Thesis Work
The biggest industry of our future

International relations and law in the present, and in the future of space mining

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- List of abbreviations -

**NEA**: near-Earth asteroids

**Moon agreement**: The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies

**Outer Space Treaty**: Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies

**(UN) COPUOS**: United Nations Committee on the Peaceful Uses of Outer Space

**NASA**: National Aeronautics and Space Administration

**UN**: United Nations

**Registration Convention**: Convention on Registration of Objects Launched into Outer Space

**Liability Convention**: Convention on International Liability for Damage Caused by Space Objects

**Moon Agreement**: Agreement Governing the Activities of States on the Moon and Other Celestial Bodies

**UNCLOS**: U.N. Convention on the Law of the Sea

**Authority or ISA**: International Seabed Authority

**National laws**: U.S. Commercial Space Launch Competitiveness Act and Law on the Exploration and Use of Space Resources (Loi sur l’exploration et l’utilisation des ressources de l’espace)
The biggest industry of the future?

Humankind owns a wonderful attribute. Every time when we were faced with a threatening challenge – we were able to overcome it – this has been the key to our survival.

At the present time humanity is facing a new and serious issue. Due to its own elaboration, it is starting to deplete the finite resources of its home planet, the Earth. According to some estimations, in the near future we will probably run out of some very important energy sources, for example by 2050 from oil. We are “rushed” by time, since these resources are part of our everyday life - their replacement means a huge challenge. As the world’s population grows, the demand is increasing in parallel, for the planet’s limited resources - we will have increasingly less time to find a solution.

But as I wrote in the beginning, we - humankind – is always finding a solution, as is our wont.

It is hardly different now. Furthermore, it appears to be the kind of solution, about which we were just dreaming until today – the kind we mostly saw it in the plots of science-fictions movies. As a result of the recent decade’s significant development in space technology, the solution that presents itself is: space mining.

Space mining

In the endless silence of “the ether” - thanks to the discoveries of space research - we know that infinite resources are levitating inside the celestial bodies. The goal of the evolving space mining industry is to mine them.

The first planned mining targets, since they are located nearest to our planet and thus seem to be the most cost-effective to mine, are the Near-Earth Asteroids (hereinafter NEAs) and the Moon.
Thanks to recent explorations we know that the celestial bodies contain a rich diversity of resources, including among others, those which are scarce or non-existent on Earth. (7) So, if space mining would start in the future – space resources could easily become the new supply of resources to quell the shortages of Earth.

It is really worth mining these celestial bodies, since according to current estimates space mining could be an extremely high-profiting industry. This is borne out of the fact, that just the value of a single NEA could be several trillions of dollars, or higher” (!) (8) Perhaps, at first, this sum “sounds” incredible, but let me demonstrate it with an example; in 2015 such a NEA passed near the Earth, containing according to some estimations up to $5.4 trillion dollars, worth of platinum (as a comparison, this value is higher than the expenditures of the United States of 2018, which was about $4.094 trillion dollars). (9)(10) This sum clearly shows us, the scale that the industry of space mining could operate on, and the extent of the profits it could bring. Some of the investors and scientist have already “seen” the great opportunities in this sector; after the millennium more and more space mining companies have been established. And now it seems that space mining is no longer a distant dream, but a reality that is fast approaching, since some of the experts predict the start of mining operations within fifteen years, or even less. (11) This is supported by the fact, that in 2015 the United States legislated the industry. (12)

Thus, we can state, that the race for the possession of the resources in space has started. Motivation is huge, as some experts predict that this will be the highest profiting industry of the future; and also ‘that the first dollar trillionaire there will ever be will be the person who exploits the natural resources on asteroids.’ (13)

This fact is the “source of my enthusiasm” for the topic as well. I truly believe, that the parallel depletion of some of the Earth’s resources, with the rapid development of space technology, space mining will one day be, as it is predicted, the highest profiting, and thus the most important industry of the future. This will also mean, that it will play a key role in the future of my current studies – in the future of international relations. In my view this is the reason why it is highly important to discuss the main topic of my study, namely: International relations and law in the present, and in the future of space mining.
My hypothesis is related to the statement above mentioned. Namely; if space mining will become one of the most important industries of the future and will play a key role in the future of international relations; I believe this “role” will be negative, if the mining starts without it being internationally regulated, but positive if it starts with widely accepted international regulations. This study aims to prove this hypothesis.

In the first part of my study, to introduce this emerging industry, I will analyze the practical aspects of it. As part of that, I will first demonstrate the most important parties related to space mining; then, I will examine the processes of mining and demonstrate some of the space resources. Due to length constraints, I will only be able to analyze the latter in limited detail. However, I shall demonstrate the most important information, in my view necessary for the understanding of our main topic - space mining law and the international relations involved in space mining.

**Space mining law**

The question naturally arises: if this industry will one day be, as I wrote, the highest-profiting industry of the future, then how will it be legislated? In order to investigate how international relations will be affected by space mining, we must first deal with the question of laws relating to space mining, since international relations usually “work” based on international law. This is also the main reason, why I gave the subheading “international relations and law”.

However, before we commence the analysis of space mining law, since the legal framework is very complicated, I considered it appropriate to divide the legal issues into the following parts: The legal status of outer space and its resources and mining; regulations about the process of space mining; the benefits of space mining; liability and environmental regulations.

Based on the existing legal situation, there is still no international consensus on most of the above mentioned issues. Rather, there is an ongoing international debate about their future international legislation. (14)
To very briefly sum up this ongoing international legal debate; the most debated question is whether space mining should be legislated internationally, based on the law principle res communis or on the principle common heritage of mankind?

As part of that debate the most contended issues are the following:

- Is the legal status of the area of outer space and the space resources res communis or common heritage of mankind or res communis?

- Accordingly, whether profit from space mining might be retained by those who do the actual mining, or if it ought to be shared among the international community?

Related to these issues, we could divide the international community mainly into three groups:

- The first group are the nations, who endorse the legislation that The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (hereinafter the Moon Agreement) provides.\(^{(15)}\)

- The second group are comprised of nations who regulate space mining law based on the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereinafter: Outer Space Treaty) on a national level.\(^{(16)}\)

- The countries in the third group are still neutral in relation to the issue.

In this section my purpose will be to analyze the above debate and to shed light on the existing legal situation. Since the current legal basis of international space law are the treaties which were developed inside the UN, as part of that analysis I will examine them first.\(^{(17)}\) During said process I will pay particular attention to the Outer Space Treaty and to the Moon Agreement. Subsequently, I will examine the national laws, American and Luxembourgish, and their compatibility with the existing international treaties.

### Space mining without and with international regulations

‘New space industries could indeed change our future, perhaps for the better or perhaps for worse’.\(^{(18)}\) In my view, as I stated in my hypothesis, this could be true to the space mining as well. Due to that reason, in the third part I will analyze the future of space mining, especially from the side of international relations. To this end I will analyze two scenarios. The first will be about the potential effects and consequences on the
international community, in case if the space mining would start with the current legal environment, so without it is international regulated.

The second scenario will be about if it would be successfully international legislated. I will analyze the potential effects and scenarios with particular attention on the international peace, the environmental questions and the issues related developing countries.

**Potential international regulations**

In the fourth part of my study, I will try to find a solution for the international community, how to avoid the legally unregulated commencement of space mining. To this end, I will analyse possible legal concepts for regulation, which could be relevant for the future international regulation of space mining.

In the last part I will evaluate the evidence and make a conclusion about my hypothesis.

**Applicable literature**

Reviewing the relevant scholarship for this topic proved somewhat difficult, since this sector is a very experimental and rapidly developing area. Because of this, not many studies have been conducted about the sector. However, I did find some excellent studies, which I will review in my study. But first of all, I would like to highlight my interview with Dr. Zoltán Székely (see page 43), which contained much useful information. Subsequently, I found Ram S. Jakhu, Joseph N. Pelton and Yaw Otu Mankata Nyampong’s book, called *Space Mining and Its Regulation* very useful in relation to the technical side of space mining. *(19)* Relating to the legal aspect, I favoured the *Handbook of Space Law* by Frans von der Dunk & Fabio Tronchetti, and the study of Gabrielle Leterre, called *Providing a legal framework for sustainable space mining activities*. *(20)* *(21)* In addition, beyond the above mentioned studies, a big part of my references were legislations and online scientific articles.
In this following part of my study I will analyse the practical aspects of space mining. As part of that; I will first demonstrate the most important parties related to space mining. Then I will examine the planned process of space mining and the mayor technical obstacles, which this starting industry is initially up against. Finally, I will demonstrate some of the space resources and their estimated value.

- I. I Most important parties in space mining –

In this chapter I would like to present the key parties of the space mining industry, as related to my study.

(UN) COPUOS (United Nations Committee on the Peaceful Uses of Outer Space)

First of all, I will introduce the UN Committee on the Peaceful Uses of Outer Space (hereinafter COPUOS). This organisation has already played (and in my view will continue to play, in the future) a key role in the regulation of the outer space law, including space mining law. ‘COPOUS was set up by the General Assembly in 1959 to govern the exploration and use of space for the benefit of all humanity: for peace, security and development. The Committee was tasked with reviewing international cooperation in peaceful uses of outer space, studying space-related activities that could be undertaken by the United Nations, encouraging space research programmes, and studying legal problems arising from the exploration of outer space’. (22) The Committee is widely accepted internationally; it has 92 members, which makes it one of the largest Committees in the UN. (23) The Committee has two subsidiary bodies: the Scientific and Technical Subcommittee, and the Legal Subcommittee. (24) Regarding the international legislation of space, COPOUS played a leading role in the development of the five comprehensive treaties about outer space. Nowadays, these treaties form the “basis” of international space law. Of these treaties, the most important is the Outer Space Treaty, or as it is also colloquially called, the “Magna Carta” of space law. This treaty forms much of the current
legal basis of space mining (I will analyze the *Outer Space Treaty* in the second part in detail). (25)

**States:**

Of all states, due to length constraints, I will demonstrate just the ones who have already legislated space mining in their national laws (so the USA and Luxembourg so far, to today’s date.) (26).

In order to show the current “balance of power” in space research, I will list the space agencies with the highest annual budget. The estimated budget of the world’s largest space agencies in 2018:

- NASA (USA): $20.7 billion (27)
- ESA (EU): $6.29 billion (28)
- Roscosmos (Russia): $2.5 billion (2017)
- CNSA (China): $2 billion (2017, it is just an estimation, since this agency is totally not transparent) (29)
- JAXA (Japan): $1.66 billion (30)
- ISRO (India): $1.2 billion (31)

**United States of America:**

The USA is the global leader in space research, in the public, and the private sector as well. This is supported by the fact, that if we examine the integrated budget of the leading space agencies, it clearly shows that more than half of it belongs to the United States. Furthermore, during recent years the private sector of space industry has started to grow significantly too. (32) The finest example of this, is from 2018, when an American private company, the Space X delivered the supplies for the International Space Station. (33)

Receiving targeted support from the government, has a main role in the development of the American private space sector. They provide every kind of support including technical, financial and legal, as US legislation mandates the governmental support of the development of the American space mining industry too. (34) As part of this, in 2015 for example the Senate legislated the sector; creating a solid legal background for it.
Furthermore, in that Act, among others, they legislated that government entities should provide every possible help to the USA’s private space mining industry. (35) As an example, in 2018 the U.S. Geological Survey has launched a program to assess the location and value of minerals on the asteroids, Moon and Mars. (36) Evidently this governmental support has given a powerful boost to the space mining sector, which is currently a global leader on the market.

**NASA: National Aeronautics and Space Administration**

NASA is the world’s leader space agency of the United States. Their role in the current stage of the space mining industry is incontestable and, in my view, it will be in the future as well.

‘The wealth of information that has been amassed in hundreds of different NASA and other U. S. agencies over a half century has now established a base from which new entrepreneurial efforts targeted toward space mining can effectively draw’. (37) Among other space agencies, the NASA mapped for example more than 90 percent of the NEAs and in some cases explored their compositions too. (38) These explorations continuing even today, currently have two missions which are targeting NEAs; The OSIRIS-REx mission, which is exploring the composition of the 4th most valuable NEA – the Benu (see later in the list of most cost-effective NEAs). (39) And the DART mission, which has a purpose among others to collect geological sample from the fifth most valuable NEA - the Didymos. (40) Naturally, the results of these missions will provide extremely useful information for the space mining sector.

**Grand Duchy of Luxembourg:**

This tinny European Grand Duchy has serious plans, to become a space miner power. During the recent years they have invested a lot into this matter. In 2017 for example, based on the American act they legislated in their national law the space mining as the second country to do so in the world. Besides that, the government is providing a substantial financial assistance to academic research and private sector projects to developing the technologies which will be needed to explore and use space resources. (41)
Subsequently, they are cooperating with international companies and other nations too. Their main goal is definitely to become the Silicon Valley of space mining.

**Space mining companies**

As I stated in the introduction, the first space mining companies were established after the millenary. In their development the space agencies played a great role with their previous researches. Nowadays, we could divide roughly the space mining companies into two big groups, one is targeting the NEAs, the other is targeting the Moon.  

Currently the biggest technical obstacle before the space mining transportation between the Earth and the Outer Space and reverse. The two main reasons for that is that still every launch contains a risk and the extremely high prices of rockets. That’s why Space X made a historic launch, when they successfully tested the first reusable space rocket. This new technology could reduce significantly the cost of space transportation and parallel to that the cost of space mining. If the companies will be able to overcome that challenge, they will definitely get nearer to the start of space mining.

- I.II Space mining –

In this chapter I will briefly demonstrate the concepts about the process of space mining. Then I will give a short summary regarding space resources.

**The process of space mining**

First of all, I would like to underline since until this day nobody conducted the process of space mining, therefore I could only demonstrate the summarized brief concept of space mining companies;  
**First step:** Mapping the potential targets and its resources. NASA and other space agencies already did the big part of that, at least the mapping part. Currently the space mining companies should mostly just discover the component of the targeted celestial objects.
**Second step:** Launching the equipment into the space and starting the mining – this is now the biggest technical obstacle what the companies are facing. The cost of the launching of the space rockets are extremely high, but due to the remarkable developments in the segment, most probably in the near future it will drop.

**Third step:** Starting the mining and transport the product to Earth or utilities it directly in the Outer Space (for example producing high-efficiency fuel). \(^{(46)}\)

**Space resources**

‘The moon and other celestial bodies, including NEAs contain vast amounts of natural resources.’ \(^{(47)}\) In the following I will list these resources and their main usages;

**Water:** Water is the first target of mining companies, since in their opinion it is probably the most valuable resource in space. First of all, they want to produce propellant from it (the water molecule consists of hydrogen and oxygen which can be refined into high-efficiency fuel). \(^{(48)}\) With that their goal is to solve one of the biggest challenges of space activities, the extremely high propellant prices in outer space (as I wrote previously, the reason for that is the extremely high transportation costs from Earth to Outer Space). This is an incredible fact, but currently one litre fuel in outer space could worth equivalent to the same amount of gold on the Earth.\(^{(49)}\) If the companies will be able to produce fuel in the outer space, this would make not just the space mining much more feasible, but among others long-distance space travel (for example Mars travel) as well. Furthermore, water could be used for its original function as well; to hydrate the human beings in the outer space. \(^{(50)}\)

**Helium-3:** ‘Helium-3 is thus often referred to as the first likely object - between water, of governmental and private interest, as it would have the potential to substitute fossil fuels as the main source of energy on Earth.’\(^{(51)}\) Helium-3 would be used as fuel for nuclear fusion power plants, what would be able to provide nuclear energy in a far safer way than how it is done currently. \(^{(52)}\) ‘It is argued that 370 metric tons of Helium-3 would be able to supply mankind with energy for an entire year.’\(^{(53)}\)
**Platinum group metals:** For example: ‘platinum, palladium, osmium, and iridium’. (54)

As I wrote in the introduction, the miner companies first purpose with that metals to sell on Earth for use it on Earth. Maybe in the future it would be possible to process them in the Space.

**Metal:** It could be used for 3D printing of hardware to use in space or making rubber or plastic or methane for rocket fuel or CO2 for plants (55)

To demonstrate the possible profits of space mining, in the following I will list the most cost effective NEAs to mining (estimated):

1. Ryugu: estimated value($): 82 billion estimated profit($):30 billion Resources

2. 1989 ML: estimated value($): 82 billion estimated profit($):30 billion Resources

3. Nereus: estimated value($): 82 billion estimated profit($):30 billion Resources

4. Bennu: estimated value($): 82 billion estimated profit($):30 billion Resources

5. Didymos: estimated value($): 82 billion estimated profit($):30 billion Resources (56)

Note: I would like to draw attention to the fact, that the above written prices are based on the current world market prices of these materials. In case of their transportation to Earth, this price could change, cause then they will be in bigger amount in the market.
- II –

- Space mining law -

In this part I would like to describe and analyze the existing legal framework related to space mining. As I wrote in the introduction, to analyze that simpler, I considered it appropriate to divide it into the following parts:
- The legal status of outer space and its resources and mining
- Regulations about the process of space mining
- The benefits of space mining
- The liability
- Environmental regulations.

I will examine these part one by one with the help of the related international and national legal framework.

As I wrote in the introduction, there are two key legal principles, the principle *res communis* and *common heritage of mankind*, which could serve as the basis for the future international legislation of space mining. Since they are contrary to each other, they could be not legislated on the same time. Before we would start the analyzation of the legal part, in order for better understanding of it I find it appropriate to definite these legal definitions at first;

*Res communis*: Under *res communis* regulation, every state has the right for the free use of the outer space, with the restriction, that they could not appropriate the area of it. In addition, the area belongs to no one.\(^{(57)}\)

*Common heritage of mankind*: According to the concept of the common heritage of mankind the outer space is the common “property” of the whole mankind. It means that neither the area, nor the resources of the outer space could be appropriated by anyone. Furthermore, the outer space should be managed by all states on behalf of mankind and in case of any benefit from it, it should be shared equally among the whole Humanity.\(^{(58)}\)
One more important point, that I will analyze the international legal framework following the legal principles lex lata (the law as it is) and lege ferenda (the law as it should be) (59)

- I.I Legal provisions -

In the followings I will list those international treaties and national laws, which I will examining related to space mining law.

The UN space treaties:

As I wrote in the introduction, the current legal basis of the international space law are the treaties, which were developed inside the UN.

- **Outer Space Treaty** (1967)
  Ratified: 109 countries - including all the nations, who are carrying out remarkable space activity. (60)

  The *Outer Space Treaty*, or the so called Magna Charta of space law, is currently the most important international legal agreement, in the same time also the most widely accepted UN space treaty. (61) Its main purpose was to demilitarize the outer space – and with that to stop the extension of the cold war into the outer space. (62)

- **The Moon Agreement** (1979)
  Signed: France, India, Romania, Guatemala
  Ratified: Armenia, Austria, Australia, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, Philippines, Saud Arabia, Turkey, Uruguay, Venezuela (63)

  The Agreement ‘reaffirms and elaborates on many of the provisions’ of the Outer Space Treaty. (64)

- **Convention on International Liability for Damage Caused by Space Objects** (1972)
  (hereinafter: *Liability Convention*)
Ratified: 96 countries - including all the nations, who are carrying out remarkable space activity.

- **Convention on Registration of Objects Launched into Outer Space** (1975)
  (hereinafter: *Registration Convention*)
  Ratified: 69 countries - including all the nations, who are carrying out remarkable space activity. *(65)*

**National laws:**

- **U.S. Commercial Space Launch Competitiveness Act** (2015) *(66)*
- **Law on the Exploration and Use of Space Resources (Loi sur l’exploration et l’utilisation des ressources de l’espace)** (2017, Luxembourg) *(67)*

The aim of these acts was to create a solid legal background for their national space mining companies.
In this chapter I will analyze two of the basic legal issue related to space mining:
- Firstly, what is the legal status of the area of outer space and the space resources? (In my opinion this two property right could not be divided, since logically if somebody owns the area of outer space, should own the space resources too) Furthermore are the space resources res communis or the common heritage of mankind?
- Secondly, who has the right to use the outer space resources and to conduct space mining?

Outer Space Treaty: First of all, the Outer Space Treaty do not provide over the legal status of the ownership of outer space and space resources. But related to the area of the outer space it declares, that could not be ‘subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means’ (Article II.). With that provision it established a ‘cardinal concept of international space law: the non-appropriative nature’ of the area of the outer space. At the same it declares, that outer space ‘shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies’ (Article I.).

To summarize briefly the above written provisions, the Treaty declares the area of outer space to res communis. Thereunder no state has right to claim sovereignty over its area, but all State has right for the free use (and exploration) of it.\(^{(68)}\) Admittedly, in my view there is no doubt, that space mining is a type of use as well, so it follows; the outer space ‘shall be free for’ space mining ‘by all States without discrimination of any kind, on a basis of equality and in accordance with international law.’ Accordingly, every States (including the private sector) could use the space resources – according with the international law. In this way based on the Outer Space Treaty the space resources is res communis too.

To summarize the treaty related to space mining. The states (including public and private sector) in accordance with international law:
- have right to conduct space mining and use the space resources.
- have right for the ‘free access to all areas of celestial bodies’.

- I.II The legal status of outer space and its resources and mining -
have no right to appropriate ‘by claim of sovereignty, by means of use or occupation, or by any other means’ any area of the outer space. (69)

**The Moon Agreement:** The Moon Agreement similar to the Outer Space Treaty states, that states ‘have the right to exploration and use of the (outer space) without discrimination of any kind, on a basis of equality and in accordance with international law and the terms of this Agreement’. But, contrary to the Outer Space Treaty it declares, that the outer space ‘and its natural resources are the common heritage of mankind’. So not res communis, because common heritage of mankind means, that the outer space and its resources are equal property of all states - what could not be nationalized or expropriated. In addition, it states, that ‘neither the surface nor the subsurface of the (outer space), nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or nongovernmental organization, national organization or non-governmental entity or of any natural person’. So, the Agreement bans the space mining for every state, international intergovernmental or nongovernmental organization, national organization or non-governmental entity or for any natural person.

*The Moon Agreement* allows the conduction of space mining just in one case, if the ‘States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the (outer space) as such exploitation is about to become feasible’.

‘In order to facilitate the establishment of the international regime referred to in paragraph 5 of this article, States Parties shall inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of any natural resources they may discover on the (outer space).’

To summarize the Moon Agreement:

- It bans the space mining for every ‘state, international intergovernmental or nongovernmental organization, national organization or non-governmental entity or of any natural person’.
- It classifies the outer space and space resources as the common heritage of mankind, what could not be not be nationalized or expropriated
- It enables just for an international regime the space mining, as it would be feasible. (70)

**National laws:** The Title IV of the *U.S. Commercial Space Launch Competitiveness Act* provides, that ‘a United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States’(71) Subsequently, the Article 11 of the *Law on the Exploration and Use of Space Resources* states, that ‘space resources are capable of being appropriated’. (72) 

Thereunder, the two national laws basing their provisions on the Outer Space Treaty’s *res communis* regime, enables the space mining and the appropriation of the mined space resources.

**Summary**

We can thus state, that there is a mayor disagreement among the international community, about the property rights of the space resources. On the one side there is the *Outer Space Treaty* and national acts, which are declaring these resources to *res communis* and the other “side” is the *Moon Agreement*, which is to *common heritage of mankind*. That means that *Outer Space Treaty* and national acts are allowing the space mining and the appropriation of space resources, but the *Moon Agreement* isn’t.

There is a legislation contrary among the treaties related to the legal status of the area of the outer space as well. On the one hand the *Outer Space Treaty* declares the area of the outer space to *res communis*, but on the other hand the *Moon Agreement* to the common *heritage of mankind*. Although, in my view this difference is unimportant, since the point is that all laws are agreeing in the non-appropriation nature of the area of the outer space.

What can give us a reason to rejoice, that all legislations are agreed in the right for free access and free movement in outer space. In general, they agreed in the right for free exploration as well.

To summarize the first chapter, there is an international consensus related to some legislations about space mining but related to the most important issues – so for example
about the legal status of space resources - there is still a mayor disagreement among the international community.

- I.III Regulations about the process of space mining -

In this chapter I will analyze and compare the national and international legislations related to the process of space mining, especially about the authorisation and supervision.

_**Outer Space Treaty:**_ The treaty provides, that ‘the activities of non-governmental entities in outer space (…) shall require authorization and continuing supervision by the appropriate State Party to the Treaty’. \(^{(73)}\)

_**The Moon Agreement:**_ The treaty adopt the related provisions of the _Outer Space Treaty_. \(^{(74)}\)

_**Registration Convention:**_ The Treaty was established to make provision for a mechanism that provided States with a means to assist in the identification of space objects. It declares, that when a space object is launched into the outer space, the launching State shall register this space object. 'Information on the object launched into space, including the date and territory or location of the launch, essential orbital parameters, and the function or role of the object in space should to be communicated to the UN Secretary-General as soon as practicable'\(^{(75),(76)}\).

In my view this legislation is highly important to prove the liability in any cases.

_**National laws:**_ Both acts are laying down according to the Outer Space Treaty, that, no one can conduct space mining activity, without an authorisation and supervision from the responsible government entitles. \(^{(77),(78)}\)

**Summary**

In my view, it is safe to say that about the so called basic regulation of the process of space mining, there is an international consensus. Although, it is clear that there are more legal issues, which are related to the process of space mining. There is a consensus about the legal issues related to regulation, since the majority of the international community,
including all the nations, who are carrying out remarkable space activity ratified the registration convention. Furthermore, about there is an international consensus about the authorization and supervision. To sum up this legal part, in my view it safe to say, that the legal issues related to registration authorisation and supervision are international legislated.

- I.IV The benefits of space mining –

In this chapter I will examine the national and international legislations about the “share” of the benefits from space mining.

**Outer Space Treaty:** As I wrote in the first chapter, according to the Article I of the Outer Space Treaty, the space resources are res communis, so they could be appropriated. It means as well, that the benefit from them should not shared among anyone. But besides that, the Article I. declares, that ‘the exploration and use of outer space (...) shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind’.

And since the space mining is a type of use as well, it follows that, space mining ‘shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development’.

By the analyzation of this provision, the question arises, that what this provision regulates. Do it provides for example, that the benefit of space mining should be shared among all countries?

In my view not, since the provision is unclear about the way, how it should be the space mining carried out for the benefit and in the interests of all countries. I think this is a very general and unclear provision, and if we would interpret as it obligates for the share of benefits, it would be lege ferenda and not lex lata. Because of that in my opinion this provision is rather a moral value - what could be considered by everyone in a different way, than a practical regulation, what could be set into practice and what legal obligation has. (81)
So, to sum the Outer Space Treaty provisions related to that legal part, it declare the space resources to *res communis*, thereunder the space resources could be appropriated by anyone and the benefit from it should be not shared among anyone.

**The Moon Agreement:** The Agreement is clear about the share of the benefits generated by space mining. Namely it provides, that an international regime should conduct an equitable share among all States Parties, ‘whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the (outer space), shall be given special consideration’. (82)

**National laws:** Basing on the res communis principle of the *Outer Space* Treaty, both national laws are enabling for their own private entities the possession of the whole amount of the benefits, what they profited from the space resources. (83)(84)

**Summary**

By that chapter we could see a mayor disagreement about the international legislation among the international community. The two contrary legislations are the:

- *Moon Agreement*, which would mandatory share all the benefits among the international community – considering the needs of developing countries and the ones who conducted the discoveries.

- and the Outer Space Treaty and basing on the *res communis* principle of the Treaty the national laws. They are enabling the retention of the benefits delivered from space resources and do not obligate any share

**- I.V International liability –**

In this chapter I will examine the liability related to space mining.

**Outer Space Treaty:** The Treaty provides clearly about the liability, it declares that ’States Parties to the Treaty shall bear international responsibility for national activities in outer space (…) whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty’. Furthermore, that ‘Each
State Party to the Treaty that launches or procures the launching of an object into outer space (...) and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space’.

In my view that legislation contains two important regulation:

- Firstly, that it legislates in detail the liability after space activity, including space mining activity.
- Secondly, that each state party is liable ‘for assuring that national activities are carried out in conformity with the provisions set forth in’ the Outer Space Treaty.\(^{(85)}\)

**Liability Convention:** The Convention adopt the provisions of the *Outer Space Treaty*. In addition, it provides, that a ‘launching State shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft, and liable for damage due to its faults in space. The Convention also provides for procedures for the settlement of claims for damages’.\(^{(86)}\)

**Moon Agreement:** The Agreement adopts the related provisions of the *Outer Space Treaty*.

**Summary**

As the Outer Space Treaty and the liability convention as well internationally widely accepted, it is safe that this field is successfully internationally legislated.

- **I.VI Environmental regulations**–

In this chapter I will analyze the environmental regulations related to space mining.

**Moon Agreement:** The agreement states, that In exploring and using of outer space, states shall *take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise*. 
States Parties shall also take measures to avoid harmfully affecting the environment of the Earth through the introduction of extra-terrestrial matter or otherwise (87).

To sum up, the Agreement protect the environment of outer space in that way, that it prohibits every kind of change in its environment (except the mining conducted by the international government)

**Summary**

To summarize the legal situation, except the *Moon Agreement* there are no other laws which is regulating the environmental side of the space mining process. Since the *Moon Agreement* isn’t internationally wide accepted, it is safe to state, that this field is internationally not legislated

- **Summary –**

To summarize the international space mining law, we can state that two legal parts: the regulations about the process of space mining and international liability more or less successfully internationally legislated.

But in my view the most important ones are still not. Furthermore, there is an ongoing international debate about the future legislation about the legal parts: legal status of outer space and its resources and benefits of space mining. These legal parts are legislating the financial side of the sector, which is always one of the most important legal issue in case of an industry, since industries are made for profit.

Subsequently, the environmental regulations related to space mining are isn’t legislated at all. I will analyze in the next part of my study, why it is one of the most important legal issue.

To sum up the space mining law, it is safe to state, that there is still no international consensus related to the most important legal issues.
- III –

- Space mining without and with international regulations –

As I wrote in the introduction, in that third part I will try to analyze the future of international relations related to space mining. To this end I will analyze two scenarios:
- The first will be about the potential effects and consequences on the international community, in case if the space mining would start with the current legal conditions, so without it is internationally regulated.
- The second scenario will be about if it would be successfully internationally legislated.

- III.I Space mining without international regulations –

In case if the space mining would start without it is internationally regulated – so with the current legal conditions - in my view we could separate the main potential effects and consequences of that into three parts:
- The first are about the possible threats which could affect the international peace.
- The second are related to the possible effects on the space environment.
- And in the third part I will analyze the possible threats and affects, which could influence the global economic situation.

In the following I will analyze them.

Danger to the international peace

It’s an undisputed fact, that mayor part of the wars during the history of the Humanity were broken out for the possession of different type of resources. (88) We shouldn’t go back much in time to find examples for that. It is enough to analyze, the recent wars which broke out on the Middle-East, most of them were started for the possession of a valuable resource, the oil. (89) Furthermore, the current biggest intension among the international community is related partly to the possession of resources as well. The ongoing territorial disputes in the South China Sea is ongoing partly for the appropriation of the valuable resources under the South China Sea. (90) It is still not a war, but some expert states, that here is the highest chance for the outbreaking of the third World War. (91)
Imagine, that space mining, which will be probably the future’s highest-profiting industry, in what great extension will threaten the international peace, if it will start internationally unregulated. It is enough to imagine the situation, if two different companies will want to mine at the same time a valuable asteroid. In my view, and after other researchers’ opinion as well, it could lead easily to a massive international conflict. (92)

**Environmental questions**

To demonstrate, what environmental risks could contain the space mining, let me use the example of Dr. Zoltán Székely. He frequently says, “that probably there were contemporary intelligent species and they even conducting space mining and then they got extinct in a mining accident”. Of course, the first part of the statement has a very low chance, but in his view the second part could be easily a reality again. If we would start space mining and destabilize the orbit of an asteroid, it could probably hit our planet and then it could lead to a mass-extension of the Humanity, just like the extension of the dinosaurs were. (93) In that way, it is safe to say that the miss-conduct of space mining could easily threat the existence of the Humankind.

Because of that in my view the proper international environmental regulations are inalienable.

Furthermore, the Humanity has already experience with the negative effects of the upregulation of the environmental protection, our Planet. Sadly, the irresponsible and ill-considered behaviour of the Humankind, leaded to many serious environment pollution in our home planet. The most significant and the best example for these consequents is the phenomena of global warming. (94)

Against the environment of outer space, we have still the chance and time not to commit the same “sins”. In my view, the best solution would be if, before the mining would begin - we will analyze and regulate the environmental questions related to the outer spaces. This is related to the sustainable development goals as well, since in my view we should use the outer space such a way, that our grandchildren will have the same possibilities like us.
Global economic inequality

Since high probably the space mining will the biggest industry of our future, there is a high chance for it, that it will determine basically the future economic strength among the nations. But since the space mining is highly capital-demanding sector, more likely just the richest countries’ companies will be able to conduct it. In the same time, it will mean, that the developing countries won’t be able to participate in that industry. In my view it is clear for everyone, that if it will happen, this will just increase the existing global economic inequality between the developing and developed countries. (96)

In my view the UN recognized that problem since decades. That’s why they involved in the Outer Space Treaty and in the Moon Agreement as well, that the use of outer space ‘shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development’. Furthermore, this was the motivation, why they legislated in the Moon Agreement, that the benefits of space mining should be shared equally among the nations, with special consideration on the developing countries. (97)(98)

Summary

In my view it is clear for everyone, that if the space mining would start without it is international regulated, it could have several bad effect on the Humanity.

- III.II Space mining with international regulations –

First of all, in my view it is important to emphasize, that the wide accepted international regulation of that sector, is a significant challenge before the international community. But, if they will be able to find a legal solution, what will be acceptable for the majority of the international community, I think it will have a very positive effects. In the followings I will demonstrate them.
Effect on the international relations

In my view, if the international community will be able to reach an agreement about the legislation of space mining, it will have a very positive effect on the international corporation, and it will strength the international relations. And we know it is not impossible to create such a legislation. The international community proved already once that they are able to unify related to space law. This consensus was the *Outer Space Treaty*, and it goal to demilitarize the outer space. In my view, that cooperation should be the example before the international community for the future legislation of the space mining.

Furthermore, in my view every economical corporation reduce the chance for a war. The best example for that is I think the European Union. If the space mining will be international regulated and it will be creating an international economical corporation, in my view it will reduce the chance for a war as well.

Biggest challenges before the Mankind

In my view, if the space mining would be successfully international legislated, the sector will be able to play an important in the solving of the biggest problems of the Humanity. Maybe this statement sounds a little bit unrealistic but let me explain it. First of all, what are the biggest problems or challenges before the humanity?

In my view one of them is the environment pollution. Since the mining is one of the most polluting industry in our globe, in my view it will definitely reduce in large extent the environment pollution of the Earth, if we will bring out some of a reasonable part of the raw material extraction to the space. After that we should just arrange, with great space environment protecting laws, that the pollution will not continue in the space. Furthermore, the other reasonable problem, what we could solve due space mining is in my view the huge economical differences between developed and developing countries. I analysed it already in the previous chapter that lack of international regulation, which will assure a kind of reshare of the benefits of the space mining, very possibly the developing countries will not be receiving from the benefits of the space mining. But if there will be an international regulation, which will provide for them certain amount of benefits, the space mining will be probably the sector which will in certain level solve that problem.
- IV –

- Potential international regulations –

As we could state in the second part, on most of the legal cases related to space mining there is still no consensus among the international community. The most debated issues are the following:
- The legal status of outer space and its resources and mining
- The benefits of space mining
- Environmental regulations

In the following I will analyse how the possible ways for an international regulating solve the above written legal issues.

-IV.1. The Moon Agreement -

In the following I will analyze the only remarkable, but unsuccessful international attempt for the regulation of space mining. Since it was an unsuccessful Agreement and become not wide accepted the international community, Experts tend to forget the importance of that agreement.

In my view this is a mistake, because of two reasons:
Firstly, why it would be a mayor mistake to underestimate this treaty's importance, especially its endorsement, is the fact that the Agreement has still a relatively strong endorsement. If we count the endorsing G20 members (so economically the world most powerful countries) we could count that Australia, Mexico, Turkey and Saudi Arabia ratified, and France and India signed the Agreement. So approximately one third of the countries with biggest economic power (so potential space miners) endorsed it.\(^{(100)}\)
Furthermore, we should take into account, that many countries from the European Space Agency (which is currently the second wealthiest space agency) endorsing the treaty (France, Netherland, Belgium, Austria and Romania) so their lobby activity will perhaps convince the other members too.\(^{(101)}\)
In addition, many Arabic states ratified the treaty as well, so they could also convince other Arabic states, trough the Arabic Ligue for example.
The second reason, why we should still “count” with that Agreement, is coming from the first. The Agreement is not enough accepted to solve the international regulation of space mining, but it is enough accepted to hinder it.

So, because of these reasons, in my view currently the Moon Agreement plays the biggest role in the international regulation of space mining. In the following I will analyze, that if it will be able to regulate the different legal issues related to space mining.

**The legal status of outer space and its resources and mining:** Briefly the Moon Agreement declares the outer space and its resources as a common heritage of Mankind and It bans for everyone the space mining, except and international regime. In my view, to declare the outer space and its resources as a common heritage of Mankind could be a legal solution. This principle could help in a certain reshare of the benefits from space mining among the developing countries. But the provision related an international regime is totally utopian. This regulation is completely contrary with the current economic situation, since it bans the space mining for everyone, including that the private companies, but currently the space mining industry are private companies! In my view, because of that reason, this legislation should be changed to regulate that issue international acceptably.

**The benefits of space mining:** The Agreement provide, that this international regime should share the benefits from the space resources equally among the international community. During that share the regime should consider the needs of developing countries and the ones who conducted the discoveries.

I would share that provision into two parts. The first part of the provision, so that an international regime should share all the benefits is utopian, since itself the conception about that international regime is utopian. However, in my view, the second part of the legislation could be valuable, since it contains values, like the support of the developing countries or the financial compensation of the discovering countries - which could be take into account during the future legislation. (In my view the compensation of discovering countries is important, since their citizens paid for that discoveries from their tax)
**Environmental regulations:** The environmental legislation of the Moon Agreement is utopian in my view as well. It isn’t a solution, that we are prohibiting every kind of change in the environment of outer space (except the mining conducted by the international government). In my view such legislation should be better elaborated. (102)

**Summary**

As I have repeatedly reiterated above, in my view most of the provisions of the Agreement is utopian and goes entirely against the current economic situation. Since this agreement has a still strong endorsement, I think the first thing what we should do to solve the international regulation of the space mining is to abolish or to change that Agreement (in a way, that it will be in accordance with the current economic situation).

- **IV.II Deep-sea mining** -

In the following I will demonstrate as a potential legal example the legislation of the deep-sea mining.

In my view this could be a relevant legal example cause of two reasons:

Firstly, because deep-sea mining has relative quite similar circumstances to space mining. Of course, it is relative since the one is conducted in the deep-sea belt and the other is in outer space, but since the deep sea belt like the outer space is as well difficult to accessible there could be a parallelism. (103)

Secondly, because this model of international legislation of a mining type was acceptable once for the majority of the international community, so in my view it could be again.

The regulation of deep sea mining is based on the following legal foundations:

- International Seabed Authority (hereinafter Authority) and its regulations and recommendations (105)

**The legal status of deep sea and its resources and mining:** Based on the existing legislations, the Area (so the high seas and the areas of the seabed beyond the continental shelf) and its resources are *common heritage of mankind.*
Furthermore, the mining of the resources of the Area is allowed for every states (including their companies), but just in accordance with the existing legal framework and with the authorization of the Authority. However, for that authorization it should be fulfilled several requirements.

The Authority: The Authority was established to regulate the legal framework related to seabed and to control every activity which are conducted there, including deep sea mining. It is ‘empowered to authorize, control and direct the exploitation of the deep seabed resources.’ By some questions related to seabed it should act on behalf of the ‘mankind as a whole’. (106) ‘The main organs for the Authority are the Assembly, the Council, the Legal and Technical Commission (LTC), the Finance Committee and the Secretariat. In the Assembly we could find all member States and elects officers (Chairs, Secretary-General etc) and sets the general policies for the Authority. The Council acts as the executive organ and discusses substantive matters. The LTC reviews inter alia applications for approval of a plan of activities in the Area, supervises the contractors and drafts rules and regulations for submission to the Council.’ (107) (108)

**The benefits of deep sea mining:** Based on the UCLOS the ‘Activities in the Area shall (…) be carried out for the benefit of mankind as a whole, irrespective of the geographical location of States, whether coastal or land-locked, and taking into particular consideration the interests and needs of developing States and of peoples who have not attained full independence or other self-governing status recognized by the United Nations.’ Furthermore, ‘the Authority shall provide for the equitable sharing of financial and other economic benefits derived from activities in the Area through any appropriate mechanism, on a non-discriminatory basis.’

In addition, this equitable sharing should be conducted under the rules which are developed by the Authority. Since the deep mining still did not started, this process about the share is still not regulated by the Authority. (110) In this way, until it isn’t legislated, I couldn’t analyze that question, but we could state that the legal background is provided for that.

**Environmental regulations**

UNCLOS in Article 145 requires that ‘necessary measures shall be taken in accordance with this Convention with respect to activities in the Area to ensure effective protection
for the marine environment from harmful effects which may arise from such activities. To this end the Authority shall adopt appropriate rules, regulations and procedures for inter alia:

- the prevention, reduction and control of pollution and other hazards to the marine environment, including the coastline, and of interference with the ecological balance of the marine environment, particular attention being paid to the need for protection from harmful effects of such activities as drilling, dredging, excavation, disposal of waste, construction and operation or maintenance of installations, pipelines and other devices related to such activities;

- the protection and conservation of the natural resources of the Area and the prevention of damage to the flora and fauna of the marine environment’

Furthermore, UNCLOS in Part XII requires, that ‘national rules for pollution from seabed activities in the Area as well as within national jurisdiction to be no less effective than international rules, standards and recommended practices and procedures.’

Additionally, ‘all States share a common obligation to protect and preserve the marine environment, including rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life.’

In my opinion, these legislations about the environment protection are accurately elaborated, so they could be an “legal example” before the future legislation of the outer space environment protection.

**Summary**

In my view, the biggest achievement of the legislation, that on the one side, it was able to regulate the sector of deep-sea mining widely accepted internationally and on the other side protecting the “whole interest of the Humanity” with elaborated environmental protections and with legislations, which provided the legal basis” to share the benefits of seep-sea mining among the whole Humanity, including the developing country.

Because of that achievement, in my view this legislation could be a perfect “legal example” before the international community for the future legislation of space mining.
- IV.III Credit system –

Another concept called “credit system” would pursue the objective, to establish a system, through what that developing countries will have also the opportunity to benefit from the revenues of the space mining. The idea of the system is coming from ‘the Kyoto Protocol to the United Nations Framework Convention on Climate Change in order to reduce global emission of CO2’. The concept of that system is that all States Parties should become a certain amount of ‘emission quota per time period. If a State needs more credits, it can buy it from another State; thus keeping global emission levels balanced’. (113)

The idea is, that this system could be used by the sharing of the benefit space mining as well. The concept is, that, ‘each country would be allocated a certain amount of lunar mining credits’, which would allow the holder to mine a certain amount of space resources. Furthermore, these credits could be sold, if a state could not use it. In that way, developing nations will be able to solve their credits to space-faring nations. And in that case also developing countries will be able to benefit from space mining. It is still an open question, that after which criteria should be these credits shared (for example population or state of development), but in my view this system could be regarded during the future regulation of the share the benefits of space mining. (114)

- IV.IV The Szilasi concept –

In the following, let me demonstrate my concept about the future legislation of the space mining. It will mostly content nut practical suggestions, but principles among what the international community should in my view to legislate the area.

First of all in my view, the future legislation of space mining should:

- be concrete and definite every part of the future’s law in details. This will prevent the potential conflicts, which could arise from the different interpretations of the legislation
- take into account the interest of everybody, from the developing countries until the space mining companies. Otherwise, it will be again such an utopian legislation as the Moon Treaty and will be again not able to regulate these sector internationally
acceptably. In my view, the best way to create such a legislation is to consider by the process the current political and economic situation.

- at last with high responsibility “instrumented. Since most likely it will be the biggest industry of the future, its legislation will have a significant effect on the whole Humanity. Because of that, the international community by the future legislation should take into account the interest of the whole mankind.

- “instrumented” for a long term.

In the following I will have different propositions related to the future legislation of the different legal parts.

**The legal status of outer space and its resources and mining:** I would legislate that legal part similarly as the deep-sea mining. According that I would allow to everyone the conduction of space mining. Furthermore, I would classify the outer space as a *common heritage of mankind*, since in my view this regime is the best to protect the interest of the developing countries.

**The benefits of space mining:** In my view, it would be a nonsense and irresponsible legislation if the benefit of space mining would be without taxation. In almost every states and by almost every industry there is a kind of taxation. \(^{(115)}\) By the outer space mining it should be not different, but the tax should not be paid for a country, but for an organisation, who is represents the whole humanity.

After that the taxations could be spent on such issues, like the financial support of these international organisation, to protect the environment of the outer space or to share it among the developing countries.

**Environmental regulations:** In my view it is highly important to legislate this sector accurately and with responsibility. In my opinion, the two most important goals are, what we should reach with the legislation, is firstly to protect the Earth from any kind of danger from space mining, secondly, we should make the space mining environmental sustainable for a long term.

I was mentioning during the demonstration of my concept many times an international organisation, which should have the same function, as the Authority by the deep-sea mining.
In my view, by the creation of that organisation the Authority could be a great example before us.

- Summary –

Previously we could read about more concepts about the future regulation of space mining, which could be “examples” before the international community by the future international legislation of the space mining. In my view, the example of the regulating of the deep-sea mining showed for us, that it is possible for the international community to create an international wide accepted legislation.
To give a fabulous example; the times have slowly come, when the seven dwarves would no longer go to an underground mine to mine ore, rather, they would build a spacecraft to do it in outer space. It is safe to state, that space mining will start in the near future. Subsequently, since the resources in outer space are “infinite”, there is a high chance, that once this happens, then it will soon become the biggest interplanetary industry.
If this will happen, space mining will most likely, greatly determine the economic situation and international relations upon our globe.
In relation to this I hypothesise that; if space mining will become one of the most important industries of the future, and play a key role in the future of international relations; I believe this “role” will be negative, if the mining starts without it being internationally regulated, but positive if it starts with widely accepted international regulations.

Based on the current situation, it is safe to state, that the most important legal issues related to space mining have still not been settled. There is still no international consensus about the legal issues as to the possession rights of space resources, or about the share of the benefit, delivered from the industry. On top of this, the environmental issues are still not decided or regulated either.

To sum up my study, if space mining starts without any change to the current legal situation, whilst the above issues are still not resolved, the result could be the accruement of situations that have an extremely negative overall effect on the international community, and consequently, a divisive and damaging effect upon international relations.

In the, currently unresolved, question of possession rights for example, we can easily imagine the situation; two different companies may want to mine the same, highly cost-effective celestial body. Since space mining will contain tremendous profits, these conflicts of interest, could easily lead to an international conflict, which may seriously undermine international peace. Furthermore, the lack of environmental regulations, could
equally lead to negative trends, for example to environmental catastrophes, which obviously will have a deleterious effect on international relations as well. In addition, in the worst case scenario, such an incident could wholly end international relations, since in a case of a major space mining catastrophe, humanity could quite easily become extinct.

Consequently, it is safe to state, that the first part of my hypothesis could be true; accordingly, if space mining begins without it being internationally legislated, it will have several negative effects to the international relations.

As for the second part of my hypothesis; Will the mining of space have a positive role in international relations, if it is internationally regulated at its commencement?

Summarizing my study, my answer is definitely; yes.

If space mining has been acceptably legislated internationally, it could, firstly, strengthen the international peace and enhance cooperation among the international community. In addition, it could deliver many other benefits for the whole of humanity as well. For example, legislation, in which the social aspects are given great emphasis, will actually be able to solve some of the biggest social issues, we face on the planet.

Of course, a question arises, in each and every intelligent reader: if the legislation of space mining could deliver so many benefits, why does it remain unregulated as yet? The answer to this, is highly complex, as ever so many aspects of international relations.

Currently the majority of the international community are of the opinion, that the major obstacle to an international consensus for international legislation, are the countries, which have regulated the industry in their national law, in other words, the United States and Luxembourg. Of course, this opinion could be partly true, since these national laws certainly do not promote, or lead to international legislation, however, one could argue that this issue is more complicated. To understand it, we should analyze the interest of these two countries.

It is plain, that the aim of the USA and Luxembourg, in legislating nationally, was to create a solid legal background for the industry, in order to aid its further development. If
they had not acted in this way, there is a high chance that their national space mining industries would have been stunted in development, or ceased developing altogether, since investors would be afraid to invest in a sector, the legal background of which is uncertain. Furthermore, we should consider the fact, that if these countries had wanted to legislate their space mining law through an international solution, the only option which would have been, and is currently available to them, is the *Moon Agreement*. An Agreement which mostly has provisions, that are contrary to the current economical situation. The best example for this, is that the Agreement altogether prohibits space mining for private entities.

To continue along this line of reasoning, these nations had just one opportunity to positively legislate their national space mining industry whilst sustaining its development. The only viable option was for them to legislate the sector on a national level. They might perhaps be judged, had there been some form of proper international legislation in place, -a good basis for comparison is the international legislation of deep-sea mining- but there was not.

Currently, the main question in space mining law, is if the international community will be able to unify, at some point in the near future, and legislate the sector to the wide acceptance of the international community. In my study I have attempted to propose legal musters and examples for this process, which might prove suitable for such future legislation.

So as a final thought, I would like to express my hope, that once there will come to be an international consensus, which will result in the legislation of the sector of space mining. If and when this occurs, it will be excellent new for all of us. Because, then perhaps the principle of the Outer Space Treaty will become a reality, and ‘the exploration and use of outer space will be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development.’
About Dr. Zoltán Székely:
Zoltán Székely is working as a technology transfer specialist and business incubation project manager by the European Space Agency.

1. What do you think, when will the first space mining activities start?
In my view space mining could become a reality within fifteen years or even less. Then could the first attempts start.

2. What do you think, what are the main technical obstacles before the starting of space mining?

The largest obstacle I currently now, is the transportation between the Earth and Outer Space. The cost of rockets is extremely high, although already several attempts have been made by public organisations such as NASA, or private companies, such as Space X to reuse rockets and make an easier and more cost-effective transportation. But still we could state, that every launch contains a very high risk and their costs are tremendous. Because of that reason, if you mine something, it is hundred percent sure, that it will not worth to transport back the ore mineral to the Earth. This challenge can we overcome if we would be able to refine the mined resources in outer space and manufacture as many as possible things in space, only bringing down products.

3. In your opinion, what environmental threats could space mining contains?

To demonstrate what environment threats are containing space mining, I always use the example of the dinosaurs. Probably there were contemporary intelligent species and they even conducting space mining and then dinosaurs got extinct in a mining accident. Of course, it has a highly low chance, but we should always consider the fact, that if we
destabilize the orbit of an asteroid, it could probably hit our planet, what could lead to the extinction of our species.

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Hungarian Summary:

Bevezetés

Szakdolgozatom témája az űrbányászat szerepe a nemzetközi kapcsolatok és nemzetközi jog jelenében és jövőjében. A motiváció, amiért ezzel a témával foglalkozom, az, hogy véleményem szerint az űrbányászat lesz egykoron az emberiég legnagyobb iparága. Ennek úgy vélem az lesz az alapja, hogy az űrben található erőforrások végtelenek, így az űrbányászat is a végtelenségik fog tudni nőni. Amenyiben bekövetkezik ez és ez az iparág lesz az akkor már Világuniverzum legnagyobbja, akkor úgy jövendőlőm, hogy meghatározó szerepet fog játszani tanulmányom tárgyában, a jövő nemzetközi kapcsolataiban.

Hipotézisem szerint, ha az űrbányászat a világ legnagyobb iparága lesz, akkor amenyiben nemzetközileg szabályozottan fog indulni, akkor pozitív hatásai lesznek a nemzetközi kapcsolatok, de amenyiben úgy fog indulni, hogy nincs nemzetközileg szabályozva, akkor ezek a hatások negatívak lesznek. Szakdolgozatom céljául ennek az állításnak a megvizsgálását tűztem ki.

Úrbányászat

Írásásm első fejezetében az űrbányászat technikai oldalát elemzem. Ezen belül kitek a legfontosabb szervezetekre, országokra, amik a szektoral foglalkoznak. Itt kiemeltem elemzé a ENSZ Világürbizottságot, továbbá a két államot, ami már nemzeti szinten szabályozta az űrbányászatot, az Egyesült Államokat és Luxemburgot. Továbbá ebben a részben még kitek az űrbányászat technikai oldalára is. Bemutatom a legfontosabb nyersanyagokat, amik az űrbányász cégek célpontját jelentik. Ezen belül elemz a becsült értéküket és összetételüket. Továbbá röviden elemz a űrbányászat tervezett folyamatát is.

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Az űrbányász jog

Mivel úgy gondolom, hogy a nemzetközi kapcsolatok alapvetően a nemzetközi jogra épül, ezért a második részben az űrbányászat nemzetközi jogi oldalát elemzem. Ezen belül megvizsgálok a nemzetközi jogi anyagot, amit az ENSZ Világűrbizottságban készült szerződések alkotnak és a nemzeti szabályozásokat.

Ha össze szeretném foglalni a nemzetközi jog jelenlegi állását az űrbányászatban, akkor kijelenthetem, hogy jelenleg nincs konszenzus a legfőbb jogi kérdéssel kapcsolatban. Ezek a jogi kérdések az űrerőforrások jogi helyzete, az űrbányászatból származó profit újraelosztásosnak kérdése, illetve a környezeti szabályozások.

A legvitatottabb kérdés jelenleg az űrbányászatjogban, hogy az űrerőforrások jogi státusznak res communisnak, vagy common herritage of mankindnak kell-e lennie.

Űrbányászat nemzetközi szabályozással és nélkül

Írásom harmadik fejezetében azt a kérdést vizsgálok meg, hogy milyen hatásokkal járhat majd az űrbányászat a nemzetközi közösségre, amenyiben az iparág nemzetközig leg szabályozva fog indulni és amenyiben nem.

Ebben a részben arra a konklúzióra jutottam, hogy amenyiben szabályozatlanul fog indulni, akkor olyan folyamatok alakulhatnak majd ki, amik komoly veszélyel lehetnek majd a nemzetközi békére, sőt az egész emberiségére.

Viszont amenyiben az iparág szabályozva fog elindulni, véleményem szerint akkor több pozitív hatása is lehet a nemzetközi közösségére.

Lehetséges jövőbeli szabályozások

Ebben a részben olyan jogi példákat mutatok be, amik véleményem szerint példaként szolgálhatnak az űrbányászat jövőbeli nemzetközi szabályozásához. Ezen példákon belül szeretném kiemelni a mélytengeri-bányászat szabályozásának példáját, amely véleményem szerint leginkább megfelelhet a célnak. Ezen kívül ebben a részben még
kifejtem a saját jogi elképzeléseimet is, az iparág jövőbeli szabályozásával kapcsolatban.

Konklúzió

A konklúzióban összefoglalom röviden a művemet a hipotézisem tükében. Úgy következtetek, hogy nagy rá az esély, hogy a hipotézisem a jövőben igaz lesz.