project, secondary employment benefits should be taken into consideration. They shouldn't be included when a project just entails moving around productively employed resources [5].

Position in Accounting

The accounting stance refers to the geographic extent or magnitude at which the benefits are measured. Size matters because a benefit-cost analysis only takes into account the advantages or costs that affect that specific geographic area. Assume, for example, that just one area benefits while the federal government pays the bulk of the costs. Even if the benefit-cost analysis shows that this effort is excellent for the region, it does not necessarily follow that it will be for the nation as a whole. After accounting for national expenditures, the national project benefits cannot exceed the national project costs. This subject is debated in relation to the social cost of carbon.

Aggregation

Aggregate challenges are related to accounting mindset. Estimates of benefits and expenses must be added together to get the total benefits and costs. Every aggregation should take into account how many people will get benefits and how many will incur costs, as well as how those benefits may alter the aggregate. Imagine that the families nearest to the project received greater total benefits than those further away. These variances in this circumstance must be taken into account.

Rule of With and Without

The "with and without" method states that only profits associated with the project should be considered, omitting gains that would have accumulated otherwise. If benefits that would have happened regardless of the program were included, the benefits would be overstated. physical advantages vs intangible benefits. Tangible advantages are those that can be fairly evaluated in monetary terms. These benefits are known as intangible benefits because it is difficult to quantify their value using statistics or because there aren't enough reliable or readily available facts to do so. The quantification of intangible benefits is the major topic of the next chapter. They shouldn't be ignored is the only appropriate answer. The results will be distorted if intangible benefits are ignored. The fact that benefits are intangible does not make them any less important.

Several Cost Estimation Techniques

Even if it is challenging, analyzing expenditures is often easier than calculating benefits. Benefit-cost analysis is prospective, therefore it necessitates an estimate of the cost of a certain strategy, which is far more difficult to ascertain than the actual cost of an existing method. This poses a huge problem for both. Two techniques have been developed to estimate these costs. the method of the survey. One method to learn about the costs associated with a program is to ask those who experience the costs and are likely the most educated about them to reveal the magnitude of the costs to policymakers. For instance, regulatory bodies might ask polluters for estimates of control costs. This tactic has a problem since lying is heavily promoted. Giving inflated costs is financially advantageous since underestimating them might lead to less stringent regulation [6].

Engineering Techniques

The engineering technique avoids the source that is being controlled by cataloguing the technologies that may be used to accomplish the aim and assessing the costs of getting and employing those technologies. The last step in the engineering process is to assume that the sources will use technology that has the lowest potential cost. As a consequence, a cost prediction for an experienced, "typical" organization is produced. The engineering approach has its own problems. These numbers may not fully represent the true expenses of any one company. Due to exceptional circumstances, the company's costs might be more or lower than expected; in other words, it could not operate normally.

The Combination Approach

To get around these problems, analysts often blend survey and engineering methodologies. Data about possible technologies as well as particular problems the organization is having are gathered using the survey approach. Engineering techniques are used to determine the actual costs of different technologies given the specific circumstances. A compromise between the information that can be best acquired independently and the information that can be best provided by the source is sought with the use of this combination method. The costs in the examples shown so far are easy to assess; the challenge is knowing how to get the most precise data. But, it's not always the case. Even though certain costs are difficult to quantify, economists have developed several creative methods to arrive at monetary estimates for them. Take into account, for example, a rule that requires more people to carpool in an attempt to save energy. If the only change is a longer average journey time, how can this cost be calculated? Transportation professionals have long recognized the value of time. The value of time gains or losses has thus been extensively studied in the literature. The basis for this evaluation is the opportunity cost, or how the time could be allocated if it weren't being used for travel. Despite the fact that the results of these studies depend on the amount of time spent, individual decisions tend to indicate that travelers value their travel time at a rate not more than half that of salaries.

The Management of Risk

It is sometimes difficult to forecast with full certainty the consequences that a certain strategy will have on various environmental concerns due to the ambiguity of scientific calculations. To assess the actual exposure to potentially dangerous substances, data at high dosages must be obtained and extrapolated to low levels as well as from animal studies to people. Moreover, it calls for reliance on epidemiological studies, which derive findings regarding the detrimental effects of pollution on human health from correlations between those indicators and information on pollution levels. Consider the potential damages brought on by climate change, for example. Despite the fact that scientists largely agree on the likelihood of repercussions of climate change, such as species extinction and sea level rise, the timing and amount of such losses remain unpredictable [7].

Let's begin with a historical example. United States and Canada have been debating the possibility of constructing a tidal power station in the Passamaquoddy Bay between Maine and New Brunswick for a long time. The long-term running costs of this project are anticipated to be low, despite the fact that its initial capital expenditures would be substantial. They produced a full inventory of costs and benefits in 1959 as part of their analysis of the issue. Using the same benefit and cost information, the US and Canada reached different judgments on whether or not the project should be pursued. As they were based on the same benefit-cost information, the discrepancies in these outcomes can only be explained by the application of different discount rates. The United States used 2.5 percent, compared to 4.125 percent for Canada. Due to the higher discount rate, which makes the initial cost weigh far more heavily in the calculation, the Canadian analysis came to the conclusion that the project would have a negative net benefit. Because of the lower discount rate, which provides the decreased future operating expenditures a much bigger weighting, people saw the overall impact as being good. More recently, economist Nicholas Stern from the London School of Economics produced a paper on October 30, 2006, using a discount rate of 0.1 percent, and came to the conclusion that the benefits of strong, early action on climate change would substantially exceed the drawbacks. The best economic strategies to prevent climate change call for relatively moderate rates of carbon reductions in the near term, followed by large reductions in the medium and long decades, according to some economists like Yale University's William Nordhaus, who favoured a discount rate of roughly 6%.

In this debate, whether or not strong current action is desired will depend on the magnitude of the discount rate utilized in the study at least in part. The marginal benefit is decreased due to rising discount rates, which reduce the value of the present benefits from current abatement efforts. As the selection of the discount rate has a significant minimal influence on the costs associated with such expenditures, a lower present value of the marginal benefit leads to a lower optimal investment in abatement keep in mind that costs coming in the near future are discounted less. The choice of the discount rate is not a trivial matter; rather, it plays a crucial role in shaping how the public sector operates, the kind of projects that are undertaken, and how resources are allocated through generations.

We previously came to the conclusion that under the "right" conditions, such as the absence of externalities, the presence of clearly defined property rights, and the presence of competitive markets within which the property rights can be exchanged, producers maximize present value of net benefits while attempting to maximize producer surplus. Let's consider one more situation at this time. If resources are to be dispersed efficiently, firms must discount future net gains at the same rate that is appropriate for society as a whole. Businesses would harvest and sell resources faster than is practicable if they employed a higher rate. In contrast, if they utilized a lower than required discount rate, firms would be too cautious.

The difference between private and social discount rates may also be caused by a component that distinguishes between social and private risk premiums. If the risks connected with certain private behaviors are distinct from the threats that society as a whole confronts, then the social and private risk premiums may differ. One blatant example is the threat that the government creates. If the corporation believes that the government will confiscate its assets, it may choose a higher discount rate to maximize profits prior to nationalization. A lower discount rate is fair since, in the perspective of society as represented by the government, this is not a threat. The present production should not be larger than private rates above social rates in order to maximize the net benefits to society. Both the production of power and forests have been impacted by this inefficiency.

Another variance in discount rates might be the result of various underlying rates of time preference. Such a variation in temporal preferences may lead to variations in otherwise equivalent research conducted in two different countries, as well as variations in individual and societal discount rates such as when businesses have a greater rate of time preference than the public sector. For instance, it would be expected that underdeveloped countries with poor access to money would have higher time preferences than wealthy countries. As the two benefit-cost analyses in these two countries would be based on two different discount rates, they may come to quite different conclusions. For example, what is suitable in a poor country could not be in an industrialized one. While they often do not differ, private and social discount rates frequently do. In the circumstances, market decisions are inefficient [8].

Cost-Effectiveness Research

What can be done to inform policy when the requisite value for a benefit-cost analysis is either lacking or not precise enough? Making an efficient choice without a trustworthy benefit measure is no longer possible. Yet, it is often feasible to choose a policy goal in these circumstances on the basis of anything other than a thorough benefit-cost analysis. One example is pollution prevention. What degree of pollution ought to be deemed the upper limit? Based on studies on how a particular pollutant affects human health, the maximum permissible concentration of that pollutant has been determined in many countries. A crucial threshold below which no damage seems to occur is sought for by researchers. In order to provide a margin of safety, the pollution objective is then calculated by further decreasing that level.

Techniques could also be based on expert opinion. Ecologists can be asked, for example, to pinpoint the specific vital wetlands resources that should be preserved or the crucial populations of a certain species. Yet, after the purpose of the policy has been determined, economic analysis may be very helpful in determining the costs associated with choosing a course of action. Cost implications are important not just because cutting down on wasteful expenditure is a noble goal in and of itself, but also because they lessen the likelihood of political backlash. There are generally many methods to achieve the stated objective; some of these approaches will be affordable, while others will out to be quite expensive. Finding the least costly approach to accomplish a goal generally requires a pretty detailed assessment of the available choices since the difficulties are typically complicated enough. Cost-effectiveness analysis often uses an optimization approach. An optimization strategy in this sense is nothing more than a methodical effort to identifying the most affordable way to accomplish the objective. This method often does not provide an efficient allocation since the chosen goal could not be efficient. Not all efficient policies are cost-effective, but all cost-effective policies are efficient. We already covered the efficiency equimarginal concept in this chapter.

According to this theory, net benefits are maximized when the marginal benefit and marginal cost are equal. For cost-effectiveness, the same, important equimarginal idea holds true: The second equimarginal principle is the equimarginal principle of cost-effectiveness. The environmental objective has been achieved using the least costly approach when the marginal costs of all practical means of accomplishment are equal. Consider that there are several strategies we may use to minimize emissions in a certain manner throughout a region. How much of the control weight should each technique bear? The measures should be used in a manner that both accomplishes the desired reduction in emissions and has a marginal control cost that is the same for all sources, according to the cost-effectiveness equimarginal principle. Imagine that we have a control responsibility allocation where one set of procedures has marginal control costs that are much higher than another. This will demonstrate the validity of the idea. This cannot be the least-cost allocation since we might lower expenses while keeping the same degree of carbon reduction. In more concrete terms, expenses might be reduced by giving sources with higher marginal costs less control and those with lower marginal costs more. It is clear that the first allocation could not have reduced costs since costs may be decreased while maintaining the same level of emissions. There is no alternative, less costly way to accomplish the same degree of emissions reduction when marginal costs are equalized, hence the allocation that minimizes costs must be adopted [9].

Impact Assessment

What can be done if the information needed to do a benefit-cost analysis or a cost-effectiveness analysis is not available? The analytical technique developed to solve this problem is known as impact analysis. Whether it focuses on the economic, environmental, or both repercussions of particular actions, an impact analysis attempts to quantify their effects. Pure impact analyses do not attempt to convert all of these impacts into a single, equivalent unit of measurement, such as dollars, in contrast to benefit-cost analyses. Impact analysis does not necessarily seek to maximize, in contrast to cost-effectiveness analysis. Impact analysis offers the decision-maker a lot of data, much of which has not been processed. The policymaker must evaluate the importance of the various predicted outcomes and take the necessary action. On January 1st, 1970, President Nixon signed into law the National Environmental Policy Act of 1969.

This law mandated that all federal agencies, among other things, include in every recommendation or report on legislation and other significant federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on: I the environmental impact of the proposed action; (ii) any negative environmental effects that cannot be avoided should the proposal be implemented; and (iii) alternatives to the proposed action. 10 This led to the creation of the environmental impact statement, which is now a standard, though controversial, part of the formation of environmental policy. In addition to other, more traditional impact measurements, modern environmental impact statements may additionally incorporate a benefit-cost analysis or a cost-effectiveness analysis. This makes them more sophisticated than their earlier forerunners. Nonetheless, there is a history of publishing lengthy, often impossible-to-understand environmental impact statements. As a result, the Council on Environmental Quality set content criteria that are now resulting in shorter, more concise statements. The Council on Environmental Quality is required by law to supervise the process of preparing environmental impact statements. To the extent that they merely quantify the impacts, statements may avoid the problem of "hidden value judgments" that might affect benefit-cost calculations, but they can only do this by saturating the decision-makers with enormous volumes of noncomparable data [10].

CONCLUSION

To develop harmony in the relationship between humans and the environment, several choices must be taken. To make rational decisions, there has to be a basis. If decisions are not thought out, they will be made instinctively. Benefit-cost analysis in normative economics is used to assess the acceptability of the quantity and composition of the services given. Cost-effectiveness and impact analysis are substitutes for benefit-cost analysis. While each of these approaches has flaws, they all provide information that is helpful in decision-making. Static allocations are effective distributions that maximize net benefit across all feasible uses of those resources. When the outcome maximizes the present value of net benefits from all possible uses of the resources, the dynamic efficiency requirement is satisfied, which is acceptable when time is a major factor.

Further chapters look at how much our social systems contribute to allocations that fit these criteria. A group of economists from very different political views got together in 1996 to attempt to reach some type of consensus on benefit-cost analysis' proper position in environmental decision-making since it is both extremely effective and very contentious. It is useful to repeat their whole analysis in full: In conversations about legislative and regulatory measures that seek to protect and improve public health, safety, and the environment, benefit-cost analysis may be essential. Formal benefit-cost analysis can offer a very helpful framework for uniformly organizing disparate information, and by doing so, it can greatly improve the process and, as a result, the outcome of policy analysis. However, formal benefit-cost analysis shouldn't be seen as either necessary or sufficient for developing sensible policy. When done properly, benefit-cost analysis may be highly beneficial to companies creating environmental, health, and safety regulations. Also, it may be useful for evaluating organizational decision-making and influencing legislation. However even in cases when the advantages are difficult to determine, economic research in the form of cost-effectiveness may be helpful. The least expensive ways to attain predetermined policy goals may be found using this technique, and extra costs incurred by selecting policies other than the least expensive policy can be computed. It cannot, however, determine if those predetermined policy goals are successful. Impact analysis is at the other extreme of the spectrum; it only recognizes and measures the impacts of certain policies without expressing any opinions about their efficacy or even the comparability of the results. Impact analysis does not guarantee successful outcomes. While each of the three techniques discussed in this chapter has its applications, none of them can be said to be the "best" way by itself. It relies on the kind and reliability of the information that is available.

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CHAPTER 9

VALUING THE ENVIRONMENT

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ABSTRACT:

Weighing society's level of preference for the environment in comparison to other goods and services is required to establish the quantity of environmental goods and services to supply or maintain. This value metric helps to guide policy and decision-making, which justifies the distribution of scarce resources among competing users. Using examples of practical applications, this article gives an overview of economic valuation techniques for environmental products. The dose-response method, contingency valuation method, and hedonic pricing are examples of valuation techniques that combine demand and nondemand curve approaches. The study also explores benefits transfer and damage schedules approach in situations when standard valuation techniques are less appropriate.

KEYWORDS:

Environment, Human Health, Meta-Analysis, Pollution, Valuation Techniques.

INTRODUCTION

Although it may be difficult, if not impossible, to accurately evaluate certain environmental amenities, failing to try results in our valuing them at zero by default. Would making the optimal policy choices require valuing them at $0? Very likely not, yet it does not stop debate from erupting over efforts to change $0 to a more suitable number. Benefit-cost assessments are a common decision-making tool used by many government agencies. With limited resources, the ideal outcome is to choose the initiatives that are the most economically attractive. Assessments of natural resource damages, such as those caused by oil spills (National Oceanic and Atmospheric Administration); the designation of critical habitat under the Endangered Species Act (U.S. Fish and Wildlife Service); applications for the relicensing of dams (The Federal Energy Regulatory Commission); and estimation of the costs and benefits of the Clean Air Act and the Clean Water Act, among other diverse actions. However crucial nonmarket values are typically left out of these evaluations. The findings will be erroneous if the analysis does not take into account all the necessary values [1].

The harm brought on by pollution and the services the ecosystem gives may both be valued using the methods we will discuss, but each situation has certain advantages. By highlighting some of the unique difficulties presented by the first of these settings, pollution management, we set the stage for our research of valuation methodologies. Damage estimates are used in the United States to establish policies as well as for the courts, who require a foundation for determining the size of liability judgments, as was mentioned in the first few paragraphs of this chapter. Pollution harm may manifest itself in many different ways. The impact on human health is the first and most visible. When consumed, contaminated air and water may lead to illness. Loss of pleasure from outside activities and harm to plants, animals, and materials are some other types of damage. Identifying the affected categories, estimating the physical relationship between pollutant emissions including natural sources and the damage caused to the affected categories, estimating the affected parties' responses toward mitigating some of the damage, and putting a monetary value on the unmitigated physical damages are all necessary steps in determining the extent of the damage. Each stage is often challenging to complete. Finding the impacted groups is difficult since the data required to determine causal correlations often comes from uncontrolled research. It is obvious that we cannot subject a huge number of individuals to controlled studies. Some individuals may become sick or perhaps pass away if they were exposed to various doses of a pollutant, such carbon monoxide, in order to research its short- and long-term consequences. This kind of human testing is prohibited by ethical considerations.

This basically gives us two options. We can attempt to extrapolate the effects on humans from carefully supervised laboratory studies on animals, or we can perform statistical analysis of variations in mortality or disease rates for different human populations residing in polluted environments to determine how strongly they are related to pollution concentrations. Each strategy falls short of being ideal. Animal trials are costly, and it is dubious at best to extrapolate from effects on animals to impacts on people. Many important exposure effects take a while to manifest. Test animals are often given big dosages for relatively short periods in order to assess these effects in a fair amount of time. The effects of low-dose, extended exposure to pollution on a human population are then extrapolated from the findings of these high-dose, short-duration tests. Several scientists differ on how to carry out the extrapolations since they go much beyond the scope of experimental findings.

Animal experiments raise additional ethical issues. On the other hand, statistical studies deal with human populations that have been exposed to low dosages for extended periods of time, but they are known to have a different set of issues since correlation does not indicate causality. To provide an example, just because there are more fatalities in places with greater pollution levels, it does not always follow that the higher pollution levels are to blame. Maybe residents in those similar cities were on average older or more smokers were present. Because of the relative lack of data, existing studies have not been able to fully account for all of these additional potential variables while being sophisticated enough to do so for many of them. The issues raised so far come up when determining whether a certain observable consequence is caused by pollution. The next stage is to determine how strongly the impact and pollution concentrations are related. In other words, it's important to assess how much of a decrease in respiratory sickness might be attributed to a specific reduction in pollution in addition to determining whether pollution increases the incidence of respiratory disease [2].

This is a challenging undertaking because to the nonexperimental character of the data. It is not unusual for different academics to reach dramatically diverse findings after examining the same data. When effects are synergistic that is, when they rely, in a nonadditive manner, on contributory variables like the victims' smoking habits or the presence of other dangerous chemicals in the air or water diagnostic issues are exacerbated. Establishing a monetary value for the physical damages is the next step once they have been determined. It is simple to see how tough of a task this is. Consider the challenges involved in placing a value on something like adding many years to a person's life or the anguish, suffering, and loss experienced by a cancer patient and their loved ones.

Various Values

The overall economic value that resources provide has been broken down by economists into three primary parts: use value, option value, and nonuse or passive-use values. The direct usage of the environmental resource is reflected in the use value. Fish caught in the ocean, lumber cut from the forest, water drawn from a stream for irrigation, and even the picturesque beauty bestowed by a natural view are examples. You have utilized the resource if you have employed one of your senses—sight, hearing, touch, taste, or smell to experience it. When a fishery is negatively impacted by an oil spill, air pollution makes people more susceptible to sickness, or when haze obscures a beautiful view, pollution may result in a loss of use value.

People's value for future environmental usage may be shown in option value. Even if one is not now utilizing the environment, it demonstrates the readiness to pay to ensure that one will be able to utilize it in the future. Unlike option value, which represents the desire to protect the possibility of potential future usage, use value reflects the value obtained from current use. Are you considering visiting Yellowstone National Park in the next summer? Maybe not, but would you want to keep the option open for the future? When the resource is not really consumed while being used, passive-use or nonconsumptive usage values are produced. The widespread observation that individuals are more than prepared to pay for enhancing or conserving resources that they will never utilize is reflected in these forms of values. A bequest value is one kind of nonuse value.

Bequest value is the amount of money you're ready to spend to make sure your children and grandchildren will have access to a resource. Existence value refers to a second kind of nonuse value, a pure nonuse value. The readiness to pay to guarantee that a resource exists in the absence of any interest in using it in the future serves as a proxy for existence value. In his now-famous comment, economist John Krutilla said, "There are many folks who receive comfort from the awareness that part of wilderness North America survives even if they would be frightened by the idea of being exposed to it." This is when the phrase "existence value" was first used. Independent of whatever current or future use these individuals may make of those resources," these ideals are. Groups like the Sierra Club mobilized in opposition to the Bureau of Reclamation's consideration of building dams close to the Grand Canyon because of the probable loss of this rare resource. Even people who never meant to visit Glen Canyon realized this possible loss when Lake Powell swamped it. This value belongs to a totally distinct type of value since it is not derived from actual usage or projected use [3].

It is hardly unexpected that they are divisive as a result. In fact, the U.S. Department of Interior forbade the inclusion of nonuse values unless use values for the occurrence under review were zero when it developed its standards on the proper methods for undertaking natural resource damage assessment. This ruling was overturned by a District of Columbia Court of Appeals decision in 1989, which permitted nonuse values to be included as long as they could be evaluated accurately.

Differentiating Valuation Techniques

Usually, the researcher's objective is to calculate the overall willingness to pay for the relevant item or service. Up to the amount eaten, this is the region beneath the demand curve. This computation is pretty simple for a market good. To estimate willingness to pay for nonmarket products and services, the subject of this chapter, one must either observe behavior, extrapolate from the demand for comparable items, or rely on survey results. Also, as was already said, it might be difficult to capture all value components. In order to give readers a feel of the range of options and how they relate to one another, this section will provide a quick review of some of the techniques available for estimating these values. The use details will be covered in greater detail in the sections that follow. The two main kinds of valuation techniques are revealed preference methods and expressed preference methods. The foundation of revealed preference techniques is real observable choices, which enable resource values to be deduced directly from those choices. The revealed preference technique, for instance, may determine how much the catch decreased and the subsequent decreased worth of the catch in order to determine how much local fishermen lost as a consequence of the oil leak.

Prices are immediately visible in this situation, and their application enables the direct assessment of the loss in value. Alternatively, more subtly, when estimating the value of an occupational environmental risk (such as some exposure to a drug that might cause some health risks), we can look at salary disparities across sectors where employees assume varying degrees of risk. Contrast this with the direct expressed preference technique, which may be used when the value is not readily apparent, such as when evaluating the importance of protecting a particular species. Analysts obtain this value from a survey that aims to elicit respondents' willingness to pay for the preservation of that species (their "stated desire"). Both indirect and direct strategies are included in each of these main groups of tactics[4].

Techniques of Stated Preference

Survey methods are used in stated preference approaches to extract willingness to pay for a marginal gain or to avoid a marginal loss. These techniques often fall into one of two categories: choice experiments and contingent value surveys. The most straightforward method, contingent valuation, offers a technique to derive values that cannot be acquired via more conventional approaches. In its most basic form, this strategy simply asks respondents how much they would be prepared to spend on either maintaining the resource in its present condition or changing the environment (by improving wetlands or reducing exposure to pollutants, for example).

DISCUSSION

Technique of Contingent Valuation

In the contingent valuation survey method, a fictitious market is created and respondents are asked to think about answering a willingness-to-pay question based on the presence of this market. Questions of contingent value provide unique difficulties. The main issue with using the contingent value technique has been the possibility of skewed survey responses. Many studies have concentrated on six categories of possible bias: (1) strategic bias; (2) information bias; (3) starting-point bias; (4) hypothetical bias; (5) payment vehicle bias (protest bids); and (6) the apparent gap between willingness to pay (WTP) and willingness to accept (WTA). When a responder purposefully gives a biased response to affect a certain result, this is known as strategic bias. The respondents who enjoy fishing may be tempted to provide an answer that ensures a high value rather than the lower value that more accurately reflects their true valuation if, for example, the decision to preserve a section of river for fishing depends on whether or not the survey produces a sufficiently large value for fishing. Social desirability bias is a variant on strategic bias that happens when respondents attempt to portray themselves in a positive manner.

One frequent example is when voters falsely claim to have voted when they did not. When respondents are required to assign values to characteristics with which they are unfamiliar or have limited expertise, information bias may result. For instance, a recreationist may base their assessment of a decline in water quality in one body of water on how simple it is to substitute recreation in another body of water. The appraisal can be totally based on a misleading impression if the responder has never used the second body of water. Visual aids have been proven to lessen ambiguity and lack of familiarity with the item or service being rated, although the reaction may vary depending on the kind of visual aid used. Respondents' willingness to pay for the Philippine Eagle was impacted by colorful photos more than by black-and-white photographs. The willingness to pay was greater for colorful than for black-and-white shots. According to the authors, the increased willingness to pay may be explained by the fact that color photos simply convey more information or by "improving respondents' capacity to integrate information." In any instance, the visual aid's characteristics seem to be crucial for displaying preferences [5], [6].

As the responder is presented with a manufactured rather than real set of options, hypothetical bias might come into play. The responder could handle the survey lightly and provide ill-considered responses since they won't really have to pay the projected amount. One early study discovered 10 studies that directly matched survey-derived estimates of willingness to pay with actual spending. While some studies discovered that surveys' estimations of willingness to pay were higher than real costs, the majority of those discovered that the discrepancies were not statistically significant. The impact of geography and/or culture on hypothetical bias was then investigated. They discovered substantial changes in prejudice across places in a research based on student studies in China, France, Indiana, Kansas, and Niger. This conclusion should not be dismissed since policymakers typically base their judgments on benefits estimates that already exist in other places. The approach known as benefit transfer using estimates generated in one situation to infer benefits in another and its advantages and drawbacks are explored here. Environmental economists are increasingly employing these kinds of studies to attempt to assess the severity of some of these biases and to discover strategies to lessen prejudice. Some of these experiments are carried out in a lab environment, such a computer lab or a classroom that is specifically suited for this. In one of these experiments, it was discovered that during door-to-door interviews, an increase in the interviewer's physical attractiveness resulted in much higher contributions. It's interesting to see that physical beauty significantly increased response rates, especially among male families. Biases like this, which are often referred to as interviewer bias, may be minimized by well-constructed and validated surveys.

When respondents have a negative reaction to the payment vehicle option, there may be another issue called payment vehicle bias. The payment method reflects the proposed method of obtaining the indicated WTP. Donations, taxes, or higher utility costs are often selected options. A responder may indicate $0 for their readiness to pay if they are against taxes or have a bad opinion of the organization collecting the (fictitious) payment. They must be omitted from the analysis if their genuine desire to pay is actually larger than zero but they are "protesting" the question or the method of payment. It is crucial to distinguish between legitimate zero offers and objections. The last form of bias focuses on discrepancies between the notions of willingness to pay (WTP) and willingness to accept (WTA) remuneration, which are thought to be closely connected. When questioned about their readiness to accept compensation for the stated loss of an item or service, respondents to contingent valuation surveys often report substantially higher values than when asked about their willingness to pay for the specified increase of the same commodity or service. According to economic theory, the two ought to be equal. Some of the justifications put up for the discrepancy are examined in debate

Two new concepts compensating variation and equivalent variation become pertinent when determining willingness to pay or accept in the context of price fluctuations. The amount required to make up for a price rise in order to leave a customer in the same financial situation as before the price increase is known as the compensating variation. The compensatory variation may be used to gauge how much of a "hurt" the price rise caused to the customer. Contrarily, equivalent variation is the amount of money needed to make a customer unconcerned (with the same income) about the difference between the money and the price rise [7].

The committee was quite explicit about its objections to the method. The panel listed three issues as being of particular concern: (1) the tendency for contingent valuation willingness-to-pay estimates to seem excessively high; (2) the challenge of ensuring that respondents have understood and absorbed the issues in the survey; and (3) the challenge of ensuring that respondents are responding to the specific issues in the survey as opposed to merely reflecting a general warm feeling of public-spiritedness, or the "warm glow" effect. The panel did, however, make plain that it came to the judgment that well-structured surveys might remove or decrease these biases to acceptable levels, and it included in an appendix detailed instructions for figuring out if a given research was properly designed. The panel recommended that practitioners adopt these recommendations in order to develop estimates that are trustworthy enough to serve as the basis for a legal procedure of damage assessment, including lost passive-use values. Judges and juries will want to combine evidence from [a well-constructed contingent valuation research] with other estimates, such as expert witness testimony. They specifically advised using follow-up questions, explicit scenario descriptions, personal interviews, and referendum-style (yes/no) willingness-to-pay inquiries. These recommendations have influenced the design of future investigations.

These suggestions use the knowledge gained from the over 8000 expressed preference studies that have been published since the NOAA guidelines were initially released to provide best practices for contingent valuation and choice experiments. The authors provide 23 suggestions, some of which include adopting an appropriate survey method, selecting a random sample of the impacted community, and explicitly describing the baseline or status quo scenario in the survey design. Also, they advise doing a survey instrument pretest. They provide detailed instructions on when contingent valuation is preferable to a choice experiment and vice versa. They also offer suggestions for minimizing and dealing with response bias. Selection Experiments Many attribute-based techniques are included in indirect hypothetical expressed preference approaches. When project alternatives include various degrees of distinct properties, attribute-based approaches like choice experiments are helpful. Choice experiments are survey-based, similar to contingent valuation, but instead of asking respondents to indicate their willingness to pay, they ask them to choose among different bundles of commodities. The levels of each property change across bundles, and each bundle has a unique collection of attributes. It is possible to determine willingness to pay since each bundle has a price measure as one of its properties.

Unveiling of Preference

Methods Inferring a value rather than estimating it explicitly makes revealed preference approaches "indirect," yet they are also "observable" since they include real behavior and expenditures. Imagine, for instance, that pollution is endangering a specific sport fishery and that one of the harms it causes is a decline in sportfishing. Given that the fishery is open to everyone, how should this loss be valued? Cost of Travel Method. Using travel-cost methodologies is one approach to calculate this loss. By utilizing data on how much visitors spend going to the location to create a demand curve expressing willingness to pay for a "visitor day," travel-cost approaches may infer the worth of a recreational resource (such as a sport fishery, park, or wildlife preserve where visitors hunt with a camera). In 2014, Freeman et al. identified two variations on this strategy. In the first, experts look at how often people visit a site.

The analysts look at whether consumers choose to visit a site and, if so, which site. The second approach involves valuing quality changes using a unique class of models called random utility models. The first option enables the creation of a demand function for trip expense. The area under the expected demand curve for those services or for access to the site, taken as the total number of visitors, represents the value of the flow of services from that site. Individual consumer surplus may be calculated using this variation. The consumer surplus is the region that is below the demand curve but above the price (travel cost). The second variation makes it possible to analyze how certain site qualities affect decision and, therefore, how important those traits are. The analyst may determine how the deterioration of those features (due, for example, to pollution) might affect the value of the site by understanding how the value of each site fluctuates with regard to its attributes. Beaches, recreational fishing, national parks, and mountain climbing have all been valued using travel-cost models. Moreover, losses from occurrences like beach closures due to oil spills, fish consumption warnings, and the price of construction that has removed a recreation area have all been valued using travel-cost models. In Parsons, the approach for both variations is described (2003). In the random utility model, a person chooses a certain site based on the attributes of the site and its cost (trip cost). Accessibility and environmental quality are factors that influence site selection. Each site generates a different degree of utility, and it is expected that each individual will choose the location producing the maximum level of benefit for them. The consequent change in utility should the individual have to choose another, less desired place may then be used to calculate the welfare losses from an incident like an oil spill. In Example 4.3, the economic effects of beach closures resulting from oil spills in Minorca, Spain, are estimated using trip cost methodologies. The travel cost model presents an intriguing contradiction in that people who reside closest to the location and may visit often would have low travel expenses. Even if their (unmeasured) desire to pay for the experience is quite high, these users will seem to have a lesser value for that site. The model's inability to properly account for the opportunity cost of time presents another difficulty. Often, salaries are used to reflect this, although not everyone agrees with that strategy [8].

Transfer of Benefits and Meta-Analysis

The NOAA panel report has produced a compelling conundrum. Although legalizing contingent valuation for calculating passive-use (nonconsumptive usage) and nonuse values, the panel also established certain pretty strict standards that trustworthy research should adhere to. An "acceptable" contingent valuation study may be so expensive to complete that it will likely only be effective for major occurrences with significant enough damages to warrant its usage. Nevertheless, the lack of alternative methods may cause passive-use values to default to zero if contingent valuation is not used. It is not a really tempting option. 11 Benefit transfer may hold the key to overcoming the conundrum brought on by the potential cost of putting the NOAA panel's recommendations into action. Benefit transfer enables estimates for the location of interest to be based on estimates from other sites or from an earlier time period to give the basis for a current estimate since original studies are time-consuming and costly. Value transfers, benefit function transfers, or meta-analyses are the three types of benefit transfer methodologies.

If there are variances between the research site and the policy location, the actual benefit values determined from point estimates may sometimes be transferred straight from one setting to another. Using a benefit function that connects site attributes to site values entails function transfer. To create novel, more site-specific values in this situation, the distinguishing properties of the place of interest are added to the previously determined benefit function. Meta-analysis has been used most lately. Meta-analysis, often known as the "analysis of analyses," determines the extent to which reported differences may be ascribed to variations in setting, topic, or technique by statistically relating empirical estimates from a sample of research to the characteristics of those studies. For instance, the drivers of nonuse value have been isolated and quantified using cross sections of contingent valuation research and meta-analysis. By identifying the value that is consistent with the new context after these determinants have been separated out and linked to particular policy contexts, it might be possible to transfer estimates from one context to another without having to spend the time and money on conducting new surveys each time. In circumstances when limited resources, time, or data prevent original investigation, benefit transfer approaches have been frequently employed. Studies that have already been published are regularly searched by policymakers for information that might support a future choice. Benefit transfer has the benefit of being rapid and affordable, but the estimates' accuracy declines as the new context tends to diverge (either temporally or geographically) from the context from which the estimates were derived the more away it is. Transferring benefits has not been without controversy. They also explain several possible drawbacks to its use, such as a dearth of research that are both of adequate quality and relevant to policy. A lot of the published research also don't include enough details about the qualities to analyze how they could have impacted the obtained value. An inventory database for valuations has developed in response to some of these issues. A searchable online library of more than 4000 empirical research on the economic worth of environmental benefits and human health consequences is called the Environmental Valuation Reference Inventory (EVRI). It was created especially as a mechanism for benefit transfers [9]–[11].

CONCLUSION

Direct observation, contingent valuation, contingent choice experiments, trip costs, hedonic property and wage studies, and avoiding or defensive expenditures were some of the several methods we looked at. Benefit transfer or meta-analysis are alternative methodologies for the estimate of values when time or money are constraints on original research. 20 years after the Exxon Valdez catastrophe and, unbeknownst to any of them when requested to participate, 8 months after the Deepwater Horizon leak, a panel of experts discussed nonmarket value at the American Economics Association's annual conference in January 2011. Each panelist has contributed to the evaluation of Exxon Valdez spill damage. The panelists came to the conclusion that even though the literature has addressed many of the bias-related concerns, there are still many difficulties that need to be resolved. Although they all agreed that it is "hard to underestimate the tremendous demand for values" (i.e., any number is unquestionably preferable than none), and that we now have techniques in place that can be used by all researchers, they also highlighted a number of issues.

First, there is no consensus about the importance of time in trip cost models. What is the opportunity cost of time, for instance, if you are unemployed? The second issue they posed was in relation to other revealed preference techniques: "How do the recent widespread real estate market foreclosures influence hedonic property value model assumptions?" 17 Finally, not all the possible issues with contingent valuation are solved by choice trials. Choice experiments do seem to better reflect genuine market decisions, but they also offer some of the same problems as contingent valuation, such as the choice of the payment method. Moreover, certain fresh difficulties emerge, such as the potential impact of choice order on results in choice experiments. The panel emphasized how the new subject of behavioral economics, which mixes economics and psychology to study human behavior, has improved this field of study. They also recommended that the NOAA panel's recommendations be modified to take into account the most recent body of evidence. To achieve precisely that, a new set of guidelines was released in 2017. The 23 suggestions in those guidelines aim to combine the already substantial body of research that underpins nonmarket value and address these concerns about expressed preference surveys.

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CHAPTER 10

DEPLETABLE RESOURCE ALLOCATION

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ABSTRACT:

A resource whose stock declines everytime it is utilized and does not rise throughout the time frame that is important for making economic decisions. Coal, oil, and mineral resources are a few examples. Depletable resources adapt so slowly that they may be modeled as being made accessible by nature just once.

KEYWORDS:

Depletable Resources, Economic, Resources, Recycling, Renewable Resource.

INTRODUCTION

How do civilizations respond when limited resources with finite supplies become available? Is it fair to anticipate that self-limiting feedbacks would aid in the changeover to a stable, sustainable state? Is it more logical to anticipate that self-reinforcing feedback processes would make the system exceed the available resources, maybe even triggering a social collapse? We start our search for solutions by looking at the effects of both efficient and profit-maximizing decision making. How do choices driven by efficiency and profit maximization imply different types of feedback mechanisms? Do they support a seamless transition or do they have a higher propensity to overshoot and collapse? We take a multi-step approach to answering these issues, starting with establishing and discussing a simple yet helpful resource taxonomy (classification system) and outlining the risks associated with disregarding the differences provided by this taxonomy.

In order to begin the study, we first define an optimal allocation of an exhaustible resource over time in the absence of any renewable alternatives. Next, we investigate the requirements that any effective allocation must meet. The effects of these circumstances are shown by numerical examples. The approach incorporates renewable resources by assuming the most straightforward scenario possible: that the resource is delivered at a steady, ample rate and is accessible at a set marginal cost. Two examples that seem to closely fulfill this description are solar energy and replenishable surface water. We describe effective extraction routes for both kinds of resources, assuming that they are perfect replacements, by including a renewable resource backstop into our fundamental depletable resource model. We also investigate how variations in the characteristics of the cost functions as well as the existence or absence of externalities impact these efficient pathways. These ideas will be used in subsequent chapters to study how different resources, such energy, minerals, land, and water, are distributed as well as to serve as a foundation for the creation of more complex models of renewable biological populations, like fisheries and forests [1].

A taxonomy of Resources

Keep in mind that there are two dimensions one geological and one economic. Moving from resources that can be mined inexpensively to those that can be exploited at much greater prices is represented by a movement from top to bottom. A shift from left to right, on the other hand, implies a growing geological uncertainty over the extent of the resource base. The term "current reserves" refers to known resources that may be mined successfully at the present price. Their current reserves' size may be quantified by a number. On the other hand, a function rather than a number is the best way to define potential reserves. The price that consumers are prepared to pay for such resources determines how much potential reserves are accessible; the higher the price, the greater the potential reserves. The ability to extract resources from previously untapped unconventional sources is made possible by higher prices, which also allow for more costly techniques to collect more of the resource from conventional sources. The earth's crust's inherent abundance of resources is represented by the resource endowment. Prices are a geological term rather than an economic one since they have nothing to do with the amount of the resource endowment. This idea is significant because it denotes a physical limit on the amount of resources that may be found on Earth. These three ideas differ from one another significantly. Using data on existing reserves as though they represented the greatest prospective reserves is one typical error made when failing to recognize these discrepancies. The time to fatigue may be significantly underestimated as a result of this underlying mistake. The assumption that the complete endowment of resources may be made available as potential reserves at a cost that people will pay is a second frequent error. Obviously, the full resource endowment might be used if an endless price were attainable, but don't hold your breath till infinite prices are available. Furthermore helpful are other differences between resource types. All depletable, recyclable materials, such as copper, fall under the first group. When a resource is depletable, it is safe to disregard the natural replenishment feedback loop. These resources' rate of replenishment is so slow that it is impossible to increase the supply within an acceptable amount of time [2].

Recycling in addition to economic replenishment may increase the existing stock of a finite, recyclable resource. Economic replenishment comes in a variety of shapes and sizes, but they all have one thing in common: they make resources that were formerly unrecoverable into ones that can now be. Price is a clear motivator for this replenishment. Producers find it lucrative to explore farther, dig deeper, and employ lower-concentration ores when prices climb. Also, higher costs encourage technical advancement. Technological development is just an improvement in our level of knowledge that enables us to broaden the range of conceivable outcomes. Two notable examples are the use of nuclear energy and the development of horizontal drilling and hydraulic fracturing. Both are covered in Chapter 7 of the book. Yet, the available supplies of depletable, recyclable materials may run out. Demand for, durability of, and reusability of items made with the resource all have an impact on the pace of resource depletion. Unless in cases when demand is completely inelastic to price, or indifferent to price, higher prices usually result in lower demand.

Products that are durable endure longer and need fewer replacements. Reusable goods serve as an alternative to brand-new goods (such as rechargeable batteries or goods found at flea markets). For certain resources, our capacity to store the resource directly affects the magnitude of the prospective reserves. For instance, natural gas and helium are often found together in common areas. If the helium isn't concurrently caught and stored with the natural gas during extraction and storage, it will diffuse into the atmosphere. Its dispersion leads to atmospheric concentrations that are so low that it is not cost-effective to collect helium from the air at the present or even expected future costs. So, how much we choose to keep will have a significant impact on the useable supply of helium. Not all finite resources are recyclable or reusable. Coal, oil, and gas are depletable energy sources that when burned undergo an irreversible transformation. The heat is no longer recoverable after it has been converted to heat energy since it dissipates into the atmosphere.

The amount of exhaustible resources is limited. Due to the fact that depletable and non-recyclable resources cannot be replenished, the question of how they should be distributed among generations is brought up in the most direct and unforgiving way possible. As recycling and reuse extend the useable stock's lifespan, depletable recyclable resources create a similar problem, but one that is not as pressing. Whilst it is alluring to think that with 100 percent recycling, depletable, recyclable resources may live indefinitely, the actual theoretical top limit on recycling is less than 100 percent a consequence of a variation of the entropy rule. It is inevitable that some mass will be lost during recycling or usage. Since mass is not regenerated at full capacity, the useable supply must ultimately deplete to zero. The cumulative useable stock is thus limited even for recyclable, depletable resources, and present consumption habits nonetheless have an impact on future generations. Solar energy, water, and biological populations are all examples of renewable resources, which are distinguished from depletable resources chiefly by the fact that natural replenishment augments the flow of renewable resources at a non-negligible pace. It is plausible, although not inescapable, that a flow of this sort of resources may be sustained indefinitely. The continuity and magnitude of the flow of certain renewable resources heavily rely on people. Food flow is slowed down by nutrient depletion and soil erosion. Fish stocks are reduced by overfishing, which slows the pace at which fish populations naturally expand [3].

DISCUSSION

Renewable resources can be stored in certain cases but not in others. Storage offers an extra method for people who can control resource allocation over time. We are not just at the mercy of the ebbs and flows of nature. Without adequate care, food spoils quickly, yet in famine situations, hoarded food may be utilized to feed the needy. The surface of the planet emits radiation that dissipates into the atmosphere. Although solar energy may be stored in a variety of ways, photosynthesis, which turns solar energy into biomass, is the most typical natural storage method. As compared to storage of depletable resources, renewable resource storage often offers various benefits. Although storing renewable resources may help to even out cyclical imbalances in supply and demand, storing depletable resources just extends their economic life. Surpluses may be kept and used when there are shortfalls. Food reserves and the utilization of dams to retain water for hydropower generation are two common examples. While it's a struggle still, managing renewable resources is different from managing depletable ones. Allocating declining reserves across generations while achieving the eventual transition to renewable resources is the dilemma for depletable resources. In contrast, maintaining an effective, sustained flow is difficult when managing renewable resources. In response to these difficulties, the political and economic spheres have mobilized resources of a particularly substantial kind [4].

Intertemporal Allocations That Are Effective

To assess the effectiveness of market allocations, we must first clarify what is meant by effectiveness in terms of the management of finite and limitless resources. Dynamic efficiency becomes the central idea since allocation over time is the key problem. The dynamic efficiency criteria makes the assumption that society's goal is to maximize the value of the resource's net benefits in the present. This calls for balancing the resource's present and future uses in the case of a depletable, nonrecyclable resource. Humans will begin by revisiting and expanding on the very simple two-period model produced in Chapter 5 in order to refresh our recollections of how the dynamic efficiency criteria determines this balance. Then, we can show how the model's inferences apply to scenarios with wider planning horizons and more complex circumstances. Revisiting the we described a scenario in which a limited resource that could be harvested at a constant marginal cost was distributed across two periods. If the resource's demand curve was steady, an effective allocation would include giving the first period more of the resource than the second period less of it. The marginal cost of extraction, the marginal cost of usage, and the discount rate all had an impact on how the resources were allocated between the two time periods. Use of a unit now prohibits use of that unit tomorrow since depletable resources are fixed and limited. Thus, forgone future net gains must be taken into account while making production choices today. The opportunity cost metric that enables intertemporal balancing is marginal user cost [5].

Since the marginal user cost, which is an increasing component of total marginal cost, accounts for a lower share of the total marginal cost of the second resource than the first, the slope of the marginal cost curve is flatter after transition. The marginal cost of extraction + the marginal cost of usage together make up the total marginal cost of each resource. The marginal cost of extraction is constant in both scenarios whereas the marginal cost of the consumer is rising at a rate of r. With the second resource compared to the first, the constant marginal cost of extraction makes up a substantially higher share of the overall marginal cost. As a result, at least initially, the total marginal cost increases more slowly for the second resource.

Marginal Extraction Costs are rising

Our investigation into the effective use of finite resources has now been broadened to take into account longer time horizons and the existence of additional finite or renewable resources that may be used in their place. In our quest for more realism, we will now take into account a scenario in which the marginal cost of obtaining the finite resource increases with time. For instance, this is often the situation with minerals, when the higher-grade ores are initially exploited before a growing dependence on the lower-grade, higher marginal-cost ores. This example is treated analytically in a similar way to the preceding instance, with the exception that the function expressing the marginal cost of extraction is a little more difficult and rises with the total quantity removed. Again, maximizing the present value of the net benefits is used to determine the dynamically optimal allocation of this resource; however, this time, the cost of extraction function has been adjusted [6].

The behavior of marginal user cost is where this scenario and others that came before it most significantly diverge. We observed that the marginal user cost increased with time at rate r in the situations of constant marginal cost. The marginal user cost decreases over time until it reaches zero at the point of switching to a renewable resource whereas the marginal cost of extraction, as in this example, rises with the total quantity extracted. Keep in mind that marginal user cost is a missed potential to get future marginal net benefits. The cost of extraction increases with each unit currently removed in the growing marginal cost situation as opposed to the constant marginal cost case. The net benefit that a future generation would receive if a unit of the resource were saved for them, if it were, gets smaller and smaller as the marginal extraction cost of that resource gets larger and larger. As a result, as the current marginal cost rises over time, the sacrifice made by future generations diminishes as an additional unit is consumed earlier. By the last time, the marginal extraction cost is so large that consuming one additional unit sooner would not have any negative effects. The marginal user cost (which reflects the opportunity cost of current extraction) decreases to zero at the switch point, bringing total marginal cost to the same level as the marginal extraction cost. Another significant distinction between the increasing-cost situation and the constant-cost case also exists. The depletable resource reserve eventually runs out in the constant-cost situation. But, in the scenario of rising costs, part of the reserve is left in the ground since it is more costly than the alternative. We have looked at a variety of situations where an efficient allocation might occur up to this point in our investigation. At the beginning, we looked at a scenario where a limited quantity of a resource is harvested at a fixed marginal cost. A seamless transition to a replacement when one is available or to abstention when one is not includes an efficient allocation, even in the absence of rising extraction costs. The complicating factor of growing total marginal cost paired with falling consumption of depletable resources does not modify the fundamental conclusion of declining consumption of exhaustible resources coupled with rising total marginal cost [7].

Exploration and the Advancement of Technology

It would not be a legitimate inference to draw from past trends of rising consumption that depletable resources are not being used effectively. The findings of every model rely on the model's structure, as we have already said. The role of population and wealth growth, which may lead demand to move upward over time, as well as the discovery of new resources or advancements in technology, have not yet been taken into account in the models that have been examined up to this point. They have historical importance in determining the actual consumption pathways. Think about how these variables could affect the effective extraction profile. Finding new resources costs money. Searches are started in less profitable and more expensive areas, including the ocean floor or regions deep into the earth, when readily found resources are depleted. This means that, like the marginal cost of extraction, the marginal cost of exploration the expense of discovering new units of the resource should be anticipated to increase with time.

Society should actively look for additional sources of a resource when its total marginal cost increases over time. More potential improvements in net benefits from discovering new sources that were previously unprofitable to extract are triggered by higher increases in the marginal cost of extraction for recognized sources. New sources of the resource would be found as a result of some of this investigation. The overall marginal cost of production might be lowered, or at the very least delayed, if the marginal extraction cost of the recently found resources is sufficiently low. The new discoveries would thus likely to promote more extraction and consumption. The model with exploration would exhibit a smaller and slower fall in consumption while attenuating the increase in total marginal cost when compared to a scenario where exploration is not allowed. It is also simple to incorporate technical progress the phrase economists use to refer to improvements in the level of knowledge in our definition of efficient resource allocation. The cost of extraction would gradually decrease as a result of technical advancement in the current situation. A one-time discovery that lowers the marginal cost of extraction might speed the transition for a resource that can be mined at constant marginal cost. In addition, more of the total resource would be recovered in the presence of technical advancement than it would be in the absence of it for a resource with a growing cost[8].

Appropriate structures for Property Rights

The most widespread fallacy among those who contend that no market, no matter how flawless, could ever accomplish an efficient allocation of finite resources is the notion that producers want to extract and sell resources as quickly as they can since that is how they obtain value from them. Many mistakenly believe that markets are short-sighted and preoccupied with the future. Natural resource markets won't always result in myopic decisions as long as the property rights regulating those resources contain the features of exclusivity, transferability, and enforcement. This is because myopia would lower earnings. The producer acts effectively to maximize revenues by accounting for marginal user cost. The value of a resource in the ground may come from two different sources: a use value when it is sold the sole source taken into account by those who diagnose unavoidable myopia), and an asset value while it stays in the ground. The value of an underground resource increases as long as the price of that material rises. Nevertheless, the resource owner only receives this capital gain if they save the resource for a future sale. A producer forfeits the possibility to profit from future price increases if they sell all of their resources during earlier times. A producer whose primary goal is to maximize profits will make an effort to strike a balance between current and planned output. A producer who ignores this incentive would not be maximizing the value of the resource as higher future prices provide an incentive to preserve. Someone willing to postpone extraction in order to increase the value of the resources offered by a shortsighted producer would purchase them. A producer who pursues maximum profits simultaneously provides the maximum present value of net benefits for society as long as social and private discount rates are congruent, property rights structures are clearly defined with no externalities, and trustworthy information about future prices is available. This theory has the consequence that, in markets for competing natural resources, the price of the resource matches the entire marginal cost of its extraction and use. As a result, through may demonstrate both an efficient allocation and an allocation made possible by an efficient market. The total marginal cost curve depicts the timeline that prices may be anticipated to follow in an efficient market [9].

Cost of the Environment

Yet, not all real circumstances meet the prerequisites for this harmonic result. When the exploitation of a natural resource imposes on society environmental costs that are not absorbed by the producers, this is one of the most significant scenarios in which property rights frameworks may not be clearly defined. Examples of related environmental costs include the aesthetic expenses of strip mining, the health hazards related to uranium tailings, and the acids leached into streams from mine activities. As it serves as one of the links between the historically distinct domains of environmental economics and natural resource economics, the existence of environmental costs is crucial from both an empirical and conceptual standpoint. Imagine, for instance, if the expenses incurred by the corporations who were exploiting a depletable resource were not sufficiently represented in the environmental harm that was created [10], [11].

CONCLUSION

Depending on the situation, both renewable and depletable resources have different efficient extraction profiles. The effective amount of the depletable resource harvested decreases with time in the conventional treatments when the resource may be extracted at a fixed marginal cost. If there is no replacement, the amount decreases gradually until it reaches zero. The amount of the depletable resource removed will gradually decrease to the quantity available from the renewable resource if a renewable constant-cost equivalent is provided. In each situation, the final unit of the depletable resource would ultimately be harvested, and the marginal user cost would increase over time until it reached its highest point. Although the quantity harvested over time reduces in the optimal allocation of a rising marginal-cost resource, there are differences in the behavior of the marginal user cost and the cumulative amount extracted. When the marginal cost of extraction is constant, the marginal user cost normally increases over time; however, when the marginal cost of extraction increases as more is extracted cumulatively, it typically drops with time.

The cumulative amount extracted is also equal to the supply in the constant-cost case; however, in the increasing-cost case, it depends on the relationship between the marginal extraction cost function and the cost of the substitute; some of the resource may be left in the ground unutilized. The shift to renewable resources is often delayed when technical advancement and exploratory activities are included. Current reserves are enlarged through exploration, and technical advancement prevents the marginal extraction cost from growing as quickly as it otherwise would. Market allocations of depletable resources may be efficient in the absence of environmental costs when property rights structures are correctly established. If these effects are sufficiently strong, marginal cost may actually fall for some time, leading to an increase in the amount harvested. Profit maximization and effectiveness are possible in this situation. Yet, market allocations often won't be effective when resource exploitation has an external environmental cost. The depletable resource's market price would be too low, extraction would occur at an excessive pace, and eventually, an excessive amount of the resource would be taken out. The shift from finite to renewable resources occurs smoothly and without overshoot-and-collapse phenomena in an effective market allocation. It needs to be seen if the actual market allocations of these different resources are efficient. To the degree that markets manage an effective transition, a laissez-faire approach would be the proper course of action for the government. On the other side, if the market is unable to provide a cost-effective allocation, then government action may be required. We will look at these issues for several categories of renewable and nonrenewable resources in the next chapters.

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CHAPTER 11

RECYCLABLE RESOURCES

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ABSTRACT:

Recycling of resources lowers the quantity of garbage released into the environment on a worldwide scale. By recycling thoroughly, trash is reduced significantly. Recycling is therefore a crucial component in preserving the environment worldwide. A lot of primary resources are used and accumulate in society as recyclable resources due to fast economic growth and urbanization, which puts a lot of strain on the environment. Green growth and sustainable development may be achieved via the expansion of the resource recycling industry (RRI). The resource recycling industry (RRI) is receiving increased scholarly attention, and this is reflected in the growth of the relevant literature. The Web of Science database has around 7041 papers on RRI from 1996 to 2018. Using the visualization analysis program CiteSpace, this report examines the temporal distribution properties of the literature and the state of the scientific research collaboration network.

KEYWORDS:

Environment, E-Waste, Minerals, Natural Sources, Recyclable Resources,

INTRODUCTION

In this work, the word "recyclable resource" refers to "a variety of wastes created in the course of social production and consumption, which have lost all or some of their original use-value, and which may be recycled and treated so that they might recover their use-value". Scrap metals, electronics, mechanical, and electrical equipment, as well as their parts, scrap paper raw materials (such as wastepaper and cotton), scrap light chemical raw materials (such as rubber, plastics, pesticide packaging, animal bone and hair), and scrap glass are all examples of recyclable resources . The term "resource recycling industry" (RRI) refers to businesses involved in recycling, processing, and using recyclable resources as well as in developing science and technology, providing information services, distributing recyclable resource-based products, and other related activities [1].

Rapid economic growth and urbanization result in massive amounts of primary resources being used and building up in society as recycled resources, which puts a lot of strain on the environment. The globe confronts the issue of resource depletion as a result of the ongoing growth of human civilization, which necessitates the acquisition of numerous natural resources. In addition, the numerous wastes recyclable resources generated by people have not been used to their full potential, which exacerbates the negative effects of human civilization on the environment. A robust RRI initiative will lower societal demand for natural resources, promote resource recycling and sustainable development, and lessen the environmental damage resulting from human needs for natural resources. As a result, another crucial indicator for determining the effect of human social development on the environment will be the RRI's level of development. Also, this has caused a lot of anxiety among academics. The management of e-waste in many different nations and areas of the globe was thoroughly analyzed by Ongondo et al., who also examined the future course of e-waste. The worldwide state of recycling used solar panels. The obstacles and potential for plastic recycling were evaluated. The development status of the anaerobic digestion process's inhibition was evaluated. In order to research how policies affect the sector, carefully went through and studied the RRI policies in China. These studies, however, are undertaken only from the standpoint of the RRI, including industrial regulations, waste recycling, recycling technology, and environmental effects.

We may categorize the movement of resources into four phases using the theories of material flow analysis and life cycle analysis, as illustrated in Figure 1. Mine extraction, production and manufacturing, use and consumption, and resource recycling are the four stages (waste management). The fourth stage is the subject of this work, and Figure 1's red dotted line designates the study's system boundary. According to the notion of material flow analysis, there should be two final homes for trash. The first host will be recycled or renovated before being returned to society, while the second host will be destroyed by burning or dumped in landfills before being returned to nature. Yet, landfills and incineration seriously damage the ecosystem. We must encourage the development of RRI to increase the rate of resource recycling in order to lessen the environmental effect of the garbage that civilization produces.

The development of RRI still has a lot of issues. Investigating the current state and future directions of RRI research and encouraging the advancement of related fields would help the RRI grow sustainably and healthily. We thoroughly sorted out the study findings from the RRI using the literature measurement visualization program CiteSpace in conjunction with social network analysis, co-citation analysis, emergent analysis, information science, and bibliometrics. As a result, the research hotspots and evolutionary settings of the RRI are investigated, as well as the research route and knowledge clustering of the RRI. The findings of this study may assist new researchers in swiftly gaining an understanding of the state of the RRI field's research so that they can focus on it fast. These results could serve as motivation for academics looking for fresh approaches and concepts for their study. In the end, it will support both the ecological growth of RRI and the furthering of associated study on the subject [2].

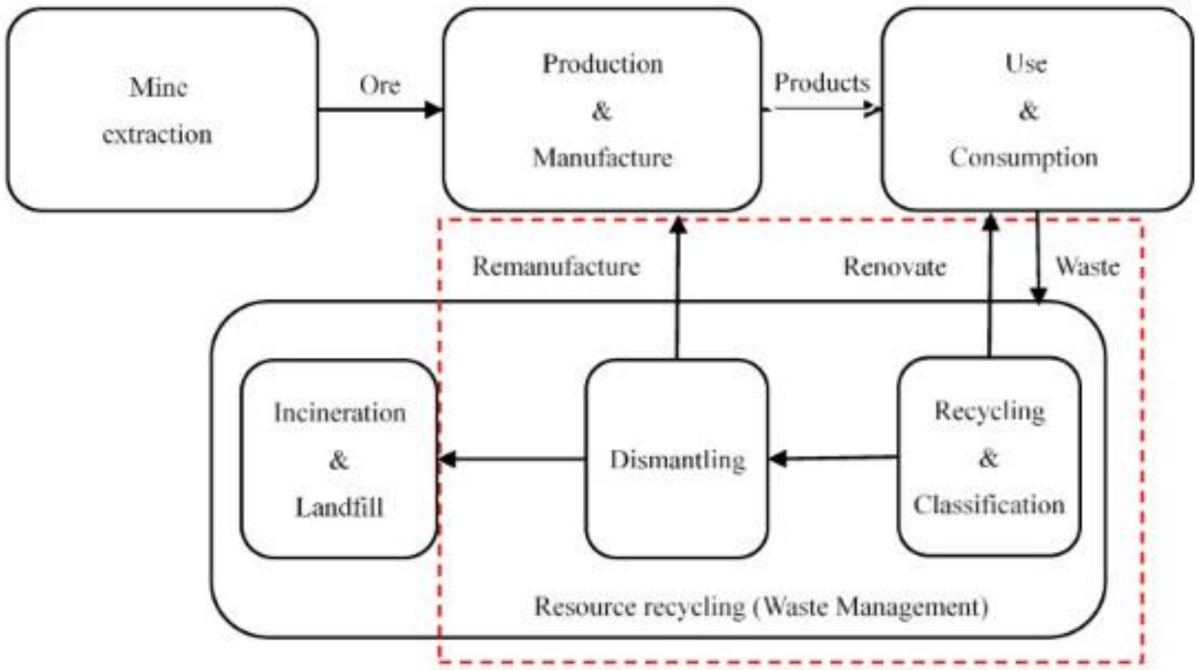

Figure 1: Visualization and study of the resource recycling industry's system boundaries.

Energy resources eventually turn to heat after being utilised. They are not recyclable. While being utilized, certain resources, however, maintain their fundamental physical and chemical characteristics, and under the right circumstances, they may be recycled or used again. They so serve as a distinct category for us to consider. What percentage of recycling is effective? In the absence of government involvement, will the market produce this amount on its own? How do the efficient long-term allocations of recyclable and nonrecyclable resources vary from one another? We look at the function minerals play in industry and the economy to start our inquiry. Next, we discuss the operation of an effective market for recyclable, finite resources. Next, we use this as a reference point to look more closely at recycling [3].

Minerals

In many manufacturing processes, minerals including metals like copper, iron, aluminum, steel, and gold are crucial. The function of nonfuel minerals in the United States. The United States Geological Service maintains a wealth of information about production's supply, demand, pricing, imports, and exports.

An Effective Distribution of Recycling

Extraction and Use of Resources

The models created in serve as a starting point for the solution to this query. Since virgin ore is the least expensive, it would often be relied upon completely during the earlier times. The mining industry would resort to lower-grade ore and foreign sources for higher-grade ores as more concentrated ores were recovered. The growing dependence on lower-grade ores would not always result in a rise in price, at least not right away, in the context of technical advancement. But, there would come a time when the expenses of extraction and the cost of the virgin material would start to increase as the sources were harder to remove. In addition, as population density increased and levels of affluence increased, the expenses associated with disposing of the goods were certain to climb. The geographical concentration of humans has significantly increased during the last 200 years. More and more individuals are choosing to reside in or close to metropolitan regions due to the allure of cities and the migration out of rural areas. High concentration causes issues with garbage disposal. The leftovers could formerly be buried in landfills when there was enough area and the waste stream wasn't as dangerous. Yet as land got more costly, burial costs rose. Buried garbage is becoming less acceptable due to worries about the environment's impact on water sources and the economy's impact on the value of the nearby property. Recycling is more alluring due to the growing prices of trash disposal and raw resources. Recycling offers an alternative to virgin ores and lessens the burden of waste disposal by recovering and reintroducing elements into the system [4].

On both the supply and demand sides of the market, consumers and producers both contribute. Customers would discover that items relying only on virgin raw materials are liable to higher pricing than those relying on the less expensive recycled resources, due to supply-side factors. Customers would thereafter be more likely to switch to goods created from recycled raw materials, provided quality is not compromised. The composition of demand effect is the name of this potent inducement. Customers have an extra incentive to return their old recyclable items to collection facilities as long as they are responsible for the expense of disposal. By doing this, businesses save money on disposal fees and profit by providing a demand-driven product. When building up genuine markets, this highly stylized representation of how the market should operate must be supplemented by certain harsh realities. There must be a market for the recycled goods in order for the cycle to end. In the end, new markets may develop, although the transition could be a little rocky. If recovered items are just thrown into a landfill nearby or if the supply is boosted so much by mandated recycling regulations that prices for recycled materials fall through the floor, returning them to collection sites doesn't do anything thereby destroying the incentive to continue supplying them.

The quality of the recycled goods also has a significant bearing on why there is such a strong market for them. The difference in the difficulty of producing a high-quality product from waste is one of the factors for the high recycling rate of aluminum and the considerably lower recycling rate of plastics. Aluminum can bundles have a very consistent grade, whereas waste plastics can include nonplastic materials or plastics of many various sorts, and the production process for plastics has a low tolerance for impurities. High-temperature combustion may typically remove any remaining impurities from metals, but at these temperatures, polymers are destroyed. Lastly, garbage that includes potentially dangerous substances like mercury and lead creates new challenges. Electronic trash (e-waste) is a fast expanding stream that comprises both precious materials and hazardous garbage, which poses challenging ethical questions. Markets for used electronics in industrializing nations may lack effective enforcement mechanisms to guarantee appropriate disposal of the hazardous components, as we explain in a later part of this chapter [5].

Defending Against Resource Scarcity

Scarcity of resources encourages recycling, while resource scarcity itself is influenced by a variety of other variables. In particular, the following three have been crucial: (1) exploration and discovery, (2) technical advancement, and (3) replacement.

Discovering and Exploring

Until the marginal discovery cost matches the marginal scarcity rent obtained from a unit of the resource sold, a profit-maximizing business will engage in exploratory activities. The level of exploration activity should be increased to maximize profits until the marginal benefit equals the marginal cost because the marginal scarcity rent the difference between the price received and the marginal cost of extraction is the marginal benefit received by the firm engaging in exploration activity. We might consider how exploratory activity would react to population and income increase by thinking about this link between scarcity rent and marginal finding cost. Both of these variables cause demand to increase over time, which in turn drives up marginal user costs and scarcity rent and encourages producers to incur higher marginal discovery costs. The quantity of exploration activity and the number of resources found per unit of exploration effort determine how much this demand pressure is reduced. Increases in scarcity rent may encourage significant quantities of successful exploratory effort if the marginal discovery cost curve is flat (signifying a substantial number of comparatively accessible resources). Increases in scarcity rent discourage research if the marginal discovery cost curve is steeply sloping, as would be the case if exploration were to take place in increasingly unfriendly and unproductive locations.

Technological Advancement

New techniques for extracting, processing, and using ore have been developed because to technological advancement. We demonstrated, for instance, how pelletization significantly affects the price of making steel from iron ore. The result was so profound that manufacturing costs gradually decreased even though a lower-grade ore was required. It's critical to understand that the degree of resource scarcity has an impact on the speed and nature of technological advancement. New business prospects for the development of new technologies are opened up by rising extraction prices. Technologies that make the most of both plentiful and rare resources have the greatest potential for profit. New technologies often consume capital and save labor at times when labor is in short supply and capital is plentiful. Future technical development would focus on using labor and conserving capital if population increase were to reverse the relative shortage. In the past, when fossil fuel energy was accessible and affordable, newly developed technology were strongly reliant on it. Technology is projected to become more efficient when fossil fuel resources become scarcer by improving the amount of usable energy produced per unit of fossil fuel input and by switching to renewable energy sources [6].

DISCUSSION

Market Inaccuracies

Because mineral imports are crucial and originate from uncertain sources, the market sees a skewed pricing ratio that leaves out part of the societal costs of imports, as we learned in the discussion of the significance of oil in national security. As a consequence, there is an excessive and ineffective dependence on imports. There are also other obvious flaws in the market. A market's preference for recycling over the usage of virgin ores may be biased if producers and consumers handle trash in an imbalanced manner. The inability of an economic agent to incur the entire cost of disposal suggests a bias toward virgin materials and away from recycling since disposal cost is a crucial factor in determining the effective quantity of recycling. We start by thinking about how the degree of recycling is impacted by the funding strategy for the disposal of potentially recyclable material [7], [8].

Harm from Pollution

The usage of new and recycled ores is influenced by another circumstance. The market allocation will be skewed against recycling if environmental harm is caused by the extraction and use of virgin resources rather than by the use of recycled materials. Damage may occur either at the point of processing, when the ore is transformed into an useable resource, or at the mine, where strip mining's erosion and aesthetic impacts may be felt. Let's say that the mining business was required to pay for this environmental harm. What impact will this cost's inclusion have on the scrap market? The supply curve for virgin ore shifts left as a consequence of this cost being internalized. The overall supply curve would then move to the left as a result of this. Since the resource would be more expensive, the market would use less of it while recycling more. So, the proper handling of these environmental expenditures, such as disposal costs, would tend to raise recycling's importance.

Moreover, disposal imposes external environmental costs in the form of pests, pathogens, and smells that contaminate water sources, as well as landscape obstructions that impair vision. As big regional sanitary landfills replace small-town facilities, the number of landfills in the United States has been declining, but their combined capacity has been rising. The location of these facilities may be quite difficult since local resistance from possible host towns is expected to increase with landfill size. While governments increasingly regulate landfills to safeguard public safety, these restrictions seldom completely remove all unfavorable landfill-related effects for the host towns. So long as these facilities are not situated in their neighborhood, many communities are in favor of their presence. If every municipality had this sentiment, finding additional facilities may be difficult or perhaps impossible.

From the beginning of our existence, humans have utilised mineral resources. Mineral resource utilization at various points in our prehistory and history has taken more sophisticated forms, and these uses serve as markers of civilizational development. But, as the twenty-first century approaches, environmental degradation and global warming caused by soaring resource and energy use present significant challenges for mankind. Our resource consumption has grown at a rate that resembles exponential growth.

The result of activity at many stages of production, from the mining of mineral resources to the manufacture of finished products; the process's culmination is the disposal of products as waste after use, is a deteriorating state of the earth's environment due to massive resource and energy consumption. As we can see from the examples provided in this article, attempts are being made to address this issue via recycling, however in many regions the issues are either not addressed at all or are only partially addressed.

Recycled paper has both environmental and Resource Benefits:

Wood comes from forests and is used to make paper. In addition to virgin, natural, and artificial forests, recycled paper is referred to as "the Fourth Forest". Office paper, kraft paper, paper boxes, discarded newspapers, books, and magazines, as well as corrugated paper, are all useful fibrous raw resources. Recycling of biodegradable raw materials for fiber may encourage pulp re-use and raise pulp utilization rates. Also, this suggests increased paper production from the same quantity of wood and a decreased need for high-intensity forest harvesting in the pulp and paper industry, all of which will help realize sustainable forest management [9].

Markets and Office Structures

Yellow straw boards make up the majority of the recycled paper from supermarkets, whilst recycled office paper and express packaging materials are the primary components of recycled paper from office buildings. Paper recycled from supermarkets and office buildings is of medium grade and has fewer contaminants and less pollution than recycled paper produced by households. Owing to their enormous quantities, recyclers often collect such paper at doorsteps, necessitating a certain level of logistical competence. But, totally shredded paper is more difficult to retrieve and carry due to the presence of shredded papers.

Factories

Paper that can be recycled from companies is mostly found in bulk raw materials and equipment packaging. Such paper is available in vast quantities, at a consistent quality, and with enormous volume. Thus, factories are often a source of rivalry for all recycling businesses. Yet, due to the many and concentrated sources of paper that may be recycled at factories, doing so poses a significant logistical challenge for recycling businesses and has specific needs for their capital flows. The quality of the paper recycled from industries may also be impacted by manufacturing activities including oil immersion, burning, and packaging breakage. Paper recycled from manufacturing facilities naturally has a higher grade than paper from residential areas since raw materials and equipment packaging materials are mostly made of straw boards and plastics. Nevertheless, since most firms fail to correctly categorize these packaging materials, recycled paper and plastic are often mixed together. This, in part, lowers the quality of recycled paper and uses up more production capacity for recyclers or during the sorting process.

The End of Recycling

Individual recyclers, small- and medium-sized businesses, large-scale businesses, and sorting and processing facilities that handle the sorting and transportation all fall under the recycling category for regenerated waste paper. Diverse recycler types primarily serve various waste paper production purposes, and their market shares also varies greatly from one place to another as a consequence of various regional laws and consumer customs. Only individual analyses of these various recycler kinds are now feasible; a horizontal comparison will only be possible after the data have been upgraded.

Personal Recyclers

The most successful sorting and recycling of the regenerative waste paper created by homeowners begins with individual recyclers. Street visits and collection by appointment are their key recycling strategies. As a consequence, their efficiency and amount of recycling are both constrained. Individual recyclers can only execute somewhat coarse treatment of their recycled materials due to lack supporting infrastructure. Also, they are passionate about recycling expensive stuff. Individual recyclers are often heavily placed in the vicinity of sorting and processing facilities and other downstream distribution hubs due to the limitation of logistic expenses, but they are seldom found in other places. This has made it difficult for many residential regions to participate in the "initial link of recycling," rendering domestic recycling ineffective [10], [11].

CONCLUSION

The failure of the market system to take into account the various environmental costs of increasing resource use, be they radiation or toxic hazards, the loss of genetic diversity or aesthetics, polluted air and drinking water, or climate modification, is one of the most serious shortcomings in both our ability to detect scarcity and our capacity to respond to it. Our detection indicators send out too hopeful signals when these costs aren't taken into account, and the market takes decisions that put society at unnecessary risk. Because of this, market systems naturally generate pressures for recycling and reuse that are typically in the right direction, but not necessarily at the proper intensity. The need for recycling does increase as disposal prices rise and fresh resources become scarcer. For many items, such as those made of copper or aluminum, this is already obvious. Yet, a number of market flaws seem to imply that the level of recycling we now experience is below the necessary level. Old scrap can and should play a role, but artificially reduced disposal costs and tax advantages for ores together diminish that potential. Severance taxes could provide certain minerals a modest, though poorly focused, remedy. One cannot help but note that the government is often to blame for these issues, such as the cost of municipal waste disposal services and tax benefits for virgin ores. Consequently, it seems that the government should play a selectively disengaged role in this sector, along with certain minor tweaks. Yet for environmental harm brought on by unlawful dumping, air and water pollution, and strip mining, disengagement is not the answer. Government intervention may be necessary when a product is made from virgin resources rather than recycled or reused components and the cost of any resulting environmental harm is not absorbed. The implementation of initiatives to internalize the costs of environmental degradation must be combined with the selective disengagement of government in particular sectors. The often repeated ideologic recommendations, which claim that environmental issues can be resolved by either reducing government intervention or increasing government control, are both oversimplified. Government must exert less control in certain sectors and more in others in order to play an effective role in creating a balance between the economic and environmental systems, and how that control is exerted matters.

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CHAPTER 12

NATURAL RESOURCES 'OIL'

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ABSTRACT:

Little research can be discovered integrating many aspects that influence the dynamics of this curse and help to reduce it, despite the fact that many key empirical studies are interested in and focused on complicated problems connected to natural resource management and the resource curse. In order to invest oil income and establish sound fiscal policies in oil-rich nations, the case study of Norway is utilized as the benchmark policy framework. As a starting point for additional evaluations of how the adaptation of such policies is included in resource management to reduce the resource curse, an analytical framework was constructed in this research to analyze the coherence of resource management with sustainability. The report contends that oil-rich nations might take inspiration from Norway's success in overcoming the resource curse and using oil earnings for national benefit.

KEYWORDS:

Resource Management; Oil Curse; Footprint; Fiscal Policy; Sustainability; Footprint.

INTRODUCTION

Little research can be discovered integrating many aspects that influence the dynamics of this curse and help to reduce it, despite the fact that many key empirical studies are interested in and focused on complicated problems connected to natural resource management and the resource curse. Natural resources may promote and maintain growth. Thus, it is essential to design an economic plan that supports the poor and better long-term natural resource management. The global environment for managing natural resources is also changing. Major importers of natural resources are many rising economies. The efficiency of resource management is induced by the rising demand for natural resources, making it even more critical. The management of oil resources' economic and environmental aspects is the main topic of this research. The objective is to empower decision-makers from organizations, finance ministries, and planning to take into account how natural resources contribute to inadequate development and the significance of laws that support sustainable management.

There is general agreement that economic growth is essential for long-term development and is often the main driver of growth. Evidence collected over time and across countries demonstrates that growth caused by beginning circumstances (primarily levels of income and resource inequality) and whether or not the poor are economically engaged in certain sectors and regions is what causes long-term poverty alleviation. For the combined pattern and speed of development to significantly reduce poverty, a coordinated strategy is needed (Co-operation, Organisation for Economic, and Development 2007) [1].

Natural resources are divided into non-renewable and renewable resources in the literature on natural resource management. As a result, it is vital to identify natural resources in order to distinguish between distinct resource groups. Whether they are renewable or not, a variety of natural resources are the focus of economic growth. Products created from sustainable natural resources include wild fish captures, timber and non-timber wood products, and others. The main non-renewable natural resources used to make oil and minerals, which form the foundation of the economies of many wealthy nations, include. A crucial component of the economy in these industrialized nations is also agriculture, together with land and water resources. Nonetheless, nature tourism is a crucial part of foreign tourist earnings in several low-income nations in Latin America, Asia, and Africa. Countries like Botswana are significantly affected by coal mining in terms of their growth. In conclusion, renewable energy sources may be crucial in ensuring that those without access to electricity continue to have it.

Natural resources provide a broad spectrum of positive externalities both locally and globally. Natural resources also help goods like water filtration and purification systems perform better. Natural resource services, such as soil stabilization in wetlands supported by upstream plants, are one example of how they help downstream water storage, irrigation, and hydropower systems operate more effectively. Global services, such as carbon sequestration from lands or forests, may help to reduce climate change (OECD 2009a).

The following two points provide a general breakdown of the fundamental roles of natural resources:

- Provide vital raw materials for the manufacture of goods and services
- A variety of environmental services that will decline with the depletion of natural resources.

Regarding resource management, there are two effects:

- Resources running out
- Resource degradation

In this manner, a number of strategies are put out to support better natural resource management. This section analyzes these ideas to determine whether they may help nations design their natural resource policies for the sustainable use of natural resources. It is important to emphasize that using natural resources sustainably is not without its difficulties. Monitoring stocks and taking action when they are substantially harmed or declining is essential to sustainable resource management.

Development That Is Sustainable

The definition of sustainable development is "development that satisfies current demands without compromising the capacity of future generations to satisfy their own needs". Generally speaking, a consensus on sustainable development encompasses at least two key concepts:

- It has three aspects: economic, social, and environmental. Development must strike a balance between the three elements that affect overall quality of life if it is to be sustainable (Des 2013).
- This generation has a responsibility to the future generations to fulfill by leaving enough economic, social, and environmental resources for them to live with at least as much comfort as the preceding generation did (Des 2013).

The Resource Management Methodologies

There are several collections of representative ideas that mimic the primary resource management strategies. The following two major concepts are discussed:

Carrying Capacity

The carrying capacity concept, which contrasts the usage of resource resources with the bio-physical limit set for the availability of such commodities, is taken into consideration by the principles. The carrying capacity of a certain unit of land refers to the greatest number of a species that it can "carry" forever. Yet, it is said that this idea is unimportant for humans. The availability of natural resources for a particular population's commodities and services is also often contrasted with that population's level of life in many other resource management ideas. Comparable to carrying capacity is the notion of ecological footprint.

Ecological Footprint

The term "ecological footprint" describes how water and land are used to supply all of the resources needed by people and to remove the trash they produce. It is a comprehensive metric that causes environmental deterioration and is often used to show this deterioration. Each country has a number of difficulties in achieving a balance between national development and global environmental output. This is used as an indicator for environmental deterioration in several research. This index's direct and indirect advantages show how consumption and production have an impact on the environment. The research has addressed how economic expansion affects the ecological footprint in a number of ways. In addition, research has been done on the effects of globalization, socio-political factors, and forging direct investment (FDI).

The literature on the effects of natural resource management, however, is mostly disregarded. Resource-rich nations are very important to the global economy. Every megajoule of crude oil emits 10.3 grams on average. More substantial climate benefits may result from spending on crude oil infrastructure and legislation. Flaming must face a policy or regulatory operating obstacle. Even the most accurate predictions of the world's crude oil supply have so far been far off, since economic data used to determine how many barrels of oil businesses should produce based on fuel costs have changed during that time. Moreover, many of the crucial emissions-producing processes are absent. The footprint may be used to assess the limitations of resource usage and take resource depletion into account. Sustainable resource management will be achievable if sustainability is defined in this manner and can be consistently monitored. The footprint, however, does not provide a whole picture of sustainable resource management. Moreover, the footprint merely shows the lifestyle's draw on environment and ignores quality of life.

If overshooting is to be avoided, it is simply noted in the footprint assessment that the entire utilization of natural resources must not exceed the regeneration stage of nature. Most importantly, ethnology may expand on depletion in the case of non-renewable resources and boost production in the case of renewable resources, making carrying capacity largely unimportant. Hence, good resource management results in an increase and development of carrying capacity. Moreover, maximizing technological efficiency is an essential tactic for minimizing the impact of people on environment. In a same spirit, these nations must lessen their ecological footprint by wisely managing and safeguarding their ecological resources while they take on greater strategic significance as a source of natural riches. If nations act in their long-term interests, the outcome will be not just national but also global sustainability. How resources are handled may be impacted by the involvement of national policies of governments, which may be split into three areas [2], [3].

DISCUSSION

Strong and Weak Sustainability

At the discussion centers, distinctions between "weak" and "strong" sustainability were developed while discussing substitutability. It is well established that social, economic, and natural capital may be compensated for weak sustainability. Economic activity safeguards natural capital while increasing societal well-being in a strong sustainability. A weak variety of sustainability requirements must apply to certain resources, while a robust variety must apply to others. Whether of the two is best relies on how easily resources can be replaced. For instance, a minor issue with sustainability is the depletion of fossil resources. A group of thresholds cannot be disregarded as powerful and sustainable. Throughout the impact assessment, any consequence of the suggested action should stay within specified bounds. To determine such boundaries, it fundamentally comes down to established social and political interests. Weak sustainability is the criterion for evaluating the political impacts in that room. The most sustainable outcome would be the highest level of natural resource output as well, assuming that strict sustainability conditions are met (Kuhlman and Farrington 2010; Ayres et al. 1998)[4].

This concept provides the foundation for oil-rich nations to follow two distinct sustainability policy trajectories (weak or strong). The administration of oil income in these circumstances should include both perspectives on sustainability. According to Nasrollahi et al. (2020), a tax on energy use should be imposed in order to give it a genuine price from a poor sustainability point of view. Nonetheless, from a strong sustainability perspective, it improves the environmental process. Lower oil prices have the potential to create a significant barrier by increasing energy demand. It is necessary to tax energy usage and charge a fair price for it. As a result, the environmental problem might be seen as calling for a robust sustainability strategy to deal with the reappearance of these countries. So, in order to manage the return of these nations, the environmental issue should be taken into account with a strong sustainability strategy in mind. These nations are less constrained to attaining sustainability via economic growth from a weak sustainability point of view (Nasrollahi et al. 2020). Also, putting the money coming in from oil sales into the infrastructure sector will prevent poor sustainability and provide a significant, steady, and ongoing income to make up for it in the future (Khodaparast Shirazi et al. 2020).

A global view on the management of natural resources is also evolving. Large-scale importers of natural resources are many emerging economies. Due to the growing demand for natural resources, resources may be used more carefully and effectively (OECD 2009a). The long-term, balanced pro-poor development may be centered on natural capital with good management. To guarantee that the natural resources not only support, but also maintain development, they must be exploited effectively, fairly, and sustainably. For instance, by increasing productivity or efficiency, the commercial value may be increased, and its profitability can be increased by investing in intellectual and human resources. Fiscal income could be diverted via ineffective spending, while policy tools that allow diversification away from the exploitation of natural resources might encourage more development that adds value (OECD 2009a)[5]. When certain requirements are met, the conversion of natural resources into certain forms of wealth, such as human and social capital, will only serve as a basis for sustainable development (e.g., by education investment). When deciding how to convert natural capital into other forms of revenue, social, economic, and environmental factors must all be taken into account. Trade-offs between different stakeholders and crucial transformation thresholds that shouldn't be achieved are frequent. When oil revenue falls outside of specified bounds, it often has lasting effects on the economy, society, and environment. To maintain long-term growth and sustainable development, certain natural resources must be maintained (OECD 2009a).

The Governance Dimension of the Management of Natural Resources

The governance of natural resources should take into account the nature of these resources, the players involved, and the institutional structure and laws. Unusual problems in this regard are created by poor natural resources systems (such as ambiguous rights, a lack of markets, and inaccessible places) (Agrawal 2001; OECD DAC 2008). Particularly, the capacity of elite groups to abuse access and exclude the poor is a problem that often results in tiny elites gaining access to natural resources and does not support national progress, much less help pull people out of poverty. Other than issues with corruption and poor administration, a range of potential uses of natural resources lead to trade-offs and opposing interests and goals (OECD DAC 2008). Governance of natural resources necessitates political choices on market-based policies, rules, cooperation, and information. The distributional impacts of these policies vary. The major participation of the poor in governance processes must be given particular attention in order to secure a pro-poor result (OECD 2009a).

The goal of this section is to identify how oil-dependent nations should handle their oil income. As was previously said, the so-called resource curse, which aims to lessen the oil curse and utilize oil revenue for government benefit, affects the majority of oil-rich nations. There are just a few examples of effective frameworks and fiscal policies that can be devised and implemented in both industrialized and developing nations, such as Norway. These measures might stop or lessen the resource curse and promote long-term development [6].

These nations' oil industries have often been weak, with frequent production interruptions, little domestic growth, and little money inflows and allocations. The implementation of the tax policy is still pending, and the policy is often altered. Despite having enormous oil riches, these nations have been severely affected by the resource curse, and their full economic potential has never been realized. Budgetary Policy State-owned oil firms manage upstream oil operations, as is the case in the majority of major oil exporting nations. Oil earnings are solely and directly collected inside the nation. So, how oil funds are used is a matter of fiscal policy, and the actual economy is affected by oil revenues including inflation through public expenditure. It was stated that resource-rich nations lack the necessary policy framework strength to facilitate the implementation of efficient fiscal policies.

Resource-dependent nations will be able to look at ways to manage saving and spending if a minimal stability feature is developed. The amount being spent on creating a nation-specific tax policy structure for the distribution of natural capital earnings is now more than the estimated costs for future generations. Not all states will find it beneficial if it goes beyond what is necessary to maintain short- to medium-term stability (i.e., to conserve natural resources revenues. To put it another way, some nations may find it more advantageous to spend as much money today as the stabilization system permits than to continue conserving resources for future generations. Moreover, studies showed that capital-starved resource-rich rising nations would be increasing their use of natural resource revenue in their domestic economies [7].

Less saving and greater investment are necessary for economic progress in poorer nations. By creating savings above and beyond the stabilization and short- to medium-term saving measures, the stabilization financing approach may solve this issue by creating a mechanism for sharing natural resource revenues the deposit and withdrawal regulations in lieu of current budget expenditures. Even if a nation wishes to spend more money right once, the economy may not be able to swiftly and effectively absorb more expenditure and investment. A developed country may also have good reasons to save more of its current resources before they become more competitive and sustainable. A tax policy approach will benefit considerably from the control of petroleum income. Such nations need to build their tax systems around non-oil deficits that are dependent on oil income and lower than anticipated prices. Government spending should be correlated with the long-term petroleum price projections under the oil-price fiscal rule. This measure would preserve a significant percentage of the current oil earnings and lessen the uncertainty surrounding government expenditures.

Oil-dependent nations should implement strong policies to ensure economic growth, including those that provide compensation for the exploitation of resources and effective tax and revenue management measures. By effective strategies, several oil exporters have been able to lessen the effects of the resource curse. The most effective government initiatives are highlighted in this section. In particular, revenue management policy fosters peace and societal stability by establishing a system of income distribution. Often, this is accomplished via management of public investment (Van Ingen et al. 2014). Government agencies should create a methodology for assessing longer-term oil income estimates and lay out fiscal policies that are advantageous to the long-term economic plans of oil-producing nations [8].

Oil Producers' Fiscal Policy

Oil revenue should be collected, invested in, and used in accordance with the fiscal framework. According to Hamilton and Ley, resource-rich nations should produce money via their fiscal policies. Governments are able to pursue growth policies thanks to their solid financial situations, which eliminate the volatility of their oil income. The literature has acknowledged that nations that produce oil would pursue a tax-related approach. Fiscal rules are referred to as the fiscal performance summary indicator by Hamilton and Ley (2012). Permanent wage restrictions, prudent fiscal management, and current oil spending are all covered by the existing tax laws. An effective metric for determining if fiscal policy is sustainable is non-oil balance. The rule does not account for future expenditures, such as social security obligations, therefore it is difficult to predict permanent income in the future. It is difficult to estimate predicted income since it excludes possible social security payments.

A relevant metric for assessing the viability of fiscal policy is the non-oil balance. Governments will work to create a sustainable income balance in order to maintain budgetary sustainability. Yet, it might be difficult to predict permanent future revenues, and the legislation does not account for anticipated expenses like social security responsibilities. The permanent hypothesis of income (PIH) serves as the model's foundation. The cautious fiscal rule, on the other hand, focuses on the erratic nature of oil income. Even if oil sales abruptly halt, the regulation is meant to assure a somewhat constant future oil consumption. As a result, governments restrict how much money from acquired financial assets may be used for consumption. Oil companies in the North Sea, particularly those from Norway, have been successful in converting their oil riches into economic development [9]. A different norm is based on a system where all government spending is funded by current oil earnings. Most oil-exporting nations, including Nigeria, have fiscal policy regulations of such kind, which are not long-term solutions. It hinders and does not promote long-term development.

Revenue Management

Governments that care about their citizens must take the initiative to develop long-term oil production from their non-renewable oil resources. Governments are required to ensure fiscal prudence through limiting expenditure. Large volumes of oil are produced; as a result, pressure may be applied on government institutions. Hence, spending would be driven by effective revenue management strategies that support infrastructure investment. Moreover, a framework for income management should be designed to guarantee openness and accountability among key government agencies and participants. Using the generally acknowledged benchmark framework for nations that export petroleum, oil profits are utilized to reduce public debt in such countries.

Systems for Public Investment Management

Effective public investment management systems are crucial to ensuring that oil wealth in low-income nations goes to public investment rather than to private consumption. Core public goods, which are typically absent in developing nations, are necessary for economic success. Oil wealth may be strategically used by governments to help fund national development. According to research, infrastructure investment returns might be significant, averaging between 15% and 20%. According to the World Bank, infrastructure investment may see long-term growth rates increase by at least 2% every year [10].

From the standpoint of a finance ministry, it might be advantageous to divide the life cycle of public investments into distinct component processes. Processes are the procedures for choosing and approving new initiatives to get budgetary support. Also, by using this procedure, the project will be able to start before financial considerations are made for approval. The project's implementation procedures are referred to as investment project processes. Service and maintenance refers to the processes used to maintain assets after the building is finished. Methods for monitoring projects to completion to inform improved investment planning.

Funding for Natural Resources

Natural Resource Funds (NRF) might be used to tighten oil revenue control, simplify wealth distribution across nations, and complement existing expenditure and procurement regulations (Van Ingen et al. 2014). Repeated oil shocks that forced oil-exporting nations to employ oil money have exposed the macroeconomic vulnerabilty of capital. The NRF may be used as a key instrument to divorce income from income inflow and utilise oil earnings in a more transparent manner. The oil funds are also used to support the economy against the volatility of the markets for natural resources, resulting in a favorable long-term tax portfolio that encourages sustainable growth. The capital will limit Dutch disease signs and symptoms.

Savings funds, stabilization funds, and precautionary funds are the three distinct kinds of oil funds that have been formed. Savings funds are created to encourage long-term sustainability, while stabilization funds aim to reduce short-term volatility. By directing petroleum income to these funds, precautionary funds seek to provide financial stability throughout the early phases of oil production. In truth, it was contentious to include the NRFs in the general fiscal strategy, and the operation of these funds has complicated efforts to maintain budget stability. The extent to which oil funds will continue to ensure budgetary sustainability is also unknown. The ease of access to these funds' investments and potential lack of accountability might promote corruption in weaker nations.

Following expansionary or careful management of resources is a crucial yearly and medium-term decision for nations that rely on natural resources. Excessive domestic expenditure may be caused by inflationary pressure, rising costs, and sweeping other domestic businesses. In the context of volatile resource pricing and output, liquid financial assets serve as tools for stabilization and saving. Several models claim that a rapid acceleration of domestic infrastructure investment, both soft and hard, in capital-scarce emerging nations might lead to possibly excessively large social and economic benefits. This section also discusses the need of focusing on public investment outside of the conventional channels, notably investment made via state-owned and private partnerships. This might be used as a commitment tool for delivering infrastructure in resource-constrained situations, especially in those with little administrative capability.

Government investments in the oil industry must be met with a number of crucial policies and capacities. The management of public investment and the capacity for absorption are essential for ringfencing. As the extractive value chain descends, income, expenditure, and investments must be assessed in terms of the real advantages of asset generation and asset preservation rather than merely the flow of capital. As a result, large advancements in the public capital stock that is both economically and socially efficient are the results that matter, together with the need for money. By having a fair and comprehensive national strategy, a uniform regulatory framework, and professional institutions, people may greatly benefit from resource management [11]. Oil-rich nations have a huge potential for economic growth by using their oil riches. Yet resource exploitation may be expensive for a nation if it is not properly managed. Governments are often in charge of managing these resources for both current and future generations as the guardians of their resource exploitation. Resource management that is effective and equitable is part of an ambitious and systematic strategic plan. To that end, the government will make a number of significant decisions that have an impact on particular communities and develop long-term plans. Governments can use a regional policy mechanism to direct resource management decisions after consulting citizens in order to avoid participation and foster a sense of leadership.

According to the resource curse, nations with large natural resources have weak economic development. On the whole, nevertheless, some energy-rich nations have been able to preserve their wealth in natural resources. To fully capitalize on the benefits that may result from the abundance of natural resources, appropriate policies must be implemented in resource-rich nations. This research evaluated how effective fiscal and managerial strategies may help oil-rich nations escape the resource curse. It is suggested that oil-exporting nations would considerably benefit from following Norway's example and enacting fiscal policy that was centered on tax regulations on its oil management. In order to manage the government's oil money, the Norwegian fiscal system employs a prudent fiscal policy plan and a stabilization and savings fund. The "Norwegian approach" employs the Savings and Stabilization Fund to regulate variations in oil revenue. Several oil-rich nations spend all of their oil income, which makes them subject to extreme oil price volatility. As the oil reserves were depleted, Norway was able to implement successful fiscal and revenue management strategies to guarantee continued development. According to the research, a rule-based approach to fiscal policy with regular savings and stabilization is the best fiscal management strategy.

The objective of this research is to ascertain the optimum way for nations that rely on oil to manage their oil sector income. A successful system and fiscal policy should be built and implemented on the basis of the few success stories that exist in both the industrialized and developing nations, such as Norway. This is intended to lessen the alleged "resource curse" and utilise oil earnings for the benefit of the nation. Also, it will lessen the effects of climate change on the oil sector and other natural resource industries on the economy while fostering development and helping to pull people out of poverty. Ecological footprint and carrying capacity are the two key ideas covered. The carrying capacity of a species refers to how many members of that species can coexist in a particular space. The ecological footprint is the amount of water and land used to produce all the resources that people need and to remove the garbage that people produce. This comprehensive metric is often used in research as a gauge of environmental deterioration. Every nation has difficulties in maintaining a balance between national prosperity and contributions to the global environment. The wealth of nations, particularly emerging nations, is crucial to the health of the global economy. The literature on the effects of natural resource management, however, is mostly disregarded [12].

CONCLUSION

The main argument is that fiscal authorities in oil-rich nations must build a smart and long-term fiscal policy framework as a top priority. Adoption of a fiscal policy framework effectively requires a high degree of unanimity, accountability, and openness. In the instance of Norway, the formation of the Petroleum Fund may draw on an already-existing institutional structure that is in place and operating well. A lot of oil-rich nations may need to make significant improvements in the areas of governance and transparency as well. These nations should focus on creating accountable, transparent, and competent budgeting procedures while attempting to implement a spending plan that necessitates a considerable buildup of public funds. According to the report, oil-rich nations may take a lesson from Norway's experience to lessen the resource curse and use oil earnings for national benefit. They can also successfully manage and safeguard their ecological resources, which are increasingly crucial strategic components of natural riches.

A starting point for the more complex creation of assessment tools is intended to be provided by the analytical framework we created.

To more accurately assess its limits and the required adjustments, more testing of its applicability to other case studies would be beneficial. The framework might also be used in other ways, including as a tool for international comparisons between South Africa and what Saudi Arabia has accomplished with Aramco, to add to the body of knowledge. The threshold level of weak and strong sustainability would be an additional fascinating issue to investigate.

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CHAPTER 13

THE ECONOMIC DEVELOPMENT AND NATURAL RESOURCES "COAL"

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ABSTRACT:

Coal mining has a long history of giving remote communities the employment they need, but it is also linked to areas with high rates of poverty and slower long-term economic development. Yet in recent decades, the business has seen significant upheaval. The landscape of coal mining has changed due to regulations, initially on air quality, moving it out from Appalachia and into the west. Similar to this, technical advancement has resulted in relatively new mining techniques including intrusive mountain-top approaches and decreased worker need. Because of this, coal mining's economic impact has significantly altered even if the sector seems to be in decline. This research examines whether the economic success of coal country has been impacted by these developments and the "boom/bust" cycles of coal.

KEYWORDS:

Coal, Environment, Economy, Human Health, Natural Resources, Management.

INTRODUCTION

The indigenous flora and animals are under a great deal of strain from mining, especially in areas where forest land is diverted for mining. Concern is also raised about how mining affects the amount of ground water and how nearby water bodies and the land get soiled. Although coal mining has a significant influence on human health, it also significantly advances the nation's economy. It also affects the sociocultural aspects of the employees and residents of the coal mining regions. Hence, a comprehensive strategy to mining operations is required, bearing in mind the issues with the surrounding ecology and habitats. This calls for the identification of different locations where minerals are present as well as a number of other variables, such as the proper slope of the overburden dumps, secure drains for waste disposal, secure methods for various silt control structures, etc. In India, coal firms are now pursuing "clean coal" techniques that attempt to lessen the effect on the environment. The thermal efficiency of burning is increased by the cleaned coal's lower ash content. This directly affects how much pollution is emitted.

While the coal cleaning process uses more water than necessary, it may get us closer to a civilization without pollution. When coal is burned, toxic gases such carbon dioxide, nitrogen oxide, and sulphur dioxide are released, along with ash and dust particles. In regions where coal is burned, dangerously high levels of air and water pollution have been seen. It is well acknowledged that coal mining has a negative impact on the regional and global ecology. Mining has a negative impact on the surrounding ecosystem by destroying vegetation, causing significant soil erosion, and changing microbial populations. With the production of coal bed methane, which is nearly 30 times as potent a greenhouse gas as carbon dioxide, coal mining also has an impact on the ecosystem worldwide. Hence, coal mining has a negative effect on air quality requirements. In many locations, underground mining results in the depletion of groundwater, as well as land deterioration due to subsidence and other factors [1]. The subsidence area must be filled if the soil settles beyond allowable limits. The negative social and cultural effect of the area's quick economic growth may be characterized as the uprooting and relocation of the affected population, a change in the culture, heritage, and other aspects, as well as an increase in crime and other unlawful activities. Changes in job trends and income possibilities, infrastructure improvements, and community development are some positive effects of mining ventures. Positive effects include advancements in the areas of communication, transportation, the educational system, commerce, leisure, and medical services, among others. So, it is evident that mining for coal causes environmental harm, but there are also benefits in terms of economic growth and improved self-reliance due to increased mining of the available mineral resources. While there isn't a different location for the mining activities, alternatives for processing location and technology may greatly reduce environmental harm.

The resources that are found naturally on Earth are known as natural resources. It is a necessary component of our life. Air, water, sunshine, coal, petroleum, natural gas, fossil fuels, oil, etc. are all examples of natural resources. Unfortunately, many have taken use of these resources for their own financial benefit. Overuse of natural resources has led to depletion, creating a grave danger to the continued survival of humanity. In order to ensure the availability of these resources, such as forests, water bodies, natural gases, minerals, and fuels, conservation of nature entails caring for and conserving them.

Long Essay on Natural Resource Preservation

In order to ensure the availability of these resources, such as forests, water bodies, natural gases, minerals, and fuels, conservation of nature entails caring for and conserving them. Saving resources for future generations to utilize is what is meant by conservation. The natural resources that nature has given us are sufficient. We have a responsibility to preserve them for our descendants. We need to learn enough about how to preserve these natural riches, and we should work in that direction.

There are two types of natural resources: renewable and non-renewable. Natural resupply is possible for renewable resources. They include sunshine, water, and air. The resources coal, natural gas, and oil are non-renewable. Natural resources are unable to readily replace these resources to meet demand. The process of recycling these materials takes hundreds of years. The use of natural resources has played a crucial role in the development of humanity. Yet because of his growth and development, these natural riches are now being exploited. This necessitates using resources responsibly in order to maintain sustainability. If we do not utilize these resources wisely, the ecosystem may become unbalanced. Future repercussions include things like starvation, drought, flooding, climate change, and global warming. So, protecting natural resources is now very necessary [2].

The most significant and priceless natural resource on Earth is water. It keeps all life alive. We utilize water for drinking, producing power, irrigating crops in agriculture, and performing industrial activities in a variety of businesses. Lack of water would result in soil erosion, loss of vegetation, and effects on all plant life. For humans, forests dictate the natural vegetation. It is the principal natural resource that supports economic growth. There is no denying their value as a source of fuel, lumber, and industrial raw materials. Moreover, woods aid in reducing soil erosion and floods.

The most vital natural resource for daily activity is fossil fuel. A lot of energy is produced from coal, oil, and natural gas. Several strategies are being used to preserve environment by the governments and agencies of different nations. Children need to be made aware of the effects of environmental exploitation. Reusing and recycling water will slow the pace at which freshwater resources on Earth are being used up. To save water, farmers must employ contemporary agricultural practices including drip irrigation, dry farming, and rotational grazing. They should begin using rainwater gathering techniques. Natural resource preservation is now necessary, and it is our responsibility to do it [3].

Use should be made of alternative or renewable resources like solar or water energy. Energy conservation may help protect natural resources including water, coal, natural gas, and biomass. It's important to develop good habits like turning off fans, lights, geysers, and air conditioners. The depletion of coal, oil, and gas may be stopped by utilizing solar-powered lighting and vehicles, traveling on public transportation, and regularly carpooling. Use biogas and biofuels more often. The natural resource of wood, which is renewable, is used to make paper. Trees grow slowly but are being taken down at a rapid rate. Modern technologies must be used in order to decrease the consumption of paper. This will aid in lowering the atmospheric carbon footprint. To stop deforestation, we must continue to plant more trees.

To safeguard marine life, industrial trash must not be dumped into waterways. In order to improve soil fertility, crop rotation strategies might be used. The greenhouse effect is caused by the massive quantity of carbon dioxide released during the burning of fossil fuels. This has to be in check. Realizing that natural resources are finite and that it is our civic duty to preserve and care for the environment is crucial. To preserve the environment and save our future, we must use these natural resources responsibly. To save water, farmers must employ contemporary agricultural practices including drip irrigation, dry farming, and rotational grazing. They should begin using rainwater gathering techniques.

What is Biodiversity Conservation?

The term "biodiversity" often refers to the abundance of species. It may be characterized as the species diversity in a given region. For the harmony of nature, biodiversity must be preserved. Based on the location of the conservation, we may distinguish between two forms of conservation. They include the following: 1. In situ Conservation, 2. Ex situ conservation. Environmental science has several conservation methods. They fall within the two groups that are listed above. Typically a Latin term, in- situ. Ex denotes outside, whereas in implies within. A method of conservation called in situ involves preserving a species in its natural habitat. Ex situ, on the other hand, refers to the sort of conservation when we keep any species away from where it normally lives [4].

Ecological Preservation

In-situ conservation involves preserving a specific species in its native environment. On-site conservation of genetic resources is another name for it. Compared to ex-situ conservation, it offers a number of benefits. For conservation, no cutting-edge technology is needed. It is also economical since we are storing any species in its native environment. Moreover, doing research in an in-situ setting is feasible. Also, it is flexible. National parks and wildlife sanctuaries are two examples of in-situ conservation.

Conservation Ex-Situ

Ex-situ conservation refers to the preservation of a species away from its natural habitat. In other words, it refers to the method of conservation in which we protect a certain species away from its natural environment. It aids in the preservation of endangered species. In an ex-situ conservation, we may transport a certain species to a location with the right natural resources for its preservation. Examples of ex-situ conservation include zoos, aquariums, zoological parks, and botanical gardens.

Ex-situ conversions have the benefits of being a low-maintenance method for increasing the reproduction of vulnerable species.

An energy revolution is sweeping the world, changing not just the geopolitical balance but also the economic environment of communities that produce energy. Winners and losers are being created as a result of the linked consequences both within and between impacted American communities. The Clean Air Act of 1990, which increased demand for low-sulfur Western coal at the expense of Appalachian coal, as well as late-1990s innovations in unconventional drilling for oil and natural gas in shale formations, U.S. climate change policies to reduce carbon, which would further increase demand for natural gas relative to coal, and rising demand for natural gas and coal in India and China, are some of the factors underlying this revolution in the U.S. The U.S. energy sector's transition highlights the urgent need to assess the effects of energy development throughout the country, with a focus on towns in Appalachia that traditionally depended on coal and where recent changes in the energy sector may be affecting the region's economic health [5].

These recent and divergent changes in the energy sector point to the urgent need to determine how energy development affects local communities, particularly at a study size that takes the whole country into account. Surprisingly little study has been done on the current energy boom, however. The majority of research concentrate on the pre-boom era, which is less relevant to patterns related to new technology. A related study investigates if there is a "natural resources curse" wherein regions with a high concentration of natural resources seem to have poorer long-run growth rates when averaged throughout the boom-bust cycle. There has been some local shale-based research. While looking at the shale gas boom in Colorado, Texas, and Wyoming, Weber (2012) finds only moderate employment impacts that fall short of those claimed by studies funded by the industry. Despite the fact that these studies focused primarily on the short- to medium-term effects of extraction, they also show small employment effects but strong income growth benefits, which are probably caused by the industry's large royalty/lease payments and salaries.

Research examining the industry's current economic consequences is uncommon when it comes to coal. The majority of earlier research focuses on the boom and bust of the 1970s and 1980s or on the long-term natural resource curse of the 20th century. Yet, issues related to current coal extraction are crucial to the US energy sector. First, coal mining towns confront enormous difficulties due to fierce competition from natural gas and a difficult regulatory environment, for which it is crucial to comprehend both losers and winners. Second, the current coal industry may have long-term repercussions that are distinct from those of the past, which might cast doubt on the conventional wisdom about the curse of natural resources. With declining employment and a rise in capital-intensive practices like mountain-top mining, the sector has experienced significant technical change in this way. As was already said, the industry has changed geographically, with output shifting west. As a result, both in terms of time and area, the effects of the coal business are probably substantially different now [6].

Prior Literature

Subnational evaluations of local economies are becoming more popular than cross-country research on the effects of natural resource exploitation on economic growth. Examining the economic effects of natural resource exploitation at a regional scale is crucial in part because variables that are relevant at a national scale (such exchange rates and civil wars) tend to have fewer confusing effects. Subnational studies provide a finer resolution of the particular situation since the influence of natural resource extraction on local economic results is highly reliant on context (i.e. the resource being harvested, the specific economic consequence, and the local environment). Subnational research has grown, revealing subtleties regarding many settings as well as overarching patterns that hold true in all situations. The most recent analyses of economic results at a subnational level are summarized here. In general, particularly during boom times, they indicate to short-term improvements in employment and wages, but there are conflicting results for long-term effects in regions that rely on natural resources. Some recent studies have looked at the effects of natural resource booms on employment or salaries in the energy and non-energy industries. The consequences of oil and gas production on jobs and wages in the energy industry in Western Canada. Employment and wages in the energy industry increased during boom times while declining during busts were not statistically significant. During the boom, non-energy industries including construction, retail trade, and services see favorable employment and earnings spillovers, albeit some of the benefits are lost after the crash. The consequences of shale oil and gas drilling on employment, income, and poverty in the Western U.S. states of Colorado, Texas, and Wyoming. To account for endogenous characteristics that could be associated with the development of shale in drilling counties, he employs a triple difference model with instrumental variables. Although the findings are more modest for employment, he shows that the value of gas generated has favorable impacts on employment, earnings, and median family income throughout the boom years of 1998 to 2008. Communities surrounding oil and gas shale booms also have favorable income and employment benefits, according to research using a similar instrumental variable technique, although the employment advantages are mostly restricted to the mining industry.

DISCUSSION

The research described above largely focus on boom or bust periods that last for a decade or two. Yet, they do not address the issue of whether the exploitation of natural resources is a long-term viable strategy for regional development. Michaels (2011) examines the long-term effects of resource exploitation via an examination of southern U.S. counties that were atop large oil deposits in 1890. Compared to comparable southern U.S. counties without oil resources, counties with oil reserves had greater per capita incomes, bigger populations, and more public infrastructure by 1990. But, after 1960, these advantageous benefits start to decline. The limitation of Michaels' (2011) analysis is that it does not address the timing of the region's energy growth or the magnitude of the effect, as shown by the proportion of "energy" employment. According to Peach and Starbuck (2010), from 1960 to 2000, New Mexico's population, employment, and income all increased as a result of the exploitation of oil and gas. Concerns concerning the long-term economic results and distributional implications of intensive natural resource exploitation have been highlighted by recent research.

For instance, while reporting positive employment spillovers into local non-traded industries during the coal boom of the 1970s, found that job losses in non-traded sectors during the crash of the 1980s were significantly worse. In particular, for every ten more coal employment produced during the boom, two more local sector jobs were also created; yet, for every ten coal jobs lost during the slump, 3.5 local sector jobs were also lost. They examine how employment in the coal mining industry affects poverty rates in Appalachia using data from the decennial census. They discovered that a rise in mining jobs during the time lowers poverty. Yet, greater poverty rates were linked to higher levels of mining employment 10 years earlier, and the impact was bigger than the contemporaneous effect, supporting a resource curse theory. Using data from throughout the whole U.S., discovered that Appalachia had a greater correlation between coal mining and poverty than the rest of the country. The 1990s coal price decline phase saw a greater link between the two than the decade of increased prices that followed the year 2000 [7].

Studies conducted at the subnational level also show that natural resource exploitation has a detrimental impact on longer-term economic outcomes other than income and employment. discover that disability enrollments decreased during the coal booms and increased during the busts in Appalachian states impacted by these cycles in the 1970s and 1980s. Spending on social programs is connected with coal booms and busts, according to the same instruments. During coal booms, local educational attainment declines, which may hinder long-term economic progress. In conclusion, there are still a few holes even if several current research exist. Considering how coal performs in comparison to oil and gas, it has received less scrutiny than those industries. The natural resource curse and how it applies to Appalachia are still up for discussion. Methodological improvements in research are required, including simulating the non-random placement of mining. The scope of earlier research is often constrained and does not cover the whole nation. Lastly, only a small number of measures of economic outcome have been studied.

Few studies track gains or losses for a variety of diverse economic groups within communities, including local business owners, members of the middle class, workers in various occupational sectors, and people with disabilities. By addressing these gaps, our work offers an original addition to the field of study on the economic effects of natural resource exploitation. current developments in the coal industry Our analysis focused on the 1990s and the years after 2000, when the coal sector underwent a number of significant transformational changes. After then, industrial employment dropped by 42% during the 1980s slump and by another 47% during the 1990s. As the pre-2001 U.S. Bureau of Economic Analysis (BEA) data includes proprietors but the post-2000 U.S. Bureau of Labor Statistics (BLS) data only includes wage and salary employees, the statistics for the pre- and post-2000 years are not precisely comparable. The BLS figures also contain a tiny number of coal industry support employees in 2001, although they have since increased.

Total coal employment increased by 14% between 2001 and 2010 when the employment of the two coal sectors is added together, which is consistent with a significant turnaround for the industry, particularly considering the continual technological development that cuts employment. They displays actual coal prices from 1970 to 2010 for the time period. It is clear that the coal boom of the 1970s and recession of the 1980s that observed occurred. Real coal prices fell 41% in the 1990s, keeping pace with the overall reduction in employment. However actual prices increased 68% between 2000 and 2010, which is probably a major factor in the rise in coal employment during that time. As a result, the price and employment patterns both support the idea that the 2000–2010 era was a “boom” time and the 1990s were a “bust” period. Nonetheless, it has been highlighted that Appalachian coal districts in particular suffered after 1998, suggesting that the area should be treated differently from the rest of the country [8].

Higher salaries and increasing land prices as more people come in diminish profits on the business side of the economy, while real earnings ultimately fall on the household side due to growing housing expenses. If quality of life suffers as a result of increased congestion, households may be adversely impacted even more; similarly, businesses may be damaged by changes to other local institutional elements. With the restoration of spatial equilibrium, place I expands at the national average pace. Wages and housing expenses start to grow during an energy boom as energy-related firms seek to recruit new employees, starting the process just outlined. The cost of factors and housing increases, which slows job growth and finally stops migration as household utility and profit levels revert to the national average. The area sees a growth in employment and population in the short- to medium-term. The longer-term growth process may be impacted by factors related to the natural resource curse. For instance, energy booms may result in environmental deterioration and population growth, both of which lower quality of life. The quality of local government may also deteriorate; this might happen, for instance, if they create too much infrastructure or become too influenced by business interests in their decision-making. A bad local government may lower earnings for the normal company and further lower the standard of living. On the other hand, when a place draws more visitors, it benefits from agglomeration economies as certain sectors reach a certain size. This would make it possible for the area to attain a higher long-run equilibrium level of employment and population. Therefore, it is an empirical question as to whether the long-term effects of energy development are growth-inducing or growth-reducing consistent with an interpretation based on the resources curse, but the short-term growth-inducing effects appear theoretically clear, even though there will likely be winners and losers across and within regions. The converse is true for areas where energy development is declining, such as those affected by coal mine closures [9], [10].

The next generation will need the protection of natural resources. Our responsibility is to protect them for the future. The preservation of biodiversity is crucial for future generations. Natural resource preservation is crucial to preserving the ecology and long-term viability of these resources for our coming generations. According to the notion of sustainable development, we should utilize our resources wisely so that they may be preserved for future generations. The surrounding communities' social, economic, and environmental fabric is significantly impacted by mining. Despite the fact that mining operations drive economic growth in the region, they also lead to difficulties with the environment and the local economy. The whole eco-system is harmed by mining. Understanding the possible negative effects of mining on flora and wildlife requires conducting appropriate evaluations. It is important to identify the negative effects as early as possible in the planning process so that preventative steps may be adopted. One should be aware of the many actions that are environmentally problematic in order to solve the issues.

CONCLUSION

According to the numerous criteria of the Government of India's mining leases and the Environment Management Plan, every mine manager shall retain a checklist with information on environmental controls. The identification of the environmental problems unique to the mining site may be made possible by routine analysis of this data. The need for stricter rules may increase as a result of poor environmental performance. The majority of the subsiding lands are unstable and barren as a result of the negative impacts of subsidence cracks. Several underground tanks and wells nearby have dried up as a result of subsidence's indirect effects. But, with a cooperative effort by coal corporations and local organizations, most of this subsided land may be returned to productive use. Instead, no coordinated and cohesive effort has been made in this regard. In Indian coalfields, little research has been done on the restoration of subsided land. A few locations of the Raniganj coalfield, like Ninga and Sripur, have tried planting on soil that has sunk. The purpose of reclamation in terms of "land-use" should be decided in consultation with the locals, according to scientists, before starting on subsided land. It may not be necessary to restore the subsided land to its original state even for use for agriculture, plantations, and housing; the most important thing is to plug the cracks. Some researchers contend that the subsoil in the subsided land needs to improve its ability to retain water. In India, there is no specific legislation regarding subsidence; however, under common law, the coal company must purchase the surface rights to the property where underground mining may cause subsidence. There are specific laws that regulate the coal industry in some nations with regard to subsidence; perhaps our nation should also enact such laws.

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CHAPTER 14

NATURAL GAS AS A NATURAL RESOURCES

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ABSTRACT:

According to current estimates, natural gas may be found in many parts of the globe in sufficient amounts to provide energy for human activities for around 250 years. In 2011, natural gas accounted for around 21% of the worldwide energy industry's total revenue, placing it third in importance after coal and oil. It corresponds to hundreds of billions of dollars in financial terms each year. This essay will examine the components of that fuel to highlight its significance as a source of energy and evaluate its potential impact on supplying energy in the future. The methodology covers a description of natural gas, its origin, its likely stocks and their geographic distribution, its extraction and use processes, how they compare to those of other energy sources, the potential for new deposits to be exploited, and the modes of transportation from the point of production to the point of consumption.

KEYWORDS:

Energy Sources, Unconventional Sources, Conventional Gas, Natural Gas, Natural Resources.

INTRODUCTION

It changes and is mostly determined by the deposit from which it was derived. It is referred to as "wet" when other gases are present in the mixture in addition to methane and "dry" when all components other than methane have been nearly entirely eliminated from the mixture. This difference is crucial since it has to do with how the product is transported and processed as well as the initial decision on the deposit to be mined. We may also create significant gases from the "wet" method of treatment, such as propane, butane, etc., which are sold for use in a number of applications. Similar to other fossil fuels, natural gas was produced millions of years ago via a similar method (oil, coal, etc.). It was either released into the atmosphere or retained in pockets of impermeable rocks after it was created, leaving behind subsurface deposits that were just recently found. Traditionally, it has been separated into conventional gas and unconventional gas. Its chemical qualities are unrelated to the differentiation; rather, it pertains to how easily it can be mined.

Deposits that have not been or are not being mined due to economic constraints, outdated technology, unique technical difficulties in their exploitation, or even possible environmental problems are considered unconventional sources. Technology advancements and the general growth of the gas industry over the last 40 years have opened up previously inaccessible reserves, boosted output, and raised hopes for the future exploitation of enormous quantities. The globe geography of natural gas stock saw a considerable alteration as a result of the confirmed unconventional sources. It should be noted that the stock evaluation is a continual and unbroken operation, and as a result, sizes are adjusted whenever a new exploitable deposit is announced. The potential of unconventional resources is well proved in each instance. Large gas resources have changed the economic landscape of many nations who previously relied on foreign energy sources and other domestic sources, such nuclear power, for their energy needs since they lacked considerable quantities of hydrocarbons that could be exploited [1]. Japan is a prime example of an effort to lessen reliance on imported energy since it is a pioneer in the development of technology for using methane hydrates [3] [4]. Based mostly on natural gas supplies in their Exclusive Economic Zones, nations like Greece and Cyprus also anticipate big improvements in their economy.

It is a fossil fuel, natural gas. Natural gas comes from ancient plants, animals, and microbes, much as other fossil fuels like coal and oil. There are a variety of hypotheses that attempt to explain how fossil fuels are created. The most popular explanation holds that they develop underground, in harsh environments. Layers of soil, silt, and even rock are progressively deposited over the decomposing remains of plants, animals, and microbes. The organic material is compacted over a period of millions of years. The temperature of the organic material rises as it penetrates farther below the crust of the Earth.

The organic matter's carbon bonds disintegrate as a result of compression and a high temperature. The result of this molecular breakdown is natural gas, or thermogenic methane. Methane is comprised of carbon and hydrogen and is likely the most prevalent organic substance on Earth (CH_4). Around oil resources are often discovered natural gas reserves. Natural gas reserves close to the Earth's surface are often dwarfed by neighboring oil reserves. Natural gas is more abundant than oil in deeper deposits because they were created at greater temperatures and pressures. Natural gas that is pure may be found in the deepest reserves [2].

Yet, the formation of natural gas need not occur very deep down. Methanogens, which are little microbes, may also produce it. Animals, including humans, and low-oxygen regions close to the surface of the Earth are home to methanogens. For instance, decaying materials found in landfills are broken down by methanogens producing biogenic methane. Methanogenesis is the process through which methanogens produce methane, a component of natural gas. Despite the fact that the majority of biogenic methane is lost to the environment, new methods are being developed to capture and use this potential energy source. The natural gas created deep under the surface of the Earth, thermogenic methane, may potentially erupt into the atmosphere. Some of the gas may ascend through porous rock and other permeable materials before dissipating into the atmosphere. Yet, the majority of thermogenic methane that rises to the surface collides with geological structures that prevent it from escaping. Sedimentary basins are the name given to these geological formations.

Large natural gas reserves are trapped in sedimentary basins. A hole (sometimes referred to as a well) has to be bored through the rock to enable the gas to escape and be gathered in order to access these natural gas reserves. Natural gas-rich sedimentary basins may be found all over the globe. Natural gas may be found in the arid deserts of Saudi Arabia, the muggy tropics of Venezuela, and the icy Arctic of the U.S. state of Alaska. Outside of Alaska, the Gulf of Mexico's surrounding states, such as Texas and Louisiana, make up the majority of the U.S. basins. North Dakota, South Dakota, and Montana, three northern states, have recently built sizable drilling operations in sedimentary basins.

Different Natural Gases

"Conventional" natural gas is readily available and inexpensive to extract. Below impervious rock, conventional gas is trapped in permeable material. Other geological settings' natural gas is not always as accessible or useful to extract. "Unconventional" gas is what this gas is. To increase the availability and economic viability of this unconventional gas, new technologies and procedures are constantly being developed. Gas that was formerly regarded as "unconventional" may eventually become such.

As organic matter breaks down without oxygen present, a form of gas known as biogas is created. Anaerobic decomposition occurs in landfills and other places where organic waste, such as animal waste, sewage, or industrial leftovers, is rotting organically. Biogas is a biological substance that originates from living or non-living plants or animals. This substance may be burned to provide a renewable energy source, such as forest leftovers. While biogas may be purified and utilized as an energy source, it does not have as much methane as natural gas [3].

Natural Gas Deep

Unconventional gas is deep natural gas. Deep natural gas is found in deposits at least 4,500 meters (15,000 feet) below the Earth's surface, as opposed to ordinary gas, which is often found at depths of only a few thousand meters. While procedures to extract it have been developed and improved, drilling for deep natural gas is not always economically feasible.

Shale

An other kind of unconventional deposit is shale gas. Shale is a sedimentary rock with minute grains that does not break down in water. Shale is allegedly so impermeable that marble is seen as "spongy" in contrast, according to some experts. This impermeable rock may "sandwich" a layer of gas between thick sheets of it. Since it requires horizontal drilling and hydraulic fracturing, often known as fracking, to obtain, shale gas is regarded as an unconventional source. A high-pressure water stream cracks up rock during the fracking process, and then small grains of sand, glass, or silica are used to "prop" the rock open. Gas may now exit the well more easily as a result of this. Drilling horizontally involves drilling straight down into the earth, followed by drilling sideways or parallel to the surface of the Earth.

Rough Gas

Tight gas is an unconventional natural gas that is impermeably trapped underground in a rock formation, making it very challenging to remove. Gas extraction from "tight" rock formations often involves pricy and challenging techniques like fracking and acidizing. Fracking and acidizing are comparable. A substance is put into the natural gas well, often hydrochloric acid. The tight rock that is obstructing the passage of gas dissolves in the acid.

Coal-Bed Methane

Another kind of unconventional natural gas is coalbed methane. Coalbed methane is often found along subterranean coal seams, as its name suggests. Traditionally, as a waste product from the mining of coal, natural gas was purposefully released out of the mine and into the environment. Methane from coalbeds is now a widely used energy source and is collected[4].

Geopressurized Zones using Gas

Geopressurized zones are another source of unconventional natural gas. Under the Earth's surface, geopressurized zones develop at depths of 3,007–7,600 meters (10,001–25,000 ft). These zones develop when clay layers quickly build up and compress on top of permeable materials like sand or silt. Natural gas is deposited at very high pressure into the sand, silt, or other absorbent material below because it is driven out of the compacted clay.

While geopressurized zones are particularly challenging to mine, they could hold a significant quantity of natural gas. The Gulf Coast area of the United States has the highest concentration of geopressurized zones.

Hydrates of Methane

Another kind of unconventional natural gas is methane hydrates. Methane hydrates have just lately been found in Arctic permafrost and marine sediments. Low temperatures (about 0°C, or 32°F) and high pressure are the conditions under which methane hydrates occur. Methane hydrates are discharged into the atmosphere as the climate changes. Methane hydrates may hold twice as much carbon as all of the world's coal, oil, and conventional natural gas combined, according to the United States Geological Survey (USGS).

Methane hydrates are formed on the continental slope of ocean sediments when bacteria and other microbes descend to the ocean bottom and decay there. The sediments' contained methane has the power to "cement" loose sediments into place and maintain the stability of the continental shelf. The methane hydrates, however, disintegrate as the water temperature rises. This releases natural gas and creates undersea landslides [5].

Methane hydrates develop in permafrost habitats when pools of water freeze and water molecules form unique "cages" around each methane molecule. The gas is held at a significantly greater density than it would be in its gaseous condition because it is caught in a frozen lattice of water. Methane seeps from the ice cages when they thaw. Methane hydrates are released from both permafrost and ocean sediment layers as a result of the present phase of climate change, which is global warming. Methane hydrates contain a tremendous amount of potential energy. Yet, procedures for collecting them are devised with the utmost care since they are such delicate geological formations capable of disintegrating and upsetting the surrounding environmental conditions.

DISCUSSION

Transport and Drilling

Normal cubic meters or standard cubic feet are used to measure natural gas. The world's known natural gas reserves were estimated by the US Energy Information Administration (EIA) to be about 6,289 trillion cubic feet in 2009 (tcf). With 2,686 tcf in reserves in 2011, or 40% of all reserves worldwide, the Middle East has the majority of the world's reserves. At 1,680 tcf in proved reserves in 2011, Russia is second in line. Around 4% of the world's natural gas reserves are found in the United States.

The EIA estimates that 112,920 billion cubic feet of dry natural gas were used globally in 2010. (bcf). The United States used the most oil of any country that year, a little over 24,000 bcf. The most frequent method of obtaining natural gas from the Earth's surface is vertical drilling. The well can only extract as much gas as it can from a single vertical drill. Acidizing, horizontal drilling, and hydraulic fracturing are methods to boost a well's access to more gas and hence its production. These procedures, nevertheless, could have detrimental effects on the ecosystem.

Fracking, also known as hydraulic fracturing, uses high-pressure streams of water, chemicals, and sand to break apart rock formations. The rocks are propped open by the sand, allowing gas to escape and be transported or stored. Fracking, however, uses a significant amount of water, which may drastically lower a region's water table and harm aquatic ecosystems. If improperly handled, the process may leak and pollute subterranean water supplies utilized for drinking, personal hygiene, industrial usage, and agricultural use. The process also commonly creates extremely toxic and radioactive wastes [6]. Fracking may also trigger minor earthquakes. Although while the majority of these tremors are much too small to be felt on the surface, some geologists and environmentalists have issued warnings that they might destroy buildings or subterranean networks of pipelines and wires. Fracking has received criticism and has even been outlawed in certain places because of these harmful environmental repercussions. Fracking offers a profitable commercial opportunity and a consistent supply of energy in other places.

A well's surface may be expanded by horizontal drilling without having to create several pricey and ecologically delicate drilling sites. Drilling may be guided to go horizontally after being directed to descend vertically from the surface of the Earth. By doing so, the well's productivity is increased without the need for additional drilling locations on the surface. By dissolving acidic substances and injecting them into a natural gas well, the process of acidizing dissolves any rock that could be obstructing the gas flow. After extraction, natural gas is typically delivered via pipes with a diameter ranging from two to sixty inches.

The 48 states of the continental United States are served by more than 210 pipeline networks that span 490,850 kilometers (305,000 miles) of transmission pipes. For this system to function, there must be more than 1,400 compressor stations, 400 subterranean storage facilities, 11,000 delivery points, and 5,000 receiving locations. Furthermore, natural gas may be transformed into liquified natural gas, or LNG, by cooling it to roughly -162°C (-260°F). Natural gas only occupies 1/600 of the volume of a gas when it is liquid. It is simple to store and move it in locations without pipes.

A specialized, insulated tanker is used to carry LNG, keeping it at its boiling point the whole time. The LNG is vented out of the storage compartment if any of it vaporizes, and it is then utilized to power the transport vessel. LNG is imported by the US from nations like Qatar and Trinidad and Tobago. The United States is currently increasing its domestic LNG output, nevertheless.

The use of natural gas

While it takes millions of years for natural gas to generate, its energy has only recently been used. Chinese engineers constructed bamboo tubes to utilize the natural gas that was leaking from the soil about 500 BCE. These pipes carried the gas that heated the water. British businesses supplied natural gas to light houses and streetlamps in the late 1700s [7].

Nowadays, there are innumerable industrial, commercial, residential, and transportation uses for natural gas. Natural gas may be up to 68 percent cheaper than electricity, according to the US Department of Energy (DOE). The most common uses of natural gas in residential dwellings are for cooking and heating. Home appliances including stoves, air conditioners, space heaters, outdoor lighting, garage heaters, and laundry dryers are all powered by it.

Moreover, natural gas is employed more widely. It is a very effective and cost-effective method of powering water heaters, space heaters, dryers, and stoves in commercial environments, such as restaurants and retail centers. In industrial settings, natural gas is also utilized for cooking, heating, and cooling. The refinement of metals, stone, clay, and petroleum are just a few of the operations that utilise it, along with waste treatment, food processing, and food preservation.

For use in place of gasoline in automobiles, trucks, buses, and other motorized vehicles. Presently, there are more than 150,000 natural gas vehicles (NGV) in the United States and more than five million globally.

While NGVs initially cost more than gas-powered cars, they are the world's cleanest-running automobiles and their fuel costs are lower. Nitrogen oxides, arsenic, nickel, and other dangerous chemicals are released by gasoline and diesel-powered automobiles. NGVs, on the other hand, may emit trace quantities of butane or propane, but they also emit 70% less carbon monoxide into the environment. Electricity is also produced from natural gas using the cutting-edge fuel cell technology. Fuel cells use electrochemical processes to create electricity rather than burning natural gas to do it. Without any additional byproducts or emissions, these processes result in the production of water, heat, and energy. In order to implement this technology of power production to electric items at a reasonable cost, scientists are currently studying it [8].

Environmental Impacts of Natural Gas

Before being utilized, natural gas often has to be treated. Natural gas may include a number of substances besides methane when it is recovered. In a natural gas well, you could find water, ethane, butane, propane, pentanes, hydrogen sulfide, carbon dioxide, water vapor, and possibly helium and nitrogen. The methane is treated and separated from the other components before being utilized as energy. Our houses' energy-producing gas is virtually entirely methane. Natural gas is a fossil fuel that may be used to produce energy. In fact, it burns the cleanest of all fuels and produces the least amount of pollutants.

When fossil fuels are burnt, a variety of substances, chemicals, and solid particles may be released (or emission). With very complex chemical structures and significant concentrations of carbon, nitrogen, and sulfur, coal and oil are examples of fossil fuels. They produce a lot of toxic pollutants when burnt, including as sulfur dioxide, nitrogen oxides, and air-polluting particles that float into the atmosphere. The chemical structure of methane in natural gas, in comparison, is straightforward: CH4. It solely releases carbon dioxide and water vapor when burnt. As we breathe, humans exhale the same two elements.

The term "greenhouse gases" refers to a group of gases that includes carbon dioxide, water vapor, ozone, and nitrous oxide. Global warming and the rising levels of greenhouse gases in the atmosphere have potentially catastrophic environmental effects [9].While burning natural gas still produces greenhouse gases, it does so at a rate that is over 30% lower than that of oil and 45 percent lower than that of coal.

Safety

Drilling for natural gas may result in leaks, like with any extractive operation. The leak might be dangerous right away if the drill strikes an unanticipated high-pressure pocket of natural gas or if the well is damaged or ruptures. Natural gas does not usually result in an explosion or burn since it evaporates into the air so fast. Yet the leaks also pose a threat to the environment since they let dirt and oil into the neighborhood. The chemicals employed in hydraulic fracturing have the potential to damage nearby drinking water supplies and aquatic ecosystems with extremely radioactive elements. People may need to temporarily leave the region due to the uncontrolled methane leak into the air. Leaks might develop gradually over time as well. Cast iron was a common material for distribution pipes up until the 1950s, although it enables a significant proportion of natural gas to escape. After years of freeze-thaw cycles, high overhead traffic, and tensions from the soil's natural movement, the cast iron pipes start to leak. More than 30% of the methane emissions in the U.S. natural gas distribution industry come from leaks in these distribution pipes. To minimize leakage, modern pipelines are constructed from a range of metals and polymers [10].

CONCLUSION

According to current estimates, there is enough natural gas present in many parts of the planet to provide energy security for human activities for around 250 years. Exploiting localized natural gas supplies from unconventional sources and looking for new ones is a scientific and economic challenge, but it also poses major environmental risks and shifts geopolitical power dynamics. As compared to other fossil fuels, natural gas burning is the cleanest, particularly in terms of CO2 emissions, yet even these negligible emissions continue to contribute to the greenhouse effect. Natural gas is a desirable energy source due to the variety of uses for which it is used, the relatively low cost of its production, the ongoing expansion of pipeline networks, and the transportation of liquefied natural gas. These factors, along with projections for rising global energy needs, form a cycle of mutually reinforcing actions. Natural gas has a significant role in determining the energy policies of several nations, particularly the producers, as well as of international organizations. Energy technology advancements have the potential to bring about a revolution in the near future by providing cheap, plentiful, and clean energy sources that would displace more traditional sources.

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CHAPTER 15

NON-RENEWABLE FUTURE METAL RESOURCES

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ABSTRACT:

Natural resources are crucial manufacturing inputs. In addition to manufacturing, many nations rely heavily on the extraction, processing, and final disposal of materials as major sources of revenue and employment. To a greater or lesser degree, these activities also have an influence on the environment. The ecosystems that support the provision of services like climate regulation, flood control, natural habitats, amenities, and cultural services are made up in part of natural resources. These services are essential for the development of human, social, and economic capital that is created by humans and other living things.

KEYWORDS:

Environmental, Natural Resources, Minerals, Pollution, Renewable Energy.

INTRODUCTION

The world's energy system uses up a tremendous amount of natural resources. These resources come in a variety of forms, including renewable (such as biomass), finite (such as fossil fuels), and recyclable (such as the metals used for permanent magnets in wind turbines). The policy discussion is heavily driven by scenarios for how the world's energy system could change, which are in turn heavily influenced by estimates of resource availability and recoverability. Yet, these estimations are typically very speculative, inconsistent, and frequently disputed. Fears about the supply of oil, for instance, have repeatedly prompted claims that switching to alternate energy sources would be required to prevent the socially disruptive impacts of rising costs.

The most likely renewable energy source to replace oil is probably bioenergy, although there is also doubt about its long-term supply in this case. Particularly, the connections between biomass and food production have sparked a contentious and public discussion over whether widespread adoption of bioenergy can actually be sustainable and the need for state assistance. Other renewable energy facilities, like wind turbines and solar cells, won't be able to contribute significantly to the world's energy supply unless there is a plentiful supply of the essential metals needed for their manufacture. Access to these metals may be hampered by the rise of resource nationalism in reaction to actual or perceived supply limits, which may eventually slow the adoption of these technologies [1].

Environmental Impact of Minerals

Minerals are non-renewable natural resources that are essential to the industrial, energy, and building sectors. The goal of sustainable mineral development is to keep mineral consumption to a minimum while not hindering economic expansion. This is accomplished by the effective use of minerals, recycling, and the use of substitute materials. Also, it's essential to safeguard the ecosystem from any harm brought on by mineral extraction. By doing this, you can preserve biodiversity and make sure that future generations won't have to worry about pollution. The protection of the environment and the sustainable use of resources are ensured through mineral planning at the local, regional, national, and EU levels. Achieving these objectives requires energy and mineral resource conservation, recycling, and reuse.

Planning

The planning system in the UK takes into consideration all laws, regulations, and policies. The objective is to provide minerals needed for building and industry at the lowest possible social, economic, and environmental cost. Mining, quarrying, and the transportation of minerals have the fewest negative effects on the environment. Recycling and waste minimization are promoted. Mineral development is prohibited in national parks and other places that are significant to science and the environment. Moreover, commercially significant mineral resources are protected from other land development. Several areas are developed for environmental protection or communal usage when quarrying or mining is complete.

Recycling

Recycling is the process of gathering and turning waste materials into beneficial goods. The primary factors limiting the quantity recovered are the energy and labor expenses of recycling. Complex manufactured goods may be more expensive to disassemble in order to extract certain minor metals than is now commercially feasible. If items are created to be recycled, this can alter [2]. The concrete, brick, plasterboard, and ceramic industries often recycle construction materials such demolition trash for use in these products. As additions for aggregate and cement, minerals refuse and waste byproducts from industrial operations are also employed. Several industrial minerals used in manufacturing and industrial processes can only be utilized again as fill in new building. Glass, which may be crushed to be used as road building gravel or melted for use in glass, is a notable exception. Metals are easily recycled since they can be melted down and utilized to create new goods, even if certain metals could only be used in trace quantities in certain industries, making their recovery highly costly.

Water and Mineral Extraction

Water is a crucial factor in mineral planning because it often plays a crucial role in the extraction and processing of minerals. Operations for extracting minerals must not considerably lower groundwater or river levels. Mineral extraction involves careful monitoring of water drainage because dissolved or suspended minerals may harm fisheries and animal habitats. To prevent overflows that might cause pollution and floods, tailings (finely ground waste) facilities and mining activities must be carefully planned and maintained. Laws are used to enforce controls. Remediation may be required in certain situations.

DISCUSSION

Mining and Metals Firms' Supply Consequences in a Sustainable World

Mining and metals businesses profit from technology advancements that have automated many laborious, repetitive operations, which is not only restricted to current material processes and suppliers. Also, there are activities in uncharted territory like the deep sea and asteroids. Diverse ownership structures are used to manage operations, and cutting-edge machinery is used to enhance water and energy efficiency while minimizing waste. Some supply consequences for mining and metals industries [3].

Current Sources

In a sustainable future, the bulk of the demand for minerals and commodities is still satisfied by conventional sources. With to automated mining techniques and the development of technologies like 3D fabrication, the extraction and production of minerals and metals are more efficient than ever. In a sustainable future, demand for materials would rise overall, but because demand per person has reduced, it is doubtful that physical scarcity of natural resources will be a problem. Mining firms have become into effective resource providers [4].

Sustainable mining operations make the most of automation technology across the mining life cycle to enhance security, boost output, and save costs. Although some businesses started using automated mining programs in the early 2000s, they have now spread across the industry as both the technology and the business case have advanced as a result of the creation of open industry standards. Using sensing and data fusion technology, operations may compile detailed geometric and geophysical data profiles of an area during exploration. Automated robots may be employed during planning to assist in creating the safest, most economical ore extraction procedures. Using automated systems, drilling is considerably enhanced in terms of variance reduction, quality improvement, and maintenance cost reduction.

Lastly, ore is removed from the site utilizing railroad operations or autonomous fleets that employ wireless technologies, object-avoidance sensors, and the Global Positioning System to provide a safer working environment. Businesses now have access to a variety of real-time data that supports better decision-making and proactive site management, resulting in higher mineral yields, better energy efficiency, and less wear and tear. The effectiveness of mining and metals operations has been significantly impacted by advances in 3D printing. Since replacement parts may be produced on-site, maintenance downtime is reduced, and operations in distant areas can take advantage of many time-saving techniques. Both cost reductions and environmental advantages result. Using 3D printing results in designs that are lighter, smaller, and more effective, which might last longer and function more effectively, lowering the environmental impact of operations.

Equipment that is obsolete or broken down may readily be recycled to make new components. Compared to traditional production techniques, 3D printing has assisted in lowering costs for terrestrial mines by 50–80%. 8 Specialized businesses in the metals sector have used 3D printing technology to manufacture conductive liquid metal that can be generated at room temperature.

Mining and metals industries have completely embraced this technology since its inception at the beginning of the twenty-first century since the first obstacles to its application have been overcome. Particularly, there are unmatched safety and quality requirements, the technology is widely used and backed by the necessary skills, and employing 3D printing reduces manufacturing costs compared to depending on external supply chains. The following tendencies are projected to predominate in a sustainable world as a result of these technological shifts[5]:

Occupational Profile:

Careers are less physically demanding and more likely to be found in cities, where a skilled and diversified workforce predominates. Information and skills: Expertise in data management, communications technology, and mechatronics are necessary. An increasing number of jobs need a higher level of education.

Diverse Neighborhoods:

A variety of services and businesses enable the transformation of historical "mining villages" into various economic communities. Mining and metals firms must spend in R&D to successfully integrate new technology into their operations, as well as acquire new skills to put themselves in a position to prosper in a sustainable future.

Models of Ownership

In the pre-sustainable world, discussions over mineral rights and ownership, notably resource nationalism and the proper distribution of resource rents, dominated the agenda for mining and metals. The conversation changed for the better as we moved toward a sustainable future, and mining and metals businesses committed to shared value creation above cyclical profits. In a sustainable society, there isn't a single ideal ownership structure or funding plan, but the following seven factors should be taken into account [6]:

Creation of the project:

The role of mining and metals businesses is that of project developers rather than owners of mineral rights. This change in management allows mining and metals businesses to concentrate on their core competencies, such as developing and managing projects, while giving governments and communities the choice to control the mineral assets and use resource rents to achieve the region's social and economic goals. 12

Long-Term Worth

Ownership models encourage business and economic diversity by reducing the risk of commodity price variations. Resource rents are efficiently controlled to strike a balance between present and future investment needs and to promote economic diversity in the area. An important factor in the value proposition's ultimate determination is environmental and social stewardship.

Fair Distribution of Profits:

Earnings are given to a larger range of stakeholders, including as governments, communities, and investors, based on previously agreed-upon, appropriate levels. Payments may be provided based on the value of the commodity at the moment of extraction or production, or the owner of the commodity can choose to receive a piece of the commodity to use or sell as they see fit. This strategy must be based on the knowledge that all stakeholders are equally vulnerable to operational performance and commodity price volatility.

Inclusivity:

A consistent, fair playing field is created for the industry by holding all participants miners from artisanal and small-scale mining (ASM), young competitors, and multinational businesses responsible to the same standards and laws. As a result, there is a tendency toward convergence and increased cooperation and partnership between the various participants, with the possibility that ASM miners may eventually work for bigger mining firms. Public-private organizations are set up to produce geological information that makes mining and metals project exploration and operation easier. Metals and mining firms exchange geological data to enable broader mineral development and provide chances for efficient teamwork to quickly create value.

Mineral Leasing

Despite the obvious challenges the industry faces, some businesses and governments utilize models to track the usage of mineral commodities along the value chain and lease resources to consumers rather than selling them. For the reuse of mineral commodities, corporations obtain a credit note against a future purchase; this calls for advanced traceability procedures. Under these agreements, clients pay businesses based on performance rather than ownership of commodities.

Mining Services Contracting:

Even though it is not a conventional mining firm, commodity owners contract out production duty to the most effective and efficient service provider. Being a service provider rather than a miner promotes competition, reduces costs, and rewards businesses that meet the highest performance requirements. In a sustainable future, the guiding principles of ownership models may be sufficiently flexible to allow mining and metals firms to work with governments and civil society to create ownership arrangements that benefit all parties. Ownership models, which aim to create shared wealth for governments, businesses, and civil society, are obviously not opportunistic. Environmental Factors That Affect Operations Mining and metals firms are impacted by the environment in a sustainable future in two different ways. The first thing that the businesses must do is think about how to adjust to new circumstances, such rising temperatures and more intense weather. Second, they must modify their operating procedures to reduce the negative effects that waste, water, air pollution, and biodiversity have on the environment. These guidelines are applicable to the following project life cycle stages[7]:

Operation Permit:

Resources became hardly accessible and became more costly due to "real cost internalization" in the late 2020s. This applies particularly to water, electricity, and arable land. Mining and metals firms work with local governments and communities to create and manage mutually beneficial adaption programs and operating standards in order to get and keep their operating licenses. Exploration: While newly accessible Arctic regions provide prospects for exploration, areas with significant biodiversity are absolutely off-limits to new activities.

Construction:

Infrastructure for energy and transportation is made to be more resilient to increasingly frequent and severe weather patterns. In order to reduce the mixing of pure and unclean water sources, operations in locations where more rain is expected have invested in more durable storm-water management systems. There are stricter guidelines for post-use treatment and operational water reuse. Furthermore, businesses that use the most energy-efficient technologies get an edge over rivals and, in certain circumstances, establish new income streams by licensing the technology to rivals. New Sources Opening Up New Horizons Mining and metals enterprises are engaged in uncharted territory in a sustainable future. Deep-sea mining is a desirable possibility and one that has proven practical since 2015. This is due to the abundance of gold, copper, zinc, and rare earth elements on the ocean bottom. The ocean bottom has been explored thanks to advanced robotic technology, and some experiments indicate that mineral concentrations in deposits beneath the sea may be up to ten times higher than in deposits on land.

A single deep-sea mining operation originally required US$ 1.95 billion in capital investment and US$ 9 billion in operating costs, however the business case is influenced by metal prices and capital needs. Over time, these expenses have dropped. At first, there were worries that projects couldn't go forward quickly since the environmental effect of offshore mining wasn't well understood. Yet when the number of exploration licenses more than quadrupled, from 8 in 2010 to 17 in 2013, it became obvious that the problem would be handled concurrently with the exploration rather than beforehand, much like the growth of offshore drilling in the oil and gas industry. In a sustainable environment, the sector should also look at mining asteroids. Mining on asteroids is possible and has been for a few decades due to the quantity and quality of the resources, the remarkable pace of technical advancement, and the strong financial backing. Asteroid mining is notably important for the platinum group metals, nickel, and iron, according to testing from meteorites in the beginning of the twenty-first century. According to some estimations, a single 500-meter platinum-rich asteroid holds 1.5 times the world's known platinum group metal deposits and 174 times the annual worldwide production of platinum. But it's not just about quantity. Since the grades of iron ore, nickel, and cobalt, for example, are far better than those on Earth, the quality of resources in asteroids is unparalleled [8].

Policies and Rules

In a sustainable society, local, national, and international laws and regulations are all followed by the mining and metals industry. To foster shared value for business, governments, and civil society, policies are developed. The industry develops broad, uniform, and predictable worldwide frameworks. Policies are formed at the regional and local levels that take into consideration local sociopolitical contexts while also adhering to the global framework. For mining and metals firms, each framework defines a set of rules that define what accountability entails. These guidelines act as a standard by which businesses and governments can measure their performance. As a result, strong policies that cover a variety of principles, such as community relations, stakeholder engagement, climate change, tax evasion, transfer pricing, and resource-rent allocation, have been developed. In a world that is sustainable, regulation is less formal. During the global financial crisis of 2008, business and governments came to the conclusion that traditional regulatory frameworks were too onerous to accurately represent the constantly expanding, internationally linked markets.

Instead, there are established minimum standards for human rights protection, environmental performance, safety, and ethical financial behavior. After that, the market regulates itself according to genuine worth. Every business has an all-encompassing market value. As a consequence, businesses are scrutinized considerably more closely. As a result of increased engagement and cooperation throughout the value chain made possible by social media and other new ICTs, all stakeholders' interests are taken into account in rules and regulations. Mining and metals firms are made to function in accordance with the covenants of a sustainable world via improved channels of communication and a commitment to transparency strengthened by actual value. Global resources are not under the jurisdiction of any state-based organization, government, or nation. Global resources are managed via multistakeholder networks, which include the government, civil society, business, consumers, and financial institutions. Governments should promote openness and increase citizen involvement to improve industry behavior rather than just regulating it. This collaborative, trust-based governance paradigm encourages inclusion, legitimacy, and stakeholder choices that are consensus-driven. Mining and metals firms must be ready for dynamic policy and regulation that more truly represents the interests of all relevant stakeholders [9].

Adapting Game Rules for a Sustainable Planet

A sustainable world has obstacles and a variety of conflicting interests; it is not a utopia. Yet the world now is more participatory and well-informed. The mining and metals industries, governments, and civil society collaborate closely, and globalization has not been slowed down. This section examines policy and regulation as well as collaborations to better understand the dynamics of the mining and metals sector's duties and responsibilities in such a world and how they connect with those of the government and civil society [10], [11].

CONCLUSION

Since significant quantities of raw materials are needed to develop new low-carbon energy technologies and infrastructure, mitigating climate change will provide new possibilities and challenges for the natural resource and supply chains (1). Yet, despite efforts to enhance corporate governance and management, many mineral and metal resources are procured in regions that are known for poor management, remain ecologically arbitrary, and, in some circumstances, are a cause of conflict at the locations where resource extraction takes place (2). This legacy of environmental degradation, negative effects on public health, disadvantaged communities and workers, and destruction of biodiversity has been left behind by these extractive and smelting industries in many regions of the globe.

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CHAPTER 16

CRUSHED STONE SAND WITH NATURAL SAND

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ABSTRACT:

One of the most common resources in the world is sand and gravel. These nonrenewable resources are essential to the typical person's existence, particularly as a supply of construction materials. Sand and gravel are used as resources depending on their physical properties, the location of the deposit, and their origin.

KEYWORDS:

Agriculture, Natural Resources, Non-Renewable Resources, Natural Gas, Renewable Resources.

INTRODUCTION

A typical by-product of mining and quarrying is crushed stone sand. It may be used in different pavement building procedures rather than being thrown off as waste material. The M-sand is another name for the crusher dust. As compared to other common materials, crushed stone sand is comparatively inexpensive. Compared to other options, crushed stone sand uses less water and is very durable and load-bearing. It may be used in different pavement building procedures rather than being thrown off as waste material. The qualities of crushed stone sand as a paving material are investigated for this project via the use of different tests and the analysis of various attributes. With the use of crushed stone sand in different pavement construction processes, my work seeks to replace traditional building materials.

Since they utilize natural resources as sources of energy and as raw materials to produce goods, people are dependent on them. Food is a natural resource that may be eaten unprocessed or in some other way. There are two categories of natural resources: renewable and non-renewable. To ensure that the supply of natural resources lasts longer, we should utilize them wisely [1]. Many of the Earth's resources are utilized to produce energy. Energy is utilized for a variety of things, including industry, building, and transportation. Non-renewable energy resources are those that can readily replenished after they are used up but only exist in small quantities. Renewable resources are those that can be replenished at any time throughout the course of a human life. Examples include wind, water, solar, nuclear, and biomass energy.

Biological Resources

Natural resources are things that we get from the planet and utilize to maintain life and meet human needs. Any naturally occurring material that is exploited by people may be categorized as a natural resource. Examples include oil, coal, natural gas, metals, stone, and sand. Air, sunshine, soil, water, as well as animals, birds, fish, and plants, are more examples of natural resources [2].

Food, fuel, and raw materials for the manufacture of commodities are all produced with the help of natural resources. The sources of food are either plants or animals. Coal, natural gas, and oil are examples of renewable energy sources. The production of things that we use every day, such as toothbrushes, lunchboxes, clothing, vehicles, TVs, computers, and refrigerators, also uses natural resources as raw materials [3].

Resources by Class

Resources are a pretty general phrase that generally refers to anything that might be thought of as a useful contribution. All resources, from air to gold, are available. Examining the two major categories of resources natural and man-made will help.

Resources

Something that is useful and enhances your life is a resource. Any element of nature that is useful to humans, such as air, water, food, plants, animals, minerals, and metals, is referred to as a "Resource". Each of these resources has a different value depending on its usability and other elements. Metals like gold, silver, copper, or bronze, for instance, have economic worth, meaning that they may be traded for cash. Forests, rivers, mountains, and the sea are all resources, yet they have no economic worth.

Time and technology are the two most crucial elements that may transform any material into a resource. Technology and innovation allow people to turn a natural or artificial material into a resource. For example, sea minerals, fish, or other marine life may be utilized to make food and medication. Time also increases the worth of a resource in a similar manner. For instance, fossil fuels may be created from the remains of species that lived hundreds of years ago [4].

Biological Resources

A natural resource is everything and everything that is naturally present on earth. They may also be divided into:

Biology and Abiotic

A biotic resource is any living thing found in nature, such as people, animals, plants, etc. Abiotic resources, on the other hand, are those that are found in nature but lack life, such as metals, rocks, and stones. Resources may be either renewable or non-renewable for both biotic and abiotic reasons.

Almost all components of nature that are capable of self-renewal are considered renewable resources. Sunlight, wind, water, woods, and so on are a few examples. When the amount of non-renewable resources is limited such minerals and fossil fuels. Although though it takes millions of years for these resources to create, if we utilize them consistently, they will ultimately run out during our lifetime.

Resources that are Prospective, Developed, and Stock

Potential resources are currently readily accessible natural materials whose whole potential has not yet been fully understood by humanity. For instance, two natural resources that have a strong potential for sustaining human existence are solar and wind energy. Even if we are utilizing them, once we realize their full potential, we will be able to utilize them much more.

A developed resource, on the other hand, is one that people have long since identified and improved. Nowadays, the majority of the water, fossil fuels, minerals, plants, and animals that humans utilize are developed resources.

Nature has certain resources with considerable promise, but humans lack the knowledge or technology necessary to fully use them. So, they continue to exist in nature as stock resources. Gases like hydrogen and oxygen, for instance, may be exploited as abundant sources of energy, but we still do not fully understand how [5].

Artificial Resources

Human-made resources are created when people employ natural resources to create something new that benefits and adds value to our lives. For instance, when we create structures, machines, automobiles, bridges, roads, etc. using materials like metals, wood, cement, sand, and solar energy, such things are referred to be man-made resources. Technology is a resource that was created by humans. Most man-made resources are replenishable. Buildings may be rebuilt, and damaged machines can be repaired. The fact that people can utilize technology to turn a natural resource into something useful and valuable also makes them a resource in and of itself. We refer to it as human resource.

Resources Protection

The availability of the natural resource or resources is a prerequisite for all man-made resources. To protect those resource(s), we first need to comprehend the worth of each natural element. Because they should be accessible to us for the duration of our lives and preserved for the benefit of future generations.

For instance, if we do not start conserving water, human civilization will start experiencing serious water shortages very soon. Similar to how there would ultimately be no more wood for humans to construct houses or create fires if we decimated all of the trees. Moreover, the amount of carbon dioxide will rise. It will thus only be detrimental to human existence. In other words, resource conservation is essential for improving the quality of human existence.

We may contribute to resource conservation by carefully using each natural resource and allowing it to replenish itself within nature. We must also concentrate on sustainable development, a strategy for making the best use of each resource while maintaining a balance. And by doing this, every one of us can do our part to keep the earth healthy and resourceful [6].

DISCUSSION

The drawbacks of exploiting natural resources include the potential for biodiversity loss, ecosystem devastation, and air, land, and water pollution as a result of resource extraction, processing, and usage. One highly harmful greenhouse gas is carbon dioxide, which is created when fossil fuels like coal, oil, and natural gas are used. Greenhouse gases absorb and hold onto heat from the sun. Examples of greenhouse gases include methane, ammonia, sulfur dioxide, and certain chlorinated hydrocarbons. Global climate change may be triggered by the buildup of greenhouse gases in the atmosphere. The shift in the average global temperature of the atmosphere close to the surface of the Earth is referred to as global climate change. But, if this scenario persists, it might result in global threats including illness, floods, and drought. Relationships within ecosystems are also disturbed by the extraction and usage of natural resources.

Ponds, forests, and fields make up ecosystems, which are self-governing groups of plants and animals that interact with one another and their non-living surroundings including soil, air, and water. For instance, uprooted trees in a field might ruin animal habitats, forcing the animals to seek for new homes elsewhere. If these creatures disappear from the environment, the populations of plants and animals that rely on them are further disrupted [7], [8]. By exploiting and removing natural resources, combined with other human actions, biodiversity may be reduced. The diversity of living things on Earth is referred to as biodiversity. Since wild animals and natural habitats are valuable commodities, reducing the biodiversity of the Earth has a large negative impact on people.

Resource Recovery:

Natural resources that have never been utilized before are referred to as virgin resources. Processing, extraction, and use of virgin resources take a lot of energy and may result in pollution. By removing things like paper, glass, aluminum, and steel from garbage and recycling them into new products or utilizing them to create energy, resource recovery protects natural resources. Several businesses are creating cutting-edge technologies that manufacture things using recycled materials. Almost exclusively recovered steel is used as raw material in the steel production process by several steel industries. Another illustration: A business has two options for producing plastic: it either utilize recovered plastic from recycling initiatives or make plastic from oil. When a business employs recovered plastic, it is recycling material that would otherwise end up in the garbage stream. By conserving energy and eliminating the pollutants that would have been produced during the extraction and processing of oil from the ground, this helps to prevent the depletion of natural resources. So, there are several approaches for every one of us to conserve natural resources. Reduce, reuse, and recycle is among the most straightforward strategies to protect natural resources. To limit consumption, you should purchase fewer goods, choose items with less packing, and reuse items that may be used again.

Natural resources are essential for daily life:

- **Food and drink:** This category covers agricultural items as well as naturally occurring foods, water, and materials for food packaging.
- **Mobility:** It encompasses both the natural resources necessary to produce the gasoline that powers vehicles like cars and aircraft as well as the materials used to create the vehicles themselves, such as airplanes and cars.
- **Housing and affluence:** It includes the raw materials needed to create things like buildings, roads, and stop signs. Also, it includes the natural resources that are utilized to provide the energy needed to heat and power these infrastructural and dwelling complexes.

Resources from nature and eco-energy

Due to the depletion of non-renewable energy sources and the increasing consequences of fossil fuels on the environment, eco energy is becoming more crucial. Eco energy businesses concentrate on developing energy solutions that benefit the environment and the world rather than harming it as other energy sources do.

Natural resources are important to the economy:

Abundant Natural Resources

Natural resources are a very valuable resource. Indeed, the majority of nations' "wealth" is made up of natural resources. Since emerging nations need more and more energy, countries with abundant natural resources, particularly non-renewable resources, see their worth increase. Due to their diminishing supply and increased market demand, non-renewable natural resources now have a higher value. As a result, many nations depend on natural resources to sustain their economies [9].

Environmental issues and poverty

Particularly those from rural regions, poor people have a propensity to rely more on natural resources for their livelihoods. Direct access to food and shelter from natural resources is another benefit. Thus, natural resources are crucial for the survival of the underprivileged. The inhabitants of natural resource-rich places may benefit from investments in such areas as well. Natural resources and employment since they provide jobs, natural resources are essential for low- to middle-class rural inhabitants. The utilisation of natural resources is a key source of employment in rural regions [10-12].

CONCLUSION

Natural resources have been utilised by people ever since they first began to settle in agricultural regions for their survival. In actuality, agriculture is dependent on natural resources. Soil, water, plants, animals, trees, materials needed to produce agricultural equipment, resources needed to generate fuel and power, and many other natural resources are necessary for agriculture. Due to their substantial reliance on natural resources, farming and agriculture have recently been under pressure to become more sustainable.

Using less intense agricultural techniques that do not deplete natural resources like soil and plants is one example of this. It also entails managing water use and using pest control techniques that are environmentally friendly and sustainable. Agriculture is dependent on a number of different natural resources, such as the climate and sustainable fuel technologies, in addition to managing the natural resources that are directly employed in agricultural practices.

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CHAPTER 17

NATURAL RESOURCES AND THEIR SIGNIFICANCE IN OUR LIVES

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ABSTRACT:

Natural resources are significant to our daily existence. They are necessary for the economic, social, and environmental health of the whole planet. Natural resources provide us with food, water, fuel, and many other things. Yet in addition to being useful on a daily basis, natural resources are crucial for maintaining a sustainable and healthy ecosystem. The significance of natural resources and their worth in our lives will be discussed in this paper.

KEYWORDS:

Energy Sources, Natural resources, Non-Renewable Resources, Renewable Resources.

INTRODUCTION

Natural resources are materials found on Earth that are utilized to support life and satiate human needs. People may classify any natural thing they ingest as an organic item. Natural resources include things like stone, sand, metals, oil, coal, and natural gas. Natural resources include things like sunshine, air, water, soil, plants, animals, and birds. Natural resources and created things are interrelated. Even though they are manufactured products, natural resources are certainly used to generate items like plastics, metal sheets, energy, textiles, concrete, and microchips. In essence, we refer to these resources as "natural" as they are products that human civilization uses but that weren't created by humans. The definition of "resource" and "natural" has evolved throughout time and across many communities. Resources that are found naturally on Earth are known as natural resources. For example, it took millions of years for fossil fuels to develop [1].

Biological Resources

A natural resource is any naturally occurring material that exists in nature and is utilised by people for survival. Oil, coal, natural gas, metals, stone, and sand are examples of natural resources. Air, sunshine, soil, and water are other natural resources, as shown in Figure 1.

Natural Resource Categories

There are two categories of natural resources:

1. **Exhaustible or Renewable Resources:** Renewable resources are those that may be found in nature in great quantities. Some resources, like water, air, sunshine, etc., are limitless and may be utilized again.
2. **Non-Renewable or Exhaustible Resources:** These resources are also present in nature, but their supply is limited. These could run out after prolonged use, including oil and natural gas, minerals, coal, etc.

Natural resources and agriculture

3. As they changed from a hunting and gathering to an agricultural existence, humans have made use of natural resources. In actuality, agriculture is dependent on natural resources to survive. Agriculture and the construction of agricultural machinery both need a range of natural resources, including plants, animals, trees, soil, water, fuel, and

energy. For agriculture, the quality of natural resources is equally crucial. For instance, a farmland with low soil quality or excessive aridity won't produce as much as one with optimum circumstances. This is why it is so important to conserve and maintain natural resources for the future of agriculture [2]. Agriculture has been pushed to become more sustainable in recent years due to farming's heavy reliance on natural resources. Less intensive agricultural techniques that do not destroy natural resources like soil and plants may be employed to achieve this.

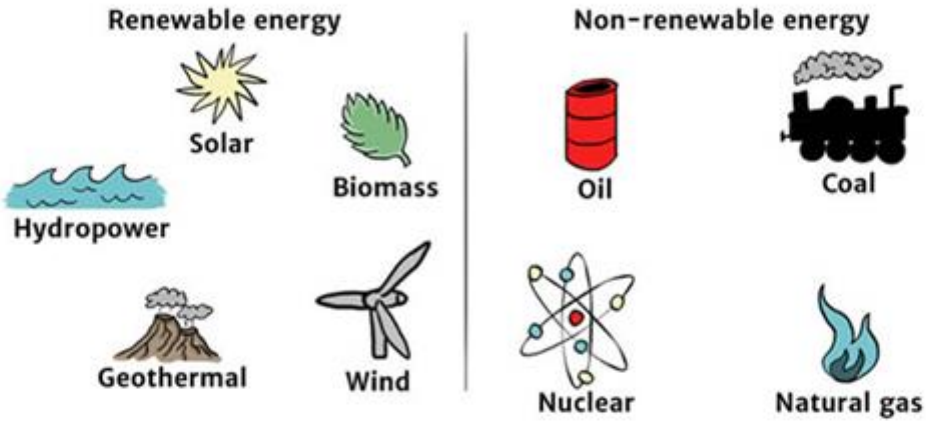

Figure 1: Renewable and Non-Renewable Energy Sources

The Role of Natural Resources in Employment

Natural resources matter to employment for a number of reasons. Natural resources are crucial for the production of energy, goods for industry, and food. Employment in these areas is directly impacted by the availability of natural resources. Natural resource exploitation may be advantageous for a variety of enterprises. For instance, in order to create homes and roads, construction firms require sand, rock, and wood. In order to make items, industries need minerals and metals. Natural resources may serve as tourist attractions that help the hospitality sector create jobs. For instance, tourists from all over the globe visit the Niagara Falls in the United States and Canada, which generates employment for tour guides, hotel employees, and restaurant personnel. Natural resource management may provide employment via projects like conservation and replanting. In addition, outdoor pursuits like camping, hiking, and fishing rely on natural resources like lakes, rivers, and woods.

Resources from nature and wealth

Natural resources are another source of wealth in addition to monetary wealth. Natural resources make up the bulk of a country's "wealth". These are really priceless resources. Natural resource wealth makes a nation affluent because it can be used to create financial capital. Countries with plentiful natural resources, especially non-renewable resources, perceive a gain in value because rising nations require more and more energy. Non-renewable natural resources are now worth more because of their dwindling quantity and rising market demand. As many of the world's richest nations also have an abundance of natural resources, it is clear that many countries depend on these resources to support their economy.

Resourcefulness and solar power

Solar electricity relies heavily on natural resources. Solar power wouldn't exist without the sun; solar panels need sunlight to produce energy. A major advantage is that solar energy is a naturally replenishable resource. We will have unending access to sunshine for the next 5 billion years. Every person on Earth receives enough power in one hour of sunshine to last an entire year [3].

Air and Natural Resources

One of the most crucial natural resources on Earth is air. It effects our climate and weather in addition to giving us the oxygen we need to breathe. A variety of gases, including nitrogen, oxygen, carbon dioxide, and water vapor, make up the air. It is an essential component of the oxygen and water cycles. There wouldn't be any life on Earth without air. For all plants and animals to survive, it is necessary. The air is one of the most vital components of our planet, despite the fact that we cannot see it or touch it.

Resources and energy in nature

Today's world is powered by energy. Energy is produced using a variety of natural resources, including wind, water, tides, geothermal heat, solar radiation, fossil fuels, and petroleum. It provides energy for our homes, workplaces, industries, and vehicles. For millennia, the primary energy sources have been fossil fuels like coal and oil. Yet since they are not replenishable, they will ultimately run out. As we explore for methods to minimize pollution and create a more sustainable future, renewable energy sources like solar, wind, and hydro are becoming more crucial. While each energy source has advantages and disadvantages, it's crucial to bear in mind that we need all of them to keep the world functioning properly.

Environmental factors and industries

For companies, natural resources are crucial because they provide the raw materials required to make goods. Industries couldn't operate without these resources. For instance, the oil and gas sector is very dependent on raw materials like natural gas and crude oil. Vehicles and other machines are powered by these materials. The textile, electricity, and food sectors are more examples. To make their goods, they rely on natural resources such as minerals, plants, animals, solar energy, hides and skins, natural fibers, and other raw materials.

For sectors that extract resources, including forestry, fishing, and mining, these resources are crucial. Also, the placement of industries may be significantly influenced by the availability of natural resources. For instance, many mining corporations decide to establish operations in regions with significant mineral or oil resources. In this manner, it will be less expensive to transport goods and easier to get raw resources. Industries can create more products or services at cheaper prices when they can extract and process raw resources effectively.

Environmental Resource Use for Medical Purposes

The value of natural resources in medicine cannot be overstated. More than 60% of the world's population depends on plants for medical treatment, and herbs are used to cure ailments and problems in both their raw and modified forms. Plant extracts are a common ingredient in many traditional treatments.

Even now, plants are still the source of many contemporary pharmaceuticals. Natural resources are often employed to make medical equipment and technology. For instance, surgical tools and other medical supplies are made from metals and minerals. Almost every medical treatment, including hydration and sterilizing, need water.

Ecosystem Services and Natural Resources

Ecosystem services, or the advantages people get from nature, have a substantial impact on the significance of natural resources in the environment. Regulatory services relate to the ways in which ecosystems control various aspects of the Earth's processes, such as the temperature and water cycle.

The products and resources we get from ecosystems, such as food, water, and medicines, are known as provisioning services [4]. Supporting services are the activities that ecosystems must do in order for other services, like pollination and decomposition, to be feasible. Cultural services are the non-material advantages humans get from ecosystems, such as leisure and aesthetic satisfaction.

Natural Resources and Academic Research

The existence of natural resources in the environment has inspired and continues to inspire a large number of passionate scientists. As a result, they have continued their study and developed goods that are helpful to people and consequently the whole globe. Without natural resources, many scientific investigations would be unfeasible. Without them, we would not be able to test novel medications or create ground-breaking technologies, for instance. Environmental research also relies heavily on natural resources. Understanding how people interact with natural resources may help us understand the possible effects that our actions may have on the planet.

DISCUSSION

Natural resources may be used in a variety of ways that are sustainable. For instance, it is feasible to utilize them in a way that does not harm or deteriorate the environment. To guarantee that everyone has enough in the future, we can make sure that we just utilize what is available and don't abuse it. Also, wherever feasible, we may recycle and reuse resources.

Using natural resources sustainably Important?

- We should utilize natural resources responsibly for a number of reasons.
- It guarantees that future generations will have access to these resources. Our children will inherit a world that has been destroyed and depleted if we continue to utilize them in an unsustainable manner.
- It may support environmental protection and biodiversity preservation. If we do not utilize natural resources responsibly, they will ultimately run out.
- Sustainable resource use may increase employment and the economy.
- It might contribute to ensuring that nearby communities have access to the required resources. For instance, we may improve people's quality of life by ensuring they have access to clean water and sanitary facilities.

Using sustainable energy is the only way to ensure that we can live on this planet perpetually. While it has been around for a very long time, the idea of sustainable energy is often thought of as something new and inventive. At first, people depended on renewable energy to exist; they foraged for food and collected wood for fires[5].

They now have more options. Renewable energy resources may be used to generate electricity. We may also adopt low-tech solutions in our residences or places of business, such as solar panels or energy-efficient lighting.

Using less coal and fuel oil alone is not a sustainable energy strategy. Using resources responsibly also entails protecting the environment and those who depend on it for existence. In order to maintain the long-term health of our planet and species, we must utilize natural resources in a sustainable manner.

Natural Resource Threats

The following dangers exist to natural resources and are to blame for their destruction:

1. **Overpopulation:** The major danger to natural resources is the growth in population since more land has been utilized for housing and development. As a result, many forests and vegetative lands have been converted for habitation, as well as for the construction of highways and farms. Natural resources suffer from overpopulation[6].
2. **Overexploitation:** The overuse of natural resources may cause their extinction and other forms of resource degradation. Natural resources are being overused as a consequence of population growth. The overuse of natural resources is also significantly attributed to industrial growth.
3. **Climate Change:** Severe climate change has had an impact on natural resources, particularly how rainfall patterns influence the development of plants, agricultural production, and the condition of the soil. There is a danger of dryness and forest fire in the absence of timely rain or high temperatures. It lowers the productivity of the forest.
4. **Environmental Pollution:** Pollution has a negative impact on the environment by affecting natural resources including air, water, and land. Natural resources are destroyed because it also alters the chemical makeup of the soil, rocks, freshwater, and subterranean water.

Making Use of Renewable Resources We need to develop other sources of energy since the world won't be able to sustain its current way of life indefinitely on oil, gas, and coal. Solar energy is the energy that comes from the sun. We are aware that solar energy drives the world's wind and ocean currents. People are spending more and more money on solar panels for their homes' roofs, where solar cells actively absorb energy and turn it into power.

Regrettably, solar cells perform worse on overcast days and do not function at all at night. Batteries may be used to store solar energy, however they have limited storage capacity and safe disposal of dead batteries can be problematic. Wind energy has been utilized for thousands of years as a source of power for water pumps and sailing ships. Currently, power may be produced using windmills, which are often found on wind farms. No waste is produced by wind, yet there aren't many places on earth where the winds are strong and consistent enough to create power.

Natural resource preservation

Natural resource conservation is the process of protecting and expertly managing the resources offered by nature. The following is a list of techniques for protecting natural resources:

Huge underground reservoirs that store hot water generated by the earth's inherent heat are known as geothermal reservoirs. Geothermal energy may be generated by this heated water by creating steam.

- These geothermal hotspots are found only in a few places on Earth, often in tectonically active or volcanic regions like Hawaii and Iceland. Geothermal energy might be produced at Yellowstone National Park.
- Biomass energy, which is produced by burning organic materials like wood, alcohol, or waste, is a typical sustainable energy source despite not being well known. Nevertheless, burning these things has the disadvantage of releasing particles into the environment, which might lead to an increase in air pollution [7].

1. Reducing, recycling, and reusing. You should always abide by the R3R3.

2. We ought to volunteer to help with local cleanups.
3. Rainwater should be collected for future use and should not be squandered.
4. It's important to regularly dig in ponds and lakes and to keep them clean.
5. Water reservoirs and dams need to be constructed.
6. It's important to halt deforestation.
7. It is important to utilise natural resources more effectively.
8. There should be a greater emphasis on raising public understanding of the value of protecting natural resources.
9. It is important to develop the use of alternate energy sources.
10. Tree planting should be done regularly.
11. Electric cars and other energy sources should be used to reduce pollution.
12. Regulations pertaining to the protection of natural resources must to be scrupulously followed [8]–[10].

CONCLUSION

In conclusion, natural resources are crucial to the maintenance of life. They provide us with the fuel for our houses and companies, food, clothes, shelter, and medications that keep us healthy. As they are limited resources that might be exhausted if improperly employed, it is essential to use them wisely. If we keep going in the same way, we will soon run out of resources. We must actively conserve natural resources if we want future generations to get the same rewards as we do. Natural resources, or elements found in nature without human intervention, are essential to humankind's existence and advancement. These resources enable humans to live on Earth. Renewable and non-renewable resources are the two categories of natural resources. Men utilise a variety of natural resources in their everyday life, including air, water, land, and minerals. The depletion of several of these natural resources has been threatened by population growth and overuse. So, protecting natural resources and using them to safeguard them for future generations is our moral obligation.

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CHAPTER 18

USE OF NATURAL RESOURCES: ATMOSPHERIC AIR

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ABSTRACT:

The interaction between animals and plants is fundamentally impacted by the oxygen-carbon dioxide cycle. Plant photosynthesis, which has been occurring for millions of years, creates oxygen. Plants need the carbon dioxide that people emit to help them generate food. In addition to this, air performs a variety of additional tasks, such as producing electricity via wind turbines, holding clouds in place so that rain may fall, as well as being employed in many different businesses and cars. A framework for using atmospheric air has been developed, and its significance in biological and technological processes has been defined. The fundamental conditions for using atmospheric air have also been established, along with its key characteristics and functions.

KEYWORDS:

Atmospheric Air, Fossil Fuels, Minerals, Natural Resources, Resource Management.

INTRODUCTION

With the focused and deliberate use of natural resources, which results in the transformation of raw materials into the intended outcome, humans may have an influence on the environment. So, human effort that is productive aims to change nature into forms that are suitable for human use. Yet, people may also have an unintended, uncontrollable influence on the natural systems, which often results in great devastation. They include various natural calamities caused by humans, ozone layer loss, etc. Consequently, when we talk about managing natural resources, we intend to include both the direct and indirect effects of people on the environment, which may be both intentional and unintentional, targeted and random. By the late 1950s, this idea of how to exploit nature had been created. At first, it was equated with resource utilization, or using resources for commercial purposes. Using the natural resources' necessary characteristics first led to their preservation, then to their reproduction, and finally to improvement and sophistication. This is how natural resource management has traditionally progressed [1].

Using the natural environment to satisfy societal ecological, economic, cultural, and recreational demands falls within the wide definition of managing natural resources. There are often two types of resource management: one that is reasonable and one that is not. The wants for material products are fully satisfied when natural resources are managed rationally, while maintaining environmental harmony and the capacity for natural resource restoration. An important practical challenge for the study of natural resource management is the search for such economic activity levels that are optimal for the various territories or locations. Sustainable development is the pursuit of such optimums. The goal of the essay is to discuss the fundamental guidelines for making wise use of the diverse characteristics and uses of atmospheric air (AA) as a natural resource.

NON-MINIMUM RESOURCES

Natural resources are items that may be found in nature that have economic worth, such as forests, mineral reserves, soil, and fresh water. Natural resources include the elements of air and wind, fossil fuels, minerals, people, soil, sunshine, water, and animals.

Atmosphere

The gaseous layer that envelops the world is called the atmosphere. The gases that make up the atmosphere are mixed together to form air. Air is moving, and this is wind. The atmosphere contains gases, particles, and water vapor [2].

Fiery Fuels

Fuels known as fossil fuels are made from dead animal and plant material that was accumulated during a prior geologic period, usually millions of years ago. The high carbon and hydrogen content of the dead plants and animals provides the fuels with their energy. Fossil fuel combustion results in pollution and carbon dioxide that contributes to global warming. The many types of fossil fuels include peat, petroleum, natural gas, and coal. Vegetable debris that has partly decomposed gathers in bogs, where low oxygen levels and acidity prevent breakdown. The liquid form of fossil fuels used to create oils and gasoline is known as petroleum. The gaseous form of fossil fuels used for cooking and heating is called natural gas. The fossil fuel used in industries and to produce power in its solid form is called coal.

Minerals

Natural inorganic materials found on or in the earth are known as minerals. They do not have life. Everything from brick to iron is made using minerals that are extracted from the soil.

People

The utilization of other natural resources is influenced by people. Natural resource demand has grown along with the growth of the human population. To guarantee that resources are available in the future, they must be used wisely.

Prerequisites for AA Use Management

According to us, the following tenets must serve as the foundation for managing AA usage. The first is environmental security, which includes protecting natural variety and preserving human habitat. The second step is the social and economic assessment of a natural resource (NR), which assumes that, on the one hand, AA is used for economic purposes and, on the other hand, that conflicts between the user of the resource and the populace are avoided. The respect for all laws and other legal actions on AA, water, and other natural media is the third legal framework. Fourth, it involves ongoing monitoring of the state of AA and its constituent parts [3].

Principal Distinctions and Purposes of AA

The primary properties of atmospheric air as a natural and environmental resource its complexity, multifunctionality, and unpredictability in composition and features have been explored in this. Based on these features, it has been suggested to categorize all atmospheric air functions into two categories: raw material functions and non-raw material functions. Five types of functions are separated within these groups: energy, social, chemical and technical, (climatic) bioecological, and landscape formation. Functions have been broken down into 13 sub-classes inside these classes.

AA Usage Structure

Let's look at the AA as NR reasonable usage structure. For social spheres to operate, management of natural resources often entails using natural media resources; in other words, it serves as a conduit of communication between these two megasystems (nature-society). Hence, management of natural resources includes both the preservation of habitat's natural features as well as their use and change to suit the material and spiritual demands of humanity. Keep in mind that the structural peculiarities of natural resource management might take on different shapes depending on the characteristics of the resource. Given the characteristics of atmospheric air, the functional organization of its rational usage seems to us to take the following hierarchical shape. The resource itself atmospheric air should be comprehended at zero level. The next level assumes control of rational usage, which is methodical exercise of targeted societal influence on AA while accounting for its functional potential and ensuring its preservation as a natural resource. A complicated set of legislative measures, directives, instructions, etc. are used to execute control. The next three levels relate to usage[4].

The social, bioecological, raw material, and landscape-forming roles of AA. The atmosphere, along with the biosphere, hydrosphere, pedosphere, and lythosphere, is a lower order system in respect to nature, hence on the second level, functions unrelated to civilization must emerge. They are the functions that keep organisms' essential processes safe and productive. The subsequent, third level is connected to those functions that influence certain types of human economic, biological, and social activities. The most crucial factor is that human activity does not harm the environment, allowing for the maintenance of a high standard of living. Many factors, including bioclimatic indicators, parameters, air quality, etc., may be used to describe a person's quality of life. The fourth level, which comprises all human activities and services directly related to utilizing AA as a raw material, is the last level. These are the procedures related to the burning of different fuel types in transportation and thermal power plants, in that order. Pollution alone has a deleterious influence on the atmosphere at this level. The creation of a complex of air protection measures aimed at eliminating this consequence of the higher levels of usage constitutes the control of the rational use of atmospheric air. Also, the collection of air protection measures that are related to issues with nature conservation must be multiscaled, ranging from global to regional to even microscale, or at the level of individual sources.

DISCUSSION

As long as the Earth's atmosphere survives to shield living things from the harmful effects of cosmic radiation and abrupt temperature changes, life is feasible on the planet. Every aerobic microorganism moves through the air. The phrase "required as air" is used to highlight significance. Although a man may go for weeks without food and days without water, suffocation will kill him in four to five minutes. The most crucial factor for living things is the atmospheric air's comparatively steady composition. The percentages of nitrogen (N2), oxygen (O2), carbon dioxide (C2), argon (Ar), and other noble gases in dry air are respectively 78.3%, 20.95%, 0.033%, and 0.933%.

Up to 4% of the air's entire volume is made up of water vapor. The use of gases by living things and their release into the atmosphere are ongoing activities that maintain the composition of the air. Recent years have seen a shift in the atmosphere's nitrogen balance as a result of human industrial activities. The manufacturing of nitrogen fertilizers now involves a greater amount of nitrogen fixation and incorporation into complicated chemical compounds. Due to the disruption of soil production processes across vast areas, such Western Siberia, its atmospheric input reduces. Yet, since there is such a large quantity of nitrogen in the atmosphere, its balancing issue is not as severe as that of oxygen and carbon dioxide. It is known that the oxygen level of the atmosphere was thousands of times lower than it is now around 3.5–4 million years ago since there was no major source of oxygen-producing green vegetation at that time. The current atmospheric composition of oxygen and carbon dioxide supports the existence of all living things [5].

The natural mechanisms of carbon dioxide and oxygen absorption and atmospheric input are in equilibrium. With the growth of transportation and industry, oxygen is employed in the burning processes. As a result, 10 to 25 percent of the oxygen created by the green vegetation is now used to burn different types of fuel. When desert regions expand and forest, savannah, and steppe habitats shrink, the amount of oxygen entering the atmosphere diminishes. The amount of oxygen produced by aquatic environments decreases as a result of river, lake, sea, and ocean pollution. According to studies, the quantity of oxygen in the atmosphere might decrease by 1/3 from its current level in the next 150–180 years. The production of planning is favourably impacted by a little rise of 2 in the atmosphere. For instance, the amplification of photosynthetic activities caused by carbon dioxide saturation of the greenhouse air enhances vegetable production. Yet, the overall rise in atmospheric CO2 concentration causes complicated worldwide phenomena. Short wave solar energy is readily absorbed by carbon dioxide, however thermal rays emanating from the heated Earth's surface are retained. This phenomenon was known as the greenhouse effect [6].

By 2050, it is predicted that the Earth's temperature would have risen by 1.5 to 4 degrees owing to the greenhouse effect. Burning fuel causes the lower atmosphere to become even more heated. It is particularly noteworthy in the territory of big cities, where the center regions often have temperatures that are 2-4° higher than the region's yearly average temperature. An increase in the lower atmosphere's annual average temperature has the potential to lead to the melting of Greenland and Antarctica's glaciers, which would raise ocean levels globally, submerge lower portions of continents, accelerate tectonic processes, and result in climate change. Air pollution from smoke and dust has the opposite impact.

The Earth's heating is reduced as a result of the mechanical particles' capacity to reflect sun radiation and improve the Earth's albedo. The presence of these processes may cause a sudden cooling, the growth of ice sheets at the poles, and the beginning of an ice age. The Earth's thermal equilibrium is now being researched in an effort to identify strategies to manage it. Both natural and man-made contamination of the atmosphere are possible (or man caused). As volcanoes erupt, rocks are eroded by wind, dust storms, wildfires, and salt crystals are ejected into the sky, naturally polluting the atmosphere [6]. Natural sources do not significantly pollute the atmosphere under normal circumstances. The man-made sources of pollution include home, industrial, and transportation exhausts. The primary sources of pollution are industrial businesses. They release ash, dust, channel black, and unburned fuel particles into the atmosphere. One ton of dust particles fall on one square kilometer every day in industrial zones. The largest sources of fine dust entering the atmosphere are cement factories.

For a very long period, clean air used to disperse local atmospheric pollutants quite quickly. Before, air currents dispersed dust, smoke, and gases, which precipitated on land as rain and snow and were neutralized by coming into contact with natural chemicals. The amount and speed of exhausts now exceeds nature's ability to dissolve and neutralize them. Special actions are thus required to get rid of the harmful air pollution. The primary focus at the moment is preventing pollution from entering the atmosphere. Equipment for gas cleaning and dust collection is available for both existing and new businesses. In this approach, almost 3/4 of all exhausts are stopped. At the moment, efforts are being made to refine them in more complex ways. Another crucial area is the creation and use of non-waste technologies, as well as the construction of industrial complexes that utilize all incoming raw materials and any firm trash. Zero waste solutions are useful because they mimic biological processes, where there is no waste since all biological discharges are used by diverse ecosystem segments. Examples of such technical processes can include closed water and air cycles that prevent exhaust from entering the environment. Modern research has led to the development of the implementation of practices to lessen and avoid pollution from vehicle exhaust emissions. Installation of filters and afterburning devices in car engines, the omission of lead-containing compounds, and traffic management in the streets without frequent changes in engine operation mood all contribute to a partial reduction in pollution. A drastic solution to the issue of automobile-related air pollution is the replacement of internal combustion engines with new ones.

Models for solar, gas turbine, and other engines have also been built. The most promising kind of automobiles are electric vehicles. The current models are not yet ideal; for example, they cannot compete with contemporary motorcars because to their slow speed and limited operating distance between charges. Several regions move from gasoline to new fuels like methane and alcohol to reduce the amount of hazardous compounds in the exhaust fumes of motor vehicles. To reduce air pollution, it is critical to plant vegetation in industrial and urban areas. The plants provide oxygen to the air. Up to 72% of airborne dust particles and 60% of sulfur dioxide may precipitate on shrubs and trees. Hence, compared to open streets and squares, there is hundreds of times less dust in city parks and gardens. Several tree species release phytoncides, which are physiologically active compounds that destroy microorganisms. The microclimate of the city is regulated by greenery, which also absorbs and lessens noise.

The negative consequences of oxygen:

The term "corrosion" refers to the electrochemical degradation of metals. The rusting of iron is the most typical instance of corrosion. Iron can only rust in the presence of water and oxygen gas. Similar to steel, copper and aluminum items likewise corrode gradually in the presence of oxygen.

Oxides are created when oxygen reacts with practically all elements.

Nitrogen

The primary component of proteins is nitrogen. A protein is created when many nitrogen-containing amino acids come together. The body is built from proteins. Proteins make up the majority of the enzymes that serve as catalysts in biochemical processes in the body. These are some of nitrogen's primary uses.Oxygen's action is muted by nitrogen. An increase in the oxygen content in the air would hasten damaging activities including metabolism, combustion, and corrosion. Thus, since nitrogen is present, food oxidation and fuel combustion happen at a moderate pace. Nitrogen molecules are essential to plants because they enable the production of proteins. Humans and animals eat plants for their proteins. Name one protein deficiency condition that affects developing children and remember the roles of proteins.

Dioxide of carbon

Everything has a different level of carbon dioxide in the air which two human activities are to blame for the rise in carbon dioxide levels in the atmosphere.The main applications for carbon dioxide include: During photosynthesis, plants take in carbon dioxide and water vapor from the atmosphere, which they then transform into sugars (carbohydrates) in the presence of chlorophyll and sunshine.

Biological Resources

Classifications several categories are used to categorize natural resources.

Nature's Biotic and Abiotic Resources

The provenance of a resource might be used to categorize it. Both biotic and abiotic origins may be found in natural resources. The biosphere is the source of natural resources with biological origins. Biotic natural resources are those that now are or formerly were alive. Living natural resources include things like trees, animals, and bacteria. Natural resources that are not biologically alive include fossil fuels like coal and oil. Natural resources classified as abiotic are those derived from inorganic, nonliving substances. Abiotic natural resources include minerals, land, water, and air [7], [8].

Natural Resources, both Exhaustible and Inexhaustible

Certain natural resources are thought to be endless. Additional resources may run out or be used. A natural resource that won't run out anytime soon is said to be inexhaustible. There are not many unending resources. Natural resources like sunlight, wind, and geothermal energy are limitless. Natural resources that are limited in supply and can be fully used are said to be exhaustible. Certain naturally occurring resources that are exhaustible are renewable, whereas others are not. Natural Resources

That Are Renewable Resources that can be replenished naturally are renewable natural resources. Fresh water, woods, different types of plants, and animals are a few examples. They are replenishable and reusable. While it may take several years for soil to regenerate, it is nevertheless regarded as a renewable resource. Renewable natural resources may run out if their use outpaces their ability to replenish themselves.

Nonrenewable Natural

Resources Natural resources that are nonrenewable are those that cannot be replenished. Natural resources that are not replenishable include minerals and fossil fuels. While they may be replaced for human use, fossil fuels are regarded as nonrenewable. Natural resources are items that may be found in nature that have economic worth, such as forests, mineral reserves, soil, and fresh water. Natural resources include the elements of air and wind, fossil fuels, minerals, people, soil, sunshine, water, and animals. Climate, the solid earth (lithosphere), water (hydrosphere), and all life on Earth interact to form environmental systems (biosphere). Both biotic and abiotic origins may be found in natural resources. The biosphere is the source of natural resources with biological origins. Certain natural resources are thought to be endless. Additional resources may run out or be used. Resources that can be replenished naturally are renewable natural resources. Natural resources that are nonrenewable are those that cannot be replenished [9]–[11].

CONCLUSION

Let's conclude by offering a few thoughts on the findings from the article. These might be used to solving the issues listed below: - the zoning of various AA manifestations as natural and ecological resources (bioclimate, recreation, wind power generation, etc.) based on physical, geographical, and territorial indicia; - the development of economic mechanisms for the AA evaluation as a whole and by components; - the creation of automated systems for complex assessments of the AA condition while taking human impact on the atmosphere into account.

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CHAPTER 19

NATURAL RESOURCES: SUNLIGHT, SOIL AND WATER

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ABSTRACT:

In this universe, only the planet Earth is conducive to life. Because of how life interacts with the resources the planet offers, life exists. The interplay between living and nonliving resources establishes a balance and maintains both of them. The air we breathe, the water we drink, and the land we dwell on are the three most significant nonliving resources for us. We would not be here without these three resources. We will talk about the significance of soil, water, and air for the survival of living things in this part.

KEYWORDS:

Environment, Renewable Sources, Natural Resources, Non-Renewable Sources.

INTRODUCTION

The biosphere of the planet is home to a wide variety of settings that provide the human race a vast array of products and services. A natural resource is any element of the environment that may be used by humans to further their wellbeing. A natural resource might be a material, an energy source, or a natural phenomena or activity. Natural resources such as land, soil, water, woods, meadows, etc. are essential examples. Some of the resources, like soil and water, are crucial parts of the system that sustains life. Natural resources not only provide humans food, housing, and fodder, but also leisure time, comfort, and even creativity. Humans have been using natural resources since the dawn of civilisation and maybe earlier. Nonetheless, there was no severe depletion since the resources were plentiful at the time compared to the human population. Throughout the previous millennium, there has been a significant growth in human population, which has severely harmed or destroyed natural resources. This chapter will cover the main categories of natural resources, as well as the factors that contribute to their deterioration and conservation [1].

Non-Depletable Resources

On the globe, there exists an infinite number of non-depletable resources. Although certain limitless resources continue to be mostly untouched by human activity, many others may see some quality changes even if their quantity does not. Human activities cannot considerably deplete resources like solar energy, wind energy, tidal power, rainfall, or even atomic energy on a global scale. Human actions may sometimes have a local impact on such resources; for instance, pollution may alter the air's quality.

Non-Renewable Resources

Many of the earth's natural resources are exhaustible, meaning that they have a limited quantity and may be depleted if utilized carelessly. In general, renewable or non-renewable resources are considered to be exhaustible. Sustainable resources biotic resources are mostly replenish able. Such resources' development and reproduction may be effectively controlled such that they continually renew. Yet if the use of these resources continues to outpace their rate of replenishment, not only does their quality suffer, but they may even run out entirely. A few examples of ecosystems and the significant renewable resources they produce include:

(1) Forests, which produce wood and other plant products;

(2) Rangelands, which support grazing animals for the production of milk, meat, and wool;

(3) Wildlife, which maintains the food chain;

(4) Agricultural systems, which produce food and fiber; and

(5) Marine and freshwater systems, which produce a variety of foods from plants and animals. Water and soil are additional renewable resources.

Unrenewable resources Certain biotic resources are non-renewable, meaning that once they are depleted, they cannot be replenished or rebuilt. The term "non-renewable" refers to biological organisms that have developed in nature over the period of millions of years. A biological species that has vanished from the planet cannot be brought back by humans. A lot of abiotic resources are non-renewable as well. Examples include the inability to renew metals and fossil fuels (coal, oil, and gas) after they have been removed. The fossil fuels will undoubtedly run out if they are continuously extracted and used [2].

78% nitrogen, 21% oxygen, and a very minor amount of water vapor and other gases make up the majority of the gases in air. The reason that there is so much oxygen in the air is not because the planet gave us an atmosphere with that composition, but rather because living organisms, including plants, have been making oxygen from carbon dioxide for more than 2 billion years.

Since humans need this oxygen to create energy from the food we consume, the air is necessary for animals to thrive. In turn, the carbon dioxide we exhale is necessary for plants to capture solar energy and convert it into food. The air performs two more crucial tasks: it controls the earth's temperature and generates various weather patterns. The land would be scorched during the day and would be bitterly cold at night without the moderating action of the atmosphere. Every monsoon, the wind's motions bring us rain. Hence, air pollution from hazardous chemical releases may endanger life as we know it and change climate patterns.

Water

The medium of life is referred to as water. There are certain types of life that can survive without air, but all life on Earth depends on water since it serves as a medium for all chemical processes that take place inside living cells. Large bodies of water, including the ocean, seas, rivers, and lakes, may be found. Moreover, it may be found in snow, glaciers, and ice shelves as a solid and as a vapour in the atmosphere.

The seas contain 97% of the world's water, which is too salty for humans to consume. 98% of the 3% of freshwater that is accessible is contained in glaciers and ice. In rivers and lakes, this natural resource is just little present. To comprehend the significance of water as a resource, watch this video. Water, which is really valuable and necessary for human survival, must thus be conserved.

Soil

The earth's upper crust contains the materials necessary for life. Yet, the majority of these are found in rocks, which neither plants nor animals can utilise. Instead, we need them to be broken down into the little pieces we refer to as soil. The soil is created when several geological, climatic, and biological processes break apart rocks. Iron, zinc, nitrogen compounds, and other minerals found in soil are all necessary for maintaining life. Moreover, it stores water so that plants may utilise it. Moreover, ores found in soil may be used to extract metals including iron, copper, gold, and aluminum.

Long-term soil quality is being negatively impacted by modern agricultural practices that use pesticides and fertilizers. Fertile soil is disappearing as a consequence of mining and deforestation. So, it is crucial that we safeguard it. We must stop the creation of pollutants in order to protect our world from contamination of the air, water, and soil. If we don't move quickly, Mother Nature will eventually decide to take action, and then life won't be as easy as it is right now. Watch this video to learn more about how the air and water are being contaminated [3].

DISCUSSION

Oceans cover nearly three-fourths of the planet's surface and hold around 97.5% of the planet's water in highly salinized form. Fresh water makes up the remaining 2.5% of the total, although none of it is directly used by people. 1.97 percent of the fresh water is frozen as glacial or polar ice. The remainder of the freshwater is found as groundwater (0.5%), water in lakes and rivers (0.02%), soil (0.01%), and the atmosphere (0.0001%). As a result, only a tiny portion of fresh water is usable by humans. More so, the geographic distribution of fresh water is inequitable, shifting significantly from nation to nation and even within a nation from one area to another. The ocean surface accounts for around 84% of all global evaporation, and the land surface for 16%. There is barely enough moisture in the air at any one moment to provide 10 days' worth of rainfall. Water moves from the ocean and land into the sky fairly quickly as a result, with an average stay of of around 10 days.

On average, 23% of the world's total rainfall falls on land and 77% of it falls on the sea surface, accounting for 16% of all evaporation to the atmosphere (compared to 84% from this section). A net increase in rainfall of 7% results in an excess of water that is returned to the seas through surface runoff via rivers and subsurface water flows. The hydrological cycle is perfectly balanced on a global scale because yearly precipitation and evaporation total the same amount. usage of water Since 1950, the worldwide water usage has grown by 4-8% year, with national consumption rates varying. Worldwide, only 10% of water is utilized for home and municipal purposes, while the other 70% is used by a variety of businesses, including the cement, mining, pharmaceutical, detergent, and leather industries, among others.

After independence, the amount of water available in India has decreased by two thirds. Major water-using businesses including agricultural, refineries, petrochemical, fertilizers, and chemicals now use 40 times as much water as they formerly did. According to estimates, the amount of water needed for the agricultural industry would double by 2025 compared to what was needed in 1990. By 2025, an estimated 3-fold and 2-fold rise in residential and industrial sectors, respectively. As a consequence, the groundwater table has fallen as a result of excessive water use without enough recharging. In addition, the quality of groundwater has declined as a consequence of pesticide and fertilizer contaminants leaking into the aquifer. Water in all 22 industrialized zones tested unfit for drinking in a 1994 evaluation of groundwater quality at 138 sample sites [4].

Issues with Water Resources

Over 40% of people on earth live in arid or semi-arid areas. These folks put forth a lot of time, effort, and money to get water for home and agricultural purposes. Surface waterways (ponds, lakes, rivers, etc.) are overdrawn in order to supply the requirements of the enormous population. Overuse of surface water may cause the neighboring wetlands to disappear. The ground water may also dry up if more is taken out of it for human use than can be replaced by rain or snowmelt. In semi-arid and dry areas, excessive irrigation may lead to salt buildup in the soil, which can lower agricultural output. Groundwater in coastal places is constantly being depleted, which often causes salty sea water to infiltrate freshwater wells and degrade their water quality. As surface waters are overdrawn, estuaries become more salinized and hence less productive. Rapid runoff from regions with exposed soil is caused by heavy rainfall, especially on mountain slopes. In addition to causing soil erosion, this greatly increases the chance of floods causing harm to lowland regions. Unchecked soil erosion causes streams to become sedimented, which may be detrimental to fisheries [5].

Management and Conservation of Water

The main methods for water conservation are:

(1) Improving irrigation efficiency to decrease agricultural water waste. By using the conventional irrigation technique, less than 50% of the water that is applied to the soil is absorbed by plants; the remainder is wasted.
(2) Recycling used water in business to cut down on water waste.
(3) Building waste water treatment facilities and recycling the purified water to reduce residential water waste.
(4) Harvesting rainwater by using techniques to store rainwater and refuel groundwater.
(5) Watershed conservation and reforestation to boost water economy.

- Building dams and reservoirs to provide a year-round supply of water while also managing flooding and producing energy are some crucial water management strategies to implement in order to offer a sustainable supply of high-quality water.
- Desalination of salty groundwater and ocean water to make it suitable for drinking and other uses. water bodies are diverted (for example, by a canal) to improve the natural water supply to a certain location. Desilting and dredging of water bodies on a regular basis.

Resources for Energy

The exploitation of the majority of energy sources will be necessary to meet the fast growing human population's future energy demands. Energy resources may be broadly categorized as renewable or nonrenewable. Nuclear power and different fossil fuels are examples of non-renewable energy sources. Coal, natural gas, and petroleum products are examples of fossil fuels. The nuclear fission of uranium is the primary source of nuclear energy. The global supply of uranium and fossil fuels is finite and will ultimately run out. There are 17 harmful environmental effects of burning fossil fuels for energy, including global warming, air pollution, acid rain, and oil spills. Reduced usage of nonrenewable energy sources and their replacement with renewable ones are now essential. Natural processes continually replenish renewable energy sources, allowing for their endless usage. Compared to nuclear or fossil fuels, renewable energy typically has a significantly less negative influence on the environment. The production of renewable energy is often more costly than the production of energy from fossil fuels or nuclear power at the moment; but, as technology develops, it is anticipated that the cost of renewable energy will go down. Solar energy is the most significant of the renewable energy sources. Hydropower, wind, geothermal, ocean waves, and tidal energy are some of the various forms of sustainable energy.

Solar Power

Direct or indirect uses of solar energy are possible to promote human happiness. The radiant energy from the sun is known as direct solar energy, while indirect solar energy is energy derived from substances that have already absorbed the sun's radiant energy. Direct heating with solar energy is a possibility, or you might turn the heat into power (thermal electric generation). Direct solar energy is converted into electricity using photovoltaic cells. In order to store and produce energy when solar power is not working at night or on cloudy days, a backup system is needed. Biomass energy is the most significant of the different energy sources where solar energy is indirectly used. Materials that may be linked to photosynthesis, such as living and dried plant matter, freshwater and marine algae, agricultural and forestry waste (such as straw, husks, corn cobs, bark, sawdust, roots, and animal wastes), etc., are sources of biomass energy. Moreover, biodegradable organic wastes from businesses like sugar refineries and breweries are included in biomass. At least 50 percent of the world's population uses biomass as their primary energy source. In rural India, fuel wood still serves as a significant residential energy source.

Burning biomass fuel, which comes in the forms of a solid, liquid, or gas, releases its energy. Wood, charcoal, animal dung, and peat are all examples of solid biomass. Particularly methanol and ethanol, which may be utilized in internal combustion, can be produced from biomass. By using the process of microbial decomposition, biomass, in particular animal waste, may also be transformed into biogas in biogas digesters. Compared to other combustible energy sources, biogas is a clean fuel whose burning emits less pollutants. It is made up of a variety of gases and is simple to store and move. A suitable amount of land and water are needed for the production of biomass for energy. To create biomass, energy plantations of certain plant species with high calorific values and growth rates are grown [6].

Other Forms of Renewable Energy

The following are significant renewable energy sources, albeit their accessibility varies by area. Hydropower: To produce energy, water flowing from a height spins turbines at the base of dams. One-fourth of the world's energy is generated by hydropower, which is often less expensive than electricity from thermal power plants. Nevertheless, constructing a dam to store the water causes a number of environmental issues, such as the flooding of plant and animal habitats and the displacing of people.

(1) **Wind Energy:** The energy from rotating fans caused by the wind may be utilised to create electricity. Nevertheless, only locations that experience relatively constant wind, such as islands, coastal regions, and mountain passes, are suitable for wind energy collecting.
(2) **Tidal Energy:** It is possible to produce power using the difference in water level between high tide and low tide.
(3) **Geothermal Energy:** In geothermal power plants, heated groundwater that is rising as hot water, steam, or hot springs may be utilized to spin turbines and produce electricity.
(4) **Energy from Ocean Waves:** Wind-generated ocean waves have the capacity to operate a turbine and create power.

AREA OF THE LAND

One-fourth of the surface of the planet is made up of land, which is mostly covered by natural grasslands, wetlands, urban and rural man-built communities, and agricultural land. Wetlands are low-lying places with shallow water covering them. Between terrestrial and aquatic regions, there exist wetlands. The earth's top, worn crust—soil—supports plant development. Soil has a crucial role in all land resources. Almost 50% of India's land is thought to be affected by soil degradation.

Sources of Soil

In terrestrial ecosystems, the productivity of all biotic products is influenced by soil fertility. Inorganic and organic substances, air, water, and a diversity of species make up soil. The establishment of soil horizons with various physico-chemical characteristics takes decades or perhaps millennia. International issues like soil erosion and fertility loss are often brought on by human activity.

Erosion of Soil

Erosion is the process by which air and water currents strip top soil from a piece of land. Soil erosion is considerably reduced by an abundance of plant cover. Human activity removes the natural plant cover, which speeds up soil erosion. Every year, millions of tons of topsoil from croplands in India are washed into the ocean by erosion. By moving organic matter and nutrients that are a vital component of the soil, erosion significantly reduces soil fertility. Water quality and aquatic creatures' habitats are impacted by eroded soil that enters streams, rivers, and lakes as sediments [7].

A reduction in Soil Fertility

In addition to losing the organic matter and nutrients gathered in the soil when natural vegetation is removed to create agricultural systems, as has occurred in the majority of India and around the globe. By crop harvest, nutrients are exported from agricultural systems. Consequently, the agricultural soil ultimately loses its fertility over time.

Erosion Damage

The downward and outward movement of slope-forming materials made of natural rocks, soils, manmade fills, or combinations of these elements is referred to as a landslide, a catastrophic occurrence and one of the physical agents of natural disturbance. Any types of sudden mass movements involving either fast flow or sliding are referred to as landslides. During a landslide, the earth's mass may move by falling, sliding, flowing, or by combining any of these three. In tropical and temperate forests, landslides the main natural disturbance occur in regions with heavy rainfall, a weak lithological structure, and steep slopes. Landslides naturally occur due to geomorphological conditions, weathering, climate, lithology, hydrology, and seismic forces. In addition to natural forces, manmade influences have a role in both the direct and indirect causes of landslides.

These problems are caused by humans and include intense farming, significant use of forest resources (deforestation), excessive grazing, poor drainage, and shoddy road building. Landslides cause the self-sustaining soil plant system to become fractured, which often disrupts community structure, disrupts nutrient cycling, and causes losses of soil containing nutrients from the ecosystem. In general, habitat degradation causes a loss of biodiversity, a decline in forest biomass, and a reduction in soil fertility. The degree of the disruption determines how quickly things recover following a landslide. Recovery happens more quickly when the disruption is mild. If the site is disturbed for an extended period of time, recovery is delayed.

Conservation of the Soil

A variety of crop and soil management techniques may lessen soil erosion and nutrient loss in agricultural soils. They include techniques like contour plowing, strip-cropping terraces, organic farming, crop rotation (particularly cereal with legumes), conservation tillage, etc. Conservational tillage, as opposed to conventional tillage, adds crop leftovers to the soil, increasing its organic matter content and enhancing soil moisture and nutrients. Conservation tillage includes both no-tillage and reduced tillage. Two processes are required to rehabilitate erosion-affected soils: stabilizing the soil to stop additional erosion, and restoring the fertility of the soil. In order to stabilize the soil, bare land must be seeded with tough plants, including drought-tolerant grasses. These plants gradually cover the land with vegetation to stop additional soil erosion. The organic matter, nutritional, and moisture contents of the soil increase with increasing additions of detritus. It takes time to get soil fertility back to its previous level. Enhancing soil fertility may be achieved by using biofertilizers. Many organic farming practices that enhance the amount of organic matter added to the soil over time improve its fertility [8].

Individuals' contributions to Resource Conservation

People in economically developed and poor nations use resources in very different ways. People in industrialized nations have higher resource demands than are required for a fair standard of living because they aspire to a higher quality of life. As a result, they deplete resources and adversely harm the ecosystem. On the other hand, owing to their simpler subsistence-level living, people in developing nations have less need for resources. Yet, their population explosion, combined with a lack of environmental knowledge and a rising desire to quickly improve living circumstances, results in careless resource degradation. The consumerism-based resource usage pattern popular in western nations is quickly catching on in underdeveloped nations. India is a distinctive nation with a wide range of climatic conditions, as well as a diverse population of flora and wildlife. Human communities in our nation have developed in beautiful environs, and we have a cultural ethos that values nature. The Upanishads and Vedic literature of our ancestors are rich in ecological and environmental ideals. The Atharva-Veda profoundly acknowledges the human race's ongoing fidelity to Mother Earth. The Isho-Upanishad has the following stanza: "The entire cosmos and all of its creatures belong to the Lord (Nature)... No species may infringe upon the rights or privileges of any other species. Giving up greed allows one to appreciate nature. It has always been stressed to take exactly what we absolutely need from the natural world and nothing more in order to live in peace with it. Earth's primary resources are known as "Khsiti" (soil), "Jal" (water), "Pavan" (energy), "Gagan" (space), and "Samira" (air). All living things, including humans, are fundamentally a part of nature, giving back all the food that we have taken from Mother Earth [9], [10].

CONCLUSION

The concept that resources shouldn't be utilized carelessly but rather should be preserved is prevalent throughout our ancient literature. For instance, the renowned work Arthshashtra by Kautilya details what can be regarded as the first forest conservation and wildlife management program in history. Modern Mauryan Rulers maintained forests for a variety of uses, including hunting, domesticating elephants, and maintaining forests as reserves. The Indian people have used nature throughout history rather than exploiting it. For over 10,000 years, humanity and agriculture have had an impact on our nation. Thankfully for us, the rate of resource depletion has not been commensurate with the length of human existence. This has mostly been caused by the Ahimsa puromo dharma principle and the compassion for both living and non-living things that are deeply established in our culture. These ideas must be taken into account while controlling resource utilization. Our resource use should be optimized based on our cultural background and traditions. Recognizing our duty to protect the planet's resources for future generations.

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CHAPTER 20

THE CONTROL OF NATURAL RESOURCES

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ABSTRACT:

Natural resource management (NRM) is the practice of managing natural resources, such as land, water, soil, plants, and animals, with an emphasis on how such management impacts both current and future generations' quality of life (stewardship). The management of human and natural landscape interactions is a function of natural resource management. It combines the management of natural heritage, land use planning, water management, biodiversity protection, and the long-term viability of sectors including forestry, mining, agriculture, and tourism. It acknowledges that people and their means of subsistence depend on the productivity and health of our landscapes, and that their stewardship of the land is essential to preserving this productivity and health.

KEYWORDS:

Environment, Natural Resource, Environment, Management.

INTRODUCTION

The management of natural resources primarily focuses on a scientific and technological knowledge of resources, ecology, and the ability of such resources to maintain life. Managing the environment is analogous to managing natural resources. The sociology of natural resources is closely connected to, but separate from, natural resource management in academic settings. The focus on sustainability may be linked to the campaign for resource conservation at the same time as early efforts to comprehend the biological makeup of North American rangelands in the late 19th century. The realization that preservationist conservation tactics had not been successful in slowing the depletion of natural resources led to the development of this form of study in the 20th century. A more comprehensive strategy was adopted in recognition of the social, cultural, economic, and political dimensions of resource management that are linked. The Brundtland Commission and the promotion of sustainable development led to the establishment of a more comprehensive, national, and even global form [1]. In an effort to increase practice uniformity and use an adaptive management strategy as its foundation, the government of New South Wales, Australia, published a Standard for Quality Natural Resource Management in 2005.

Ownership systems

Natural resource management strategies may be categorized based on the kind of stakeholder and their rights.

- State-owned property: The state is in charge of ownership and management of resource utilization. The resources may be used by individuals or organisations, but only with the state's consent. Examples from the US include national forests, national parks, and military reserves.

- Private property is any real estate held by a specific person or business. The owner is responsible for both the resources' benefits and obligations (s). The most typical example is private land.
- Shared property: It is a group's personal property. The group may vary in size, composition, and internal organization, for example, native village neighbors. Community woodlands are one kind of common property.
- Non-property (open access): Some properties don't have a clear owner. It is equally open to use by any prospective user. The most overused places are those. Nobody's property is everyone's, according to a proverb. A lake fishery is one example. Common land may exist without any owners, in which case it is owned by the local government in the UK.
- Hybrid: Since many ownership regimes regulating natural resources will include elements of many of the foregoing regimes, natural resource managers must take hybrid regimes into account. Native vegetation management in NSW, Australia, a region where law acknowledges the public's interest in the preservation of native vegetation but where the majority of native vegetation is found on private property, is an example of such a hybrid [2].

Stakeholder Evaluation

Stakeholder analysis has become more popular in natural resource management and was originally used in business management methods. Natural resource management stakeholder analysis highlights diverse interest groups impacted by the use and protection of natural resources. As seen in the table below, a stakeholder has no clear-cut definition. Particularly in the management of natural resources, where it may be difficult to ascertain who has a stake since this can vary depending on each possible stakeholder.

DISCUSSION

Problems with natural resource management are naturally complicated and divisive. These first concern biological cycles, hydrological cycles, climate, flora, fauna, and topography, among other things. They are all dynamic and connected. A modification in one of them might have long-lasting, far-reaching, and even irreversible effects. Second, managers must take into account a variety of stakeholders and their interests, policies, politics, geographical borders, and economic ramifications in addition to the complexity of natural systems. It is difficult to completely meet every need at once. Hence, natural resource management is often a difficult issue due to the scientific complexity and the varied interests [3].

Most countries adopted new guidelines for the integrated management of land, water, and forests after the 1992 United Nations Conference on Environment and Development (UNCED), which was held in Rio de Janeiro. All programs have identical objectives while having different names from country to country. Top-down (command and control) natural resource management, community-based natural resource management, adaptive management, the precautionary approach, integrated natural resource management, and ecosystem management are some of the several methodologies used.

Management of natural resources at the Local Level

The goal of community-based natural resource management (CBNRM) is to provide economic advantages for rural communities while pursuing conservation goals. The three main presumptions are that locals are better equipped to protect natural resources, people will only protect a resource if the benefits outweigh the costs, and people will protect a resource that is directly related to their standard of living. As a community's standard of living improves, so do its efforts and dedication to ensuring the resource's continued health. The subsidiarity concept also forms the foundation of regional and community-based natural resource management. In the Convention on Biodiversity and the Convention to Prevent Desertification, the United Nations promotes CBNRM. Local communities may race to exploit natural resources while they still have the chance if decentralized NRM is not clearly defined, as is the case with the forest communities in central Kalimantan (Indonesia)[4].

The challenge of balancing and harmonizing the goals of socioeconomic development, biodiversity conservation, and sustainable resource use is a challenge for CBNRM. The idea and competing goals of CBNRM demonstrate how the motivations for involvement may be classified as either planner- or people-centered (active or participatory outcomes that are actually empowering) (nominal and results in passive recipients). The effectiveness of community-based NRM depends on an understanding of power dynamics. Locals could be hesitant to disagree with government suggestions out of concern that they won't get promised advantages.

CBNRM is primarily based on advocacy by nongovernmental organizations working with local groups and communities, on the one hand, and national and transnational organizations, on the other, to build and extend new versions of environmental and social advocacy that link social justice and environmental management agendas. Both direct and indirect benefits, such as a share of revenues, employment, diversification of livelihoods, increased pride and dignity, have been observed. The triumphs and failures of CBNRM initiatives in terms of the environment and society have been recorded. When notions of community, territory, conservation, and indigenous are included into politically diverse plans and activities in distant locales, CBNRM has posed new obstacles. Strategies for handling conflict in CBNRM successfully are covered by Warner and Jones. The Australian Government's Caring for Country Program recognizes the ability of Indigenous communities to protect natural resources. The Australian Government Departments of Agriculture, Fisheries, and Forestry and the Department of the Environment, Water, Heritage, and the Arts work together to run the project Caring for our Country. The Australian Government's environmental and sustainable agricultural initiatives, which have historically been collectively referred to as "natural resource management," are jointly delivered by these Departments. Regional communities have been effectively given the opportunity to choose the natural resource priorities for their areas via the successful regional delivery of these programs through 56 State government agencies.

More generally, a research study conducted in Tanzania and the Pacific examined the factors that influence why communities embrace CBNRMs and discovered that the particular CBNRM program, the community that has chosen the program, and the larger social-ecological setting all play a role [5]. Overall, nevertheless, program uptake seemed to reflect the relative benefit of CBNRM initiatives to neighborhood people and their availability to outside technical support. While CBNRM has faced socioeconomic criticism in Africa, it has been consistently shown in Tanzania that it is ecologically successful as evaluated by animal population numbers. Delivering community-based or regional natural resource management is seen as requiring careful consideration of governance. The Natural Resources Commission (NRC), which is in charge of conducting audits of the efficacy of regional natural resource management programs, is in charge of overseeing the 13 catchment management authority (CMAs) in the State of New South Wales.

Gender-Based Management of Natural Resources

Gender and social capital have an influence on community-based natural resource management (CBNRM), which includes conservation efforts and staff-community partnerships. Ben

Siegelman conducted three months of participant observation at a fishing camp in San Evaristo, Mexico, where he discovered that the fishermen establish confidence through making up stories and jokes. He places a strong emphasis on the idea of social capital as a process since it is created and amassed via adherence to complex social rules. According to Siegelman, fun humor often excludes women and is associated with masculinity. He emphasizes that social capital and gender are both performed. The gendered network of fishermen in San Evaristo also functions as a social network. Most families of San Evaristo have been there for many generations, and almost all of the fisherman are males. Males develop close connections by working together for 14 hours a day, while women spend their free time caring for the family and the home. Among the fisherman, Siegelman notices three types of lies: exaggerations, deceptions, and jokes. For instance, a fisherman could overstate his success at a certain location to deceive acquaintances, put his hand on the scale to make more money, or use a sexual joke to get someone's admiration. According to Siegelman, "lies generate trust." According to Siegelman, the reason this division of labor persisted had something to do with the fact that the culture of deception and trust was a particularly male activity practiced by fishermen. Conservationists were excluded from this social structure in a manner similar to how the culture of lying removed women from the social realm of fishing. As a result, they were unable to build the trust necessary to carry out their mission of regulating fishing methods. Being outsiders, conservationists—even men—were unable to live up to the fishermen's concept of what it means to be a "trustworthy" man and persuade them to adopt or take part in conservation measures. The researcher once humorously answered a fisherman's question about where the others were fishing that day, "in the sea," when he was asked. He gained his trust through the evasive answer. This kind of social capital excludes women since so many jokes focus on "male adventures."

Modeling and Frameworks

To help with natural resource management, several frameworks and computer models have been created.

Systems for Geographic Information (GIS)

GIS is a potent analytical tool because it can overlay information to find connections. The interaction of rainfall, cleared land, and erosion may guide a plan for bush regeneration. Data about Australian natural resources including vegetation, fisheries, soils, and water are available through metadata directories like NDAR in Australia. The possibility of subjective input and data tampering places restrictions on these [6].

Frameworks for Natural Resources Management Audits

To help with the formation of a performance audit role in the administration of regional natural resource management, the NSW Government in Australia released an audit framework for managing natural resources. The performance audit, environmental audit, and internal audit are all foundational components of this audit methodology. Audits conducted utilizing this approach have given stakeholders confidence, pointed out areas for improvement, and articulated broad public policy expectations.

The Australian Government has devised a structure that closely complies with the Australian Guidelines for Assurance Engagements for auditing greenhouse gas emissions and energy reporting. A framework for auditing water management is presently being developed by the Australian government, with a particular emphasis on the Murray Darling Basin Plan's implementation.

Additional Components

Conserving Biodiversity

Conservation of biodiversity is seen as a crucial aspect of managing natural resources. Describe biodiversity. The term "biodiversity" refers to a broad notion that describes the breadth of natural diversity. According to Gaston and Spicer (p. 3), biodiversity refers to various forms of "biodiversity organization" and is defined as "the variety of life". According to Gray (p. 154), the United Nations proposed the first widely accepted definition of biodiversity in 1992, incorporating several facets of biological variety.

Management of the Biodiversity with Caution

The "threats" decimating biodiversity include "foreign species" invasion, "climate change," habitat fragmentation, which strains already-stressed biological resources, forest degradation, and deforestation (p. 2). Environmentalists and the general public have begun to pay more attention to these dangers, therefore the precautionary management of biodiversity is now a crucial aspect of natural resource management. According to Cooney, there are tangible steps that may be taken to maintain biodiversity in a preventative manner while managing natural resources [7].

Real-world "policy tools"

Cooney contends that "evidences," a "high standard of proof," the prohibition of certain "activities," and "information and monitoring requirements" are all necessary for policymaking. Categorized evidence is required before using the precautionary principle. When "activities" pose a serious and "irreversible" risk to public safety, such "activities" should be outlawed. For instance, the South Africa Marine Living Resources Act issued a number of laws outlawing the use of explosives and toxicants to "capture fish" because of the catastrophic effects that would result for the environment and human health.

Administrative procedures and rules

According to Cooney, there are four methods to manage the precaution of biodiversity in natural resources management;

1. "Ecosystem-based management" including "more risk-averse and precautionary management", where "given prevailing uncertainty regarding ecosystem structure, function, and inter-specific interactions, precaution demands an ecosystem rather than single-species approach to management"[8].
2. "Adaptive management" is an approach to management that specifically addresses the dynamic and unpredictability of complex systems.
3. Notwithstanding its flaws, "environmental impact assessment" and exposure ratings reduce the "uncertainties" of precaution.
4. "Protectionist methods," which "most usually connects to" the preservation of biodiversity in the management of natural resources.

Management of Land

Understanding and using suitable management techniques is crucial for maintaining a sustainable ecosystem. Young emphasizes a few crucial aspects of land management for understanding:

- Understanding natural processes, such as those involving ecosystems, water, and soils
- Using proper management techniques and adjusting them to local circumstances
- Collaboration between locals with skills and expertise and scientists with knowledge and resources

According to Dale et alresearch .'s from 2000, there are five essential ecological principles that may be used by land managers and others who require them. The time, location, species, disturbance, and terrain are all related to the ecological principles, and they all interact in various ways. The term "management of natural resources" refers to all actions involving both renewable and non-renewable energy sources. To keep the ecosystem in balance, it is crucial to control these sources. Let's examine the justifications for why natural resource management is essential.

Mother Earth has given us a variety of energy sources. To maintain the many living forms on our planet, we require energy. We get many types of energy from various sources. The primary sources of energy for our everyday activities are the natural resources that are found on our planet. These natural resources aren't entirely renewable, however. Hence, managing natural resources is necessary to guarantee optimal use of each of these resources and prevent any from being exhausted. Let's find out more about how to manage natural resources. Managing the natural resources at our disposal is crucial. We must manage our resources for the following reasons.

- To keep the ecosystem in balance, natural resources must be managed. The environment's many elements are interconnected. This equilibrium will be upset by an imbalance brought on by the over use of these resources, having an impact on all types of living forms that are either directly or indirectly tied to it.
- Maintaining balanced strain on several energy sources minimizes overdependence on any one source. In the past, coal and petroleum were the main sources of energy for people's labor and technologies. Nevertheless, both of these sources are non-renewable and, as a result of their use, produce a number of hazardous compounds and pollutants. Current trends indicate a transition away from non-renewable sources and toward renewable ones, such solar and hydropower.
- We must permit the utilization of these resources by future generations. No resource should be used excessively to the point of depletion. By doing this, we are denying such energy sources to the next generation.

The need of managing and Conserving Natural Resources

We should protect the natural resources that we utilize every day for good reasons. To support this claim, let's examine the following issues.

- The usage of natural resources is the basis of the majority of our operations. These materials come from many sources. Our resources make up a substantial portion of the non-renewable category, making it challenging to restore them after usage.
- The efficient utilization of all resources is made possible by the rational distribution of pressure. Solar and hydropower are two examples of renewable energy sources that need increased pressure. Also, this action will ease the strain on non-renewable resources. Moreover, this management may also be used to regulate other types of pollutants [9].

Let's now talk about some crucial measures to address the problems with waste management in the form of the three Rs:

The Waste Management Three R's

Resource management and waste management are synonymous terms. This is due to the fact that both garbage creation and waste management need resources. It is crucial to follow the three Rs of trash management—Reduce, Reuse, and Recycling—to avoid using excessive amounts of resources for garbage management. Let's examine each of them in further depth.

1. **Cut back**

Minimize the need for wise product usage, administration, and acquisition. It is founded on the idea that if we don't consume resources, we won't generate as much trash. The most effective strategy to reduce our consumption is to:

- Avoid using throwaway items like paper plates and cups and plastic straws and switch to reusable ones.
- Examining the product's durability and choosing the higher-quality options.
- Stop using plastics and switch to cloth-based items in their stead.

2. **Reuse**

Using things that have already been used is known as reuse. Both economically and ecologically beneficial, such a move will be. The greatest ways to reuse are to: • Reuse paper and plastic bags for various needs.

- Donate used clothing, books, furniture, electronics, etc.
- Use common home objects over and again.

3. **Reuse**

Recycling is the process through which discarded items are changed into new items with a variety of uses. For instance, people may utilize several DIY techniques to transform plastic bottles into domestic items like planter pots [10].

- Create newspaper bags using the recycled paper goods.
- Buying things that have been recycled and can be recycled again.

Natural Resource Management Techniques

Natural resources include oxygen, water, sunshine, coal, petroleum, and natural gas as well as other fossil fuels and oils. Humans often use these resources for economic benefit. Certain resources have the capacity to be renewed, whereas others cannot. As nature provides for our most fundamental necessities for survival, it is our duty as humans to preserve, protect, and care for it. Let's talk about what part we can play in the conservation and management of natural resources.

The techniques for managing natural resources are as follows:

- Upkeep and improvement of water resources;
- Sustainable management of land resources

Enhancing skills, capacity, and engagement; preserving and restoring the marine and coastal environment; conserving and recovering biodiversity; making efficient use of alternative energy sources like wind and solar energy; planting trees to prevent soil erosion; and conserving water in our homes by using judicious practices.

- Transporting oil via pipelines, since oil spills have a severe negative impact on aquatic life.
- Collecting rainwater is another crucial activity to guarantee water conservation, as is the proper treatment of sewage and industrial wastes prior to their release into water bodies.

Degradation of the Environment

One third of the earth is badly degraded, and 24 million tonnes of fertile soil are lost each year. Poor agricultural practices including intensive tilling, several successive harvests, and overuse of agrochemicals also contribute to the destruction of natural resources.

Management of Natural Resources in Environmental Planning

Natural resources management is a component of environmental planning that takes community objectives at the regional and local levels into account while protecting environmental resources. The proposed projects' overall effects on the neighborhood, including their effects on the environment, society, and economy, are considered. While drafting a proposal for a new project site, these resources must be taken into account since natural resources management places a strong emphasis on conserving our environmental resources. This will help to reduce the effect as much as possible [11], [12].

The management of natural resources may facilitate quicker and more affordable project approvals. Biological surveys and assessments, Clean Water Act compliance, construction monitoring and reporting, Endangered Species Act compliance, endangered species surveys, habitat characterizations, mapping, and impact analyses, habitat conservation plans, mitigation and restoration plans, mitigation monitoring and reporting, and overall compliance with habitat mitigation and monitoring plans for pre- and post-construction plan elements may be included.

CONCLUSION

There are both renewable and nonrenewable natural resources in your immediate environment. Nonrenewable resources are those that cannot be maintained at the same rate at which they are being utilized. Renewable resources may be naturally recovered over time. Hence, let's take action to limit the deterioration of natural resources and also adhere to the conservation measures.

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CHAPTER 21

NATURAL RESOURCES AND AQUACULTURE

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ABSTRACT:

A significant activity that has had a significant impact on how people and animals interact is fishing. Aquatic creatures have been hunted for a variety of uses, including food production, medical treatment, and recreational pursuits, sustaining several economies all over the globe. Fish, mollusks, crabs, and other species are caught on a wide range of sizes, from artisanal subsistence fishing to high-tech industrial fleets. Concerns concerning the depletion and/or collapse of some populations have been raised recently as a result of overfishing. This chapter focuses on the significance of fisheries and their contribution to human progress, taking into account historical factors, the primary uses of the species under study, and the techniques used to catch them, some of which include the employment of animals.

KEYWORDS:

Aquaculture, Environment, Fishery Resources, Natural Resources, Management.

INTRODUCTION

Throughout the beginning of time, humans have incorporated the capture of aquatic creatures into their culture and conduct. For shelter and food, hominins used to reside in coastal regions or along the banks of rivers, lakes, and lagoons. Through time, they became better at managing natural resources. Fishing was originally used as a means of obtaining food, then it was used subsequently for healing and the manufacture of tools, becoming a part of the lifestyle and culture of the first hominins. Fishing was predominantly done by hominins in lakes, rivers, mangroves, and estuaries with calm waters. Techniques that developed along with preparation, conservation, and navigational abilities were used to catch fish, mollusks, crabs, turtles, sirenians, and other aquatic species. Fishing evolved from its original subsistence function and, with the rise of human civilizations, into a significant commercial endeavor.

The early elites of the Egyptian and Roman civilizations ruled it via a system of slavery in which slaves carried out the captures. The Phoenicians were regarded as famous merchants who also made their living mostly from fishing and maritime commerce. Large mounds of shells suggest that the manufacturing of the purple dye was a significant industry. In fact, one of the most sought-after goods in Phoenician marketplaces, the purple dye, was derived from purple dye murex gastropods, which were gathered on coastal locations. Thus, fishing resources were exploited as a negotiating chip in business transactions. Moreover, the acquisition of new targeted creatures, such cetaceans, followed the exploration of additional aquatic areas, including the open ocean. Eventually, the capitalist system now includes fishing as one of its most significant economic activity [1].

Despite its present commercial focus, fishing is still done for pleasure, leisure, and sustenance. Yet, owing to overfishing or the capture of more animals than a population can naturally replenish via reproduction, commercial fisheries stand out as the main cause of various socioeconomic difficulties. Since 1970, overfishing of aquatic life has caused a crisis in the fishing industry, with some species becoming extinct economically and endangering the livelihood of individuals who rely on fishing either directly or indirectly.

Apart from the effects of overfishing, a number of societal problems associated with continued population growth and coastal development have also contributed to the deterioration of aquatic habitats and the loss of biodiversity. Fishing may be impacted by a number of challenges to aquatic habitats. For instance, destruction of mangrove and riparian forests, changes in the dynamics of sediment in coastal regions, degradation brought on by tourism, an increase in boat traffic, invasive species, and, from a global viewpoint, climate change. Our most recent publication, "Natural Resources Used for Aquaculture," addressed this issue.

Environment, Resource Use, and Aquaculture

The natural resources that are used to produce seafood via aquaculture, explores the relative effect of aquaculture in relation to other food production methods, and offers opinions from the industry and from environmental non-governmental groups. Together with its drawbacks, aquaculture has positive and bad effects. Basically, we tried to illustrate the larger discussion around aquaculture's environmental sustainability in terms of the availability and usage of natural resources [2].

Our earth has limited natural resources. As of right now, we as humans are devouring these natural resources at a ratio of 1.5:1, which means that our activities are outpacing the Earth's ability to regenerate. In essence, we pay off our obligations by using interest and a portion of our principle. This would be a perfect example of something that cannot be sustained. The aquaculture business does not need to bear the full load, and in certain circumstances it makes excellent use of available natural resources. There are plenty of concrete examples close to home for the aquaculture industry, but where is the best site with sufficient water availability and quality to practice aquaculture in the future? How many more pelagic fish can we get from the seas to generate the fish meal and oil required for aquaculture of carnivorous animals? As the price of fossil fuels rises, how will we power aerators, pumps, make feed, and process goods? This is not intended to be a doomsday prophecy, but rather a call to halt, step back from the minutiae of our daily lives, and examine our global food system holistically in order to assess aquaculture's position and performance relative to other industries.

In our book, we make the observation that aquaculture is more resource-efficient than several alternative sources of animal protein. Recently, there have been rumors that Tyson may stop using human antibiotics in chicken rearing. With the exception of individuals who use them illegally, the aquaculture business would not allow the mere notion of utilizing these medications. A comparative benefit of aquaculture over conventional agriculture is that it uses a three-dimensional medium, water. The depth dimension enables great production in aquaculture per unit of land. In certain cases, aquaculture may be conducted entirely in aquatic bodies, with the exception of land used to produce feed.

Naturally, some of the most widely cultivated species in aquaculture are carnivores, and a large portion of the present commercial research and development focuses on cultivating the most carnivorous species, such tuna and grouper. So, until a substitute is found, there will be a reliance on wild fish, and aquaculture in these industries will either be constrained by the availability of this resource or contribute to overfishing of populations [3].

There was a great deal of worry about the human rights abuses committed by fishermen to provide the raw ingredients for shrimp aquaculture feeds at a recent conference of feed makers, retailers, and eNGOs in Asia. It's interesting to note that those who argue that the aquaculture sector won't have a negative impact on reduction fisheries because the market for fish meal will maintain some sort of homeostasis with harvests never took into account the use of forced and bonded labor to offset the increased effort required to keep capturing fish from a depleted system. One might see the expressions on the feed producers' faces as they were forced to sit and listen beside foreign merchants while the fishing captains freely described how to load migrant boats with debt. The danger of depending on wild fish no longer only lies in the possibility of stock overexploitation. In the book, we go into further depth on the dependence on wild fish as well as difficulties with land conversion, water usage, biodiversity loss, energy use and consumption, etc. Although the aquaculture sector should assess how it stacks up against other food production systems, regardless of how it stacks up against cows, chickens, or pigs, it also has to look internally at how it can become more efficient. The industry is making a lot of effort to do that. Of course, some people take longer to realize that they need to become better. In the end, these individuals damage the reputation of the larger aquaculture industry as a whole.

Resources for Fishing, Fisheries, and System Complexity

The populations of animals and plants that are utilized by humans, particularly for food, to make fishmeal for animal husbandry, aquaculture goods, as well as numerous crafts and decorations, constitute the resources of the fishing industry. Throughout the marine environment, complex biotic and abiotic interactions produce and sustain the populations of aquatic creatures. Their texture and development are influenced by a variety of ecosystem-level selecting variables (hydrographic conditions, productivity, predation, etc.), as well as human actions during the last 200 years, particularly fishing. Hence, important activities impacting population patterns and communities of creatures in the natural system, which is regulated by the rules of biological evolution, are brought about by a single species, man. This fact quickly demonstrates how the social and economic features of human groups interact with the ecological dimensions of natural systems [4].

One of humankind's first occupations, fishing is the gathering or capturing of wild species from the oceans, seas, and inland waterways (lakes, rivers, streams, etc.). Fishing is a significant economic activity that provides food from the sea and thereby creates employment for those involved in the entire supply chain, from the building of vessels and equipment supplies to the marketing of products. This includes not only the fishermen who directly collect the food (fish, crustaceans, and molluscs). Fishing is therefore one of those human activities that also involves economical (people involved in the industry), technical (boats, engines, equipment, etc.), political, and administrative considerations. The majority of the organisms used in fisheries are part of food chains, with tiny algae serving as the initial link. Their spread is limited by the availability of light, which is generally within the first 200 meters of depth. The primary productivity of phytoplankton is influenced by the availability of nutrients (nitrogen, phosphorus, iron, etc.), as well as certain secondary energy sources, in addition to light (upwelling currents, tidal flows, etc.). According to estimates by Pauly and Christensen (1995), 8% of the world's primary marine production, or, in other words, the portion of primary productivity that is converted into human food, sustains worldwide fishing. This proportion rises in coastal regions and places with increasing currents (between 24 and 35%) and decreases in the open ocean (around 2%) to corroborate the greater productivity of these latter environmental systems in terms of resources used by humans.

The study of fishery resources entails a significant increase in the complexity typically seen in ecological studies of the relationship and interaction between the parties (living forms as well as physical, chemical, and biological factors, climatic conditions, etc.), which determines a particular and unrepeatable scenario. The integration of several scientific disciplines is necessary for the investigation of relationships and linkages between natural events on various space-time scales. When it comes to managing fishery resources, the social and economic sciences are crucial [5].

Management of Fisheries Resources: Balancing Ecology and Economics

In fact, fish stocks were thought to be inexhaustible and that all that was required to gather a larger amount was to spend more time and develop the tools used in their acquisition, or to increase the so-called "fishing effort." Mankind could not even begin to imagine that our actions could lead to the depletion or even the extinction of exploited populations before the nineteenth century. In actuality, while aquatic species populations are replenishable, they are not endless. The term "stock" refers to the portion of the population that is exploitable and is characterized by its own dynamics relating to the recruitment of new people, their growth, and individual death rates. This latter is true both in terms of nature and how it relates to the way that fisheries catch people (fishing mortality). Generally speaking, rather than increased resource availability in the sea, the rise in catches sometimes seen in certain places may be attributed to the expansion of the fleet and advancements in fishing technique. According to the most recent data, there were 158 million tonnes of output in the globe in 2012, of which 91 million tonnes came from fisheries' catches and 67 million tonnes from aquaculture (FAO 2014). The collapse of one or more resources in the distribution zones might be caused by the fishing effort being maintained at high levels. Almost 70% of fish populations worldwide are being completely exploited, 20% are overexploited, and just 10% are being underexploited by fishing (FAO 2014).

Resources are overfished in an unmanaged fishery in both a biological and financial sense. In terms of bio-ecology, over-exploitation of resources may result in the decline of populations of many species, including those incidentally captured along with the target species that are of interest to fishing activities but have little to no economic worth. Finding a level of exploitation that might provide the largest yield by weight over the long term, or maximum sustainable yield, has been the major goal of fisheries management (MSY). Parallel to this, achieving maximum sustainable economic performance, or MSE, is the primary goal in terms of economics. In light of the many fisheries concerns, management goals at the moment extend beyond the conservation of specific stocks impacted by fishing to include the protection and preservation of species and the marine environment in order to ensure both economic viability and the maintenance of employment [6].

DISCUSSION

Materials from Fishing and Their Uses

A wide range of creatures that are caught by humans and mostly inhabit watery environments are referred to as "fishery resources" in general. In spite of the fact that only fish and crustaceans are measured in fisheries statistics, invertebrates and vertebrates are thus regarded as fishery resources. Despite having a variety of fishing options, fish have by far been the most often sought species. The fact that these creatures have been used as a source of food since the middle Ages has actually increased the significance of their commercialization. They are crucial to the economies of various coastal communities in the North Sea and the English Channel, for example. Also, throughout the years, fisheries output has increased in response to rising demand, a rise in the number of fishermen, and advancements in fisheries technology [7].

Fishing Supplies

Fishing resources include target species stocks and their habitat. Gordon, who put up a beautiful theory of rent dissipation along just the biomass and productivity margins of a fish population, really went into considerable depth about a number of characteristics of fisheries resources. The availability of the nutritional salts that serve as the cornerstone of marine food chains is maintained by the constant mixing of cold water, where demersal fishes reside and eat. The fish from various banks may sometimes be distinguished from one another morphologically. This fact is significant because it means that each fishing ground may be thought of as distinct in the same way that a piece of land can be, having at least one feature that no other piece has, namely location. The fish, sea bottom, and water were also used as collective terms for fishing resources by Cheung, whose fundamental work was heavily mentioned above.

Fishing resources come in a variety of biological, chemical, and physical forms, and they may be further classified according to their quantity, quality, and relationship characteristics. A species of fish, for instance, may be classified according to its stocks, biomass, population, structure, geographic location, size, gene pool, disease, dynamics, and cohabitation with other species, food, habitat needs, and other factors. Several life phases, cohorts, or even individual fish may be described using many of the same characteristics. One may begin to understand the breadth of characteristics related with fishing resources when one multiplies this list by the significant number of finfish and shellfish species that fishermen have successfully caught, such as more than 200 in the Northeast Area of the United States.

The literature on property rights makes mention of the enormous costs of enforcing ownership rights over substantial fish populations, particularly those belonging to fugitive species like tunas that travel far. Unfortunately, it is impossible to estimate the amount of data and other transaction costs necessary to first properly characterize each characteristic of a fish population and its habitat for property rights. Whichever kind of governance is in place, we should anticipate that certain characteristics of fishing resources will be in the public domain, where their value may be lost [8].

Relational qualities, such as gear disputes, bycatch, habitat damage, and predation, appear as spillovers in many ways, adding to the high costs of designating fishing resources for property rights. Competition over the non-exclusive spatial characteristic of fisheries resources leads to disputes over gear. Mobile trawl and dredge gear may damage fixed gear, such as pots, gillnets, and longlines. This dispute first emerged in New England and the Pacific Northwest in the late 19th century when coastal trap and weir fishermen began to outperform fish wheels and in-river traps on a comparable basis.

"The unexpected capture or death of live marine resources as a consequence of a direct interaction with fishing gear" is referred to as bycatch. It is a challenging idea because it brings together disparate issues like ineffective technological or gear choices, de facto harvest rights claims in competitive fisheries, and purely accidental catches of unprofitable "trash" fish and protected species like marine mammals, threatened or endangered species, and seabirds. According to Alverson et al., one-quarter of the world's entire commercial catch is discarded.

The main trawl, gillnet, dredge, and seine fishing methods are only minimally specialized to capture the necessary sizes and numbers of target species, with certain exceptions, such as speargun and harpoon. Just approximately half of the captures by groundfish trawl, sink gillnet, and scallop dredge boats in the Northeastern United States during voyages to Georges Bank in the 1990s were made up of conventional target species. The Gulf of Maine sink gillnet fishery takes protected species including the harbor porpoise (Phocoena phocoena) and the endangered right whale (Eubalaena glacialis), while the Atlantic swordfish (Xiphias gladius) and tuna (Thunnus spp.) pelagic longline fishery takes leatherback and green sea turtles.

Since they may be modified to employ alternative gear based on relative prices, costs, and biomass levels, vessels are also only minimally specialized. For instance, several boats in the Gulf of Maine engage in seasonal groundfish, Northern shrimp, and Atlantic sea scallop (Placopecten magellanicus) fisheries [9].

When fishing equipment comes into touch with the ocean bottom, it may potentially affect the ecology. Dredge and trawl gear effects are often highlighted as potentially reducing the survival of young of prized species and as potentially having an influence on marine biodiversity. When a fishery harvests the prey or predator that another fishery has claimed, spillovers also result from trophic linkages when a fishery consumes a species that other fisheries have claimed. Trophic relationships, which have co-evolved for a long time, are linked, ongoing, and challenging to quantify and forecast. For instance, Link observed that the omnivorous and highly generalized food web that includes finfish, invertebrate, mammal, and bird species that live on the Northeast Continental Shelf. Top predators in this food chain include American goosefish and spiny dogfish (Squalus acanthias), which eat a variety of other commercial species that also feed on one another. Several commercial species' mortality may be caused more by other predators in the system than by fisherman, like silver hake. Lastly, fisheries resource dynamics are very unpredictable and occur at several geographical and temporal dimensions. Larval survival is a mystery, and species recruitment to a fishery is unusual and very unpredictable. Even qualitatively, the potential impact of habitat disturbance on the production of fishing resources remains unclear.

Several demersal populations are declining due to overexploitation of marine resources, and habitat degradation is becoming more severe in maritime coastal zones, where human activity has traditionally been concentrated. In actuality, rising coastal waste and material discharges, pollution, as well as urban and tourist developments, have often resulted in irreversible habitat loss, which has serious ramifications for coastal small-scale fishing and subsequent economic and social repercussions. Together with the previously mentioned restriction of fishing operations and the preservation and protection of marine environments, alternative initiatives to transition fishermen from fishing to tourism have been established in recent years.

The Ministerial Decree 293/99, in particular, governs "fishing tourism," or fishing activity for tourist and educational purposes, with the goal of enabling the local fishing community to augment its revenue. The greatest approach to contribute to local development while including socio-economic and cultural activities is via fishing tourism. Tourist fishing strives to educate people how to enjoy and appreciate nature as well as to learn about the ocean's riches. The greatest way to learn about the history of the sea, fishing, coastal regions, and lagoons while also enjoying delicious fresh fish prepared on board is to take a cruise. In actuality, much as at a museum or a natural park, anybody may learn about the old history of fishing methods and Italian customs while onboard a traditional fishing boat. Also, the tourist-related fishing activity that is spread out across many seasons may help to modify the tourism flow according to the season while also minimizing resource exploitation during the crucial time.

By engaging in this activity, fishermen may contribute directly to the socioeconomic growth of their community while reducing their overall fishing effort. The gradual decline of the primary fishing activity brought on by fishing tourism may ensure the sustainability of resource management and/or habitat preservation, either directly by making a contribution to conservation or indirectly by bringing in enough money to the community to enable residents to value and, consequently, protect their wildlife heritage as a source of income. The expansion of tourism focused on regional specialties and cuisine, as well as various activities where visitors participate actively in fishing demonstrations, is another significant contribution that the fishing industry can make. It also suggests the launch of new services like fishing tourism, whale-dolphin watching, and environmental education [10].

Human activity has a negative influence on ecological services through reducing habitat and species variety, altering population and community structure, and more.

While the Ministry of the Environment regulates the establishment of Marine Protected Areas (MPAs) along the Italian coasts for biodiversity protection and nature conservation rather than for fisheries goals as in other nations, the MPAs also represent a viable and promising management strategy for sustainable use of marine resources. Mediterranean MPAs provide essential products and services, such as leisure and tourism possibilities, which foster social and economic growth as well as other advantages for local people and economies. They could support research and teaching in the field of the environment. Additionally, MPAs keep marine ecosystems productive and diverse while protecting rare species and their habitats as well as overfished species, allowing them to recover, increase biomass, and restock fishing grounds through the spillover of eggs, larvae, juveniles, and adults that restock commercial stocks in nearby fisheries.

Approaches for the Ecology and the Maritime Environment

Several of the administrative tactics mentioned above encourage simultaneous user and administrator participation. Moreover, they have the significant effect of incorporating ecological goals, which take into consideration how complicated the resource-environment system is. The need for a decrease in their influence on marine waterways, regardless of where their impacts are seen, is ever more important, as stated in the framework paper, since constraints on natural marine resources and demand for marine ecosystem services are often too great. The marine environment, on the other hand, is a priceless resource that must be safeguarded, maintained, and wherever possible, restored in order to preserve biodiversity, safeguard the variety, and protect the livelihood of seas and oceans, which must be clean, healthy, and productive. The European Parliament and EU Council enacted the framework Directive on the Strategy for the Maritime Environment (EC Reg. 2008/56) on June 17, 2008, to address these demands. On October 13, 2010, Italy passed legislation n. 190, which took into account this directive.

The EU Directive seeks to become the environmental cornerstone of the EU's future maritime policy and is based on an integrated approach. The Directive mandates that member states achieve Good Environmental Status (GES) for their maritime waterways by 2020. Each member state must create a maritime strategy for GES, and this plan must be approved by other member states as well as third parties.

The primary objective of the EU and the Marine Framework Directive today is to prevent the loss of biodiversity. A crucial prerequisite for attaining GES for marine environments is maintaining biodiversity. The marine protected areas (MPAs) serve as a crucial safeguard for the long-term preservation of the environment and ecosystem services. The human element, as well as the close relationship between the coastal marine system and the cultural, social, and economic background of the local populations, must be taken into account in order to ensure biodiversity. If the social and economic circumstances of their region are not taken into consideration, the biological advantages of MPAs risk becoming secondary.

By using an ecosystem perspective to controlling human activities that is, a technique that views the human community as an inherent element of ecosystems and of the systems that regulate them—the framework also aims to guarantee the sustainable exploitation of maritime commodities and services.

Lastly, going back to where this article began, the Marine Framework Directive's (EC Reg 2008/56) basic premise of the ecosystem approach, which was initially distilled into 12 principles, may be summed up in the following three important points:

(1) The biodiversity that exists in a region is a result of the communities that call it home.
(2) The three pillars of sustainability are social-cultural, economic, and environmental.
(3) In order to manage an ecosystem, it is vital to comprehend both scientific concepts and regional customs [11].

CONCLUSION

The development of property rights and governance structures that support economic growth is a key barrier to management of fisheries and other resources in LMEs. The management of marine fisheries in the United States and many other coastal nations is primarily under the control of the federal and state governments, with access and harvest rights allocated to different fisheries and separated from the governments' authority to control resource management and fish harvesting.

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CHAPTER 22

PETROLEUM AS NATURAL RESOURCES

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ABSTRACT:

The review aims to update and improve the body of knowledge about the definition, applications, origin, formation, exploration, processing, and products of petroleum, as well as the main petroleum-producing nations, octane rating, petrochemical industry, and petroleum and environment. It combined old and new reports using the table research technique. Several millions of years ago, organic substances found underground or as a result of chemical reactions in the atmosphere likely gave rise to petroleum or rock oil. During refinement, fractional distillation separates the mixture of gaseous, liquid, and solid hydrocarbons into several products. Petroleum has been a source of energy since the middle Ages and has lately dominated the synthesis of chemical molecules. Using and exploring petroleum provide certain environmental difficulties.

KEYWORDS:

Atmosphere, Coal Petroleum, Hydrocarbon Molecules, Management.

INTRODUCTION

Petroleum is a complex combination of hydrocarbons that may be solid, gaseous, or liquid and is found naturally on Earth. While technically speaking, petroleum also refers to natural gas and the viscous or solid form known as bitumen, which is found in tar sands. The word is often limited to the liquid form, popularly known as crude oil. The most significant of the major fossil fuels is petroleum, which exists in its liquid and gaseous forms. Because of their close ties to one another in nature, liquid and gaseous hydrocarbons are often referred to simply as "petroleum" instead of "petroleum and natural gas". The German mineralogist Georg Bauer, also known as Georgius Agricola, wrote a book that was first printed in 1556, and it is commonly considered to be the source of the term petroleum (literally, "rock oil," from the Latin words petra, "rock" or "stone," and oleum, "oil"). Evidence suggests that it may have started with the Iranian scientist-philosopher Avicenna some five centuries before.

Large amounts of carbon dioxide (CO2) are released into the atmosphere during the combustion of all fossil fuels, including coal and biomass. Most of the long-wave solar energy that is absorbed by the Earth's surface is prevented from reradiating from the surface and escaping into space by the CO2 molecules. The lower atmosphere stays warmer than it would otherwise be because the CO2 absorbs upward-propagating infrared light and reemits some of it downward. Because of this occurrence, Earth's natural greenhouse effect is amplified, leading to what scientists refer to as anthropogenic (human-caused) global warming. There is strong evidence that rising CO2 and other greenhouse gas concentrations have had a significant role in the rise in Earth's near-surface mean temperature since 1950 [1].

Use history

The use of surface seeps Small-scale surface deposits of petroleum, such as seeps of natural gas and oil, have been recognized since ancient times. More than 5,000 years ago, crude oil, bitumen, and asphalt (collected from enormous seeps at Tuttul, present-day Ht on the

Euphrates) were utilized for numerous uses by the ancient Sumerians, Assyrians, and Babylonians. Ancient Egyptians are said to have utilized liquid oil as medicine for the first time as a laxative, liniment, and wound treatment. Bitumen was poured over the heads of lawbreakers by the Assyrians as a form of punishment.

In the ancient world, goods made from oil were prized as military hardware. During the 480 BCE Persian siege of Athens, flaming arrows covered with fibers drenched in oil were utilized. The Arabs and Persians distilled crude oil in the early Common Era to produce combustible goods for military use. During the 12th century, Western Europe had access to the industrial technique of distillation into illuminants, perhaps as a consequence of the Arab conquest of Spain. Spanish explorers found oil seeps in modern-day Cuba, Mexico, Bolivia, and Peru some centuries later. Early explorers discovered oil seeps across North America, including in what are now New York and Pennsylvania, where Native Indians are said to have utilized the oil for medical reasons.

Extraction from subterranean storage facilities

The lighting in the United States and many other nations was not much better than that which was prevalent throughout the Mesopotamian, Greek, and Roman eras until the beginning of the 19th century. The oils generated by plants and animals (such as fish and birds) were often used in Grecian and Roman lamps and light sources (such as olive, sesame, and nuts). To provide light, wood was also lit. Mesopotamia had a limited supply of lumber, therefore "rock asphalt" limestone or sandstone that had been infused with bitumen or petroleum residue was mined and blended with sand and fibers to be used as a substitute for wood in the construction of buildings. It became vital to look for new supplies of oil as urban centers developed and needed improved lighting, particularly since whales, which had long supplied fuel for lights, were becoming more and more elusive. Kerosene, also known as coal oil, which is made from coal, was widely used in both North America and Europe by the middle of the 19th century [2].

An ever-increasing need for a less expensive and more practical supply of lubricants and lighting oil was brought on by the Industrial Revolution. It also called for improved energy sources. Prior to the burning of solid fuels like wood, peat, and coal, energy had been produced by the muscle of people and animals. They were painstakingly gathered and carried to the location where the energy source was required. On the other hand, liquid petroleum was a more portable kind of energy. Compared to earlier fuel options, oil was a lot more versatile and concentrated.

The first well that was expressly drilled for oil was the result of an endeavor by American businessman Edwin L. Drake in northwest Pennsylvania. The well's completion in August 1859 laid the foundation for the petroleum industry and signaled the beginning of the closely related modern industrial epoch. By the end of the century, oil resources had been found in 14 states, ranging from New York to California and from Wyoming to Texas. Cheap oil from subterranean reservoirs was quickly processed in coal oil refineries that already existed. Oil resources were also discovered in Europe and East Asia around this time.

Resource management is necessary:

To fulfill the resources' exponentially rising demand as a result of the growing global population ensuring fair resource allocation so that the exploitation of these resources does not favor a small number of wealthy and powerful individuals minimizing the environmental harm that resource exploration causes when so much garbage is dumped during mining, it pollutes.

Resource management strategies for the properly disposing of these wastes are necessary for sustainable development. To uphold modern global concerns for sustainable development and resource conservation to uphold the long-standing history and culture of environment protection in our nation [3].

- Vedic epoch: Helpful, just as defensive aspects of the vegetation in the wood were highlighted
- Vedic era later: The concept of a social landscape with sacred woods, woodlands, and a variety of ethnic ranger service rehearsals was promoted.
- The post-Vedic era many ethnic forestry practices were adopted to preserve the environment and natural resources. These practices were blended with local traditions, customs, and rituals.
- Coal and Petroleum: Degradation of cellulose produced coal and petroleum millions of years ago.
- These supplies run out eventually. There is a need to look for optional energy sources.
- Petroleum will likely persist for around 40 years, while coal and petroleum will likely endure for another 200 years, according to various estimations regarding the known petroleum resources.
- These materials include hydrogen, nitrogen, and sulfur, and when burned, they release carbon dioxide, water, nitrogen oxides, and sulfur oxides.
- Burning produces carbon monoxide rather than carbon dioxide when there is insufficient air (oxygen).
- High amounts of carbon dioxide and the oxides of sulfur, nitrogen, and carbon monoxide are hazardous.
- Global Warming is exacerbated by an increase in atmospheric carbon dioxide.

The Five R's of Environmental Protection

Saying "No" to anything that is not necessary is referred to as refusing. Refuse to purchase anything that could be bad for the environment or you. Refuse to use disposable plastic convey bags

- Reduce: It seeks to be ineffective. By shutting off superfluous lights and fans, you may save power. Water may be saved by fixing leaking faucets. Avoid wasting food.
- Recycle: Instead of synthesizing or segregating new plastic, paper, glass, or metal, this method tries to gather plastic paper and recycle these resources to manufacture useful things. The separation of wastes is the first step in the reuse process.
- Reuse: Since the most prevalent method of reusing requires some energy, this is preferable to reusing. The "reuse" strategy involves repeatedly using the same items.
- Repurpose: This means carefully considering whether to utilize an object for a different, more useful purpose when it cannot currently be used for the original one. ‘ We are aware of being in tune with nature. It is connected to our long-standing practices, traditions, folklore, arts and crafts, celebrations, cuisine, and beliefs. Sustainable living has always been a crucial component of Indian tradition and culture.

Global Warming

Global warming is one of the negative effects brought on by the indiscriminate use of non-renewable resources. The phenomena of "global warming" is the general increase in Earth's temperature as well as odd weather patterns. Energy is produced by burning coal and petroleum. Their burning produces hazardous gases into the atmosphere in addition to energy. The buildup of these gases causes the Earth's atmosphere to become trapped with damaging

UV radiation. Global Warming results from this rise in Earth's temperature. By reducing harmful emissions, sustainable management of natural resources, including coal and petroleum, may assist to slow global warming [4].

DISCUSSION

The Industrial Revolution had advanced by the turn of the 20th century to the point where using refined oil for illuminants was no longer of fundamental significance. Due in significant part to the development of internal combustion engines, particularly those used in vehicles, and the oil and gas sector rose to prominence as a major energy provider. Oil is a significant feedstock for petrochemicals, but its main value is as an energy source for the global economy. It's impossible to overstate the importance of oil as a source of energy for the whole planet. Unprecedented expansion in energy output occurred throughout the 20th century, and rising oil production has been by far the main driver of that development. Over 100 million barrels of oil per day were being transported from producers to consumers by the 21st century thanks to a massive and complex value chain. International relations are critically dependent on the production and consumption of oil, and foreign policy has often been decided by these factors. The place of a nation in this system is determined by its capability for production in relation to its level of consumption. Oil reserves can sometimes make the difference between a wealthy and a poor nation. The availability or scarcity of oil has significant economic repercussions for every nation. The use of oil as a primary source of energy will only be a transient phenomenon lasting a few centuries on a timeline within the scope of potential human history. Even so, it would have been a matter of crucial significance for global industrialization [5].

Hydrocarbons' Properties

A Hydrocarbon Substance

Despite just being primarily composed of molecules of the two elements carbon and hydrogen, oil has a wide range of complicated chemical structures. Yet, practically all crude oil contains between 82 and 87 percent carbon by weight and 12 and 15 percent hydrogen, regardless of physical or chemical changes. The most viscous bitumens typically include 8 to 11 percent hydrogen and 80 to 85 percent carbon. Alkenes with single-bond hydrocarbons of the type CnH2n+2 or aromatics with six-ring carbon-hydrogen bonds, or C6H6, make up the majority of the organic substance known as crude oil. The majority of crude oils are bundled into combinations with different and apparently limitless ratios. No two crude oils from various sources are exactly same. The most prevalent hydrocarbons in crude oil belong to the alkane paraffinic family of hydrocarbons, generally known as the methane (CH4) series. Paraffins, which are liquid at room temperature but boil between 40 °C and 200 °C (100 °F and 400 °F), are the main components of gasoline. Lower-density paraffins may be refined to produce plastic and solid paraffin wax leftovers.

The naphthenic series is a saturated closed-ring series with the general formula CnH2n. While it makes up the majority of the complex leftovers from the upper boiling-point ranges, this series is an essential component of all liquid refinery products. The series is often heavier as a result. Asphalt is a byproduct of the refining process, and crude oils with a high concentration of this series are referred to as asphalt-base crudes. An unsaturated closed-ring series is the aromatic series. All crude oils include its most prevalent constituent, benzene (C6H6), however the aromatics as a group typically make up a very minor portion of most crudes.

Contains Non-Hydrocarbons

Crude oil is composed of almost unlimited combinations of hydrocarbon molecules, along with sulfur, nitrogen, and oxygen, which are often present in tiny but frequently significant amounts. The third most prevalent atomic component of crude oils is sulfur. It may be found in crude oil's medium and heavy fractions. Sulfur is exclusively connected with carbon and hydrogen in the low and medium molecular ranges, but in the heavier fractions it is commonly included in the massive polycyclic molecules that also contain nitrogen and oxygen. The total sulfur content of crude oil ranges from less than 0.05 percent (by weight), as is the case with certain Venezuelan oils, to over 2 percent for typical Middle Eastern crudes, and up to 5 percent or more for heavier Mexican or Mississippi oils. Generally speaking, the sulfur concentration of crude oil increases with its specific gravity, which defines whether it is heavy, medium, or light crude. Since sulfur oxides discharged into the environment during oil burning would be a substantial contaminant and because they are a strong corrosive agent in and on oil processing equipment, excess sulfur is removed from crude oil before it is refined [6].

Typically, less than 2% of crude oil's weight is accounted for by oxygen, which is typically found in the heavier hydrocarbon molecules. Because of this, the heavier oils have the highest levels of oxygen. Almost all crude oils contain nitrogen, generally in amounts of less than 0.1 percent by weight. Most crudes also include sodium chloride, which is often eliminated like sulfur. Crude oils include a large number of metallic elements, including the majority of those that are present in saltwater. This is most likely caused by the intimate relationship between saltwater and the organic materials used to make oil. Vanadium and nickel, which seem to exist in organic combinations much as they do in live plants and animals, are two of the most prevalent metallic elements in oil. Moreover, crude oil may include trace amounts of biological materials that have resisted degradation, such as wood, spores, resins, coal, and numerous other byproducts of previous life.

Bodily Characteristics

The closely related group of complex hydrocarbon molecules that make up crude oil includes anything from heavy solids to gasoline. The many combinations that make up crude oil may be divided into from light to heavy gasoline, kerosene, gas oil, lubricating oil, residual fuel oil, bitumen, and paraffin via distillation at increasing temperatures. Crude oils come in a wide range of chemical compositions. They differ greatly in terms of their physical characteristics, such as specific gravity, color, and viscosity a fluid's resistance to change in form, since they are mixes of hundreds of hydrocarbon molecules.

Particular Gravity

Crude oil floats because it is lighter than water and immiscible with it. On the basis of specific gravity (i.e., the ratio of the weight of equal volumes of the oil and pure water under normal circumstances, with pure water taken to equal and relative mobility, crude oils are often classed as bitumens, heavy oils, medium oils, and light oils. Oil sands contain bitumen, a degraded, immobile byproduct of ancient petroleum that does not flow into a well bore. By using enhanced recovery techniques that is, technologies that use heat, gas, or chemicals to reduce petroleum's viscosity or direct it toward the production well bore heavy crude oils have enough mobility to eventually be extracted via a well bore. Via production wells, the lighter, more mobile medium and light oils may be recovered [7].

Reserves of Resources

Hydrocarbons that are further classified as resources or reserves are found in reservoirs created by traps or seeps. Before wells are drilled, the total quantity of all potential hydrocarbons is assessed from formations. Contrarily, reserves are subsets of resources; their quantities depend on how economically or technologically possible it is to extract and utilize petroleum from them within the existing economic and technical framework. Based on how much is expected to be taken, reserves are divided into a number of categories. The likelihood of successfully extracting proven reserves for commercial use is more than 90%, whereas the likelihood of successfully extracting probable and potential reserves for commercial use is assessed to be 50% and between 10% and 50%, respectively.

The larger category of resources comprises either conventional and unconventional petroleum plays (or accumulations), as recognized by analogs, i.e., fields or reservoirs with few or no wells drilled but with geological similarities to producing fields. Technical specialists and geoscientists assess the amount and quantity of undiscovered hydrocarbon accumulations for resources where some exploration or discovery activity has already occurred using metrics generated from geologic framework modeling and visualization[8].

Non-Traditional Oil

There are many distinct kinds of hydrocarbons, including extremely heavy oils, oil sands, oil shales, and tight oils, that fall within the large category of unconventional resources. At the beginning of the twenty-first century, technical developments had made it possible to turn what were hitherto unexplored resource plays into profitable reserves. Extremely expensive crudes have become more affordable. If the temperatures and pressures in the natural reservoir are high enough, it is possible to extract those with less than 15° API by working with them. For instance, such circumstances exist in the Orinoco basin in Venezuela. Certain Canadian crude oils, for example, are quite heavy and need the injection of steam from horizontal wells that also provide gravity drainage and recovery. In contrast to highly heavy crude oil, bitumen sticks to sand particles in tar sands. Surface mining or subsurface steam injection into the reservoir must be done first in order to turn this resource into a reserve. An extraction facility that can separate the oil from sand, fines (extremely minute particles), and water slurry processes the material that was previously removed [9]–[11].

CONCLUSION

The idea of sustainable development promotes growth that satisfies fundamental human needs today while preserving resources for future generations. An essential measure of our efforts to rescue the globe is the sustainable management of natural resources, particularly coal and petroleum. Petroleum and coal are non-renewable resources that will eventually run out. It is difficult to employ these resources wisely and maintain development. The Five R's approach to sustainable development, however, provides a guide for resource conservation. Refuse, reduce, reuse, repurpose, and recycle are a few of them.

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CHAPTER 23

THE WORLD'S OIL AND GAS INDUSTRY

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ABSTRACT:

The book follows the discovery and use of oil and gas from antiquity up to the contemporary oil and gas industry, which was born in America and quickly expanded across the rest of the globe. The paper draws the conclusion that, as long as some economically significant alternative energy sources are not discovered, hydrocarbons will continue to have their enormous dominance and influence on the global economy, politics, and other social activities for many years to come. This is based on a condensed but comprehensive historical review of the oil and gas industry.

KEYWORDS:

Greenhouse Gas, Global Oil, Fossil Fuels, Natural Gas, Natural Resources.

INTRODUCTION

The oil and gas sector is under growing pressure to explain how energy transitions will affect their operations and business models, as well as how they can help reduce greenhouse gas emissions and advance the Paris Agreement's objectives. Several oil and gas firms are under growing social and environmental pressure, which raises complicated considerations regarding the place of these fuels in a shifting energy economy and their place in the society in which they operate. Yet in light of growing GHG emissions, the fundamental question is very straightforward: Should current oil and gas corporations be seen as solely contributing to the issue, or may they also be essential in finding a solution? The International Energy Agency (IEA) has addressed this issue in its latest World Energy Outlook (WEO) report, which builds on a multi-year program of studies on the future of oil and gas [1].

Given the vast range of oil and gas firms and corporate strategies throughout the globe, not least of which is the goal of this analysis, it is not intended to provide firm conclusions. It does attempt to outline the dangers that various segments of the industry face, as well as the variety of choices and solutions. The limits of this study are set by three factors. First, there is the potential for increased demand for the services that energy offers as a result of a developing worldwide economy and an expanding global population, some of whom do not yet have access to modern electricity. The second is the understanding that inexpensive, dependable supplies of liquids and gases (of various forms) are essential components of a vision for the future and that oil and natural gas play crucial roles in the energy and economic systems of today. And finally, but by no means least, is the need to cut emissions connected to energy in accordance with global climate commitments. These components could seem to be at odds with one another, but this is not always the case.

By keeping the increase in global temperatures to "far below 2°C... and pursuing measures to restrict it to 1.5°C," the WEO Sustainable Development Scenario (SDS) maps a course that is entirely compatible with the Paris Agreement and achieves goals for cleaner air and universal access to energy. The SDS serves as a reference point for the discussion throughout this study along with the variety of technologies needed to realize it. The Stated Policy Scenario (STEPS), which offers an idea of where current policy objectives and intentions might take the energy sector, is the second scenario included in the report. These results are a long cry from the global sustainability targets. This paper focuses on faster energy transitions, the drivers that may lead to them (whether from society, policymakers, technology, investors, or the business itself), and the effects that would follow for various segments of the current oil and gas sector.

To divide the risk and profit and promote technical and operational cooperation, businesses often split stock ownership in exploration and new field development. This structure typically also specifies who will run the field after it begins production. An effective way to disperse the risk is for the interested parties to create a joint venture, which may take many various forms but typically aims to encourage cooperation between the parties and preserve some degree of corporate independence. The fact that certain tax systems in some nations allow for the production of barrels to be transferred to the host government rather than applying a royalty or tax on financial flows complicates the issue of "ownership" of barrels. The equity ownership for businesses may change during the course of a field's existence or may change in response to outside variables like the price of oil [2].

It is impossible to overstate the importance of oil and gas energy to human activities or how much of an impact they have on the economy of both oil-producing and oil-importing nations. The politics of these nations and the whole globe are profoundly impacted by oil and gas. The global industrial revolution has advanced dramatically since the discovery of oil and gas, and it has also made transportation easier on a local and an international scale. At the domestic level, energy sources like oil and gas have made life simpler for people in areas like cooking, heating, power supply, local transportation, and many more1. Hence, in the modern world, there is little chance that petroleum and its associated products will be replaced as sources of energy. Petroleum has been the primary source of energy for civilization ever since it was discovered in the fourth quarter of the nineteenth century. This claim is further supported by the 2011 Fortune Global 500 ranking of international firms. Six of the ten largest firms in the world are oil and gas companies, and of those six, five have subsidiaries that operate around the globe, according to this list (see Table 1). While its use and the environmental effects of its discovery and production are far more substantial in the present world, petroleum was also valuable to civilization in the distant past. Petroleum has been used for thousands of years throughout human history, developing through time to play a crucial role in the current global economy.

The source of Hydrocarbons

Coal, oil, and natural gas are the three main types of fossil fuels, and they were produced over millions of years. The remnants of animals or plants from a previous age that have been preserved within rocks or other geological structures4 are known as fossils. The term "carboniferous period" refers to the time period during which these fossil fuels were produced. Carbon is the main component of coal, oil, and natural gas5. The organic hypothesis, which contends that oil and natural gas (hydrocarbons) come from the remnants of plants and animals that lived millions of years ago, is the explanation for the origin of petroleum that is most largely accepted6. The deposits of plants and animals, coupled with pieces of eroded igneous rock, underwent microbiological and chemical transformations under intense heat over the course of these millions of years to generate hydrocarbons. 7 8 3 A thorough history of the Nigerian oil and gas industry is given in section 3's chapter on the African oil and gas business. In this regard, Bastianoni et al. (2005) outline three steps that naftogenesis, or the creation of petroleum, goes through. The following are the stages: I photosynthesis (ii) bacterial breakdown and diagenesis (iii) catagenesis. The following is a basic explanation of these phases:

Photosynthesis:

The energy contained in crude oil and natural gas was first stored as solar energy by plants when they created the hydrocarbons. The plants that were left at the bottom of the sea or in the earth's crust used photosynthesis to store solar energy while they were still alive. By the decrease in atmospheric carbon, this solar energy was converted into chemical energy ($CO2$). It is necessary for photosynthetic plants and animals to be present in a nearly confined maritime environment, to have increased in biomass (such as a gulf or lagoon), and for the area's water exchange with the wide sea to be very constrained [3].

Bacterial Degradation and Diagenesis:

At this stage, simple chemicals are formed from the organic biomasses that have been deposited at the bottom of a sea via the process of bacterial degradation. Next, via a process called diagenesis, these simple substances are converted into kerogen. Diagenesis is a process in which the residues of degraded biomasses are subjected to pressure and heat from the soil, resulting in the formation of kerogen (a solid, waxy, organic material). These circumstances make it possible for diagenesis to occur in the regions of the globe where there are petroleum resources.

Catagenesis and Oil Formation:

After diagenesis, the following step in the creation of petroleum includes the formation of oil and gaseous hydrocarbon from Kerogen. The strength of the heat emanating from deep under the ground determines how easily petroleum may be formed from kerogen. In this regard, it is noted that at a depth of 2 to 6 kilometers under the earth's surface and at a temperature of 50 to 115 degrees Celsius, kerogen transforms into oil and natural gas.

The Oil and Gas Industry's History Worldwide.

Oil and Gas Industries from the Past The American Petroleum Institute states that "the utility of hydrocarbons to humans is as ancient as history" due to how long humanity has relied on petroleum. Humans utilized crude oil for a variety of purposes in ancient times. For instance, crude petroleum was employed by early humans as a water repellent. In other words, they employed petroleum as a product or material to stop water from getting into locations it wasn't wanted. Moreover, due to its stickiness, petroleum was employed by early man to tie objects together. Petroleum was used by Sumerians, Mesopotamians, and Egyptians 5,000 years ago for a variety of reasons. Around this time, people in Mesopotamia and Sumeria employed bitumen to help build water channels and put images and designs on walls and floors, respectively. In order to ensure hitch-free water transportation, they also utilized it as sealer in the joints of wooden boats [4].

Oil and Gas Industry

Throughout the nineteenth century, America saw the birth of the modern oil and gas sector. Individual oil producers built dams in western Pennsylvania at a location named Creek where petroleum was thought to be deposited during the first quarter of this century39. As a result, the crude oil was able to float on the water's surface. After that, blankets placed on the water's surface were used to capture the floating oil. The oil was finally salvaged and sold for $2 per gallon40. Also, during this time period, people in California utilized crude petroleum that they extracted from saline seeps to light up places of worship.

DISCUSSION

Growth of other hydrocarbons' markets. Eventually, the business, which is now known as British Petroleum, successfully expanded its operations around the globe to rank among the largest oil and gas businesses in the world. The development of electricity-powered illumination at the start of the 20th century significantly decreased demand for kerosene, the main product of the oil and gas sector at the time76. This was a blatant sign of impending calamity for both the domestic and international oil and gas industries. As was previously said, other petroleum products like gasoline, gas, diesel, etc. that are created in tandem with kerosene are merely byproducts that are often dumped at night in rivers or oceans. As a result, the oil and gas sector was in danger of failing due to the potential decline of the kerosene market as an illuminant. A sudden development at this very moment revived the oil and gas industry's promising future. Therefore, the development of internal combustion engines, such as those used in cars and industrial machinery, created a profitable market for hitherto practically worthless petroleum products [5].

The Fall of Standard Oil and the Ascendance of the Seven Sisters:

Fuels like gasoline, diesel, and lubricants gained value and marketability as a result, allowing the rebirth of the oil and gas sector. For over 20 years, Standard Oil controlled both the domestic and, to a large degree, the global oil and gas industries. To the disadvantage of customers and other oil businesses, the corporation grew to be so strong that it could dictate pricing both domestically and globally. As a result, once antitrust legislation was passed in 1907, the United States federal court ordered the division of Standard Oil into 34 separate corporations. As a result, Standard Oil's monopolistic dominance was ended, particularly in America. Nonetheless, Rockefeller's creation of the machinery of Standard Oil's oil and gas sector continued to dominate the world. As a result, America was in charge of producing more than half of the world's oil.

The Oil and Gas Sector in Europe

Since the early 1600s, Romania has been the first place in Europe to be recognized to contain commercially significant amounts of oil. For more than 200 years, Romania has been a significant supplier of hydrocarbon energy to nations in Europe80. In the contemporary era, small-scale oil and gas sector growth in Europe began in Turkey in the 1920s. The North Sea didn't see the start of serious exploration until the 1960s. One of the key regions in Europe with significant oil and gas deposits is the North Sea. The first commercial natural gas deposit was found in the Netherlands in the late 1950s. Oil was first found in the North Sea in commercial quantities in 1961, and more oil reservoirs were subsequently found. In 1965, British Petroleum found oil in the North Sea off the coast of East Anglia. This discovery appeared to provide Britain with a solution to its deepening economic crises at the time.

A few years later, additional businesses from America and other parts of Europe started to become interested in the North Sea oil deposit. There were more than 100 oil fields in the area by the middle of the 1980s, and Great Britain had turned into a net exporter of crude oil. The country's continued expansion in the oil and gas sector became more obvious in the 1990s, when it also started to become a net exporter of natural gas. Important oil and gas resources may be found in the North Sea in places like Aberdeen, which is known as the oil capital of Europe, Yarmouth, Shetland, and the Northern Island of Orkney. After peaking in 2001, North Sea oil and gas production started to drop, making Britain a net importer of these commodities. The North Sea is now at a mature stage of exploration and production. Due to significant technical breakthroughs, oil and gas businesses are still able to produce substantial amounts of oil and gas [6].

The Middle East's Impact

Major Frank Holmes, a mining engineer of New Zealand descent, learned of oil seeps along the Arabian shore of the Persian Gulf in 1918 from an Arab dealer. Holmes became fixated with searching for hydrocarbons in the Arabian Gulf as a result of this. Holmes took the chance to study more about the oil reserves in the area when he found himself in Basra, which is a portion of modern-day Iraq. Holmes traveled from one Arab monarch to the next, attempting to persuade them of the region's profitable potential for exploration and production while also securing as many oil concessions as he could. Holmes was successful in obtaining concessions across the Arabian Gulf, including Bahrain, Kuwait, the eastern region of Saudi Arabia, and Baghdad. When Holmes was ready to start oil exploration, the London financial market refused to fund him. His efforts in the US also encountered a number of setbacks. There were two main factors that discouraged investors from funding oil exploration projects in the Arabian Gulf. Initially, the Anglo Persian Company held the opinion that there was almost little prospect of finding oil in the Arabian portion of the Gulf. Second, the prospect of commercial petroleum resources in the area was categorically disregarded by a geological study written by a renowned professor of geology.

The Protective Oil Price Era

The main oil exporting nations were outraged when Standard Oil unilaterally reduced the quoted price of oil in 1960 on the advice of the company's then-Chairman. In reaction to the drop in oil prices, the main oil exporting nations including Iran, Venezuela, Saudi Arabia, Kuwait, Iraq, and Qatar (as an observer) met. These nations together supplied 80% of the world's oil at the time101. After the first backtracking of the oil price cut, sparked by Standard Oil, a number of global corporations expressed their regret to the oil exporting nations. Their response was the creation of the Organization of Petroleum Exporting Countries (OPEC), and they made it plain that the group's two major goals were to protect the oil price as it was advertised and prevent unilateral price reductions by western multinational oil firms.

Since the newly created organization was not taken seriously by the western industrialized countries, who use the majority of the world's oil, the international oil firms gave it no more consideration than to act as if it didn't exist. The strength and impact of OPEC were acknowledged to have been underestimated to the extent that "the CIA dedicated just four lines to the new organization"102. Of course, it was obvious that in its early stages, it had little influence beyond halting further price declines in oil and preventing crucial international decisions on the oil market from being made without involving the exporting nations. After realizing that its members' inability to fully manage their oil resources was the main obstacle to its success, OPEC concentrated on assisting its members in doing so. All OPEC members had a significant amount of control over their oil and gas resources by the middle of 1970. In this respect, I've seen "...The abruptness with which oil exporting nations had taken over the position once occupied by the multinational corporations.

The oil reserves in the exporting nations were theoretically the property of the international oil firms, which was a major feature at the time that constrained OPEC's authority. This undermined the capacity of the nations that export oil to make OPEC a potent force. The oil glut caused by severe foreign competition on the global oil market was another factor that reduced the power of OPEC. In order to prevent income drops, this compelled the members of OPEC to concentrate on preserving their market share.

Several political factors were at work in preventing OPEC from exerting much influence. Oil firms and Western affluent countries were confused. The little, toothless dog suddenly gained sharp fangs, transforming it into a formidable, menacing creature. The members of OPEC were so strong and influential that they controlled whether there would be inflation or a depression [7]. Pressures on the sector from the economy, society, and politics are intensifying. To be able to construct and run facilities, the oil and gas sector needs societal approval of its undertakings.

Projects have historically sparked social and environmental concerns because of their local effects, such as the possibility of air pollution and the contamination of surface and groundwater. Rising worldwide emissions have recently increased scrutiny of the sector on a wider environmental scale, particularly in Europe and North America. This may also be seen in the increased attention that listed oil and gas firms' investors are paying to the risks associated with climate change and the limitations on access to financing in certain places. These are the key pressure points:

Financial Markets

Over the past ten years, shareholder resolutions on climate change, which frequently aim to improve disclosure or align business strategies with a more sustainable path, have sharply increased, and investor collaborations, like the Climate Action 100+, aim to facilitate engagement on sustainability issues more and more. Investors have raised the needed rates of return on equity for the sector by purchasing and selling shares (i.e., the supply of finance). Additionally, a growing number of banks, pension funds, insurance firms, institutional investors, and private investors are limiting their exposure to specific types of fossil fuel projects. The main focus to date has been on coal, but restrictions are also increasingly being seen on some oil and gas projects. A taxonomy to direct capital allocation towards sustainable activities has been developed in Europe, and there is growing appetite for and regulatory attention towards sustainable finance as a result of the introduction of green-labeled securities, increased pressure for disclosures of climate-related risks, and recommendations from the Task Force on Climate-related Financial Disclosures (TCFD). Dissent to new infrastructure initiatives. The desire to preserve fossil fuels in the ground combined with local environmental concerns has fuelled resistance to new oil and gas infrastructure projects in various nations and areas. Long permitting processes and litigation as a consequence have caused project delays and expense overruns. Other times, initiatives have been canceled or postponed indefinitely. Infrastructure constraints might result in local market price reductions and act as a strong deterrent to additional upstream investment. As compared to oil, natural gas often depends more on fixed networks to get to customers. Climate concerns have led to prohibitions or limits in several jurisdictions, including the Netherlands, New York, and California, on adding new gas customers to the grid or developing gas distribution infrastructure [8].

Prohibitions on Fracking

With the introduction of shale, hydraulic fracturing now accounts for the vast bulk of the rise in worldwide oil and gas output. The most pressing worries are impacts on water supply and increasing seismic activity, which are not directly tied to the climate. Yet, fracking prohibitions are regularly brought up when discussing the need to retain fossil fuels underground and stop methane leaks. Throughout a large portion of Europe, New York, California, and Quebec in North America, as well as in several states of Australia, fracking is either prohibited or practically impossible [9], [10].

CONCLUSION

This historical review's findings demonstrate that petroleum has long been associated with human endeavors. As a result, hydrocarbon has served humans well from the dawn of time. The impact of oil and gas energy on the global economy in the contemporary era has undoubtedly been felt everywhere throughout a variety of historical economic events, including recession, economic expansion, boom, increased welfare, and conflict. This effect, which was sometimes detrimental and other times advantageous, makes oil and gas energy both adored and loathed. In the industrialized world particularly, oil and gas are essential to human survival. Without hydrocarbon energy, life would be exceedingly difficult, even in less developed regions of the planet. The cost of hydrocarbon-related energy has been increasing, which has led to higher production costs and, as a result, higher pricing for products and services. Another unfavorable aspect of petroleum and natural gas is GHG emission, which is to blame for the current environmental problem caused by climate change and is shared by all hydrocarbons. Energy experts have long advocated looking for alternate energy sources to oil and gas because of the volatility associated with the price of oil and the multiplier impact that this volatility has on the global economy. While several other energy sources, both renewable (such as wind, solar, biofuels, and geothermal energy) and nonrenewable (such as uranium and shale gas) have been discovered, hydrocarbons continue to be the most prevalent and will continue to be so for a very long time.

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CHAPTER 24

USE OF LIMITED NATURAL RESOURCES

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ABSTRACT:

The construction industry, one of the major users of these resources, has an interest in preserving raw materials to limit the consumption of non-energy resources beyond fossil fuels and the quantity of trash to be dumped in landfills. This interest serves as a reminder of the value of recycling. Based on the author's multi-year investigations and research on sustainable buildings, this brief study examines a variety of elements impacting the strengthening of recycling. Food, fuel, and raw materials for the manufacture of commodities are all produced with the help of natural resources. People consume food that was either produced by plants or animals. Heat, light, and electricity are all produced by using natural resources like coal, natural gas, and oil. Conserve paper and plastic bags, fix damaged toys, furniture, and appliances. Use things in a variety of ways. The great majority of the world's energy needs are met by fossil fuels, and this situation is likely to persist for some time.

KEYWORDS:

Ecosystem, Fossil Fuels, Natural Resources, Recycle, Recycle.

INTRODUCTION

Natural resource exploitation and use harm the ecosystem and cause pollution. Using less natural resources, such as wood and fossil fuels, will safeguard both environmental and human health. Burning fossil fuels pollutes the air and produces the bulk of greenhouse-gas emissions, which have an impact on climate change, according to the U.S. Environmental Protection Agency. Since certain resources, like fossil fuels, are not replenishable, it will be advantageous for future generations to have access to the natural resources we protect today. There are several strategies to preserve natural resources, and many of them are simple to implement into our everyday activities [1].

Reduce Energy Use

According to the U.S. Energy Information Administration, burning fossil fuels produces around 80% of the energy utilized in the country. As a result, whatever energy we save will also help preserve these non-renewable resources, such as coal, oil, and natural gas. Air pollution, which causes respiratory and other health issues, will be decreased as a result of energy saving. Instead of driving alone, save energy by walking, riding a bike, or using public transit. When feasible, switch to alternate energy sources like solar energy and biodiesel. When not in use, turn off the lights and swap out your incandescent bulbs with compact fluorescent ones. To save energy on water heating, wash your clothes in cold water. Install a programmable thermostat, upgrade to new, more efficient equipment, and reduce the heat by one or two degrees.

Protect Water

A natural resource that is in low supply in many areas is water. According to the U.S. Environmental Protection Agency, there has been a recent scarcity of water in every part of the country. Water conservation is important and may be accomplished by changing a few everyday routines. While cleaning the dishes or brushing your teeth, stop the water from running. Run the dishwasher and washing machine only when they are both full. Keep showers short. By watering lawns less often and being aware of water use, you may further cut water usage. A four-person household in the US consumes roughly 400 gallons of water per day on average.

Use and Recycle

Reusing goods and resources helps stop the exploitation of natural resources. The U.S. Forest Service reports that there is an increase in timber harvesting across the country. By reading e-books and checking out books from the library, you may lessen the consumption of trees. By paying bills online and interacting electronically, be paperless whenever possible. Reuse cardboard wrapping and boxes for storing or delivering items. Materials that cannot be reused should be recycled. Plastics, aluminum, steel, glass, and paper recycling all need energy but result in less raw material extraction [2].

Launch a Campaign

Individual adjustments will contribute to a reduction in the use of natural resources, but collective changes will have the most impact. Start a conversation about how to protect our environment, and urge your loved ones, friends, colleagues, and students to follow suit. Offer to run the recycling program at your place of employment or plan clothes and book exchanges at neighborhood schools. Join a carpool with nearby neighbors who are traveling the same route. Discuss the value of our natural resources with your kids, and encourage them to embrace eco-friendly practices.

This experience made clear the many obstacles in the way of accomplishing this goal and the need of taking larger ecosystem dynamics into account. "A dynamic complex of plant, animal, and microbial communities and their non-living surroundings interacting as a functional unit" is how an ecosystem is described. Ecosystems' capacity to withstand disturbances of all types is a key factor in determining their resilience. This in turn depends on the ecosystem's variety of species and other biological resources. As it is possible to determine "the amount of disturbance that an ecosystem can sustain without affecting its self-organized processes and structures," the 5 SMNR for ecosystem resilience is based on this premise. 6 Due to the complexity of ecosystems, SMNR for ecosystem resilience is, on a technical level, a highly difficult undertaking. The first is that ecosystems resist the idea of borders, functioning hierarchically and at many geographical scales that are connected. Second, ecosystems include a variety of elements that interact with one another across a range of time scales in both expected and unforeseen ways. Finally, ecosystems may self-organize and are adaptable to destabilizing impacts. Focusing on adaptive processes that incorporate "structured decision making," where institutions and decision-making processes both allow for ongoing learning, re-evaluation, and modification in response to new knowledge or surprises, has been the approach [3].

The resilience of ecosystems may be most at risk from human development, but that development also depends on the sustainability of natural resources. For many years, the idea of sustainable development has emphasized the significance of natural resources for ongoing social and economic growth. Using natural resources in a way that will ensure their availability to future generations is necessary for sustainable development. More recently, the idea of ecosystem "benefits" or "services" has attempted to explain the importance of ecosystem resilience in terms of the economy. Food and fuel are included, as well as regulatory services like controlling water and air quality, cultural services like entertainment and spiritual upliftment, and services that support all of these like photosynthesis and nutrient recycling.

DISCUSSION

The preservation of the planet's climate and the mitigation of the effects of climate change depend heavily on reducing the usage of natural resources. Thankfully, individuals may greatly minimize their consumption of natural resources with a small amount of knowledge about their utilization. The sustainability of the earth's ecosystem may be greatly impacted by reducing the use of a range of natural resources, including water, energy, and forests[4]

Forests and Wood

In order to mitigate issues with climate change and ecological loss, forests should be used less. One of the most significant roles played by forests is the reduction of atmospheric carbon dioxide (CO_2) via the conversion of carbon dioxide into oxygen and the retention of carbon in their wood. Yet forests also prevent floods and preserve topsoil and water, among many other purposes. Forest preservation is essential because all of these roles are so important. To limit the use of beef and the conversion of forest area to agricultural use, the world should work to use less paper, wood, and beef. Additional judicial and political reforms, such as the prohibition of the importation of wood from the Amazon, the legal protection of old-growth forests, and improved logging regulations, may also aid in the preservation of forests.

Purer Water

The world's climate and ecosystems are also being challenged by the over use of water resources. Although while water covers 70% of the surface of the globe, just 3% of it is fresh water, and only 1% of it is drinkable. As drinking water is a limited resource, protecting it is essential to preserving life as we know it. The purchase of more water-efficient equipment, such as washers and toilets that use less water, is one of the simplest methods to limit the excessive use of this resource. In addition to supporting the development of wastewater treatment infrastructure, governments may promote these policies. Currently, only around 10% of all wastewater is effectively treated; thus, raising this percentage might significantly increase the quantity of water that can be reused, hence lowering the amount of fresh water that is withdrawn from natural sources[5].

Fiery Fuels

Natural resources are under strain due to the ongoing increase in demand for fossil fuels like coal, natural gas, and oil. The demand for various forms of energy is anticipated to rise by 60% by 2030. With new laws and consumer behaviors, it is becoming easier to lower this figure. Governments and businesses should make a major effort to utilize and promote renewable energy sources like solar panels and hydropower. Governments can mandate more fuel-efficient vehicles even if we may never totally stop using fossil fuels. Modest modifications, such as direct fuel injection technology, may reduce a car's fuel consumption by up to 13%. Our dependence on fuels may be decreased with more research and development.

Systems Biological and Animals

Humans employ animals for a variety of purposes, including food, research, fur, leather, and even entertainment. Yet, problems like overfishing put ecosystems in jeopardy and exhaust fish and animal supplies to the point that people could experience food insecurity. For instance, despite being a cherished delicacy all over the globe, the population of tuna has dropped to the point that the Atlantic bluefin tuna is in danger of becoming extinct. The tuna and other animal species might be saved with the help of improved fisheries control and less waste. For instance, it is estimated that between 8 and 25% of the bluefin tuna harvest is wasted or thrown away each year. This example may be extended to many different species all around the globe, and cutting down on this waste would make it unnecessary to overfish.

Everyday Activism

Natural resources are used by humans, but those who are reading this may take action to limit their use. Participate in the recycling program in your area, or if there isn't one, urge your local government to create one. To save water and energy, fix leaks coming from hoses and faucets. By choosing to bike or walk instead than drive, you consume less fossil fuels. Help the organizations working to conserve natural resources in your community or throughout the country by becoming involved, contributing financially, campaigning for change, or taking other action [6].

Resources may be divided into two main categories: renewable and non-renewable. Renewable resources do not deplete with continued usage, in contrast to non-renewable resources, which do. Non-renewable resources run the risk of becoming extinct if improperly handled. This is due to the fact that they are used up considerably more quickly than they are replenished. Geothermal energy, wind energy, and water are examples of renewable resources. Minerals such as coal, natural gas, and oil are non-renewable resources.

Controlling Water

The most plentiful natural resource on earth is water. The Earth's surface is really covered with it to the extent of 70.9 percent. It is crucial to remember that only around 3% of water is fresh, and that only little more than 1% of this is suitable for direct human usage. Hence, effective water management is crucial. Water treatment on both a local and big scale helps with proper water management. Storm water, industrial effluents, and black and gray water may all be treated. The process of treating the water restores it to its initial condition, making it suitable for both home and industrial usage as well as safe disposal. As it guarantees that there is enough water for human consumption, water treatment is crucial. A change in lifestyle might also help with water management. Water conservation may be greatly improved by using just the quantity of water you need and turning off the faucets when not in use.

Conserve, Recycle, and Use

Certain materials may be recycled or reused instead of being disposed away. The volume of use must be reduced for better management and more effective resource use. Less waste will result from improved efficiency, which is a change in lifestyle. Reusing and recycling are significant methods of resource management as well as pollution prevention. Destruction of soil and water occurs when materials including plastics, glass, ceramic, oil, porcelain, and metals are disposed away carelessly. These dangerous pollutants may also have detrimental consequences on both aquatic and terrestrial life. As these substances are inorganic, bacteria cannot degrade them. Recycling and reusing these materials are much preferable than disposal. For instance, when oils are recycled, many grades of oil with various uses are produced. Paper waste that is also not biodegradable is recycled and used for a variety of purposes, including tissue paper [7].

Statutes and Rules

The management of resources must prioritize putting rules and regulations into place to prevent resource waste. People are made aware of the need to protect resources for future generations by these rules and regulations. People will refrain from resource waste if severe penalties are imposed on those who violate the rules and regulations. Government and business organizations should both promote the value of effective resource management through the media and on other platforms.

Mass Transport and Hybrid Vehicles

Fossil fuels are used by almost all vehicles to transport people and goods. A big part of lowering the quantity of petroleum utilized globally is discouraging people from driving their own automobiles. Since they have a lower person-to-fuel ratio than personal automobiles, buses and trains are viable options. This prevents the limited fossil fuel reserves that are still accessible from being depleted while also reducing air pollution levels. Hybrid cars that run on alternative fuels like butanol and ethanol are a good choice for those who don't like public transportation. Because to the fact that they are made from agricultural products like maize, ethanol and butanol are easily accessible. The quantity of natural resources that humanity utilizes is enormous, from fossil fuels to potable water. Although certain natural resources, like sunshine and wind, can be replenished and are not in danger of running out, others, like natural gas and trees, must be preserved since they decline more slowly than they can be replenished.

Lessen Reliance on Fossil Fuels

Lessening the use of gasoline and electricity, which are often generated by the burning of fossil fuels, is a common way to prevent the depletion of fossil fuels. Purchasing locally produced or locally raised food goods helps farms and businesses that don't use fossil fuels to transport their products over vast distances, even when driving less and carpooling more are apparent strategies to save gasoline. Additional consumer decisions that promote the preservation of fossil fuels include acquiring an efficient automobile and Energy Star appliances[8].

Keep Our Water Clean although water may seem to be a limitless, universal resource, availability to clean water for a given population declines as a region's population rises. There are various actions you may take in and around your house to prevent pure water waste. One important step is to read your water meter, turn off the water for two hours, and then check to see whether the reading is the same to check for water leaks. Otherwise, you have a leak. Replace or repair faulty faucets since this is another efficient approach to save water. In a year, a faucet that drops once per second may waste 2,700 gallons of water.

Protect Forests And Trees.

Preventing the destruction of forests is a top concern since the world has to chop down over 4 billion trees every year just for paper. You have a variety of possibilities in your everyday life to use less paper, from switching to an online-only membership to your preferred newspaper to using more cloth towels instead of paper towels. Also, it's crucial to behave appropriately while in a local forest. By according to the "Don't Move Firewood" advice provided on The Nature Conservancy's website, campfires may be properly maintained and the spread of dangerous invasive pests and diseases can be minimized.

Keep Coastal Ecosystems Safe

Not only are coastal habitats crucial for preserving biodiversity, but the fishing and tourist sectors also greatly value them. Consumers of seafood, whether or not they live close to a coastal reef, should be mindful of how their purchase choices impact the ecosystem. If you want to boat along the shore, be careful to research the location of the coral reefs. Reefs should only be accessed carefully and with respect since they are sensitive to disruptions. "Take only images, leave only bubbles" is a wise maxim for individuals who dive or snorkel near a reef.

Protect Wildlife And Plants [9]

The two fundamental pillars of human attempts to preserve plants and animals are preserving the habitats in which they may flourish and refraining from harming the actual plants and animals. The purpose of conservation is to protect resources for the future. Yet, economic opportunity often pushes people to modify their surroundings and take advantage of various plant and animal species, sometimes to the point of extinction. Sometimes, the nature of economics runs counter to conservation. Resources become more valuable to those who can still get them as they become scarcer, hence incentives increase as a result.

Protect the environments for animals and plants

Although if people need plants and animals as commodities, their environments may also be valuable. Africa offers instances of how agricultural development has resulted in the loss of forest area and biodiversity. Across the globe, coastal mangroves are being replaced by aquaculture and agriculture, and many species' natural habitats are also being destroyed by development. Between 1968 and 1983, the Philippines lost around half of its mangroves to aquaculture. The biodiversity found there would be preserved if these settings were preserved by appropriate agricultural expansion and laws protecting remaining wild areas from development. There are initiatives to enhance these areas, but more work is needed.

Impact of Market Pressure on Plant and Animal Resources

African elephants and rhinos serves as an illustration of how animal resources are being depleted; when these animals are killed for their ivory by poachers, their tusks and horns become more scarce and expensive. In anticipation of greater prices in the future, buyers stockpile ivory. In the last year alone, prices for Asian tropical hardwoods like rosewood have increased by as much as 90%. In each instance, preserving the plant and animal resources necessitates battling market pressures, such as prohibiting the sale of ivory and imposing limitations on the export of timber.

Lessening Demand from Humans On Plants And Animals

Demand for meat is increased by rising living standards in emerging nations because more people can afford to consume meat. As a result, more natural resources are needed to produce meat. For instance, the grains that the US uses to feed its cattle could feed 800 million humans. As a result, people decimate more natural habitats to satisfy the need for meat. Reducing the amount of meat one consumes would lower the demands made on the food, water, and space needed to produce it?

Recycling is a method that is now gaining popularity due to its favorable impact on the environment and improved economics. The LCA (Life Cycle Assessment) method emphasizes that recycling is not a new concept in the building industry. Therefore, C&D (Construction and Demolition) waste recovery has increased significantly in recent years, at least in Europe ; however, because the majority of recovered materials are used for low-value construction projects like filling roads and excavations, it is imperative to improve C&D waste recycling on both a qualitative and quantitative level . Also, recycling takes place more off-site than on-site. This situation is influenced by a number of factors, some of which are relevant here: the original materials that make up C&D waste; the original construction methods; the cost of waste treatments; the lack of adequate research and application of treatment processes in the construction sector; the lack of preparation of the actors involved in the construction process; and the weakness of the legal framework [10].

It is also important to keep in mind that, in order to promote land conservation and lower C&D waste creation, the same sustainable resource conservation principles that encourage recycling also call for the reuse of already-built structures for as long as feasible . This entails renovating old structures on an ongoing basis while delaying destruction for decades, creating a certain quantity of C&D waste each time. It becomes clear that improved recycling efforts, both on-site and off-site, need for a more coordinated effort. Recycling in construction will continue to be weak and continually influenced by building material producers that market their goods as sustainable because they include a certain amount of recyclable/recycled material as long as there is no clear and comprehensive vision that supports it. This is certainly advantageous, but it is neither sufficient nor necessarily really sustainable.

When it comes to the original materials that make up C&D waste, one of the biggest barriers to high-value recycling is related to the original construction method: if it necessitates wet operations, like walls made of brick and mortar, selective demolition separating the basic materials is expensive and time-consuming. Because of this, the waste produced by nonselective demolition is "dirty," greatly decreasing or even eliminating its value for the production of secondary raw materials unless it is put through appropriate treatment procedures at a cost, which favors its use as low-value material (typically aggregated) for construction projects. When dry building methods are first used and disassembly is made available, basic materials and components are gathered more readily and efficiently and directed toward reuse/recycling. However, for a variety of reasons, it is typical for them to be sent through basic recycling treatment processes, such as those for steel, wood, glass, PVC, etc. , rather than going through maintenance and adaptation procedures that could make them usable in the same or different construction sites as second-hand materials and components, like beams, windows, tiles, etc [11].

Regarding pricing and technologies that can provide second-hand raw materials for building, treatment techniques are also crucial to enhancing recycling. Like with plastic or tires, many waste recycling treatment methods are researched and put into practice outside the construction industry; occasionally they aid in the production of construction products like recycled polypropylene components for crawl spaces or recycled rubber aggregates for composites. With the introduction of the need to respect a particular amount of recycled materials in building goods by law, at least for public investments, things have changed. This is helping to cut the cost of goods that would otherwise be greater than the cost of raw materials and boosting manufacturers' commitment to the research and use of innovative operational technologies for waste treatment processes in the construction industry. Yet, due to a focus on producer interests and statutory requirements rather than, or in addition to, what may be most effectively required on building sites, study and use of treatment techniques in the construction industry remain limited. This is shown by research and manufacturing initiatives that, although being important for eco-innovation, are nevertheless very localized and underutilized.

The lack of preparation of the actors involved in the construction process, who typically adhere to normative guidelines, such as the previously mentioned percentage of recycled materials to be respected in public constructions, without understanding the true possibility inherent in recycling to modify the design and construction processes , in new constructions as well as in renovation of existing ones, even more important no There is a dual responsibility as a result: on the one hand, legislation is not at the forefront , merely providing threshold values without promoting a vision of recycling; on the other hand, architects, engineers, researchers, professionals, and construction companies generally do not play a dynamic, proactive role , asking manufacturers for new treatment processes, supplying them with sufficient knowledge and technologies, aiding in the investment and design of new processes.

This makes it clear that even for recycling, which was originally pursued for energy conservation, we are pursuing sustainability goals as if they were independent of one another. Development actors can act independently, with a lot of commitment but with the result of struggling without really succeeding. Recycling for the purpose of saving raw materials must be pursued alongside the use of second-hand materials and low-value renewable materials as part of a comprehensive sustainability vision for the construction industry. It must also be done on a large scale , with this being supported by advancements in research and technology and policies, regulations, and financial measures in the industry[12], [13].

CONCLUSION

With the introduction of sustainable development principles in the building industry, we have taken a step-by-step strategy rather than a systemic one, which is well known to be beneficial in addressing the complexity of sustainability. That has been true for both reducing the use of fossil fuels and other current hot topics like recycling. Although if this method of operation unquestionably results in improvements, they are insufficient to stop the unsustainable use of natural resources, clean up the environment, and stop climate change. To support a comprehensive approach to the sustainable development of the built environment, recycling is a crucial goal in the building industry that can and must be reinforced.

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