INTRODUCTION

1.1 Introduction:

Economic development has been concerned with the exploitation of resources within the country for the welfare of the people. In the past or even today, capital plays an important part in the exploitation and harnessing of the resources. The classicals emphasised the role of capital and capital accumulation in the process of development. Over the centuries, when the evils of capitalism were brought to light by Marxists, labourers took the pride of place. Various measures to protect labourers from exploitation were introduced by the governments in the beginning of the 20th century. Influenced by the writings of Webbs the concept of 'welfare state' was evolved, which is supposed to take care of the individual from 'womb to tomb'. It cares for the individual both as a producer and as a consumer. It provides good conditions of work, reasonable wages, facilities for training and development of skill, adequate compensation for accidents during the working period, housing facilities, provident fund facilities etc., to the individual. Till the 50's of the last century, little attention was paid to the utilization of Land (Natural Resources) a primary factor of production without which nothing can be produced. The very term "exploitation" suggested reckless use of natural resources. This is because most of the countries were influenced by the G.N.P. (Gross National Product) approach. The goal was maximum production of goods and service for the benefit of the members of the community. It led to a 'mad-race' among the nations to achieve higher and higher rates of growth of G.N.P. (Gross National Production) for which natural resources were exploited. No attention was paid to
know as to how the output was produced, how much of the output was returned to nature to maintain and sustain its productivity, and also as to how much of the output was consumed and how it was consumed and how much of the output was wasted and how much it affected the growth of the economy and the welfare of the people, etc.

The recognition of any country had depended on the rate of growth of output and the consequent rise in the level of "standard of living". This was described by Samuelson\(^1\) as consumption approach or cow-boy approach, where a cow-boy is not worried about the future. He is interested only in feeding his livestock. The defects of this approach were discovered very soon. The chief defects amongst them are;

1. Growth of industrialisation leading to overcrowding of cities and creating housing and sanitation problems. It gave rise to slum areas with excessive congestion in cities.

2. It led to pollution of all kinds-air, water, land and noise, about which attention has been paid only recently. All these became, in the words of E.J. Mishan\(^2\) costs of economic growth. It is aptly described that the solution became the problem. Economic development which was supposed to provide solution to the problems of welfare, became a problem itself, creating issues of ill-fare. A more serious threat to mankind is the rate at which natural resources are utilised, causing their rapid depletion especially those resources which are fixed in quantity and are likely to be exhausted completely within a short span of time. For example, the U.S.A. at present uses so much energy every day which would be sufficient for six months for under developed

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countries. If continued at this rate, the world as a whole would face the problem of exhaustion of important mineral resources very soon. During the 50's and 60's it was this fear which caught the attention of the world body. In 1969, in the General Assembly of U.N.O., the then Secretary General Mr. U. Thant appealed to the member nations to conserve the resources. To quote him: "I do not wish to seem over dramatic but, I can only conclude, from the information that is available to me as Secretary General, that the members of the United Nations have perhaps ten years left in which to subordinate their ancient quarrels and launch a global partnership to curb the arms race, to improve the human environment to diffuse the population explosion and to supply the required momentum to development efforts. If such a global partnership is not forged within the next decade, then I very much fear that the problems I have mentioned will have reached such staggering proportions that they will be beyond our capacity to control."

The arms race, environmental deterioration (pollution), population explosion and economic stagnation would be long term problems of the modern world though the common man is neither aware of, nor interested in, these issues. The leaders, the thinkers, and the scientists (Physical and social) must address themselves to these issues and find out remedies, so that they can save the world from the problems as observed by the Secretary General of U.N.O. The Club of Rome made an interesting and thought provoking study in

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3 Meadows (Donella, H.)et.al.: *Limits to Growth* ; Report for the Club of Rome, Project on Predicament of mankind, Edn.II, 1977, p.17
this connection and published its findings in the publication 'The Limits of Growth'.

The group led by M.I.T. (Massachusetts Institute of Technology) Scientists, i.e. Meadows and others employed the latest technology to develop a model known as 'world dynamics', the basis of which is the recognition that the structure of any system, the money circular interlocking, dooms times delayed relationship among its components is often as important as the individual components themselves. It considered five important variables of the "world dynamics, viz : i) Population, ii) Food, iii) Industrialization, iv) Depletion of resources and v) Pollution.

All these interact with one other and grow at an exponential rate, finally causing the collapse of the economy. Population for example is now increasing at a fast rate, thanks to the substantial fall in the death rate, improved health facilities and effective control of major diseases like plague, malaria, but the birth rate has not similarly comedown. Hence the explosive trends in population. The world when? more than 100 billion people creating problems of food, clothing and shelter and also providing of basic facilities like health and education especially in the Third World countries.

Secondly, food supply cannot cope with such an explosive increase in population. All fertile lands have already been brought under cultivation, hence increases in food output can only come about following the "Recardian principle" by bringing in inferior land under cultivation or taking to intensive cultivation. In both cases, it leads to rising cost and food becomes dearer and dearer.

4 Meadows (Donella, H.) et.al., Limits to Growth, Report for the Club of Rome, Project on Predicament of Mankind, Edn.II, 1977, pp.18-19
Thirdly, industrialization is taking place in all the developing countries also. Though this is a welcome feature from the point of view of income and employment this is taking place only in the rich countries and will further aggravate the differences between rich and poor countries.

Fourthly, higher rate of industrialization has led to rapid depletion of vital resources like coal, energy, minerals etc. The present life style is described as energy-intensive. Sooner or later important resources which are fixed in quantity or stock would dry-up.

Lastly, growing population and industrialization have resulted in pollution of all kinds including air, water, land and noise. Big cities have become dens of pollution.

All these are not only growing but they also interact with each other causing acceleration in the growth rate of others. Thus economic development, which is aimed at increasing welfare of the people, is actually reducing the welfare due to the side effects of development. The Massachusetts Institute of Technology (M.I.T.) projecting on the basis of 'system dynamic' prophesied that the world economy would collapse within the next 150 years, if remedial measures are not immediately taken. It suggested the following, viz,

1. The population should take advantage of the possibility of birth control.
2. The desired number of children should be two per family.
3. The average level of industrial production should remain constant at the 1975 level.
4. The consumption of natural raw materials should be reduced from 1975 onwards to 20% of the 1970 level.

5. The industrial and agricultural emission of toxic substances should be reduced to 25% of the 1970 figure.

6. Capital for food production should be made available for the elimination of malnutrition in such a way that it should be independent of profitability criterion.

7. More capacities should be directed to agriculture and in this context land improvement should take priority, and

8. The quality of industrial goods should be improved with the purpose of extending the scope of their application.

According to Limits To Growth (L.T.G.) study the present trends would severely affect sustainable development. It is frightening even to think of the emerging situation of complete exhaustion of resources. L.T.G. study is described as the second 'Malthus' warning the people, about the future of mankind.

Though M.I.T. forecast that the 'world economy would collapse within the next 150 years', and evoked lot of research, later researchers criticized this approach and its conclusion, severely and dispelled the fear among the people. More discoveries, more inventions, improvement in technology, varied substitute materials, efficiency in the use of resources, and economy in their use, are the remedial measures suggested, which will postpone indefinitely the dreaded collapse. According to them, as long as there is no dearth of human ingenuity, there is no such fear of a collapse. The world has been using the resources right from the day "Adam and Eve" appeared on the scene. So many civilizations arose and fell. The world has
continued, it has not collapsed. Nevertheless, optimum use of resources is a must. Indiscriminate use of resources may endanger the availability of even renewable resources in future, for example, water. Hence, conservation and careful use of resources have assumed great significance now a days.

1.2 Significance of the Study:

Interest in sustainable development and conservation of resources is of recent development which is urgently needed everywhere. Earlier development theories emphasised exploitation for the welfare of the people rather than conservation. It followed the consumption approach. During the seventies of the last century, the MIT scientists threatened the world of “dooms day” within the next 150 years, if suitable steps are not taken to alter the present high life style requiring high rate of exploitation of resources causing complete exhaustion in the not very distant future. Later researchers dispelled the Malthusian fear of dooms day. Nevertheless, the researchers emphasised the need for conservation and sustainable development to maintain optimum balance between present and future. Economic development cannot be imagined in the absence of natural resources. The quantity and quality of natural resources coupled with technology, ultimately determine the state and extent of development in any country.

Natural resources are broadly divided into two categories, viz; a) The renewable resources, which do not pose a serious problem, and b) The exhaustible resources, which are non renewable resources. These resources, especially exhaustible ones, have to be optimally used keeping in mind the inter-temporal equity and availability.
The unequal distribution of world resources among the countries of the world, compels each country to take suitable measures for optimum utilisation of resources available within the country. Incidentally, it may be noted that even renewable resources also pose a problem if the rate of exploitation of such resources exceeds the rate of replenishment.

In respect of exhaustible resources an interesting exercise was made by R.M. Solow. In his article, he tried to answer the question 'can an economic system which uses its exhaustible resources, maintain its standard of living forever? He considered a highly simplified analysis taking the following production function of Cobb-Douglas's type.

\[ Y = e^{ct} L \cdot D^{h} \cdot K^{1-g-h} \]

Where, \( e = \) has a value little over 1.0,

\( c_t = \) rate of technology change and time respectively.

\( Y = \) output, \( L = \)Population, \( D = \) Natural resources, \( K = \) Capital

The explanation of the above formula runs as follows:

(a) Assume there is no technological change then \( c = 0 \), and \( e^{ct} \) becomes constant. If \( k/L \) ratio is constant, \( D/L \) approaches zero as resources are used up. \( Y/L \) must also approach zero. The per capita standard of living will eventually fall to zero.

But if \( K/L \) ratio grows without limit and, \( D/L \) reduced to zero, \( Y/L \) can remain positive. Capital accumulation can compensate for resource exhaustion.

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b) If $L$ increases in Malthusian fashion, there must be an upper limit to $K/L$. So with exponential growth, $Y/L$ reaches eventually zero. So hold population constant, allow $K/L$ to increase without limit. So that $Y/L$ remain positive. The highest standard of living that can be provided depends on initial stock of capital per worker.

(c) If $c > 0$ (technological programme increasing) so that $e^{ct} + \text{increase with time for any value of } c$ we can calculate the rate of growth of population, that will keep standard of living constant and positive. Here, technological programme compensates the growth in population.

The strong assumptions for these results are:

i) Cobb-Douglas Production Function (P.F) assumes constant returns to scale,

ii) It assumes Cobb Douglas Elasticity substitute (C.E.S.) among inputs,

iii) With CES between "D" and 'K" there is nothing special about 'D'. This means "K" acts as a perfect substitute for "D",

iv) So Solow suggested, if use of exhaustible resources is directed toward production of renewable substitute goods and investment in human capital and if population is controlled, it is possible to maintain the standard of living forever. Progress in science and technology is likely to aid exploration and exploitation, new resources may be found out, new methods of efficient exploitation may be employed, new uses, new substitutes may be suggested thus dispelling the fear of "Dooms Day".
However, unrestricted optimism about future availability of resources is not justified. On the other hand, overall pessimism is equally one sided and unwarranted. A realistic assessment is necessarily more complex and will involve dealing with specific individual resources. Poor countries faced with pressure of population cannot afford to become optimistic about their resources. They must use their resources optimally so that development becomes sustainable. This is especially so with exhaustible resources. Much care has to be taken in the use of exhaustible resources to preserve inter-generational equity as exhaustible resources are fixed in stock. If we want to have more now, less will be available for future. On the other hand if we preserve more for the future, we will be unnecessarily put to hardship at present. A proper balance has to be struck between the present and the future in the use of natural resources, particularly this been true in the case of exhaustible once. Hence, the present study has assumed great significance in this respect.

1.3 Statement of the Problem:

Against this background, the quarrying industry is taken for the study. Quarrying essentially deals with the exhaustible resources. It consists of extraction of stones from the underground and shaping the stones into different sizes and forms, required for fencing, construction, flooring, etc. The main demand for quarry products, namely stones of different sizes, comes from building activities. Due to poor and inadequate housing facility, there is ever growing demand for buildings and houses, which would generate unlimited demand for building materials. In recent years, there is a housing boom also. Finance is made available for building houses by the Government, LIC, Banks and Non-Banking Financial Institutions. The rate of interest on housing loan is also reduced recently. Therefore, we have a
situation where ever growing demand chases fixed stock of a resource. This is likely to lead to misallocation of the resources, and depletion of the resources too rapidly. There is a need for optimum use of resources over the years to maintain equity in the use of resources over time. Hence the present study.

1.4 Review of Literature:

Undoubtedly, there has been a good account of theoretical literature on exhaustible natural resources. But empirical work on stone quarrying is not in existence much. Still there is a gap which has to be filled up. There is need for such a research which prompted us to undertake the study of exhaustible natural resources, specially, on stone quarrying.

Contemplation of the disappearing of the world's supplies of minerals, forests and other exhaustible resources has led to the demand for regulation of their exploitation. Presently, these products are being selfishly exploited not only at too rapid a rate but also at cheaper cost leading to wasteful consumption. Therefore, for the benefit of future generations, suitable measures to conserve such natural resources must necessarily be adopted.6

Most studies on non-renewable resources production and pricing assumes that there is a fixed reserve base to be exploited over-time. But, in fact, with economic incentives, reserves can be increased. Here, we treat the reserve base as the basis for production and exploratory activity, as the means of increasing or maintaining reserves. Potential reserves are unlimited, but as depletion ensures given amount of exploratory activity result in even smaller discoveries.

Given these constraints, resource producers must simultaneously determine their optimal rate of exploratory activity and production.\textsuperscript{7}

The study relates to the demand for building materials, environmental problems like rocks-slips, rockslides, deforestation, sound and air pollution which are being experienced in areas of quarrying which can be checked by adopting remedial measures.\textsuperscript{8}

The Economics of Natural Resources Availability, draws a distinction between Malthusian view and Ricardian view on resources scarcity. In their view while Malthus emphasised on absolute scarcity,\textsuperscript{9} Ricard spoke of relative scarcity. Scarcity of non-renewable and resources would be a constraint on economic growth irrespective of population problem.\textsuperscript{10}

Models of the extraction process of renewable and non-renewable resource stocks, in which the rate of extraction is constrained by the size of the physical capital stock. Investment in physical capital is undertaken in the initial time period and is terminated before the end of mines life.\textsuperscript{11}

The assumption of complete versus incomplete exhaustion of resources, the concept "full marginal cost" must include a term under complete exhaustion which reflects the

\textsuperscript{7} Pindyck, R.S.: \textit{The Optimal Exploration and Production of non-renewable resources}, Journal of Political Economy,1978, Vol.86, No.5 pp.841-861

\textsuperscript{8} Misra, R.P. and Misra, H.N.: \textit{Human survival and Development}. Focus on water and minerals. Annals of NAGI, 1986 vol.6, No.2, pp.21-38


\textsuperscript{10} Mill J. S.(1929): \textit{Principles of political Economy with some of their applications to social philosophy}.

alternative cost of producing "an extra unit At the terminal time. Under incomplete exhaustion, this term vanishes.\textsuperscript{12}

Intergenerational equity means equal consumption per capita at each date. The problem is to find a path which is equitable by this sense and also inter temporarily efficient if there exists such a path, then already there alertly there is no conflict between equity and efficiency. A necessary condition for the existence of inefficient equitable path is that there is some path which can maintain a positive consumption level.\textsuperscript{13}

The use of modern concepts of production, which allows substitution between capita, labour and natural resources, it is difficult to believe that per capita consumption of mineral in the developed world should necessarily decline or cease to grow. On the other hand for a developing "economy such as India, per capita consumption of mineral resources does not show any definite trend of to the growth of GNP.\textsuperscript{14}

Optimal extraction from a resources stock of uncertain size, information indicating the size of the stock, assuming costs and social preference must be known. A method for determining the optimal extraction programme, when there are no opportunities for exploration or storage of the resources, or the optimal rate of extraction when the resources stock is uncertain is less than the optimal rate of the expected value of the stock, that is uncertainty


\textsuperscript{14} Sen Ranen (1985) : \textit{Growth with Exhaustible Resources. The Case of developing Countries, A Review – Asian Studies, Vol.3 (1 and 2) pp.24-30.}
implies a more conservative extraction policy. Extraction provides more information about cost and location of resources conditions that are necessary for efficient investment in exploration information.\textsuperscript{15}

A steady growing per capita consumption is possible under the Cobb-Douglas, techno-Economics considering that natural resources are essential and that they have a fixed reserve.\textsuperscript{16}

The optimal depletion policy for a country with a variable resources which is inexhaustible but available in various grades and at various costs. Cost is assumed to increase with cumulative remain extraction point, but then to upto a constant as a backstop supply is reached. Emphasis is placed on the behavior of prices along on optimal path and it is shown that the price-cost relationship is very different from the standard one of an exponentially growing royalty.\textsuperscript{17}

The importance of the natural resources such as land water, and mineral resources to human kind is in their survival on this planet. The authors have posed this problem in the context of the impeding ecological crises.\textsuperscript{18}

The environmental experience of the people of a particular place can be described by interrelated phenomenon of its lived


\textsuperscript{17} Heal. G. (1976) : \textit{The Relationship between Price and Extraction cost for a Resource with a Backstop Technology.} Bell Journal of economics, Vol. 7 No. 2.

space landscape and place. The uncontrolled technological development can prove to be a major disturbance to the environment. According to the author the modern process of development in India is largely responsible for disturbing the ecological balance. The author has also suggested a strategy for envelopment to promote human welfare without disturbing the eco-system of a region.\(^\text{19}\)

There is another study which leads us to that environmental planning and management is essential to avoid environmental degradation reaching unmanageable limits. The systems analysis approach to environmental problems seems to be only to arrive at balanced comprehensive solution.\(^\text{20}\)

Disturbances and wastes produced by mining are a serious threat to our environment yet mining is an important part of national wealth. To reduce its environmental impact we must find reliable and economic ways in which we can reestablish on mine-wastes.\(^\text{21}\)

Against this background regarding the exhaustible resources, quarrying activity in Gulburga district is studied with the following objectives.


1.5 Objectives:

The following are the specific objectives of the present study:

1. To study the nature of quarrying activity.
2. To assess the kind of relations that exists, among the owners and workers in quarrying activity and examine the type and kind of quarry output.
3. To study the extent of employment of labour found in quarrying activity and estimate the level of income of the people engaged in quarrying activity.
4. To study the extent of awareness among quarry workers about the exhaustibility of resources.
5. To study the impact of quarrying activity on environment
6. To recognise the realities of the situation and identify the real reasons of the problem and propose suitable remedial measures.

1.6 Hypotheses:

With a view to examine the above objectives the following hypotheses are tested in the present study.

1. People (owners) engaged in quarrying activity are not aware of the ultimate impact of exhaustibility of resources on the living standard of the people.
2. People engaged in quarrying activity are also not aware of the environmental impact of their activity.
3. The workers employed in quarrying activity do not earn sufficient income to have a decent standard of living.
4. The workers working in quarrying activity are exploited by the owners.
1.7 Research Design and Methodology:

a) As the subject is concerned with the exhaustibility of the resources and the economic well being of the people engaged in the exploitation of the resources, the study has relied upon primary investigation in the area where quarrying activity is carried on, in Gulbarga district. Random sampling method is adopted in the study. Random samples are collected from all the talukas of Gulbarga district where quarrying activity is found and used for drawing inference in the study.

(b) Sources of the Data:

The study has used both primary and secondary data.

i) Primary Data: The Primary data about production, income, cost, expenditure, investment, number of labourers employed, marketing, prices, profits etc, are obtained through prepared interview schedules from the concerned quarry owners and workers.

ii) Secondary data: Data relating to total area, total population, total quarrying stone area are obtained from the Department of Mines and Geology, Government of Karnataka Bangalore; District at a Glance, Government of Karnataka, Bangalore; and other various published journals and periodicals and also information from various offices within the district and outside the district.

(c) Tools of Analysis Used:

The data/information are tabulated and analysed through simple statistical tools. Arithmetic mean and percentage methods are employed in analysing the data/information. In addition, tabular and
graphic methods are also employed. Further, diagnostic approach is used wherever necessary.

**d) Period of the Study:**

The data are collected for a period of five years i.e from 1995 to 2000 A.D.

**e) Area and Scope of the Study:**

The present study is concerned with quarrying activity found only in seven talukas out of ten of Gulbarga district. Data are collected through well structured schedule for two hundred respondents spread over thirty nine villages of seven talukas of Gulbarga district. The record maintained by the Department of Mines and Geology (Government of Karnataka) is sued for preparing a list of quarrying units operating in the study region by 1999-2000. It is found from the record that quarrying units are highly heterogeneous in character so far as capital investment, employment and nature of production are concerned. Totally 190 quarrying units are registered in the study region.

The stone quarrying units in each stratum are serially arranged and it is decided to select 25 per cent of the units from owners and 10 percent of labourers from the total number of workers employed in the units. For each stratum the ultimate sample units have been selected on the basis of simple random sampling.

In each village respondents are chosen by random sampling method. Since quarrying activity has an agrarian type of relation in some talukas, of the two hundred respondents, one hundred belong to owners of quarries and remaining are workers. The distribution of respondents of thirty nine villages in seven talukas is not uniform.
since the number of respondents have been decided on the basis of the extent of concentration of quarrying activity in the taluka and selected in such a way that, where quarrying activity is highly concentrated samples are more and where it is not so, respondents are less. Through schedules, information is collected about the nature of the activity, employment, income etc.

1.8 Relevance of the Study:

The present study, though concerned with exhaustible resources is essentially a study dealing with socio-economic conditions of the people engaged in exploiting exhaustible resources. The people employed in this industry mostly belong to scheduled caste and scheduled tribe. This is a useful study for the government which is striving its best to ameliorate the economic and social conditions of the backward communities. It has policy implications because the quarrying activity can become an important antipoverty programme with substantial income and employment opportunities.

1.9. Chapter Scheme and Brief outline of the Study:

The present study is organized into 7 chapters as mentioned below:

CHAPTER-I:

Introduction

Introduction - Significance of the study, Statement of the Research Problem, Review of Literature - Objectives of the Study-Hypotheses-Research Design and Methodology-Relevance of the study- Chapter Scheme and Brief outline of the study.
CHAPTER-II

Natural Resources and Economic Development

CHAPTER-III

Theories of Exhaustible Resources: A Critical Review

CHAPTER-IV

Profile of the Study Area

CHAPTER-V

Working of Quarry Industries in Gulbarga District: An Economic Analysis of Quarry Owners.

CHAPTER-VI

Position of Quarry Workers in Gulbarga District: An Economic Analysis.

CHAPTER-VII

Conclusion and Suggestions

Introduction - Significance of the study, Statement of the Research Problem, Review of Literature - Objectives of the Study-Hypotheses-Research Design and Methodology-Relevance of the study- Chapter Scheme and Brief outline of the study are explained in the Introductory chapter.

The second chapter has discussed the nature of resources, their classification as exhaustible and inexhaustible resources, and the characteristics of exhaustible resources. It also discusses the approaches for the use of resources, exhaustible resources in
particular and its role in economic development in general. The third chapter explains the theoretical background of the study of exhaustible resources. It discusses the leading theories of exhaustible resources, especially the Gray and the Hotelling models. This chapter also overviewes the exploitation activity among different market structures like perfect competition and monopoly and their impact on rate and period of exploitation.

In the fourth chapter, the study is concerned with the profile of the district. It gives a brief history of the district and examines the latest position with regard to important economic indicators like population, density, distribution of population, sex-ratio, educational status etc.

In the fifth chapter, discussion about quarrying activity as distinguished from mining activity and general description of the nature of relations in quarrying activity and the socio-economic features of respondents selected for study is undertaken. The sixth chapter analyses the data collected and discusses the kinds of quarry output, income earned by the owners of the quarries. It also highlights the expenditure pattern in the quarrying activity, with its emphasis on the workers. It also deals with the problems of exhaustibility of resources and environmental impact of the quarrying activity.

The seventh chapter summaries the main findings of the study and offers some recommendatory suggestions for policy perspective.

1.10 Summing Up:

While there is adequate literature on mining, quarrying which is different from mining, (through it is a sub-set of mining) lacks adequate attention of the public as well as the Government. As no
adequate is literature available on the economics of quarrying, economic relations that exist in quarrying activity, extent of employment, socio-economic conditions of the workers etc., there is a need of separate study in this respect. **This work contributes to the understanding of socio-economic relations in quarrying activity.** A modest attempt has been made here to throw light on the issues connected with quarrying activity for solving the existing problems.