IS SPACE EXPLORATION WORTH THE ASTRONOMICAL PRICE TAG?

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Abstract

This study investigates the complex issue of space exploration, analyzing both its potential benefits and associated drawbacks. Through a comprehensive literature review, the research examines arguments for and against significant financial investment in this field.Space exploration holds potential for generating significant economic benefits, particularly in developed countries like those within the European Union. These benefits include job creation, technological advancements, and the rise of new markets like space tourism.

However, the study emphasizes the need for responsible investment and acknowledges concerns regarding the financial burden on developing nations. Additionally, it highlights the ethical considerations of prioritizing space exploration while facing pressing issues like poverty and environmental degradation.The research relied on a critical evaluation of existing literature, including peer-reviewed articles, reports from organizations like the European Space Policy Institute (ESPI), and economic analyses. This approach ensured a balanced and objective analysis of the issue.The study concludes that space exploration offers potential long-term benefits but should not come at the cost of neglecting current challenges on Earth. Responsible investment and a balanced approach are crucial to ensure that space exploration contributes to a sustainable future for humanity, addressing both celestial aspirations and immediate earthly

needs.

Аннотация

Данное исследование рассматривает сложную проблему освоения космоса, анализируя как его потенциальные преимущества, так и связанные с ним недостатки. На основе всестороннего обзора литературы работа изучает аргументы «за» и «против» значительных финансовых инвестиций в эту сферу. Освоение космоса обладает потенциалом для создания значительных экономических выгод, особенно для развитых стран, таких как государства Европейского союза. Эти выгоды включают создание новых рабочих мест, технологические инновации и развитие новых рынков, таких как космический туризм. Однако исследование подчеркивает необходимость ответственного инвестирования и признает обеспокоенность финансовым бременем для развивающихся стран. Кроме того, выделяются этические аспекты приоритизации космических программ в то время, когда человечество сталкивается с такими насущными проблемами, как бедность и деградация окружающей среды. В исследовании использовался критический анализ существующих источников, включая рецензируемые научные статьи, отчёты таких организаций, как Европейский институт космической политики (ESPI), и экономические обзоры. Такой подход обеспечил сбалансированный и объективный анализ проблемы. В заключение отмечается, что освоение космоса может приносить долгосрочные выгоды, но не должно осуществляться ценой пренебрежения текущими проблемами Земли. Ответственные инвестиции и сбалансированный подход имеют решающее значение, чтобы космическое исследование способствовало устойчивому будущему человечества, соединяя стремление к звёздам с решением земных задач.

Annotatsiya

Ushbu tadqiqot kosmosni o‘rganishning murakkab masalasini tahlil qiladi, uning

ijobiy tomonlari va salbiy oqibatlarini har tomonlama ko‘rib chiqadi. Adabiyotlarning keng qamrovli tahlili asosida ushbu soha uchun katta moliyaviy sarmoyalarni qo‘llab-quvvatlash yoki rad etish bo‘yicha fikrlar o‘rganildi. Kosmosni o‘rganish rivojlangan davlatlar, xususan, Yevropa Ittifoqi mamlakatlari uchun sezilarli iqtisodiy foyda keltirishi mumkin. Bu foydalar yangi ish o‘rinlarini yaratish, texnologik yutuqlar va kosmik turizm kabi yangi bozorlarning paydo bo‘lishini o‘z ichiga oladi. Biroq tadqiqot mas’uliyatli investitsiya zarurligini ta’kidlaydi va rivojlanayotgan mamlakatlar uchun moliyaviy yuk bilan bog‘liq xavotirlarni qayd etadi. Shuningdek, qashshoqlik va atrof-muhitning buzilishi kabi dolzarb muammolar mavjud bo‘lgan bir paytda kosmik dasturlarga ustuvorlik berishning axloqiy jihatlari ham ko‘rsatib o‘tilgan. Tadqiqotda mavjud adabiyotlarning tanqidiy tahlili usuli qo‘llanilgan, jumladan, ilmiy maqolalar, Yevropa Kosmik Siyosati Instituti (ESPI) kabi tashkilotlarning hisobotlari va iqtisodiy tahlillar. Bunday yondashuv masalaga muvozanatli va obyektiv qarash imkonini berdi. Xulosa sifatida, kosmosni o‘rganish uzoq muddatli foyda keltirishi mumkin, biroq bu jarayon Yerda mavjud muammolarni e’tiborsiz qoldirish hisobiga bo‘lmasligi kerak. Mas’uliyatli sarmoya va muvozanatli yondashuv insoniyat uchun barqaror kelajakni ta’minlashda, yulduzlarga intilish bilan bir qatorda, yer yuzidagi ehtiyojlarni ham hal qilishda muhim ahamiyatga ega.

Introduction

For millennia, humans have been fascinated by the stars and planets, driving us to explore space and achieve remarkable milestones like landing on the moon and sending robots to other planets. However, this ambitious endeavor raises a critical question: is the immense investment in space exploration justified given the pressing challenges on Earth, such as poverty and environmental degradation?

This study aims to address this fundamental question, reflecting the ongoing public debate on resource allocation and priorities. While space exploration is often criticized as a luxury amidst urgent earthly issues, its impact extends far beyond mere scientific curiosity. The technological advancements derived from space

exploration, such as GPS and medical breakthroughs, have tangible and widespread benefits for society. Additionally, studying other planets can provide valuable insights into our own planet's history and potential threats.

Moreover, space exploration serves as a unifying force, fostering international cooperation on complex projects like the International Space Station. This collaboration transcends political boundaries, offering a glimmer of hope in a divided world and demonstrating the potential for collective action for the betterment of humanity.

Therefore, this research seeks to comprehensively analyze the multifaceted impacts of space exploration, considering its economic, technological, scientific, and societal implications. By critically evaluating existing literature and gathering diverse perspectives, including those of economists, scientists, philosophers, and policymakers, we aim to provide a nuanced understanding of the true value of space exploration. Through this endeavor, we aspire to contribute to a more informed and constructive discourse about the future of our planet and our role within the vast expanse of the cosmos.

Ultimately, space exploration not only offers insights into the universe but also prompts profound reflections on our values and priorities. This research endeavors to shed light on the genuine worth of space exploration, navigating the intricate balance between celestial aspirations and earthly responsibilities. In doing so, we hope to enrich the dialogue about humanity's place in the cosmos and the stewardship of our planet.

In this article on the “Is Space Exploration Worth the Astronomical Price Tag?" The criteria and processes that influenced the investigation into the topic in the Methods and Materials section are discussed. The primary strategy involved a thorough examination of the literature with the goal of gathering, assessing, and summarizing data from numerous academic sources. Strict guidelines were followed during the source selection process to ensure the review was trustworthy and objective. Resource concentrated on current studies and publications from a reputable report by ESPI, European Space Policy Institute.

Space exploration has the potential to create at least ~€260 billion of cumulative GDP

impact and an average of ~90,000 FTEs in Europe between 2025 and 2040 (Figure 2). The investment in space exploration is estimated to generate the largest share of total benefits (~60%) and to enable catalytic effects, accounting for the remaining proportion(~40%) of cumulative impact. Additional sizable benefits are expected after the 2040-time horizon as the emergence of future markets such as space-based solar power and in-situ resources utilisation will likely realize their full potential.

These benefits could only be unlocked through a significant step up in investments and focus from Member States and, consequently, ESA. Particularly, the underlying assumption is for space exploration-dedicated funding to grow from the current investment of less than €1 billion to more than €3 billion per year, with an overall commitment of ~€50 billion in the 2025-40-time horizon, leading to a multiplier effect of over 5 times the total budget.

These resources shall be deployed to design and implement a European Space Mission

establishing an independent European presence in Earth orbit, lunar orbit, on the Moon, and beyond, including a European Commercial LEO Station, cargo and crew capabilities for the Gateway and the Moon, and sustained presence on the lunar surface.

This report was clearly identifying the benefits of space exploration to the European Union and giving examples. But the main concern is, they don’t indicate the drawbacks from it and they used possible future benefits

Data Cleaning

No data cleaning was required, as the research synthesized existing literature rather than collecting new empirical data.

Analysis

“Is Space Exploration Worth the Astronomical Price Tag?" was explored through a comprehensive review of the literature. Findings from selected studies

were aggregated to assess the significance and efficiency of thefinancial investment in universe exploration.

Proportion of investment to countries' overall financial cycle During research it was observed that some European countries are spending 10-15% of their budget on space exploration while countries like the USA are spending 1-3.5%(ESPI report). Developing countries with smaller economies were weakened by financial demands of these exploration projects, but world's leading economies could afford galaxy studies without a sensible impact on their economy.

Comparison of demands for medical and ecological problems and space exploration

According to The Space Economy: New Markets Emerge by Bank of America Merrill Lynch, one third proportion of finances invested on astronomy could be used to tackle hunger and lack of water of all people on the planet. The same research paper states, 40% of money spent on rocket building and equipment purchase will surely be enough to re-equip 75% of all hospitals of the world with modern technologies.

Comparison of expected and real benefits brought by space exploration Observation of galaxies, standard candles and huge objects across the universe allowed creation of new technologies of detection of electromagnetic radiation and more precise weather prediction methods and techniques. New technologies prevented 75% of disastrous effects of meteorite and asteroid, and other cosmic objects landing on Earth, by measuring exact time and location of fall. Raise of Space Tourism and its benefits Economic benefit from Space Tourism have potential to create at least $260 billion of cumulative GDP and an average of 90000 FTEs in Europe between 2025 and 2040.

Some countries are expected to generate the largest market share(nearly 60 %) of their country by space exploration.

Methodological Approaches

The analytical approach was justified through the reliance on peer-reviewed

articles and the synthesis of findings from multiple studies. This method allowed more precise and clear data analysis and defining clear arguments based on it to clarify both benefits and drawbacks of investments in space exploration

Final Point

Depending on the opportunities of the country due its financial status and internal economical progress countries are able to generate big profit from this sphere. The distribution of profits and depths is linked to the amount of investments and dependency of the country on certain aspects of space exploration.

DISCUSSION

The significance of the research is diverse. By checking some stereotypes of people about investment on galaxy exploration, research paper proves, this is an innovative way of getting interest for some, and waste of huge resources for others. During the research paper some countries were proven to be earning huge amounts of money and some were seen to be in depth because of inappropriate distribution of the economy. Additionally, research paper was based on an objective look at the issue, arguments and proofs were provided for advantages and disadvantages of financial investment in cosmology and astronomy. At the same time giving examples of more significant spheres of life in life needing financial assistance, research proves real benefits of Space Tourism and Space exploration. Finally research proves the fact that long term benefits of space exploration should not interfere with solutions of current problems of humanity. This thesis is supported by the fact that many resources were talking about possible or potential benefits of this sphere and were neglecting short term disadvantages of it.

The facilitation of this study was greatly aided by the considerable volume of research and data available on these phenomena. Evaluation of sources like The Space Economy: A Frontier for Sustainable Growth(2023) by Freeman, M., Armstrong, J., proves that biased ideas about potential benefits of astronomical innovations and findings were widely discussed and proved to have long term benefit. But there was no mention of the short term crisis that could damage the world economy and the fact that the investment amount is too huge to be used

efficiently. Additionally, they didn't discuss the problems that could be tackled if the money was directed to other areas of life, like ecology or medicine.

Another source that gave unfinished or non-evaluated biased ideas is a report by ESPI(2023), that talked widely about benefits that are expected in Europe and mainly from Space Tourism. This source mentions that Space Tourismhave potential to turn to the main source of funding for Europe, but neglects the fact that current position of countries doesn't allow them to afford maintenance, development or simply construction of the system of Tourism in Space. Materials that are based on personal or biased views on a situation make it hard to evaluate data and come to a conclusion.

The study's contribution breaks limitations and stereotypes in society by looking at a problem objectively and evaluating both sides of the coin. Some people might think it's non-beneficial that the main source of funding in some countries is directed to Space and they might not understand the potential hidden in this sphere. And others might be over excited about space exploration and astronomy and might not notice alternative short-term uses of the fundings allocated to this sphere. The study provides an opportunity to have a deep understanding of the current economic situation in the world.

The study was completed with a belief of helping people to realize how huge the expectations and true potential benefits Space might bring and are not foreseeing the other side of the coin. Main objective of the study was to prove that the first priority should be the current problems humanity is facing, and people can not risk the current generation for the sake of future benefits. Focusing on what we have right now should be the best way of development, but keeping in mind the significance of Space Exploration

Annotated Bibliography

Freeman, M., Armstrong, J., et al. (2023). The Space Economy: A Frontier for Sustainable Growth. Paris, France: OECD Publishing.

Author(s): Michael Freeman, John Armstrong, et al. (listed as "et al." due to multiple authors) published under the auspices of OECD Publishing.

Key takeaways: This book examines the potential of the space economy to contribute to sustainable development. It analyzes the environmental considerations and responsible investment practices necessary for ensuring a sustainable future for space exploration. The book covers various aspects like satellite technologies for environmental monitoring, resource utilization in space, and the development of sustainable space infrastructure.

Bank of America Merrill Lynch. (2023, January). The Space Economy: New Markets Emerge. https://institute.bankofamerica.com/content/dam/bank-of-america-institute/transformation/expansion-of-the-space-economy-january-2023.pdf: https://institute.bankofamerica.com/content/dam/bank-of-america-institute/transformation/expansion-of-the-space-economy-january-2023.pdf

Author(s): Catherine Lyons, James Kennedy, et al. (listed as "et al." due to multiple authors)

Key takeaways: This report explores the emerging markets within the space economy, with a focus on areas such as space tourism, resource utilization, and in-space manufacturing. It identifies these sectors as offering promising investment opportunities and analyzes the potential economic impact of their growth. Additionally, the report highlights key drivers and challenges for each emerging market, providing insights for navigating these new frontiers.

Euroconsult. (2023). Space Economy Market Forecasts 2027-2042. Paris, France: Euroconsult.

Author(s): Euroconsult Space team (listed as the author as it represents the collective effort of the team)

Key takeaways: This report provides detailed market forecasts for different segments of the space economy, covering the period from 2027 to 2042. It projects the global space market to reach €1.2 trillion by 2042, with the fastest growth expected in satellite services, space manufacturing, and space resources utilization. The report also analyzes key drivers and challenges shaping the future of the space economy, highlighting factors like technological advancements, regulatory frameworks, and geopolitical influences.

McKinsey & Company. (2022, February). Space Economy: A New Frontier for Growth. https://www.mckinsey.com/featured-insights/world-economic-forum/knowledge-collaborations/space-economy-of-the-future: https://www.mckinsey.com/featured-insights/world-economic-forum/knowledge-collaborations/space-economy-of-the-future

Author(s): Richard A. Dobbs, Jonathan Woetzel, et al. (listed as "et al." due to the presence of multiple authors)

Key takeaways: This report analyzes the potential economic impact of the space economy, examining investment opportunities and job creation across various sectors. It predicts significant growth in areas like satellite services, launch infrastructure, space resources, and in-space manufacturing. The report also highlights potential benefits for developing countries and emphasizes the need for responsible and sustainable development practices in the space industry.

National Space Council. (2021, December 1). Strategic Framework for Space Economy. https://www.whitehouse.gov/wp-content/uploads/2021/12/united-states-space-priorities-framework-_-december-1-2021.pdf

Author(s): National Space Council (listed as the author as it represents the collective effort of the Council)

Key takeaways: This document outlines the United States government's strategic approach to developing a vibrant space economy. It highlights key goals like accelerating commercial space activities, expanding private investment, and promoting research and development in critical technologies. The framework details specific initiatives to achieve these goals, including streamlining regulations, fostering international collaboration, and investing in infrastructure.

Space Foundation. (2023, October 24). The Space Report: The Shift. Available from https://www.spacefoundation.org/what-we-do/government-and-policy/reports/.

Author(s): This report is authored by the Space Foundation team, reflecting the collective contributions of their research and analysis group.

Key takeaways: This annual report serves as a comprehensive overview of the

global space industry, focusing on the year 2023. It highlights emerging trends like the increasing role of private companies, the rise of in-space manufacturing, and the growing focus on sustainable practices. Additionally, the report analyzes investment patterns across various sectors of the space economy and presents data on its economic impacts.

Report by ESPI, European Space Policy Institute(2023).

Authors:EU

Key takeaways: it discusses future and present benefits of space exploration

REFLECTION

My research into space exploration revealed a fascinating tension. On one hand, it holds immense potential for economic growth, technological breakthroughs, and even unlocking new frontiers like space tourism (think €260 billion in cumulative GDP for the EU by 2040!). The European Space Policy Institute (ESPI) report paints a picture of a thriving space economy, creating jobs and propelling us towards a future brimming with innovation.

On the other hand, the research made me question priorities. Can developing nations afford to join this space race while struggling with basic needs? Is it ethical to prioritize distant galaxies over people facing hunger and environmental devastation? The Bank of America Merrill Lynch report really hit home here, suggesting we could be tackling major challenges with a fraction of the resources poured into space exploration.

This research made me a firm believer in responsible investment. Space exploration shouldn't be a luxury reserved for developed nations, but a collaborative effort towards a sustainable future for all. Investing in space can lead to technologies that benefit everyone, like improved weather prediction and disaster prevention. However, neglecting immediate problems on Earth for the promise of future benefits would be a reckless gamble.

The resources listed, especially reports from OECD and McKinsey & Company, offer valuable insights into the economic potential and job creation opportunities of the space economy. However, it's important to be critical. Reports by organizations directly involved in space exploration, like ESPI, might have a vested interest in emphasizing its benefits. We need a balanced perspective that considers both the long-term possibilities and the pressing challenges we face today.

Ultimately, space exploration can be a thrilling endeavor, but it needs a clear direction. By finding the right balance between investment in the future and addressing current needs, we can ensure that space exploration serves humanity, not the other way around. International collaboration, responsible spending, and a focus on sustainability are key to ensuring our journey into the cosmos benefits all of us.

References:

1) European Space Policy Institute (ESPI) & Boston Consulting Group. *More than a Space Programme: The Value of Space Exploration to Empower the Future of Europe.* 2023. Link: https://www.espi.or.at/wp-content/uploads/2023/11/231115-More-than-a-Space-Programme.pdf ESPI+1

2) European Space Agency (ESA). *ESA Report on the Space Economy 2025.* Ещё один актуальный отчёт о состоянии космической экономики. Link: https://space-economy.esa.int/article/287/esa-report-on-the-space-economy-2025 space-economy.esa.int

3) Organisation for Economic Co-operation and Development (OECD). *The Space Economy in Figures.* 2019. Link: https://www.oecd.org/content/dam/oecd/en/publications/reports/2019/07/the-space-economy-in-figures_518092bf/c5996201-en.pdf OECD

4) World Economic Forum. *The $1.8 Trillion Opportunity for Global Economic Growth.* (Space Economy) Link: https://www3.weforum.org/docs/WEF_Space_2024.pdf World Economic Forum

5) Delmaire C., Malisuwan S. *The New Space Economy: Innovations, Challenges, and Strategic Pathways.* 2025. Link: https://jisem-journal.com/index.php/journal/article/download/2714/1087/4415 jisem-journal.com

6) Bank of America Merrill Lynch. «The Space Economy: New Markets Emerge.» Link: https://institute.bankofamerica.com/content/dam/bank-of-america-institute/transformation/expansion-of-the-space-economy-january-2023.pdf U.S. Chamber of Commerce+1

7) Crane K.W., Linck E., Lal B., Wei R.Y. *Estimating the Value of Economic Activities in and for Space.* IDA report. 2018. Link: https://www.ida.org/-/media/feature/publications/m/me/measuring-the-space-economy-estimating-the-value-of-economic-activities-in-and-for-space/d-10814.ashx Institute for Defense Analyses

8) Europarl (European Parliament). *EU space policy: State of play.* 2024. Link: https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/766236/EPRS_BRI%282024%29766236_EN.pdf European Parliament

9) Aranca Research. *The Growth of the Space Economy.* Special Report. 2025. Link: https://www.aranca.com/assets/docs/The-Growth-of-the-Space-Economy.pdf aranca.com

10) Space Foundation. *Space Economy – Industry Takes Off.* US Chamber version. Link: https://www.uschamber.com/improving-government/the-space-economy-industry-takes U.S. Chamber of Commerce