ISSN No:-2456-2165

The Economics of Space

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Abstract:- This article focuses on the capacity of space that can provide resources to lower the cost of living and space activities that helppeople to protect the environment and the quality of air in the world. Whenever the space is studied in the context of economics, it is seen that it helps to generate new jobs in the world. In order to improve the economics of space, there are several approaches that could be applied. Firstly, it is important to establish market through decentralization of financing and reaching targets for space activities. Secondly, it is significant to create a healthy market structure and lastly to regulate the market according to the requirements.

Keywords:- *Economics; Resources; Space; Technology.*

I. INTRODUCTION

It is known that technological advancement significantly changes everyday lives of humans. Whenever the technological development is considered through the history, it is seen that the improvements have started with single prototypes that took much labor and the manufacturing cost that was so high that the demand could be done by wealthy people in the World. The manufacturing process was standardized to assembly line manufacture by decreasing the price level making it more affordable to more people than before by applying economies of scale and using cost efficient materials and designs. This vision initiated the production of goods that have demanded by ordinary people.

A commerce-based structure is used everywhere in the World by letting us to extend the vision to space environment. It is meaningful to try to find new energy alternatives throughthe environment with lowgravity or weightlessness.Developing and underdeveloped countries currently create significant damages in the quality of air because of trying to develop industrial environments to lower the cost of living. Space has the capacity to provide clean energy and some certain minerals in airless and lifeless places causing no damage to the environment.

Whenever certain minerals are taken into consideration, asteroids are good places for mining since they stand in microgravity [1].The mining machinery requires no special structure to do mining and their composition makes them valuable in space. Potential asteroid resources can be divided into three categories in economic terms: 1. valuable both on Earth and in space such as platinum group metals, 2. somewhat valuable on Earth and valuable in space like ferrous metals and 3.not valuable on Earth and significantly valuable in space such as organic materials. Asteroid and lunar mining [2]could reduce the cost of Earth-based mining in the sense of environment such as preventing the contamination of water supplies and the quality of air.

It is known that there is opportunity of getting abundant solar energy in space. Additionally, advanced fusion experiments can also be done in deep space or on the Moon.For instance, cheap satellites in Low Earth Orbit (LEO)(A low Earth orbit (LEO) is an Earth-centered orbit. It has an altitude of 2,000 km or less which is approximately one-third of the radius of Earth[3]. Most of the manmade objects in outer space are in LEO and theycan deliver high-resolution imagery and comparable to aircraft photography[4]. This capability can generate economically valuable information[5]and it can also be combined with drone imagery to get affordable data in detail. For example, farmers can see the effectiveness of irrigation with the imagery of soil and decide about the watering of the small areas or fishers can find the stocks of the fishby receiving data related with the ocean surface. If the cost of space travel can be decreased, it will be possible to inject new ideas into business with market prices.

In order to generate important private economic interest for using satellites for the communication and for some of the purposes mentioned above, the near-term economic goal is to decrease the price of launch to low-earth orbit to around $1000 perpound.

It is realized that public to private priorities in space is especially important because a widely shared goal among commercial space's leaders is the achievement of a large-scale, largely self-sufficient, developed space economy. For example, Jeff Bezos has funded the startup Blue Origin aiming to make millions of people living and working in space.The centralized control leads topoor allocation of resources, weak aggregation of dispersed information, resistance to innovation and hardly achievement of the objectives set at the centerbecause of decreased competition[6].

A self-encouraging cycle of development could be created to support the space economy. For instance, more frequent and cheaper rocket launches[7]mightaffect short-term tourism in a positive way andlead industrial and scientific experimentation on orbiting spacecraft. If these activities become routine, demandcould be generated for resources in space bringing workers and residents.

Some questions can be asked whenever it is tried to develop a commercial space sector. The questions are listed below:

1. How should the governmentscoordinate and subsidize these technologies?
2. How can the governments prevent the generation of the monopoly market?
3. What method would be most suitable to distribute the profit among the participants?

On the other hand, there is a problem that should be solved related with space debris. [8]recommends a standard Pigouvian price on debris but he also mentions that there is a problem of not having any space taxing authority. Another problem could appear about the sharing of activities in the space. For example, who has the right to mine in the asteroids and to get the profit? There is also a problem of having conflict with the public and commercial interest in asteroids. This problem has been indicated in the study of [9].

Commercial space has vast amount of resources and significantly growing market that will reach trillions of dollars over the next decade. The space industry will create space-based agricultural expertise; additive manufactures who will design and construct customized components through the environment of microgravity to prevent the huge cost of hauling spacecraft components firstly from Earth to Earth orbit later beyond; media specialists who will film private space tourism's experiences in Earth orbit; mining specialists who can organize operations to get water and other valuable resources from extraterrestrial surfaces; space-health practitioners who will focus on the health of astronauts; space architects who will construct structures in the environment of space; space traffic managers who will coordinate human piloted and robotic spacecraft through crowded Earth orbit and holoportation experts who will virtually place people from different locations in the same room.

II. CONCLUSION

The space industry with a budget of 414, 75 billion USD creates significant number of employment for mathematicians, chemists, physicists, engineers, biologists and similar jobs[10]. On the other hand, the 2020 allocation for NASA amounts to $22.629 billion[11].In order to improve the economics of space, several approaches could be suggested.Firstly, it is important to establish market through decentralization of financing and to reach targets for space activities. Secondly, it is significant to create a healthy market structure and lastly to regulate the market according to the requirements.

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