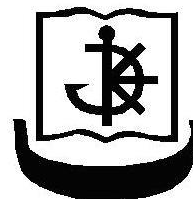


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# MODERN METHODS AND APPROACHES OF TEACHING IN THE PROVISION OF EFFECTIVE COMMUNICATION AT SEA

**Zurab Bezhanovi, Leila Khardina, Kristine Zarbazoia**

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## **Abstract**

*Taking into account the fact that the English language shall be used as the working language for bridge-to-bridge and bridge-to-shore safety communications, as well as, for communications on board between the pilot and bridge watchkeeping personnel, the vast majority of companies determine English as appropriate working language to enable the officers to perform their watchkeeping duties. Therefore, a wide range of the results to be achieved during the process of Maritime Education and Training implementation related to the language competence development, needs application of modern approaches actively used in different fields of skills - oriented education.*

**Keywords:** *communication skills, Maritime English, modern methods, hypertext.*

## **Introduction**

Under the requirements of the International Convention for the Safety of Life at Sea , and the International Safety Management Code, the use of the English language is increasingly becoming a mandatory requirement for all categories of seafarers.

The specification of minimum standard of competence for the officers on board the ships of 500 gross tonnage or more (the Convention on Standards of Training, Certification and Watchkeeping for Seafarers), requires “adequate knowledge of English to enable the officer to use charts and other nautical publications, to understand meteorological information and messages concerning ship’s safety and operation, to communicate with other ships, coast stations and Vessel Traffic Service centres and to perform the officer’s duties with a multilingual crew, including the ability to use and understand the Standard Marine Communication Phrases”. [1]

At the same time, Maritime English is also used as a provider language of informational symbols, signs and alarm signals concerning safety.

Thus, a wide range of the results to be achieved during the process of Maritime Education and Training implementation related to the language competence development needs application of the modern approaches actively used in different fields of skills - oriented education.

Accordingly, the aim of the presented paper is to propose a set of two modern teaching database models (designed for non-native English students) intended to meet STCW 78/95 as Amended, the ISM Code and the SOLAS requirements, which principally underline the significance of the English Language competence for the seafarers.

Consequently, the goal of the proposed models is to present teaching methods and approaches aimed at providing MET trainers and instructors with the components offering (non-native English) nautical students the adequate competence and proficiency, to enable them to use specific nautical terminology and to develop their oral and written communication skills.

## **Model I – Contact English Development at the Beginner Level**

The model offers a text, for the basic knowledge of the Black Sea with a set of activities of communicative competence development for practicing speech acts such as agreeing, expressing points of view, emphasizing, giving opinions and making conclusions.

### **The Black Sea**

***Skim and scan the text, then compile the results and present them orally***

The Black Sea is an inland sea between south-eastern Europe and the Anatolian peninsula (Turkey); the Mediterranean and Aegean Seas and various straits connect it to the Atlantic Ocean. The Black Sea has the area of 436,400 km<sup>2</sup> and the maximum depth of 2,200 m (7,200 ft).

The Bosphorus Strait links it to the Sea of Marmara and then the long strait of the Dardanelles connects it to the Aegean Sea region of the Mediterranean.

These waters separate Eastern Europe and Western Asia. The Strait of Kerch also links the Black Sea to the Sea of Azov.

The Danube is the most important river that enters the Black Sea.

Six countries - Romania and Bulgaria to the west; Ukraine, Russia and Georgia to the north and east; and Turkey to the south - border the Black Sea. The important cities along the coast include Constanta, Istanbul, Odessa, Burgas, Varna, Kherson, Sevastopol, Yalta, Kerch, Novorossiysk, Sochi, Sukhumi, Poti, Batumi, Trabzon, Samsun and Zonguldak.

**Pair Work. Ask and answer the following questions:**

Define the geographical position of the Black Sea.

.....

Name straits and seas which connect the Black Sea to the Atlantic Ocean.

.....

What area has the Black Sea?

.....

What is the maximum depth of the Black Sea?

.....



Figure 1. The maps of the Black Sea and the Bosphorus Strait [5]

What strait links the Black Sea to the Sea of Marmara?

.....

What strait connects the Black Sea to the Aegean Sea?

.....

What waters separate Eastern Europe and Western Asia?

.....

What is the most important river that enters the Black Sea?

.....

What countries border the Black Sea to the west, to the north and east and to the south?

.....

What are the important cities along the Black Sea coast?

.....

**Test your knowledge on the Black Sea geography: read the text and fill in the gaps with the words given below. Note: there are two extra words.**

- |                         |             |         |               |              |         |
|-------------------------|-------------|---------|---------------|--------------|---------|
| 2,200 m                 | Atlantic    | east    | Mediterranean | Sea of Azov  | west    |
| 436,400 km <sup>2</sup> | Bosphorus   | Eastern | Mediterranean | south        | Western |
| Aegean                  | city        | Europe  | north         | southeastern |         |
| Aegean                  | country     | inland  | peninsula     | Strait       |         |
| Asia                    | Dardanelles | Marmara | river         | The Danube   |         |

The Black Sea is an ..... sea between ..... Europe and the Anatolian ..... (Turkey) (between southeastern.....and ..... Minor), the ..... and ..... Seas and various straits connect it to the ..... Ocean. The ..... strait connects it to the Sea of..... and then the strait of the ..... connects it to the ..... Sea region of the ..... These waters separate ..... Europe and ..... Asia. The ..... of Kerch also connects the Black Sea to the..... The Black Sea has the area of ..... km<sup>2</sup> and a maximum depth of ..... m ( ..... ft). Six countries — Romania and Bulgaria to the .....; Ukraine, Russia and Georgia to the ..... and .....; and Turkey to the ..... - border the Black Sea. The important cities along the coast include:

*Individual work: read the presented text and conclude why it is important for a future seafarer. Motivate your answer in the form of a short summary. Use your own sentence structures; do not simply copy the text.*

*Using the previous models define the position of the Mediterranean Sea; name the strait which connects the Mediterranean Sea to the Atlantic Ocean. What countries border the Mediterranean Sea to the west, to the north and east and to the south? What are the important cities along the Mediterranean Sea coast?*



Figure 2. The map of the Mediterranean Sea [6]

*Individual work/Presentation: use the given maps, plot and comment upon two courses from the Black Sea to the Atlantic and the Indian oceans.*



Figure 3. The blind map of two courses from the Black Sea to the Atlantic and the Indian oceans [6]

***Write a paraphrase (the same ideas in different words) for the given passages:***

The Black Sea is an inland sea between southeastern Europe and the Anatolian peninsula (Turkey); the Mediterranean and Aegean Seas and various straits connect it to the Atlantic Ocean. The Black Sea has the area of 436,400 km<sup>2</sup> and the maximum depth of 2,200 m (7,200 ft.)

The Bosphorus Strait links it to the Sea of Marmara and then the long strait of the Dardanelles connects it to the Aegean Sea region of the Mediterranean. These waters separate Eastern Europe and Western Asia. The Strait of Kerch also links the Black Sea to the Sea of Azov.

Six countries - Romania and Bulgaria to the west; Ukraine, Russia and Georgia to the north and east; and Turkey to the south - border the Black Sea. The important cities along the coast include Constanta, Istanbul, Odessa, Burgas, Varna, Kherson, Sevastopol, Yalta, Kerch, Novorossiysk, Sochi, Sukhumi, Poti, Batumi, Trabzon, Samsun and Zonguldak.

**Model II Contact English Development via Computer Based Training at the Elementary Level**

One of the best ways to meet the above-noted requirements, and consequently to achieve the results is to put the use of a hypertext into Maritime English teaching.

Hypertext is a logically built text-looking pyramid of necessary data presented on any electronic platform with connects with other related units of information (texts, glossaries, illustrations, multimedia files, graphs, etc) which the student can instantly reach. The hyperlinks, by which the hypertext pages are interrelated, in fact provide a frame of the entire necessary data. The hyperlinks or the same key words manage, steer and direct the student on his/her way to the desired aim. The option of playback, self control and assessment presents a double positive effect – as the educational activity, as well as, the factor increasing personal conscientiousness of the student. At the same time, separately from the analogue text, dynamic and elastic nature of the hypertext provides uninterrupted increasing and development of the content in response to student necessities. As a result, a hypertext enables elastic linking and interrelation of the educational information of the complete intended database. Thus, a hypertext, as the teaching tool, is the result of highly developed and well planned educational policy with the above- stated obvious advantages, which are rapidly increasing giving the educators possibility of constant tuning and updating of the existed teaching data [3].

As an example of essential advantage of the hypertext technologies use in Maritime English teaching, we would like to present a set of six integrated screenshots (taken from our own electronic interactive course) of the hypertext “A Cargo Ship Construction”, which provides the students of Batumi State Maritime Academy with a set of simultaneously accessible hypertext availabilities, such as:

- the whole text listening;
- listening and reading of Georgian translation of (preliminarily chosen) key words;
- pictorial illustration of the marine terminology (a picture in Maritime English is really worth a thousand words and explanations);
- usage of the picture as the knowledge development source – clicking the unknown part of a ship the student is immediately provided with the term’s pronunciation and translation;
- related topics access;
- self - check, control and evaluation

**“A Cargo Ship Construction”**

Some components exist in a vessel of any type, size and purpose. Every ship has a hull, propulsion system and steering system, as well as, a funnel (smokestack/chimney), bow, the main deck, the superstructure, Portside/Starboard side, lifeboats, cargo space, the stern, propellers, scuttles, cabins and cargo equipment.

Understanding of such texts for non-native English students is related with obvious difficulties because of hardly imaginable definitions of a large number of technical terms. At the same time, the hypertext gives the students possibility of:



Figure 4. A screenshot of the same text in its hypertext variant with the whole text listening [7]

The hull is an area between the main deck, the sides (portside and starboard side) and the bottom. There are frames, beams; and the keel inside the hull. Decks and bulkheads divide the hull into a number of watertight compartments. The hull is covered with plating and is divided into three main parts: the bow, the stern and the midship.



Figure 5. A screenshot of the same text in its hypertext variant with listening and reading of Georgian translation of (preliminarily chosen) key words (marked in red) [7]

The part of the hull below water is the ship's underwater body. A bulkhead is a vertical steel wall going across the ship and along her. The hull contains the engine room, cargo space, tanks and holds. The bow is the foremost part of the hull (some ships have a bulbous). The rearmost part of the hull is a stern (and many hulls have a flat back known as a transom); the part between is called midship. The keel is at the very bottom of the hull, extending the entire length of the ship.



The key structural elements of a Ship's Hull are typically presented by:

Deck Plating (aka Main Deck, Weatherdeck or Strength Deck)	Transverse Frame (1 of 2)
Transverse Bulkhead	Keel Frame
Inner Bottom Shell Plating	Keelson (1 of 4)
Hull Bottom Shell Plating	Longitudinal Stiffener (1 of 18)
	Hull Side Beam

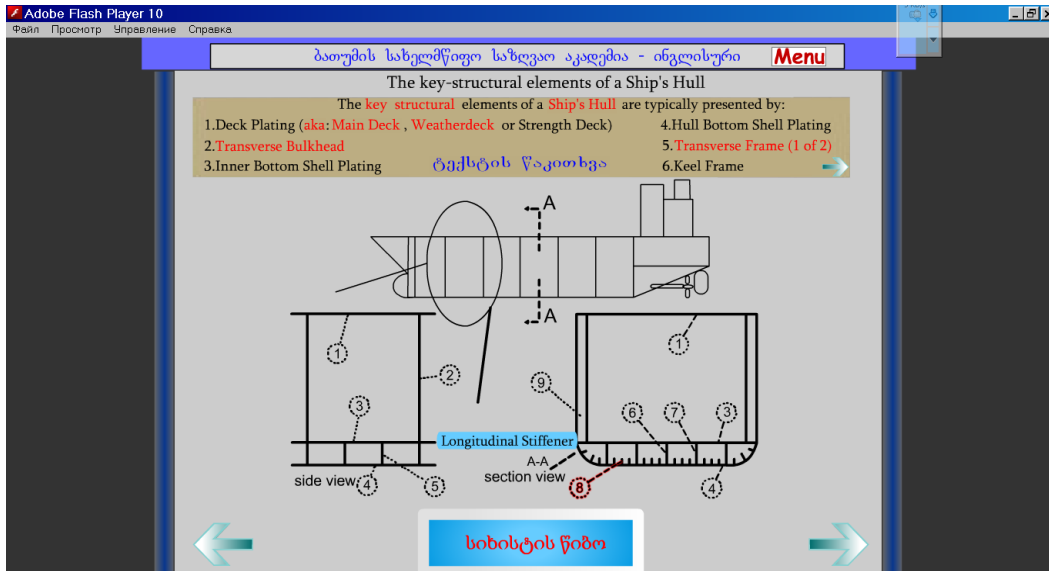


Figure 6. A screenshot of the same text in its hypertext variant with pictorial illustration of the marine terminology (clicking a word the student is provided with the explanation of a term) [7]

A General View of the Hull: transverse frame; beam; stanchion, keel, longitudinal frame.

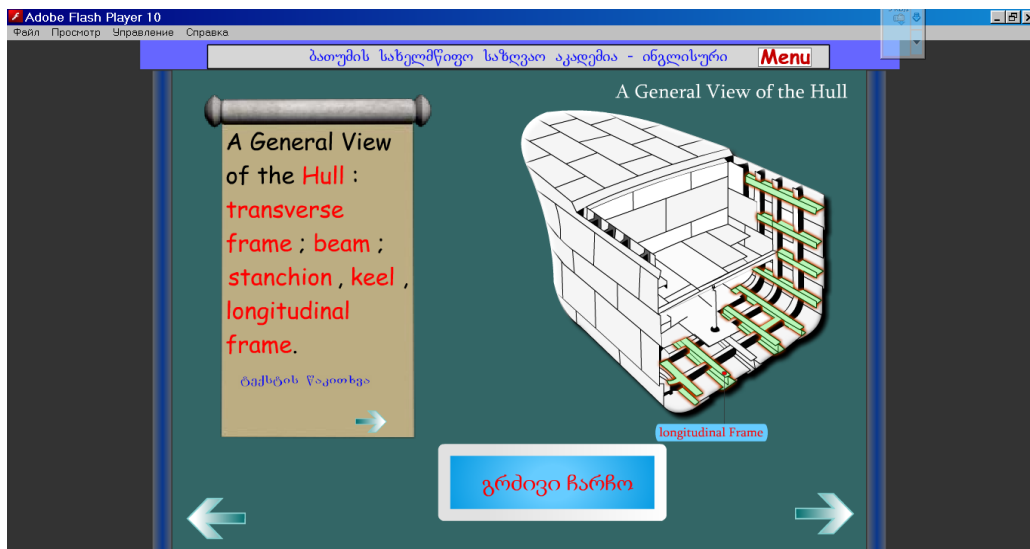


Figure 7. A screenshot of the same text in its hypertext variant with usage of the picture as the knowledge development source – clicking the unknown part of a ship the student is immediately provided with the term's pronunciation and translation [7]

The lowest part of the hold is called a bottom; the space under the bottom represents the double bottom. Single Bottom, Double Bottom, Double Hull:

Bulk Carrier Midship usually contains: cargo hold, hatch cover, upper tank for water ballast or oil, double bottom, lower tank for water ballast:

Forward Hold Arrangement typically contains beam, coaming, tween deck, bulkhead, hatch ladder and deep tank:

After Hold Arrangement typically contains: coaming, tween deck, bulkhead and hatch ladder

The openings giving access to holds are called hatches. Bulk carrier waterproof hatches slide apart or lift up and open:

Tanks are usually used to store liquid cargo, fuel, engine oil, fresh and ballast water.

If a ship has double sides, the space between the sides contains wing tanks and ballast tanks. Ballast tanks are equipped to change a ship's trim and modify her stability.

Forepeak tanks are at the fore end of the hull and afterpeak tanks are at the after end.



Figure 8. A screenshot of the same text in its hypertext variant with related topics access (marked in blue) [7]

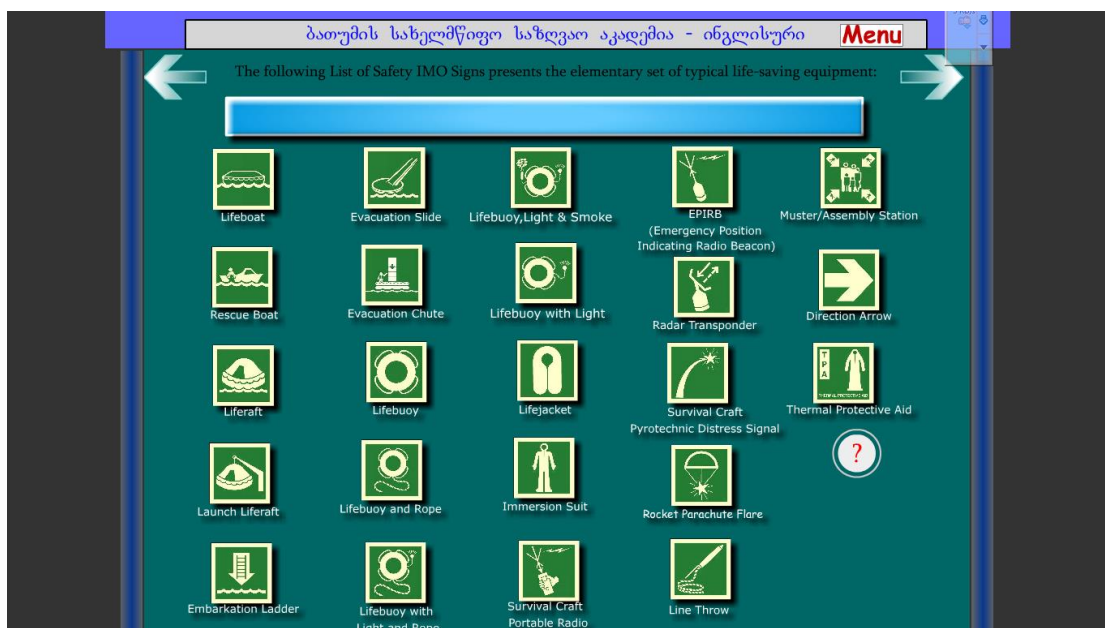


Figure 9. A screenshot of the same text in its hypertext variant with self check, control and evaluation [7]

## Conclusion

Thus, the modern maritime education is changing from analogue form into an electronic one, in which the creation and sharing of information and skills is of principal importance. Accordingly, educational data provision should also follow the challenges of this policy. Thus, hypertext can play a considerable role in rebuilding traditional teaching data to respond to contemporary maritime education needs, filling in the gaps that exist between maritime needs and the outputs of Maritime Education and Training system.

The use of hypertext in Maritime English delivery can raise access to learning opportunities. It can help to improve the quality of education with advanced teaching methods, progress learning results and enable better planning of unlimitedly elastic digital educational tools.

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# THE MARITIME ECOLOGICAL LEADERSHIP IN REGARD TO IDEOLOGY, PSYCHOLOGY, EDUCATION

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## **Abstract**

*The maritime ecological leadership is discussed at ideological, psychological and educative levels by revealing the ecologically important ideological characteristics of epochs, analyzing the psychological mentality of polluters, and socio-political initiatives, characterizing the psycho-educative problem of ecological conventions, revealing the psychological limits of conventional moral, discussing the possibilities of ecological education, in the paper. The type of the research is theoretical, retrospective and descriptive. The main methods such as analysis, interpretation, heuristic analysis and synthesis were used in the research. The methodological principles are existentialism, basing the maritime ecological leadership and self-leadership of the personality, and cognitive psychology, basing the conscious decision of ecologically constructive expression and of becoming a leader for oneself and his/her life.*

**Keywords:** *maritime leadership, ecology, ideology, psychology, education.*

## **Introduction**

The maritime ecological leadership directly relates to the spiritual dimension of the personality, his/her consciousness and self-concept that must be developed by using the mechanisms of ecological upbringing based ideologically, mentally and psychologically. These mechanisms should improve ecological leadership of the personality at the social level, and ecological self-leadership at the personal level only. However, it is not perceived globally and is not popular compared with the authoritative juridical documents based on sanctions and fear.

A field of leadership conceptions:

- *Leadership* is usually considered as a managerial expression of the authority who respects oneself and others, is characterized by the working competence and constructive relationship to his/her subordinates by motivating and encouraging them.
- *Maritime ecological leadership* is a system of the personal and working competence to organize the maritime activity regarding to ecological norms.
- *Maritime ecological self-leadership* relates to the maritime ecological leadership but more from the point of view of the conscious personal engagement, ecological self-concept and pure expression at sea at the level of personal giving meaning to ecological life.

The concept “ecology” traditionally relates to biology, chemistry and technology. There are exact sciences. However, the scientific paradigms of spiritual ecology of the personality, his/her psychological stability, mental health and ecological development of maritime culture, are rarely discussed in the educational system usually.

It is appropriate to combine the exact science with the socio-humanitarian one by seeking development of ecological leadership of the mature personality. This educative possibility depends on the holistic approach. The ideological, psychological and educative issues of the maritime ecological leadership are discussed in this paper with reference to the change of epochs, polluter’s mentality, social policy, psycho-educative problems of conventions on ecology, psychological limits of conventional moral, and possibilities for the ecological upbringing.

## **The grade of the exploration**

The issue of maritime ecology is globally developed at political, juridical and conventional levels [18; 5]. It is rarely developed from the ideological and ethical point of view. Institutional, psychological and hodegetical levels of the issues are not popular regarding ecological problems. Society does not believe in autonomy of the personality, and his/her leadership competence based on consciousness. The projects of the maritime ecological education [6; 14] became of the utmost importance but a fragmental attempt that is not related to the encouragement of the personality’s value, his/her self-esteem, self-feeling, emotional experiences, giving meaning to them, and individual and direct self-concept in life.

The ecological leadership as a deep spiritual expression of the personality is based on the historically classical and some modern scientific works [1; 2; 3; 4; 8; 9; 10; 11; 13; 16].

Conventions and legislations of the international and national institutions, related to the ecological problem, are regularly issued. However, ecological consciousness of the society fails to exhibit signs of improvement. People are unable to autonomously implement ecology as a life style. They often want to be leaders for others. However, they are rarely successful being constructive and significant leaders who ecologically perform in their life.

Problems of the maritime ecological leadership, in reference to ideology, psychology and hodegetical education, are not directly and systematically investigated.

### **The goal, tasks and object of the research**

The goal of the research is a discussion of the maritime ecological leadership at ideological, psychological and educative levels.

Tasks are as follows:

1. Revelation of the ecologically important ideological characteristics of epochs.
2. Analysis of the polluter's psychological mentality and socio-political initiatives.
3. Characterization of the psycho-educative problem of ecological conventions.
4. Revelation of psychological limits of the conventional moral.
5. Discussion of possibilities of the ecological education.

The research object is a maritime ecological leadership.

### **Methodological principles and type of the research**

The research is methodologically based on existentialism and cognitive psychology.

- *Existentialism* includes the actualities of human being in life, deep problem of the personal spiritual expression that relates to the human inner attitudes, substantial needs of life, nature and oceans as the most important source for mankind. Ecological condition of the nature directly determinates human life and bases his/her ecological leadership and self-leadership.
- *Cognitive psychology* reveals a free conscious personality who does not passively depend only on genes, subconsciousness, reflexes and defense mechanisms. However, he/she is able to think, learn, improve, realize and meaningfully chose an ecologically constructive expression, and become a leader for oneself and his/her life.

The methodological type of the research is theoretically descriptive and retrospective.

### **Methods and methodological limits of the research**

The main methods such as analysis, interpretation, heuristic analysis and synthesis were used in the research.

Results of the research are based on the theoretical conceptions and scientific prerequisites regarding methodological limits, and can be applied by methodologically basing the theoretical and empirical personalistic researches of maritime ecology, and by improving the content of the maritime ecological education and didactical strategies in the educational system.

### **Ideological characteristics of epochs**

The human being as a personality was not appreciated from the point of view of the modern dignity in earlier epochs. Natural resources have not been exploited massively until the modern times. The natural balance of living organisms and their habitats was not disturbed.

However, natural exploitation and pollution mostly increased over the past two centuries, e.g.:

- A destructive water use has led to the ecological catastrophe of the Aral Sea. The sea almost entirely dried up, toxic substances pollution have caused the incurable diseases and prompted a mass evacuation.
- An island, formed from plastic waste, is floating in the Pacific Ocean a few decades already. The plastic waste is not degradable. It crumbles into small particles that are swallowing by water animals that are killed, poisoned, damaged and might be captured and turned to food [7].
- A plastic pouch is removed. It will not disappear over the centuries. The plastic pouch finally falls into the water body. A dolphin can swallow the pouch considering it as a jellyfish. The marine

orderlies such as sharks, whales or dolphins are massively destroyed by concerning the so-called threats and delicacies despite a pollution.

A lot of examples of nowadays could be mentioned because of global industrialization. It is appropriate to know the laws of the epochs' development for the upbringing of the maritime ecological leadership, especially - self-leadership. The oldest ideological and mental form of human being was a paganism that transformed into Judaism and Christianity, enlightenment and atheism, modernism and postmodernism that both eco-mentally relate to the Neopaganism (Figure 1).

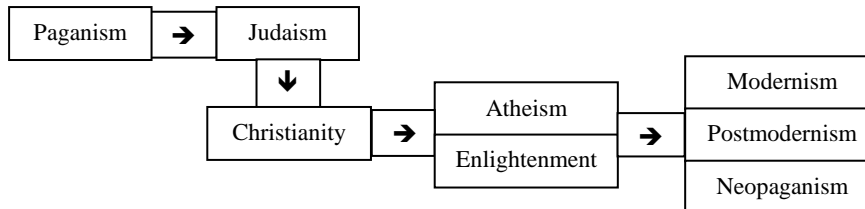


Figure 1. Development of main eco-mental epochs

The sea was considered as a sacred, full of gods, and itself was as a deity in the paganism. So, the relationship to the sea was characterized by the fear and respect. There was no place for pollution. A person has perceived that a clean sea is divine. It was an example for a personal spiritual cleanness.

A cultural leap happened in Judaism in the 13<sup>th</sup> century B.C. The human ecological world-view changed. The personality has perceived that the sea is not a God. Self-consciousness of the personality achieved the transcendental level. It was mentally distanced from the nature. Monotheism ideologically promoted a perception of the sea as a creation of God. So, it is appropriate to constructively exploit the nature on land and at sea. The personality ecologically participates in creative processes and helps Creator to create the world at the ideological level.

Human ecology characterizes the European thinking in the Christianity. The human becomes the largest value. His/her dignity is invaluable. The human is a personality whose self-respect is very important because it does not let immorally behave at the ideological level. The maritime ecological position relates to the self-esteem and feeling as a child loved by the Creator.

The highest level of the self-consciousness, regarding harmony with the sea, is marked by the Franciscan Order established by St. Francis of Assisi in the 13<sup>th</sup> century in Christianity. This order became famous Europe-wide because of:

- Natural nursing and development of the constructive and holistic education;
- Beer manufacturing technology;
- Special respect to the nature, the beauty and worth of the sea and its animals;
- Traditions of joy at the psychological and transcendental level by the sea environment.

The Protestant epoch was characterized by the extreme approach to the science and sense of the human activity in 16-17th centuries. The enlightenment epoch and atheism relate to the neopagan ideals characterized by syncretism. However, the personality, without transcendental thinking and adequate ecological self-concept, is unable to feel a responsibility for oneself and his/her home and work environment, historical, vocational and valuable heritage regarding future generations. There were no conditions for the appropriate development of the ecological self-leadership. Atheism has mentally and finally desacralized the sea in 18-20th centuries. Exploitation of the sea resource was too courageous. It achieved the level of uncompensated and one-sided violence of the nature.

Modernism is characterized by the most aggressive activity on the nature from the point of view of Neopaganism. The sea was a sacral place in the old paganism. However, arrays of garbage are thrown into the sea in the newest times [15]. Neopaganism of the 19<sup>th</sup> century is different compared with the paganism. Neopagan activity of the personality has showed the contrast to the pagan activity that is the oldest and first ideological teacher of the harmonious human relationship to the nature. The most primitive form of Neopaganism was in 20<sup>th</sup> century in reference to the culture anthropology and ecology at the national-socialist level. Cleanliness and purity were extremely reduced to the cult of a pure race.

Postmodernism characterizes the 20-21th centuries. Primitive but physically powerful approach at the political and industrial level started to express a narrow, fragmental, endless and chaotic thinking. It has hardly and almost globally provided a position of the trivialized worth of the human, sea and entire natural environment. It has raised a global ecological anti-leadership.

## Polluter's psychological mentality and socio-political initiatives

Some strange modern, especially - postmodern, generations of users and polluters formed after paganism, Judaism, Christianity, enlightenment and atheism. They are characterized by the mentality as follows:

- Their approach to the sea and themselves is extremely relative;
- They do not have nothing sacred and eternal regarding to desperation usually;
- They lack of self-respect;
- They fear to fear (in a positive sense of the careful behavior);
- They psychologically experience the inner conflict (e.g., the chief-officer on board orders young subordinate to pollute the sea, and this situation is even extreme in regard to his/her future maritime career);
- They defensively think that it will be of no effect when some groups will not pollute the sea because of the globally large pollution;
- They do not think about their offsprings as a future generation and their approach to them.

The pairs of the most important psychological features of the polluter's mentality (Figure 2).

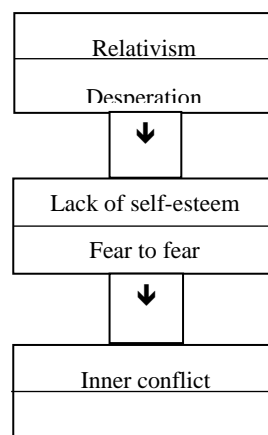


Figure 2. Psychological features of the polluter's mentality

Relativism does not show an ecologically moral authority after who should follow his/her students or subordinates. The personality becomes confused in life, he/she does not feel sense and naturally disappoints. Desperation disturbs him/her to learn to respect, appreciate, bring up and improve oneself. The personality becomes taught to feel a fear to show his/her personal problems to others. He/she always demonstrates his/her strengths and powers that he/she is not a loser.

So, the person becomes careless and feels a permanent psychological distress. He/she is not as himself/herself and is not free. The person always experiences the inner conflict that promotes a permanently defense position. Such kind of person does not have higher aspirations and more noble purposes. He/she passively obeys to psychological defense mechanisms and can pollute the sea. So, this action is psychologically natural and is not difficult.

The seas and oceans are massively polluted nowadays. Plastic waste, paints, lubricants, different debris off board of ships and industrial waste contaminate the water. Meaningfulness of the working activity was narrowed to primitive operation. Plato lets the person to take the business, manufacturing or military if he/she is unable to think critically [12]. A manipulative self-expression remains only without critical, strategic and cultural thinking. It is natural to combine the maritime business with culture of the ecological responsibility. The ecological leadership is a responsible leadership firstly.

However, the culturally ecological development is usually unacceptable for the maritime business because it is traditionally characterized by unconscious automatic functions. The maritime sector lacks examples of the constructive relationship with the sea and moral authorities according to traditions of the ecological behavior and mentoring. Sustainable culture development at the ecological level of global survival must be promoted in all stages of the educational system.

Ecological self-concept, at the level of socio-political initiatives, started in 20<sup>th</sup> century. One of the most remarkable ecological initiatives was a prognostic project, called "Club of Rome", with the first report "The Limits of Growth" (1972). Club of Rome consists of the international professionals from the

fields of diplomacy, industry, academia and civil society. Invited by Italian industrialist Aurelio Peccei and Scottish scientist Alexander King, they came together to discuss the dilemma of prevailing short-term thinking regarding unlimited resource consumption in an increasingly interdependent world [17]. The report “The Limits of Growth”, commissioned by the Club of Rome, has promoted UN General Assembly to adopt a resolution for preparation of the global change programme in 1983 [5].

However, it was stated that it has been less achieved than was planned in the field of the sustainable development since end of the 20<sup>th</sup> century after the huge number of sustainable development conferences world-wide, based on discussion on the ecological balance [2].

The ecological culture of the political education, of resolution implementation, of states, of different groups and of individuals’ ecological self-concept and of engagement, has not advanced further. The political initiatives are prevailed but focus on the spiritual development of the personality by promoting the global conscious ecological leadership, is not sufficient.

### **The psycho-educative problem of ecological conventions**

We can state that people of industries know about the international conventions on ecology at political and juridical levels but seas are being too much polluted from the problematical point of view of the maritime self-concept development. Various non-biodegradable wastes are thrown away from the vessels into the water. The sea is polluted by accidents of tankers or industry companies on land, e.g.:

- Oil flowed into open waters in the Gulf of Mexico in 2010. It was extending for three months and is considered as a largest oil spill in such a short period of time in the history of mankind.
- Oil spills in the Niger River Delta persist for more than 50 years. It is considered as the biggest environmental tragedy caused by human [4].

The conventional status of the protection of seas and oceans, based on sanctions, is not effective and does not ensure the natural desire to follow conventions at the psycho-educative level. Responsibility and dutifulness might be improved by basing them on the valuable ideology only. The ecologically mature personality, who wants and is able to follow conventions, is forming in the psychologically favorable environment with traditions of the axiological development.

The maritime ecology decisions might be implemented. It requires the ecologically mature officers of the maritime sector in all levels of the management. Needs are clear. However, problems of maritime ecology are very difficult and relate to the problems of people’s poverty and might be solved at the level of multidisciplinary policy.

Nevertheless, some mechanisms of the conventions implementation run. However, all systems are characterized by problems. Author’s (of this paper) axiological researches on the seafarers’ behavior at sea have showed that seas and oceans are recklessly polluted by driving the vessel further from the zones controlled by environmentalists and ignoring the international conventions. It disturbs the development of the maritime ecological leadership. The system of the environmental protection cannot be perfect and each polluter cannot be provided with an environmentalist. It is impossible and unnecessary, especially from the point of view of personal self-leadership and conscious and constructive ecological expression.

It is appropriate to solve the maritime ecological problems by using the personal ecological development, especially at the feeling level of the world-view. Consciously changing and improving personality becomes more respecting oneself and his/her environment. He/she will properly behave without observation of environmentalists. We know that a duty of the environmentalist is not necessarily related to his/her own ecological position.

So, it is very important to ecologically promote the personality in all stages of the education system teaching him/her to implement the philosophy that is favorable to oneself and to the environment. It is appropriate to improve the working conditions in the prospect of universal polit-economical ecology. This complex view is founded in some positions publicized by EU politicians, scientists and practitioners characterized by broader approach. Nevertheless, ecological problems of seas and oceans are rapidly growing [18]. One of psycho-educationally valuable directions is a cultural development of spiritual and technological harmony.

However, there are few opportunities to solve this educative problem without traditions of responsibility that should create the appropriate micro and macro environment for the education. Democratic states are characterized by the opposition, which distinguishes conservative and liberal approaches to society:

- *Conservative* approach is based on order and necessity to protect the sea and rationally and responsibly use its resources. It notes the continuity of ideas of the past and nowadays that are recognized, and concern for the natural environment of current and future generations.



– *Liberal* approach is based on freedom. The methodology of liberal economy does not accept a control. It is oriented to the possibly fast individual material wealth with the motto “here and now”. Too much free development of industry in 20<sup>th</sup> century has determined the global ecological disbalance.

Psycho-social education at the level of maritime ecology is complex. We do not have single universal model of the maritime ecological leadership development. The society, its approaches and quality of the political management, that affects the business and ecological development, are changing. Classical and fundamental ideas of the ecological education are permanently relevant. Unchangeable ideas of the upbringing of spiritual values take a legitimate place in ideological diversity of postmodernism regarding appropriate ecological practice.

### Psychological limits of the conventional moral

Life shows that international maritime conventions and rules are insufficient that people would be able to follow them. Seas will be polluted further, until the person tells himself/herself to protect oneself (nature protection is ultimately directed to self-protection) and until he/she becomes a rule to oneself, and until experiences a sense of duty in life, where exists confrontation of people’s rights and duties.

The mature personality, who respects oneself, does not need the environmental conventions because he/she does not allow himself/herself to pollute the sea from the point of view of maritime ecological self-leadership. The conventional moral can be partly accepted for the morally social education but more as a management of the social masses.

The psychologist L. Kohlberg has clearly showed the psychological limits of the conventional moral more than four decades ago. The scientist has revealed the problem of the personal self-esteem by differentiating three stages of the personality’s moral development:

*Stage 1 (pre-conventional):*

- Obedience and punishment orientation;
- Self-interest orientation.

*Stage 2 (conventional):*

- Interpersonal accord;
- Social-order maintaining orientation.

*Stage 3 (post-conventional):*

- Social contract orientation;
- Universal ethical principles [11].

Mentioned stages of the personality’s moral development are reformulated regarding maritime ecological development (Figure 3).

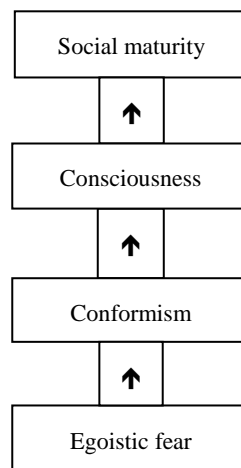


Figure 3. Development of eco-moral stages

Initial egoistic fear of the personality relates to the primitive ecological behavior. The person, egoistically seeking to remain, is searching for a group that accepts and strengthens him/her and improves his/her self-confidence. The maritime ecological expression of the personality is immature. It is instinctive and depends on others in this stage. There is no ecological self-leadership.

However, the second stage is characterized by the opportunity to observe, control and manage oneself by using possibilities of the self-concept in life, searching meanings and prognosing one's behavior in the higher valuable consequences. An independent personality, whose social maturity might later relate to the maritime ecological leadership, is initiated. The conscious and socially mature personality follows the highest values and is unable to pollute the sea in general. It firstly would undermine his/her own principles, on which his/her life is based.

Conventional moral is important but it reveals a middle of the personality's moral development. It is insufficient from the point of view of the personality's integrity. Ecological conventions are popular and considered as the most important by solving the ecological problems. However, it is appropriate to valuably mature and to experience self-respect and joy regarding psycho-educative level of the personality's ecological development. It was stated a scientific need of the wide psychological analysis of the whole context, in which it is made the moral decisions, especially the areas of personality's emotions and motivation by solving the moral issues in general [3].

So, it is appropriate to promote the maritime ecological self-development of the personality, and properly estimate the principles of the spiritual (or ecological - in broad sense) education, and comprehensively respect all possible conditions for the valuable personality's expression in the nature regarding post-conventional moral.

### **Possibilities of the ecological education**

Mankind raises the question - how to teach the honest (in this case - the ecologically mature) personality for thousands of years. There are two approaches:

- *Individual* level (the person is improving, maturing and enriching oneself with knowledge and wisdom in favorable conditions; so, he/she is developing the maritime ecological leadership);
- *Mass* level (we cannot hope for the good ecological effect by applying the conventional and mandatory teaching of social macro groups based on juridical violence).

The sea is polluted further without growing of the personality in his/her inner world. The crimes against the sea (and oneself as a part of the nature) are performing covertly because of the threat of sanctions. Massive education at the level of "show" does not ensure the ecological self-development. It is necessary to individually work with the students in micro groups by helping them perceive the sense of implementation of their own joy based on pure conscience in the clean maritime environment.

The nature and oceans are the great teachers for the persons and their aesthetic life-style. The personality can be enriched with the ecologically valuable information of the nature [8]. So, the important objective of school teachers and all actors of the educative activity is inventive and permanent working by adequately paying the students' attention on the ecological information of the nature that is relevant for the students themselves. This way might help promote the maritime ecological self-leadership.

The noble scientist of the pedagogical philosophy S. Šalkauskis has stated that self-improvement is a start of each progress [16]. It would be an answer of the classical hodegetics to the question of maritime ecology. We cannot hope for a paradise on our planet. We will always have the problems. However, a long-term human happiness in life, based on the meaningfulness, is a factor for the ecologically altruistic activity at the level of the personality's value. It needs an antecedent belief that an ecological activity of each person is powerful, especially when different self-respectable persons (or they who wish to learn to respect oneself) are effected by noble ideals, and create the educative groups, usually - non government organizations, that are constructively performing.

It is important to perceive the psychological causes of the sea pollution by seeking the educative changes in a field of the ecological consciousness. The person pollutes his/her environment because he/she is not enough educated and unconsciously or semi-consciously feels dirty at the spiritual level. Poor education does not allow the personality to love and to appreciate oneself and his/her life, and to spiritually rise after disappointment at work or in life in general. Spiritually poor person does not appreciate his/her own personality and performs psychological suicide by polluting his/her natural environment. This is a big problem of the personality's ecological self-leadership in life.

The psychological projection is a tool for an explanation of self-pollution. The person, who is polluting the sea, pollutes oneself defensively, especially when he/she performs that spontaneously and irrationally, from the point of view of the ecological self-concept. This defensive personal self-pollution is related to the problems of so called "dirty" consciousness and imagination, especially at the feeling level of the world-view in general.

It is appropriate to solve this problem by using the axiological development. The person, who protects and cleans the nature, does not follow the popular examples of negative relationship to the sea,

and protects and cleans oneself personally and nobly develops his/her own value. It is a natural, ecological and human affinity based on a holistic system of the clean sea, noble thinking, pure conscience, not pornoficated speech and good behavior.

The sea has been considered as washing, cleaning, clarifying and purifying from ancient times from the archaic point of view of the mythology. So, this meaning of the sea, extrapolated and universalized, becomes a mental tool that helps develop aesthetic expression of the thoughts, speech and behavior by ensuring the maritime ecological leadership. All this is integrally connected. Harmony of the personality naturally requires the complex approach. The ecological development of the maritime self-concept relates to the ecological improvement of all his/her powers in the context of the personality's worth. And on the contrary. If there is bringing up of a clean thinking and clean speech, then the constructive ecological leadership is integrally developing as well.

We do need a lot of wisdom and responsibility to live ecologically and perform in the world. It is appropriate to learn integrally at physical, mental and spiritual levels. Technological development, emotional comfort, honesty and meaningful life help become a respectable personality regarding ecology. The commitment of the personality, a special respect, safety as a concern for his/her natural environment, perception of the nature as a place of the physical and spiritual recreation, and universal aspiration to limit the pollution relate to the nature from the psychological and socio-educative point of view [13].

It is natural that the personality protects that, what he/she loves, and what increases his/her own self-esteem. This duty is not alien. It is a natural basis of the ecological self-leadership. However, the personality must learn to love oneself that he/she would be able to love someone else. So called *the school of self-love* might be a beginning of the great ecological engagement to love and to protect the nature as one's own existential area.

It is attempted to develop the intelligent and sensitive relationship with the sea and its life forms by using the school- and academic ecological projects Europe-wide [6; 14]. However, the practical methodology of the maritime ecological leadership improvement, based psychologically, consists of the integral and universal idea of the foresight ecological development of the personality in regard to the love of oneself and others, life and entire vast ecosystem that directly depends on oceans.

## Conclusions

Ideological attitudes on the relationship to the sea are changed by losing the transcendental level of the self-consciousness in the newest times. Too much pragmatic exploitation of the sea wealth, and pollution have raised the ecological problems that are solved by issuing conventions of the sustainable development. Conventions are not sufficient for improvement of the ecologically conscious personality as a leader of ecology. The human worth, undermined ideologically, and inability to love and respect oneself and others, do not ensure a sustainable relationship to the sea at the psychological level.

The maritime ecological leadership requires the development of a human spiritual culture, so that a personal expression could be naturally improved in life at the ecological level. It is appropriate to use an existential potential of the maritime self-concept for upbringing of the personality who must be spiritually enriched in the context of the European civilization. The ecological upbringing of the personality at the spiritual level, global ecological education and tradition of the appropriate maritime activity might help achieve the ecological progress from the educative point of view.

The results are based on the theoretical conceptions and scientific prerequisites regarding limits of the research, and can be applied by methodologically basing the theoretical and empirical personalistic researches of maritime ecology, and should be applied by improving the content of the maritime ecological education and didactical strategies in the educational system.

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# EVALUATION OF THE EFFECTIVENESS OF THE QUALITY MANAGEMENT SYSTEM IN MARITIME CREWING COMPANIES

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## **Abstract**

*Recently the maritime technologies are improving and getting more complex every day. It is resulting in increased need to pay more attention to properties and qualification of maritime workforce before employing labor and crewing the vessels of today. Article evaluates the effectiveness of the quality management system in maritime crewing activities in Lithuania and Latvia. Theoretical aspects of the quality management are revealed by analyzing the scientific literature. Afterwards, the essential criteria are being evaluated by accomplishing quantitative and qualitative surveys, in such areas as – leadership, human resource management, strategic planning, process and result management, impact of QMS for the company and other.*

**Keywords:** *effectiveness, maritime crewing company, quality management system*

## **Introduction**

The technology of maritime business is growing smarter, stronger and more demanding every day. That is why it has become more essential to guarantee the quality and operational effectiveness of maritime crewing activities all over the world. In the third quarter of 2014, the Republic of Lithuania has implemented *Maritime Labor Convention 2006* with the quality management system *ISO 9001:2008* in maritime crewing companies.

The main object of this article is to evaluate the effectiveness of the quality management system in maritime crewing sector. Firstly, the article reveals the theoretical aspects of the quality management effectiveness, which are used in creation of a representative survey. Secondly, a survey is presented to a number of crewing companies throughout Lithuania and Latvia, allowing to collect data and to evaluate the effectiveness of quality management system in maritime crewing companies.

## **Theoretical aspects of quality**

Throughout the decades of humankind experience, while the management processes are being researched, the notion of *quality* has developed many different yet similar definitions. Author Ray Tricker (2011) has managed to gather a few descriptions of quality – ‘Conformance to requirements’ (Cosby), ‘Fitness for use’ (Juran), ‘The result of care’ (Page) or even ‘Quality in a product or service is not what the supplier puts in. It is what the customer gets out and is willing to pay for’ (Drucker). However, nowadays internationally accepted definition for quality (as defined by ISO) is as follows – *Quality is a degree to which a set of inherent characteristics fulfils requirements.*

Despite the amount of information this definition holds, it is essential to expand it in order to get a better understanding of quality itself. According to authors researching quality and management (Northouse, Boys, Madan, Asif, Al-Hakim, Kaziliūnas, Ruževičius), seven main theoretical aspects take part in maintaining successful quality management in an organization (Table 1).

The main aspects of successful quality management were adapted to maritime crewing activities and spread into detailed questions about the quality management in companies of this type. Respondents expressed their opinion by evaluating current situation and future goal with marks from 1 to 5 as explained in the next chapter.

Table 1. Theoretical aspects in charge of creating quality in an organization

No.	Aspect	Definition
1.	Leadership	A process, when an individual makes positive influence to a group of people in order to improve while reaching a mutual goal.
2.	Human resource management	Members of the organization are being effectively empowered, improved and promoted according to the personals needs and qualities of each individual.
3.	Approach to the client	The level of clients' satisfaction is periodically analyzed and changes are made in order to adapt to changing conditions of market.
4.	Strategic planning	Steady growth of the organization is being planned by managing changes, risks, determining future tasks and other aspects.
5.	Data management	Gathered information is carefully analyzed and conclusions are being made in order to determine potential areas for improvement.
6.	Process management	Available resources and work force is distributed in order to get maximum effectiveness.
7.	Result management	Results and achievements are periodically analyzed and conclusions are made deciding what changes and improvements organization should implement.

## Research methodology

Two types of surveys were chosen to accomplish the current evaluation – qualitative and quantitative. Anonymous questionnaires were created according to the theoretical aspects of quality management in order to collect representative data.

Respondents of the quantitative research include six crewing companies in Lithuania, Klaipėda and for qualitative research, two companies in Latvia were chosen as experts (Table 2).

Table 2. Research attendants

No.	Companies in Lithuania	Established	Employees
1.	Baltic Group International Klaipėda	2002	6
2.	UAB Jūrinis personalas [General Crewing]	2014	5
3.	Ismira Recruitment & Crewing	1999	8
4.	Limarko Shipping Company	1989	19
5.	Novikontas Employment & Recruiting	1995	12
6.	Sailinga Crewing Agency	1998	6
	<b>Companies in Latvia</b>	<b>Established</b>	
1.	Astor Shipmanagement	2013	
2.	Columbia Shipmanagement	1978	

Main method of presenting the questionnaires to respondents was by visiting the companies and handing in the printed versions. Experts from Latvia received electronic versions and answered the questions via e-mail.

Quantitative survey consists of 20 questions describing the main aspects of quality management. There are two perspectives for respondents to express their opinion – present situation and future goal of the company. A fragment of a qualitative survey is presented below (Figure 1).

<b>1. Leadership and strategic planning in the organization.</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	
1.	The manager determines the direction of the organization: promotes and develops vision, mission and values of the company. (Clear organizational values. Employees are introduced and involved in the development of vision, mission, creation of strategic and operational goals.)	<i>Current situation</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<i>Future goal</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1. Fragment of the anonymous qualitative questionnaire

Qualitative survey consists of three open-hand questions for companies established in Latvia. These questions reveal main things that are important for quality management system in maritime crewing companies.

1. The benefits of Quality Management System for maritime crewing companies.
2. Problems that occur while implementing the Quality Management System in maritime crewing company.
3. Factors, that do most influence to the effectiveness of the Quality Management System in maritime crewing companies.

Established questions of surveys allowed revealing the competent opinion of the companies' representatives and experts to evaluate the current and desirable effectiveness of the quality management system in maritime crewing companies.

## Results of the Research: Quantitative Survey

After collecting the data of quantitative survey from crewing companies' representatives, it is clearly seen that overall respondents evaluate the effectiveness of their quality management system in high marks. However, a few slight flaws are revealed in different areas of management.

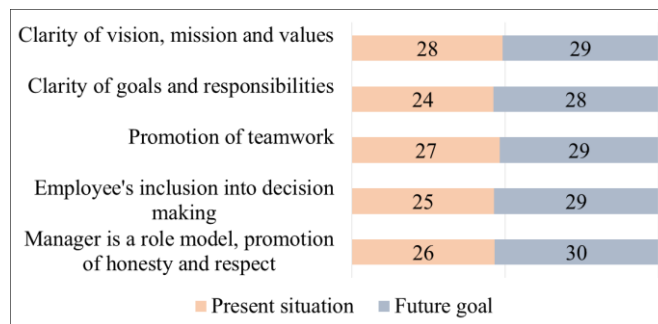


Figure 2. Results of the Leadership and strategic planning aspects

**Leadership and strategic planning.** By summarizing the results of these areas, a specific conclusion can be stated about leadership and strategic planning in maritime crewing companies. A slight uncertainty of goals and responsibilities is noticed (24 of 28), inclusion of employees' into decision making is also showing a minor lack (25 of 29) and a shortage of managers being appropriate examples for employees can be seen as well (26 of 30) (Figure 2).

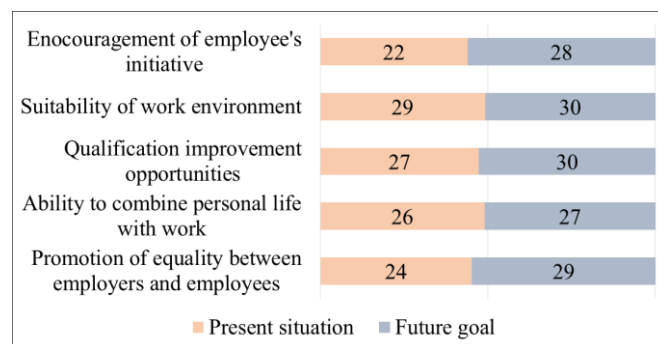


Figure 3. Results of the Human Resource Management aspect

**Human resource management.** Accomplished research reveals areas for improvement in the aspect of human resource management. Respondents express that the initiative employees should be encouraged more actively (22 of 28) and a slight weakness can be seen in the area of developing equality between employees and employers in the maritime crewing companies (24 of 29) (Figure 3).

**Approach to the client.** In the aspect of client approach the results came out very positive. However, quantitative survey revealed one area with more deflection than 1 current point from desired result. The surveying of the clients needs more attention in the maritime crewing activities (23 of 26). It is essential to guarantee the satisfaction of the clients on the both sides – the mariners (client / resource) and the ship owners (client) (Figure 4).

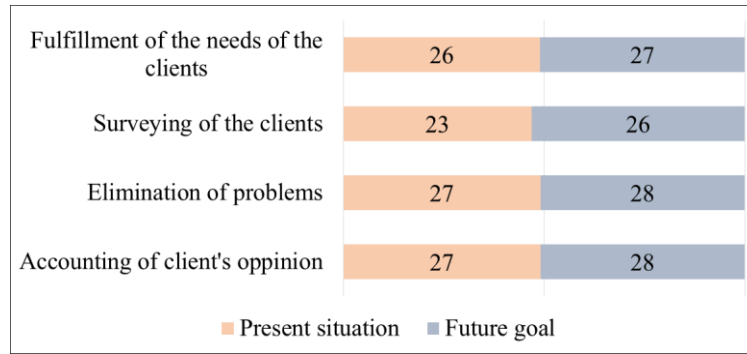


Figure 4. Results of the Approach to the Client aspect

**Process and result management.** All areas of these aspects reveal a slight weakness in management in maritime crewing companies. The accomplished quantitative research reveals that management of the specific processes should receive more attention (26 of 30) by clarifying to employees what tasks must be accomplished in order to reach desired goals. Also, employees remain timid while dedicating responsibilities personally to employees (24 of 28). Finally, the careful accounting of the activities' results requires more attention as well (26 of 30) as the ability to review accomplished results in the end of the period allow the company to make useful and effective conclusions (Figure 5).

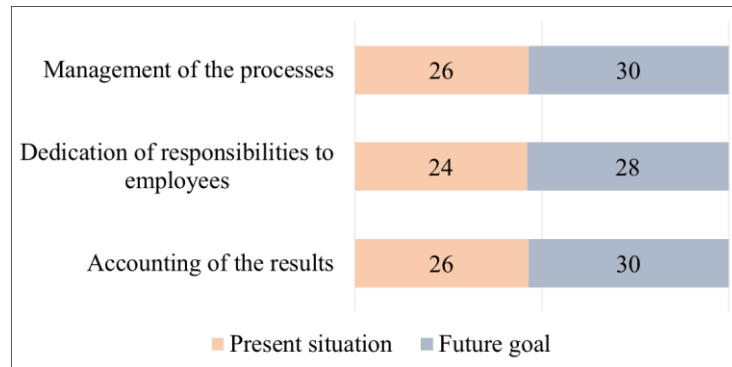


Figure 5. Results of the Process and Result management aspects

Concluding the results of quantitative survey it is obvious that the quality management system in maritime crewing activities is working properly and is granting some useful perks, such as: ability to consider whether the management in the companies is processed correctly, ability to track all areas of crewing activities in a more thorough way. Also, the accounting of results is done more carefully which allows the managers to implement corrective changes in the principles of work. The most important factor of QMS is confirmed – importance to maintain the fluent work with pleasant work atmosphere and guarantee growth of the results at the company.

### Results of the Research: Qualitative Survey

The point of establishing qualitative survey with open-handed questions and distributing it to expert managers of companies in Latvia was to have a raw experience and opinion about the true influence of the quality management system to the crewing companies. Both respondents expressed the opinion that quality management system is useful for crewing companies and supplemented each other with knowledge of their own experience. The results are summarized and presented below (Table 3).

Concluding the opinion of two experts it can clearly be said, that the operational quality of the maritime crewing companies has increased after implementing the Quality Management System. Organizational structure became more definite, employment and recruitment processes became simpler and safer, it has become easier to adapt to constantly changing outside environment and changing needs / demands of the clients. Also, overall climate and proper approach to quality are the benefits that can be felt after implementing the QMS. According to the opinion of the experts, implementation of QMS does not bring any severe problems despite some slight inconveniences while getting used to it. In addition,



main aspects, that greatly influence the effectiveness of QMS are these – clearly defined future goals and accurate observation of processes that are executed in the company.

Table 3. Results of qualitative survey

<p><i>1. The benefits of Quality Management System for maritime crewing companies</i></p> <ul style="list-style-type: none"> <li>- With the help of implemented instructions, procedures became more specific and easier to understand.</li> <li>- Planning became easier.</li> <li>- Observation and control of results became more structured.</li> <li>- Systematic problem elimination.</li> <li>- Effective management of needs and changes in the company's environment.</li> <li>- Evaluation of employees became easier.</li> <li>- Overall climate of the organization became better.</li> </ul>
<p><i>2. Problems that occur while implementing the Quality Management System in maritime crewing company</i></p> <ul style="list-style-type: none"> <li>- Increased strain and stress while getting used to QMS.</li> <li>- Slight problems while implementing standards in all areas of company's activities.</li> <li>- Additional expenses for QMS coaches / experts / auditors.</li> </ul>
<p><i>3. Factors, that do most influence to the effectiveness of the Quality Management System in maritime crewing companies</i></p> <ul style="list-style-type: none"> <li>- Clarity of procedures and instructions.</li> <li>- Definite future goals.</li> <li>- Improved observation of crewing activities in the company.</li> <li>- Proper approach to quality in the company.</li> </ul>

## Conclusions

1. Analysis of scientific literature revealed seven main aspects that influence the effectiveness of QMS in maritime crewing activities – Leadership, Human Resource Management, Approach to the Client, Strategic Planning, Data Management, Process Management and Result Management.

2. Quantitative research revealed that QMS in general operates effectively in maritime crewing companies. However, slight weaknesses emerged after completion of the survey, such as – clarity of goals and personal responsibilities, inclusion of employees in decision making processes, equality between employers and employees, encouragement of employees' initiative, surveying of the clients, dedication of responsibilities and accounting.

3. Qualitative research revealed benefits, problems and main factors influencing effectiveness of the QMS. Most influential factors are – qualified and competent work force, defined strategy, clarified short-term and long-term goals and available resources.

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# ASSESSMENT OF THE IMPACT ON THE ENVIRONMENT OF SECOND GENERATION FUEL

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## **Abstract**

*Nowadays renewable energy sources are given great consideration. This is determined by the following key factors: aim to ensure energy supply and mitigate dangerous climate change associated with greenhouse gas emissions into the atmosphere. This paper presents the environmental impact in used car tyres life cycle. “Gabi 6” software was used for environmental impact assessment. The four environmental impact categories were evaluated: global warming potential for 100 years, acidification potential, eutrophication potential and ozone layer depletion potential. Results show that even if biofuels are cleaner than usual fossil fuel, production of biofuels make a significant environmental impact.*

**Keywords:** *biofuel; environment; life cycle assessment; “Gabi 6” software.*

## **Introduction**

Nowadays renewable energy sources are given great consideration. This is determined by the following key factors: aim to ensure energy supply and mitigate dangerous climate change associated with greenhouse gas emissions into the atmosphere. Biofuel is liquid fuel produced from biomass and commonly used for land transport [1]. Standard fuel that ships are using is marine diesel oil or gasoil. All of these fuels are the fuels that meet international standard (ISO 8217) and have certain specific viscosity as well as yield values that are different from land-based transport fuels. Ships that use these marine fuels emit more sulphur compounds. For this reason, we must search substitutes for these fuels [2, 3]. As an alternative, it is possible use second generation biofuels – fuels produced from lignocellulosic biomass (wood and wood waste, agricultural waste, such as straw, corn stalks, etc.), energy crops and organic waste [4].

In order to develop effective measures to improve environmental performance solutions are being searched for by assessing environmental impact throughout entire product life cycle. For that purpose, impacts to environment from product creation to its end life are being evaluated. Product’s life cycle consists of the following stages: extraction of raw materials, energy extraction, transportation, preparation of raw material, product manufacturing, packaging, distribution, consumption, waste collection and final disposal [5, 6, 7].

The aim of this work is to evaluate the second-generation biofuels, produced from used car tires by pyrolysis, environmental impact of the life cycle, using „Gabi 6“software. In this study environmental impact of fuel produced from used car tires was evaluated by four categories – global warming, acidification, eutrophication and ozone layer depletion potentials. The biggest environmental impacts of biofuels throughout the whole life cycle are transportation phase and pyrolysis process. For example as it is shown in Figure 1 pyrolysis process has largest impact to acidification potential and transportation phase has largest global warming potential.

## **Materials and methods**

Data, such as energy, water consumption, amount of raw material used and emissions emitted during production, was collected from international company “Scandinavian Enviro Systems (SES)”. This company was selected because it uses used car tyres as material for biofuel production and it is produced in this company via pyrolysis technology. The data was used for assessment of environmental impact in life cycle.

In order to simplify this study, only one product was evaluated and not compared with others, also, calculations made for one-ton product. By using SES data, material balance for each life cycle phase was made. As an example, in Table 1 it is shown material balance for pyrolysis process. For transportation

phase, the product was transported to three different places depending on product – biogas, biofuel or charcoal.

Life Cycle Assessment (LCA) is a tool for the systematic evaluation of the environmental aspects of a product or service system through all stages of its life cycle. LCA provides an adequate instrument for environmental decision support. Reliable LCA performance is crucial to achieve a life-cycle economy. The International Organisation for Standardisation (ISO), a world-wide federation of national standards, has standardised this framework within the series ISO 14040 on LCA. The phases of life cycle assessment shown in Figure 1.



Figure 1. Life cycle assessment phases  
Source: UNEP. <http://unep.org>

For environmental impact assessment, “Gabi 6” software was used. Software used a process tree and material balances to evaluate global warming potential, acidification potential, eutrophication potential and ozone layer potential.

Table 1. Material balance for pyrolysis process

Material	Amount
<b>Input data</b>	
Tyres (shredded)	2020 kg
Nitrogen gas	8240 kg
Electricity	334,4 kWh
Water	314 kg
<b>Output data</b>	
CO	1,1 kg
CO <sub>2</sub>	244 kg
NO <sub>x</sub>	0,264 kg
SO <sub>2</sub>	7,19 kg
VOC	0,0033 kg
Biogas	220 kg
Biofuel	990 kg
Carbon	660 kg
Steel	330 kg

## Results and discussions

By using “Gabi 6” software a process tree was made, which is shown in Figure 2. In this process tree main stages are shown – raw materials transportation to production site, shredding process, pyrolysis process, magnetic separation and products transportation to consumers. This process tree is open loop because there is nothing that can be returned back into cycle beginning.

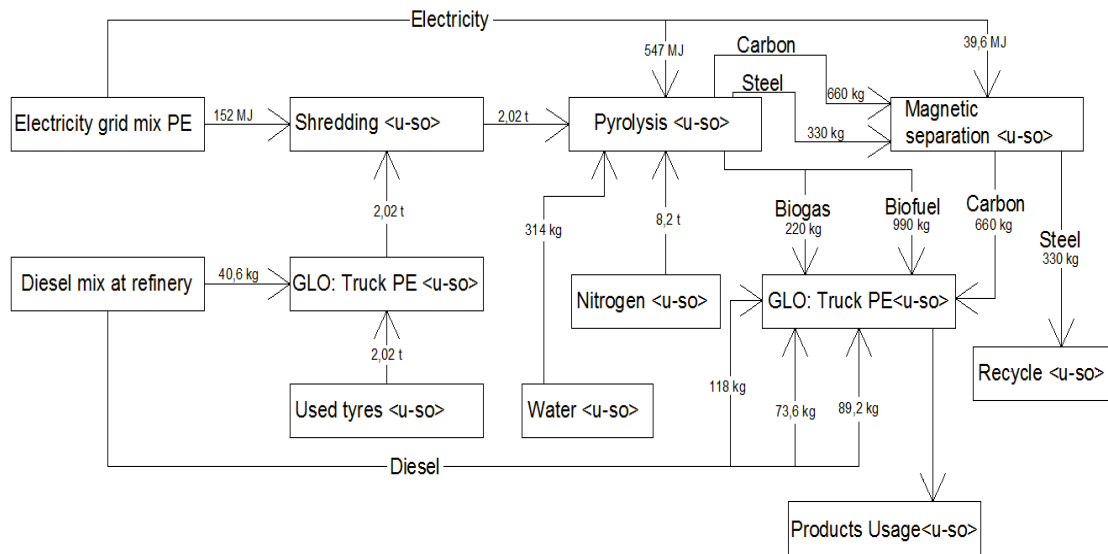


Figure 2. Biofuel production from used car tyres via pyrolysis life cycle assessment process tree

After “Gabi 6” analysed all data collected from SES, environmental impact in biofuel from used car tyres production life cycle was shown in four figures for global warming potential 100 years, acidification potential, eutrophication potential and ozone layer potential.

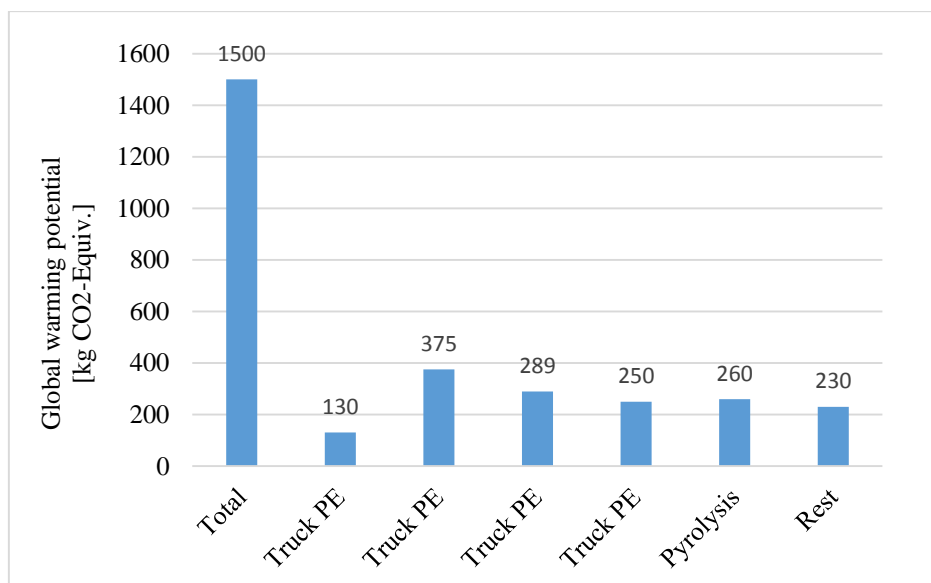


Figure 3. Global warming potential 100 years in life cycle assessment

Figure 3 shows that the highest global warming potential was in transportation phase. This phase consists of raw materials transportation to production site and transportation from production site to consumers. In Figure 3, there are four different transportation columns because pyrolysis products transported in three different places. In this environmental impact category, pyrolysis process has lower global warming potential value. Other processes have insignificant global warming potential value so in the figure they are shown as the column “Rest”. Measurement unit for global warming potential is kilograms CO<sub>2</sub> equivalents. In order to make evaluation of other gases, such as methane, value to global warming potential they calculated to this measurement unit.

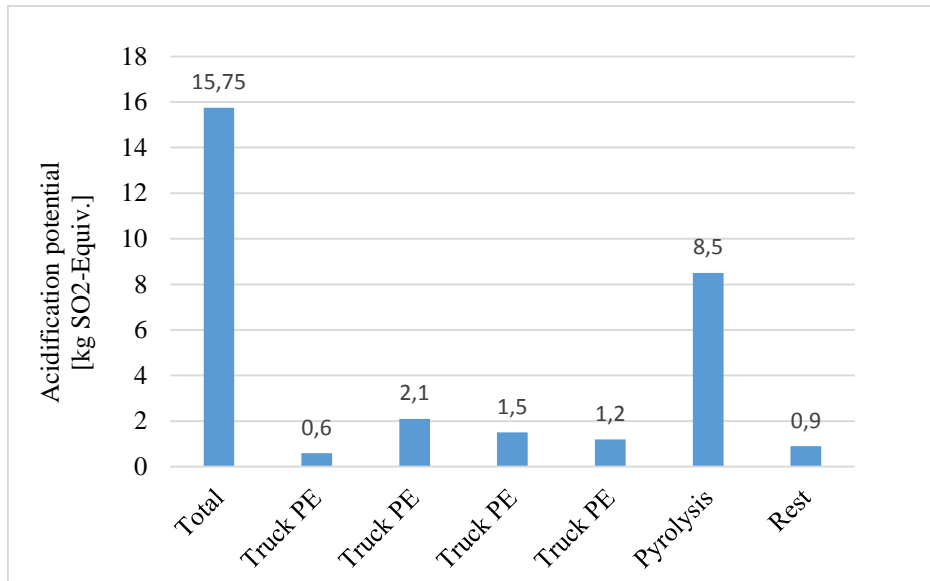


Figure 4. Acidification potential in life cycle assessment.

As shown in Figure 4 the highest acidification potential is in the pyrolysis process. It covers 54 percent of total acidification potential value in life cycle. Transportation phase also has an acidification potential value; however, it is less than pyrolysis process. All four transport columns together cover a little bit more than half of pyrolysis column value; this is due to sulphur content in fuel being lower than in car tyres which are used to make biofuel. The rest of the processes' acidification potential is negligible, therefore, program summed them up and showed as column "Rest". The highest acidification potential in pyrolysis process is determined by SO<sub>2</sub> emissions during this process. SO<sub>2</sub> is the main gas, which cause environmental acidification. Acidification potential measured by kilograms SO<sub>2</sub> equivalent. All other gases, which also cause environmental acidification, calculated to these measurement units.

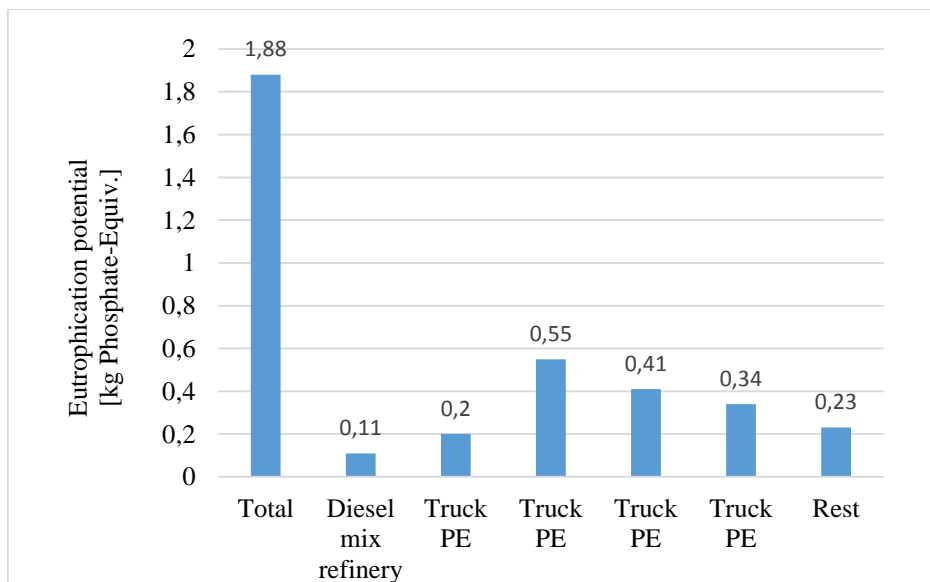


Figure 5. Eutrophication potential in life cycle assessment

Eutrophication potential values in life cycle assessment are shown in Figure 5. The highest eutrophication potential is in transportation phase of life cycle. The main reason why transportation has the biggest eutrophication potential value is nitrogen oxides (NO<sub>x</sub>) emissions to atmosphere during fuel combustion in vehicles engines. This potential measured by kilograms phosphate equivalent. In order to evaluate transportation phase's environmental impact through eutrophication potential, "Gabi 6" program

automatically recalculated nitrogen oxides emissions to kilograms phosphate equivalents. During pyrolysis process there are nitrogen oxides emissions too, however these emissions are insignificant comparing with transportation phase. For this reason pyrolysis process, as well as other processes, are shown in column “Rest”.

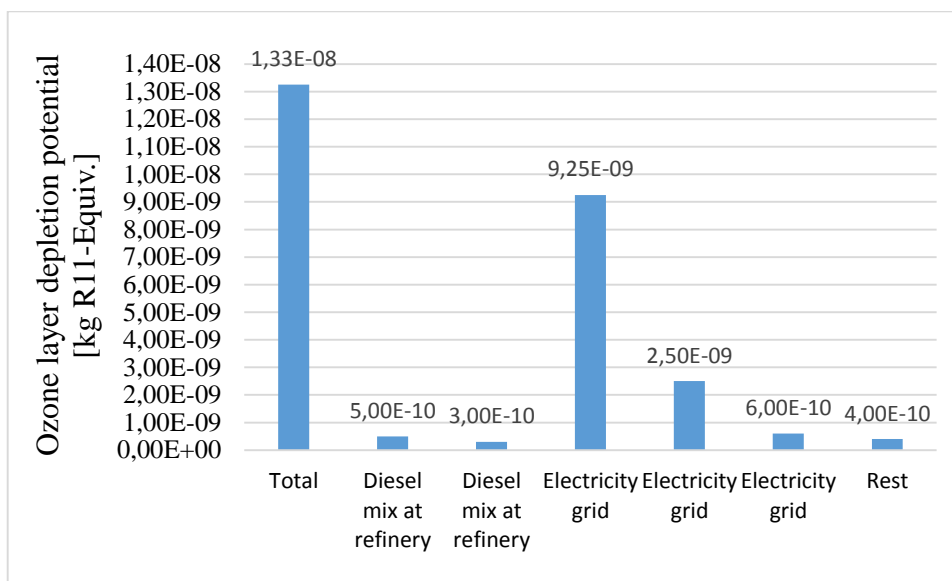


Figure 6. Ozone layer depletion potential in life cycle assessment

In Figure 6 we can see that the most significant impact to environment through ozone layer depletion potential is due to electricity, which is required in production of biofuel. In addition, some part of this impact to environment is done by making fuel for transportation, which delivers products to consumers and raw materials to production site. Throughout electricity production process, there are CFC – 11 (R-11) releases in atmosphere. This CFC-11 or trichlorofluoromethane is the main pollutant which cause ozone layer depletion. Ozone layer depletion potential is measured by kilograms CFC-11 (R11) equivalent. Pyrolysis and other processes in this environmental impact category have negligible values, so they are shown as column “Rest”.

## Conclusions

1. Global warming potential was the highest in transportation stage, slightly less than the pyrolysis process.
2. The pyrolysis process produces SO<sub>2</sub>, which is considered the main cause acidification. The compound of the acidification potential is the largest in pyrolysis stage.
3. The eutrophication potential is the highest in the transportation stage of life cycle due to nitrogen oxides (NO<sub>x</sub>) emissions in this stage.
4. Ozone depletion potential is the largest in power generation and fuel production processes, because of releasing CFC-11.

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# EVALUATION OF BUNKERING SERVICES ATTRACTIVENESS AT KLAIPEDA SEAPORT AFTER ESTABLISHMENT OF LNG TERMINAL

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## **Abstract**

*Authors are investigating the bunkering market in Klaipeda State Seaport from technological attractiveness viewpoint. The environmental regulations at the Baltic and North seas increasing the demand of low sulphur or alternative ecological fuel. From that viewpoint the importance of LNG fuel as alternative type of ship's fuel can be analysed. The main idea of this research is to assess changes of bunkering services' attractiveness influenced by LNG terminal establishment at Klaipeda seaport. The research results show that most important bunkering services' attractiveness' factors are accessibility of low sulphur fuel, enough efficiency of bunkering equipment and efficiency of port activities, as additional positive factors the geographical location of seaport and establishment of LNG terminal and container distribution centre, but most negative factors for increasing of attractiveness of bunkering services are low competitiveness of bunkering services' providers.*

**Keywords:** *bunkering market, LNG terminal, bunkering services' attractiveness, Klaipeda seaport.*

## **Introduction**

One of the factors which creates the possibility to improve the technological services at the sea port is environmental regulation. The Regulation of the International Maritime Organization (IMO) was approved on the 1<sup>st</sup> of January 2015. It declares that the highest permitted sulphur content of fuel will fall to 0,1 % in the European Sulphur Emission Control Area (SECA) [4]. World bunkering market analysis showed that different types of bunkering fuel are used in shipping industry, but one of the newest type of fuel is liquefied natural gas (LNG). That type of fuel is great alternative for traditional used fuel types, because it fulfils all environmental requirements, it is cheaper, but main conditions have to be fulfilled for successful bunkering of LNG carriers [3]. This led to LNG chain building, which will create new opportunities to other ports to have LNG bunkering facilities and will able to increase technological attractiveness of seaports with established LNG terminals and required infrastructure.

On the 27th of October 2014 the LNG Terminal started to operate in the southern part of Klaipeda state seaport, near Pig's Back Island. The aim of this terminal is to ensure independence from "Gazprom" company, which is the sole natural gas supplier, and increase the energy security not only in Lithuania, but also in other Baltic States and Finland. The main activity of the liquefied natural gas (LNG) terminal is to receive and store liquefied natural gas, degasify it and supply to the main gas grid. LNG terminal is one of the most important Lithuania's energy projects that will improve energy security situation in the country, and will create conditions for natural gas market in Lithuania and provide economic boost for local economies and residents. From other viewpoint, establishment of LNG terminal can increase the technological attractiveness of Klaipeda sea port in the area of bunkering services, but it is important to analyse infrastructure readiness for that kind of bunkering services, enough conditions of market in the Baltic Sea area.

*The aim of the research* is to evaluate possibilities to increase attractiveness of bunkering services at Klaipeda seaport.

*Objectives of the research are:*

- 1) to describe the bunkering technological process;
- 2) to evaluate the shipping trends at SECA region;
- 3) to evaluate the attractiveness of bunkering services at Klaipeda seaport before and after establishment of LNG terminal.

*Research methods.* Methods of literature analysis, document analysis, and statistical analysis, linear trend forecasting and expert survey were applied during the research. The bunkering services' attractiveness evaluation methodology was analysed in J. S. L. Lam, D. Chen, F. Cheng, and K. Wong



research about the assessment of the competitiveness of ports as bunkering hubs on the base of empirical situation at Singapore and Shanghai sea ports. The assessment of Klaipeda state seaport's bunkering services were published in E. Valionienė and N. Matulytė research paper and the part of results were used for evaluation of main factors which have influence for changes of bunkering services attractiveness at Klaipeda seaport.

## Evaluation of technological bunkering process at seaport

Bunkering is a service of refuelling ships and it makes a huge strategic importance for the port as the current market functioning marine bunkering industry provides for more than 93 thousand world fleet work [3]. According to foreign academic researches about special marine bunkering market services sector, and established trends of bunkering services, ship fuel demand in 2020 will reach about 385-405 million tons per year depending on the global trade fleet development, and in the long term to 2050 this value is projected to 402-543 million tons per year [7]. This shows that the demand of bunkering services for shipping market is increasing, this leads to bunkering services importance increasing too [6].

Bunkering – is a technological complex process, when the ship is refuelled by the type of fuels needed. [9] The procedure requires especial care and attention not only during the procedure by filling the vessel with oil products, but also assembly contaminated waters. The following procedures must ensure that they comply with environmental requirements thereby avoiding contamination of the harbourwaters by oil facilities. In practice, there are several types of bunkering, depending on what type of engine of the vessel (Figure 1).

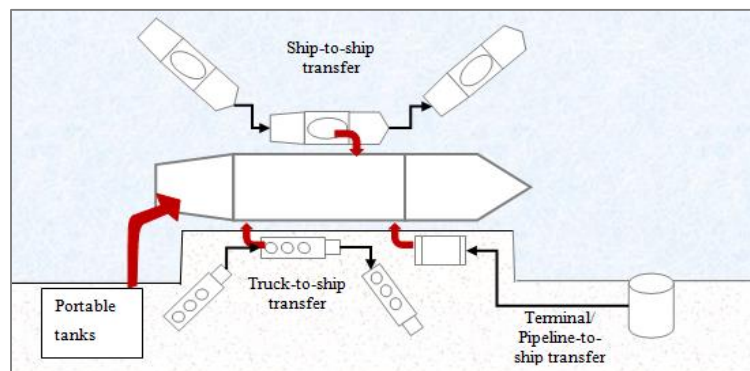


Figure 1. Standard LNG bunkering scheme [9]

To ensure a competitive fuel supply, LNG bunkering must be possible for each type of gas-fuelled vessel under the same conditions as bunkering heavy fuel oil (HFO). This includes the safe bunkering of LNG during cargo loading and unloading, as well as during passenger embarking and disembarking operations. The complete LNG bunkering supply chain ranges from the production and conditioning of natural gas to liquefied natural gas (LNG) and its transportation via sea-going vessels and gas pipelines to storage facilities. LNG supply modes are possible: ship-to ship transfer, truck-to ship transfer, terminal/pipeline- to ship transfer, changing of portable tanks [19].

Ship to ship transfer (STS) – it is the transfer of LNG from one vessel or barge, with LNG as cargo, to another vessel for use as fuel. STS offers a wide range of flexibility in location bunkering, and flexibility on quantity and transfer rate. Bunkering can be performed when ship is at the quay or pier or in water area or anchoring territory. In case of ideal circumstances, STS bunkering is recommended to be performed by mooring bunkering ship to bunkered ship [5]. That technology of bunkering creates possibility to combine bunkering and cargo loading operations, so the bunkering flexibility has high level of attractiveness. The analysis of scientific researches on bunkering technologies found out that STS bunkering type is very suitable for ro-pax ferries, container and LNG feeder ships, large fishing ships, but it is not suitable for seaport's servicing ships. For other types of ships this bunkering solution is enough suitable, so it can be stated, that STS bunkering service can be evaluated as middle attractive service [17].

Truck to Ship transfer (TTS) – it is the transfer of LNG from a truck's storage tank to a vessel moored to the dock or jetty. It is recommended to use TTS bunkering method to ships having the tanks of the capacity of 30–200 m<sup>3</sup> because TTS bunkering method is suitable only for ships which are bunkered in low amounts of LNG as the sizes of trucks' bunkering tanks are of 40 to 80 m<sup>3</sup> [6]. It can be stated that TTS

bunkering technology has low efficiency level and this factor creates a risk of the technological attractiveness of bunkering services at sea ports decreasing, but the low operational costs can be attracted by ship owners and low investments requiring can be attractive for seaports. By the types of ships TTS bunkering technology is very suitable for seaport's servicing ships, navigational, coast guard, technical maintenance and small passenger ships and unsuitable for ro-pax ferries, bulk cargo ships, LNG feeder ships, tankers (140000 m<sup>3</sup>) and extra-large tankers [11]. It can be stated, that TTS bunkering type is more attractive for seaport navigational and passenger's transportation services as a local bunkering service.

Terminal/Pipeline to ship transfer (TPS) – LNG is transferred from a fixed storage tank on land through a cryogenic pipeline with a flexible piece or hose to a vessel moored to a nearby dock or jetty. TPS bunkering solution is usually used to bunker ships from permanent bunkering location as well as in case of need of bunkering large ships at high intensity. Typically ships which are bunkered by TPS method are linear short-distance ships running at high intensity [17]. Furthermore, in some ports, TPS bunkering (from bunkering station) method is used for bunkering small ships (tow-ships, fishing ships, other port servicing ships). It can be noted that this type of LNG fuelling realization needs for additional infrastructure facilities and equipment, such as a specialized not less than 200- 300 m quay or jetty [3]. Requirement for a specialized quay is based on the fact that the use of such bunkering form can be served with larger fuelled tank ships and automatically larger vessels, which will be moored at the special quay. It must be noted that TPS bunkering operations has almost the highest efficiency in execution but it is difficult to synchronize the bunkering and cargo handling operations, so usually bunkered ships have to stay at the port longer, which leads to increasing the size of the port charges and additionally creates the risk of seaport's attractiveness decreasing. In addition, the use of TPS bunkering procedure requires significant investments in infrastructure, additional territory in the port area and considering such alternatives seaport authority must decide to give a certain territory of bunkering service installation in the terminal. For these reasons the establishment of TPS technology requires detailed market demand analysis and have to be approved by scientific researches [10]. As early bunkering market researches [6, 9, 10, 11, 13] showed, TPS bunkering type is very suitable for towage ships, LNG feeder ships, LNG bunkering ships and tankers, large fishing ships and small passenger ships an unsuitable for bulk cargo ships.

Portable tanks – in the case of using portable tank systems empty tanks will be unloaded and replaced by full portable tanks. In comparison to the above mentioned procedures the reception of LNG gas fuel consists of loading / unloading and connection / disconnection of the portable tank systems [5]. They can be driven or lifted on and off a vessel for refuelling. The quantity is flexible and dependent on the number of portable tanks transferred. The method of bunkering LNG supply in tank containers can be applied to all types of ships, except for ships with large containers [7]. That type of bunkering is attractive for seaport authority because it doesn't need additional large investments in infrastructure, and it can be attractive for ship owners because in that bunkering way it is possible combine loading and bunkering operations [11].

The analysis of bunkering technologies' types found out, that there are different types of ships, which require individual bunkering services and choosing the right bunkering way is necessary to ensure efficient and productive seaport's recourses usage and enough technological attractiveness of seaport from both sides, from the ownerships and ships operators, and from seaports development and competitiveness. On the base of made literature analysis it can be concluded that it is very important to analyse whole shipping market, seaports specific and forecasts of market development for establishment of main bunkering services' attractiveness indicators for bunkering services' attractiveness' evaluation: establishment of STS type of bunkering is required in the seaports where ro-pax, container feeder and bulk cargo shipping is very intensive. In the way of intensive tanker shipping or development of STS bunkering it is required to develop TPS bunkering technologies in the seaport. TTS and TCS bunkering types are more suitable for local shipping needs such as passenger's transportation, towage services and other services in the seaport.

## **Review of bunkering market at SECA region**

The changing legal environment for bunkering services starts from changing of the technological environment associated with changes in fuel types and permissible rates of harmful substances. In this way, the seaport, providing services as bunkering port or technological hub, has to find the best, most effective, economic decision, which has no negative impact on the attractiveness of bunkering services [13]. As the shipping intensiveness increasing each year, the environment of the Baltic Sea is in danger. As the Regulation was approved by International Maritime Organization (IMO) on the 1<sup>st</sup> of

January 2015, the permitted sulphur content of fuel has to be decreased to 0.1 %. It includes all ships in the SECA (Sulphur emissions Control Area), which includes the English Channel, North Sea and Baltic Sea [12]. The purpose of the stricter environmental regulation is to make short sea shipping more environmentally friendly. Alternatively, the vessels must have cleaning system (scrubbers), which reduces the sulphur content of the exhaust gases accordingly [4]. Ship owners can also choose LNG or alternative fuels such as methanol or biofuel. LNG is great alternative for traditional used fuel types, because it fulfils all environmental requirements, it is cheaper, but main conditions have to be fulfilled for successful bunkering of LNG carriers [4]. Operating on LNG does not affect the speed or otherwise the operational qualities of the ship, though it does involve some additional technical and operational complexities, which necessitate special training for the crew members [7]. These regulation conditions creates possibilities for seaports prepare LNG bunkering services for the moment of ship-owners decide to renew their exploited fleet and prepare for LNG bunkering procedures. At the moment it seems that bunkering attractiveness has big probability for increasing, but real situation in the market shows that a couple of years required for efficient transformation of bunkering technologies. So it is important to analyse the fleet structure by types of ship and their building age for establishment the moment for LNG bunkering services is required.

There are about 5000 vessels in the SECA at any time, on average. About 14000 vessels visit the area in a year. 2200 ships spend all of their time in the area and 2700 more than 50% of their time (Figure 2a). 71% of the ships belong to European operators. Analysis of fleet structure in SECA showed that biggest part of ships, 3000 ships, operated in Baltic sea spend here 50% of all their shipping time, less of ships, 1800 ships, spend 50-100% of their shipping time here (Figure 2a). And about 1000 ships shipping only in the Baltic Sea. The biggest part of ships spending all their shipping time in the region are ships from the shipping area in English channel and North sea and it is understandable because the Baltic sea belongs to the short shipping and feeder shipping region. On the base of these results it can be said, that potential LNG bunkering market in the Baltic Sea seeks 1000-1800 ships (Figure 2a).

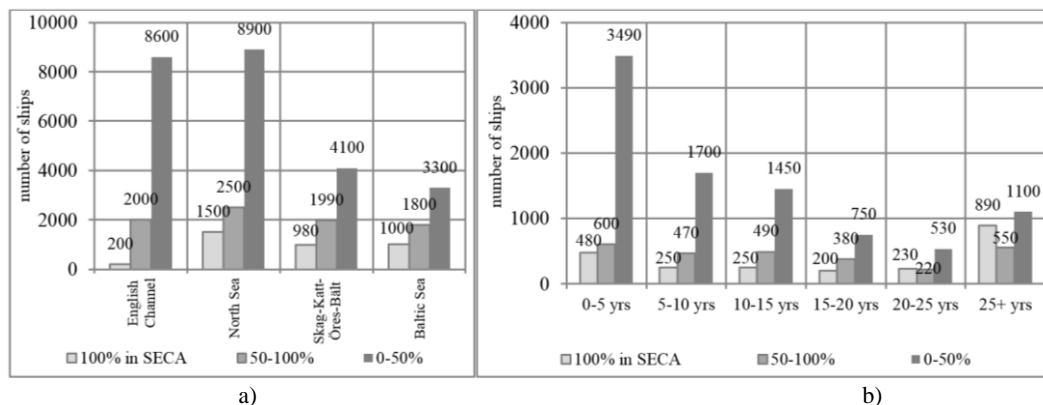


Figure 2. Structure of fleet in SECA: a) by area and time spent in SECA; b) by age of ship and time spent in SECA [8]

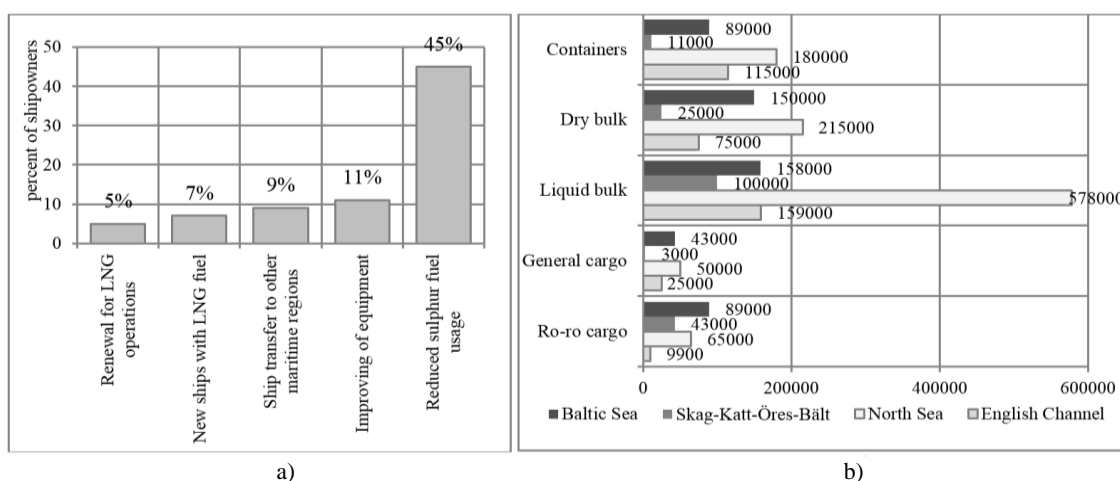
In accordance with number of LNG terminals in the Baltic Sea and possibilities to bunker ships with LNG fuel in this region, it can be concluded, that market is enough for development of bunkering services in Klaipeda seaport, but now days demand is low because the age of ships is too big for renovation of them and adaptation for LNG fuelling (Figure 2b). The biggest part of newest ships spend 50% of their shipping time in SECA and the biggest part of oldest ships spend their all shipping time in the region (Figure 2b) and that situation can be explained by the two viewpoints:

- from one viewpoint it can be said that possibilities of renewing fleet has big probability and it means that demand of LNG fuelling will increase;
- from other viewpoint it can be said that renewing processes are slow and at the moment of renewing fleet the number of LNG plants will increase in the Baltic sea too, so the attractiveness of bunkering services will become dependent on the technological implementation of bunkering services at the seaport.

As the juridical environmental changes affected ports' technical alterations, it also affected the ship owner's decisions about shipping regions. Assessing the ship owners' intentions about vessels' shipping conditions in SECA and implementation of the EU directive on emission control regulations, it was found out that even 23% of ship owners did not decide what they will do (Figure 3).

The majority (45%) of intend to use reduced sulphur fuel, which leads to new bunkering opportunities to service clients and 9% of the ship owners are going to transfer to other maritime regions (Figure 3a). 5% of ship owners are going to renew ship's fuels and engine systems and adopt them to LNG bunkering and 7% of them intend to start exploitation of new ships with LNG fuelling systems (Figure 3a). On the base of these indicators it can be noted that regarding to ship owners intentions the LNG bunkering service demand will increase in near 5-10 years.

As the market review showed (Figure 3b) main types of vessel types are divided into two groups in the Baltic Sea: dry bulk and liquid bulk vessels and container, general cargo vessels and Ro-Ro, Ro-pax ferries. It is obvious that LNG market is not really developed in the Baltic Sea region and is not prepared for LNG bunkering services starting. And on the base of made conclusions it is most probable that at first LNG will be used in the short-distance shipping, i.e., container carriers and Ro-Ro, Ro-Pax ships, as they spend the majority of time or all the activity in the Baltic Sea, where the strictest limitations of emissions are applied by EU directive.



**Figure 3. Bunkering market perspectives' assessment:**  
a) ship owner's intentions for force reduction of sulphur directive at Baltic Sea;  
b) number and the categories of ships in the SECA sub-regions by major vessel type at 2010 [8]

In the Baltic Sea, the ferry (Ro-Pax) in line uses 20-30 tons of fuel in the route, thus 40-80 m<sup>3</sup> of LNG would be required for its bunkering. On the base these research results it can be concluded that development of bunkering services in the Eastern Baltic sea should be implemented on the base of STS (for short sea shipping vessels) and TPS (for tankers) technological solutions.

Wide development of LNG supply and distribution infrastructure in Norway is conditioned by large natural gas reserves and mountainous relief that makes LNG supply via pipelines more difficult. LNG supply and distribution in Norway could be used as an example of good practice for the installation of LNG supply and distribution infrastructure in the SECA territory. LNG is transported from LNG plants by small capacity LNG transportation ships or tank trucks to LNG bunkering tanks-containers or bunkering stations. In some cases, LNG transported by LNG transportation ships is refilled and further distributed by coast LNG transportation ships. It should be noted that tank containers are also widely used for LNG supply and bunkering and due to their mobility and significantly lower costs their usage is constantly increasing in Norway. It should be noted that part of LNG supply and distribution infrastructure in Norway is adapted to the servicing of LNG fuelled ships [5]. Some ships (passenger ferries, vehicle ferries, coast guard ships and LNG feeder ships) operate on LNG. A simplified version of Norway LNG bunkering model can be offered at Klaipeda seaport. LNG import terminal AB "Klaipėdos nafta" filling bunkering ships and tank trucks with LNG. It means, that STS bunkering type is possible at Klaipeda sea port. Now modernization and development of infrastructure for LNG fuelling services are in progress and after finishing LNG tanks with 700 m<sup>3</sup> capacity will be installed and AB "Klaipėdos nafta" import terminal would be used for LNG ship bunkering [3].

## The evaluation of attractiveness of bunkering operations at Klaipeda seaport

The LNG terminal is located in southern part of Klaipeda state seaport, near Pig's Back Island. According to technical information, the floating storage volume of LNG terminal is 170 thousand m<sup>3</sup>, it is 294m length, 46m width and with the draft of 12.6 m. Maximum gasification coverage takes 4 billion m<sup>3</sup> per year [9]. The terminal is based on a floating LNG storage and regasification unit technology. LNG FSRU is supplied by Höegh LNG. The terminal is connected to the natural gas transmission system operated by AB "Amber Grid" gas transmission network connected via pipeline. It is obvious that the LNG import terminal in Klaipeda Seaport could be one of the main sources of LNG suppliers for ship bunkering. However, the planned technology of LNG import terminal is such that there is no planned LNG connection with coast infrastructure: LNG is pumped from LNG carrier to floating storage regasification unit (FSRU) where LNG is degasified to gas status and natural gas is supplied to the coast systems.

Assessing the technical aspects, bunkering ship could be moored to floating storage regasification unit and filled with the required amount of LNG. According to the technical specifications of FSRU, the mentioned opportunity to refuel LNG bunkering ships with liquefied natural gas directly from FSRU is planned. However, the plans of terminal also stipulate the establishment of a preventive zone of 250 m where the navigation of ships not related to terminal activity would be restricted. The fact that filling of LNG bunkering ships from FSRU is a part of activity planned to be pursued by LNG import terminal, the restrictions of the prevention zone should be applied to LNG bunkering ships [2]. Summarizing the technical possibilities it should be said, that the attractiveness of bunkering services increasing so it is important to analyse what is the forecast of dynamics of bunkering attractiveness at Klaipeda seaport.

The technological development of the sea port services in the area of vessels supply (vessel service sector) has a huge importance for increasing freight volumes and increasing economic value of sea ports in the region. The services market is relatively complex, multi-criterial, so to evaluate it and predict it is extremely difficult, but according to the researches of the bunkering competition and competitiveness at the ports of the Gibraltar Strait [1] and the assessment of the competitiveness of ports as bunkering hubs: empirical studies on Singapore and Shanghai [6] where the propose is to use the concept of attractiveness for identification of the most required technical services. The attractiveness of technological services can be described as a complex of various factors affecting service availability, selectivity, usability indicators [1]. In assessing the attractiveness of bunkering services, it has been used the empirical survey about bunkering services in Singapore and Shanghai seaports [6] where authors had justified and established the 10 attributes that affects the sea port as bunkering services hub. These attributes can be divided into three categories:

- first group port factors: geographical location, political stability in the region, operating efficiency;
- second group are bunkering factors: such as market transparency, price competitiveness, equipment efficiency, quality of service;
- third group are fuel resources factors: fuel sufficiency, suppliers punctuality and reliability, the availability of low sulphur fuel.

On the base of these factors expert research was made with the aim to assess the attractiveness of bunkering services in Klaipeda Sea port. In the research participated 9 experts: 5 experts were ship agents, 2 experts were bunkering service providers at Klaipeda sea port and 2 scientists investigating the shipping market. Experts were given a questionnaire which they were asked to evaluate each factor in two time perspectives: before and after LNG terminal establishment at Klaipeda sea port. The experts were also asked to identify the factors that are positive affecting the bunkering attractiveness, that were not identified in the study. Assessing the instantaneous bunkering services attractiveness in the Klaipeda seaport, the experts were asked to identify the most influenced factors increasing and reducing the attractiveness of bunkering services.

The results showed that the assessment of the main ports factors (first group) includes two most bunkering attractiveness influencing factors – the ports efficiency, which has the level coefficient 0.43. Also geographical location of Klaipeda seaport influences seaports attractiveness by 35%. The lowest indicator was political stability factor, which reached 0.22 significance rate. Such results create possibilities to make conclusion, that bunkering attractiveness of seaport depends not only on bunkering infrastructure preparation, it is only prerequisite, but important condition is the efficiency of seaport services dependent on organization of operational processes at the seaport.

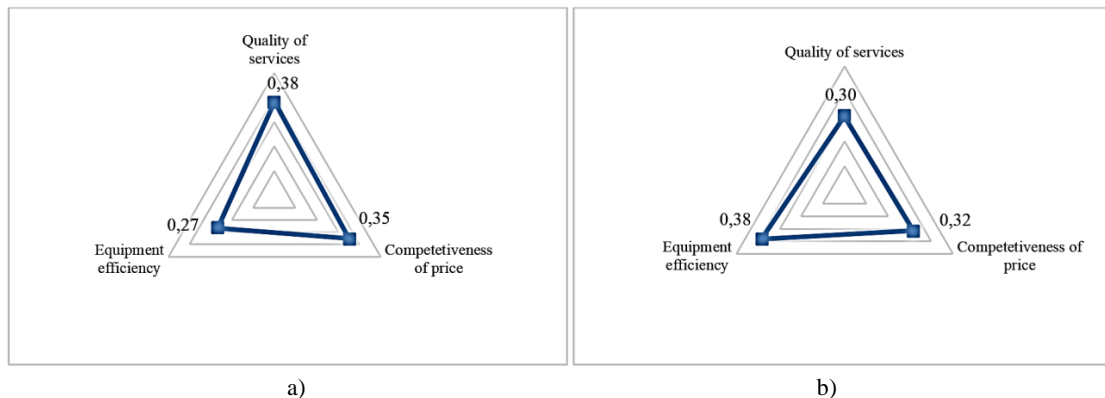


Figure 4. The evaluation of bunkering factors at Klaipeda seaport: a) till the 2015; b) after the 2015

During assessment of bunkering group factors it was found out that establishing of LNG terminal and forming new bunkering possibilities changed the evaluation of bunkering services' factors: especially important factor of bunkering services' attractiveness has become bunkering equipment efficiency with 38% of importance (Figure 4b). Before LNG terminal establishment main factor was quality of services, less important factors was competitiveness of bunkering price and the least important factor was bunkering equipment efficiency (Figure 4a). Analysing the factor of bunkering equipment efficiency from the viewpoint of bunkering services attractiveness, it can be seen, that up to the EU directive coming into force and till the opening of LNG terminal in Klaipeda seaport using equipment was the penultimate according to the significance rate in the range of whole factors. But after the 2015 January 1 its significance factor has increased by almost a quarter and became the second factor by the significance. And it shows that the changing legal environment and the outlook for ships to bunker with LNG fuel influence changes for physical properties of bunkering equipment which could to increase the bunkering operations' efficiency.

The most important of fuel resource (third) group factors is the availability of low sulphur fuel, which importance increased from the beginning of 2015 when sulphur emission regulation went to a force. And the sufficient fuel recourses is important factor for bunkering services attractiveness and seeks 27% of importance. While the LNG bunkering services are developing and ship owners strategically planning their operated ship's shipping region or fleet renovation, the low sulphur emission fuel is on the highest demand in the market.

Research found out that bunkering services' attractiveness depends on these factors:

- accessibility of low sulphur fuel – 0,125;
- efficiency of bunkering equipment – 0,122;
- efficiency of sea port activities – 0,117;
- sufficiency of fuel recourses- 0,111;
- price competitiveness – 0,101;
- geographical location – 0,095;
- quality of bunkering services - 0,095;
- supplierpunctuality- 0,088;
- supplier reliability - 0,088;
- political stability of region - 0,058.

It should be noted that currently the main bunkering services in Klaipeda seaport bunkering attractiveness factors are related either to the port infrastructure, or has an economic character. Main bunkering services attractiveness factors are: LNG terminal and container distribution centre, which allow to increase ships' flows, and the demand for bunkering services at Klaipeda seaport. As well the experts evaluate positively Klaipeda ongoing infrastructure's modernization, which facilitates navigation processes and bunkering services, so these factors haspositive influence for increasing the attractiveness.

The main reducing factorof bunkering services' attractiveness is insufficient competition of bunkering services'providers in Klaipeda seaport and it is directly related with low price competitiveness comparing with other seaports in the Baltic Sea. According to the experts, the number of bunkering services'providers at Klaipedaseaport are not enough and it is difficult to evaluate the level of market competition, the level of services, market transparency, and, directly, competitiveness of bunkering price. The port dues and the lack of efficiency of bunkering equipment was called as the negative factors by experts.

## Conclusions

1. Description and analysis of the bunkering technological process create possibilities to evaluate different types of bunkering technologies from the efficiency, financial, and attractiveness viewpoints. Evaluation of bunkering technologies and their suitability for different types of vessels showed that the optimal bunkering infrastructure for bunkering of ro-ro, ro-pax ferries, tankers and bulk cargo carriers is ship-to-ship bunkering technology and this type is accessible at Klaipeda sea port. Other types of bunkering technologies are suitable for development at Klaipeda seaport excluding the terminal-to-ship via pipeline bunkering technology as it requires large investments into infrastructure and additional territory in the seaport.

2. Evaluation of shipping trends in SECA region where low sulphur emission regulation entered into force from 1st of January 2015 showed that the biggest part of ships used in Baltic sea region are older than in other SECA regions, at least 1000 ships spend their all shipping time here and the analysis of vessels' types explain the Baltic sea as short shipping and feeder shipping region. Research results let to forecast the increasing of potential LNG bunkering market in Baltic Sea and sufficiency conditions for LNG bunkering market formation. Regarding to ship owners intentions the LNG bunkering service demand will increase in the nearest 5-10 years.

3. Evaluation of the attractiveness of bunkering services showed that the most important bunkering services' attractiveness' factors are accessibility of low sulphur fuel, enough efficiency of bunkering equipment and efficiency of port activities, as additional positive factors the geographical location of seaport and establishment of LNG terminal and container distribution centre, but most negative factors for increasing of attractiveness of bunkering services are low competitiveness of bunkering services' providers, the port dues and the lack efficiency of bunkering equipment.

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# EVALUATION OF KLAIPEDA SEAPORT AS TECHNICAL SERVICES' PORT IN CRUISE SHIPPING MARKET

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## **Abstract**

*Cruise shipping is considered as a profitable port activity, however it might not be always easy to achieve. The new terminal was opened at 2014th in the seaport of Klaipeda, however the number of cruise passengers has not changed significantly according to the general trends. The previous researches established the group of affecting factors such as the number of attractions and entertainment, local authorities and tourism sector cooperation with the seaport authority, which have significant impact on cruise shipping tendencies. However it is not always sufficient due to the availability of natural and artificial tourism facilities and also other required resources are limited. It is for such reasons the idea came up to develop a cruise ship technical services concept and evaluate the Klaipeda seaport development opportunities in this area. Research results showed that the overall technical services' attractiveness for cruise shipping at the Klaipeda seaport is relatively low, that is why the development of technological services' attractiveness has sufficient capacity to attract more cruise ships, especially with the perspective of bunkering cruise ships by liquefied natural gas.*

**Keywords:** *cruise shipping, maritime tourism, technical services*

## **Introduction**

Cruise shipping is of major importance for various ports around the Baltic Sea. The number of cruise ships passengers grew more than 4 times during the last 14 years [1]. While the global cruise market has grown averagely by 8% per year, cruise visits to the Baltic Sea have been growing more than 12% averagely per year. One of such growing reasons was the cruise roots' offer for passengers including the unique combination of exciting harbour towns with cultural and historic attractions and beautiful scenery, 10 from the economical viewpoint cruise ship calls became an additional source of income for both the seaport and the region. As example of income would be the forecast that global cruise ship industry will contribute up to 3600 million dollars in 2016. Klaipeda seaport is attributed [9] to medium sector of cruise shipping (on the base of classification medium cruise seaport annually has 25-49 cruise calls) with direction to large (50-199 calls): averagely annual increasing of calls seeks 3% and averagely annual increasing of tourist seeks 17%.

From one side, it must to be investigated all possibilities to increase cruise tourism, according to motivation of cruise tourist on the base of increasing information about attractions and places to visit. Earlier researches found out that strong dependence exist between cruise tourists visits to cities and the attractiveness of places to visit and other cultural or artificial places with ethnical heritage. From another side it is important to investigate attractiveness of seaport as technical services' node for cruise shipping. That is the main idea of research to identify main technical services, to find optimal balance between tourism and technical services development possibilities in the context of Baltic Sea market's limitations and limited Klaipeda attractiveness for tourists.

*The object of the research* - cruise shipping at Klaipeda seaport.

*The aim of the research* – to evaluate possibilities to increase cruise shipping on the base of technical services for cruise ships development at Klaipeda seaport.

*Objectives of the research:*

- 1) describe necessity and sufficient conditions for successful development of cruise shipping at the seaport;
- 2) classify technical seaport's services for cruise shipping;
- 3) evaluate possibilities to develop Klaipeda seaport as the high level and technical attractive seaport for cruise shipping.



*Research methods.* In order to assess the cruise market changes and identify the main cruise shipping development assumptions, also in order to identify successful cruise assumptions at the seaport literary sources and references analysis was used. The adopted SWOT analysis was used for evaluation of cruise shipping tendencies and intersector relations. By taking advantage of the statistical data and statistical analytical methods the cruise ship dynamic's indicators and development trends were established.

## **Necessarity and sufficient conditions for successful development assumptions of the cruise shipping**

Cruise shipping – the popular travel and holiday mode in the global tourism industry. One of the cruise shipping attractiveness factors for seaports and regions is economic benefit because it is the additional source of income, however on the other side it is also the object for effective investments. According to the statistical financial data Klaipeda Seaport contributed the budget of 739 thousands EUR in 2014 from cruise shipping services. Based on these results averagly one cruise passenger generated 14 EUR for seaport and whole expenses for one passenger seeked 50 EUR including expences in the city. This is not a huge amount, because averagely cruise tourist expenses seeks averagely 53.13 EUR in Baltic Sea region. For example one cruise tourist's expenses are averagely 56.3 EUR in Talin seaport and city [1]. These indicators show that development of cruise shipping port in such favorable market conditions is one of the sources of income not only for the port but also for the whole region and country and analysis of necessary and sufficient conditions for successful development are very important.

Cruise shipping – the sector of growing success in the tourism dustry and that is why the requirements for the development of cruise shipping are very dynamically and dependant on the needs of cruise tourists. In order to maximize the harmonization of cruise ship passenger needs with the port and the port city it is important to know the basic offered services for both passengers and cruise ships, in particular the factors that encourage tourists to choose the tour package. As the M. Manchini [6] research showed, the main cruise trip advantages over other types of trips can be identified:

- fine dining 81% (other trips 67%);
- chance to visit several different locations 79% (other trips 63%);
- being pampered 78% (other trips 66%);
- relaxing and getting away from it all 77% (other trips 55%);
- being hassle free 76% (other trips 46%);
- being luxurious 74% (other trips 64%);
- being easy to plan and arrange 71% (other trips 42%);
- high quality entertainment 69% (other trips 53%);
- good value for the money 69% (other trips 31%);
- variety of activities 68% (other trips 42%) .

As shown by the following factors, the strongest impact has the “visiting different places during one trip” factor, which is the only external factor determining benefit of cruise: cruise ship entertainment related all other factor, and factors identified by internal of the cruise tourism sector [13]. Analysis of the cruise selection factors requires to take into account that cruise shipping ports can be divided into different types: port of departure, port of arrival, departure - arrival ports, and intermediate ports. Such seaports classification gives preconditions to analyze the development of cruise opportunities and trends in one or another seaport [1].

On the base of theoretical literature analysis, ports are different from cruise shipping viewpoint. The European cruise industry is to a large extent destination-led and the Mediterranean and Northern European regions include many attractive destinations [8]. Many of the leading ports are regarded as “must see” or “marquee” destinations that destination planners will wish to include in their itineraries. Other ports, some of which are also marquee ports in their own right, have advantages of strategic position, access to major hub airports and suitable bed-stock, enabling them to feature prominently as Home Ports [6]. Comparison shows that some ports are cruise start or end ports, but some ports are only intermediate travel ports where cruise travel is diversified by various cognitive excursions, shore entertainment and so on. Big part of Baltic Sea ports are assigned to the group of intermediate or transit seaport, so in order to attract cruise vessels it is important to investigate different development directions and scenarious including possibilities to increasing of attractiveness as technical services seaports. So in the context of comparison of different development scenarious and situations it is important to describe some conditions which create and applicable for development planning environment.

Theoretical background of cruise shipping showed that cruise shipping in the port and the port city including tourism services can not be analysed separately. So it can be stated that it is quite difficult to distinguish the shipping from tourism and the sea port from the city. Comprehensive analysis of the cruise sector is one of the main methods creating opportunities to define the basic requirements for sea ports and for the regions. First of all there should be interesting tourist attractions and also the opportunity of different types of services for cruise ships at the sea ports [2]. So cruise shipping can be described as the interface between shipping and tourism sectors, because they are not possible to exist without one another [4]. Such type of interference highlights the importance of the integration and cooperation between the seaports and the cities' authorities, including tourism departments (Figure 1). In terms of cruise shipping development, the cruise shipping sector have to ensure the enough of infrastructure and superstructure elements, including the special package of technical services for cruise ships, passenger services at the passenger terminals (Figure 1).

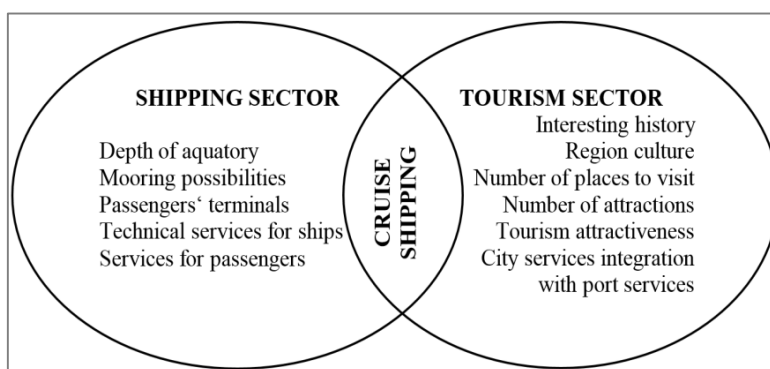


Figure 1. Shipping and tourism sectors' integration from cruise shipping development viewpoint [10]

From the tourism sector viewpoint is is important to have well developed tourism infrastructure in the city or region, which can be measured by:

- the connectivity famous places in cities and around them by public transport;
- the number of attractions in the city or around it;
- a variety of services for tourists, and events, tourism attractions for travellers.

Also, it is required to have well developed marketing strategy and partnership network: cooperation with ship agencys, cooperation with city and port authorities and their marketing departmens. The less measurable factors could be such factors as the interest of the historical region, region's historical links with the rest of the world culture and historical path (Figure 1).

Factors that have a positive impact on the development of cruise shipping at seaports makes it possible to discern a link to the outside and unified marketing strategy for the development of cruise shipping. One of the solutions popularizing cruise shipping routes in the Baltic Sea was a creation of Local Baltic Cruise shipping Network (LBCN) [7]. Currently there are 10 countries and 27 ports in LBCN, including Klaipeda seaport. According to 2014 data, LBCN had 88 cruise ships and served 4.3 million passengers and income seeked 346 million EUR in the Baltic region [8].

One of the global marketing tools, popularizing cruise shipping in the Baltic Sea Region and also having a positive impact on cruise shipping in the Baltic region requires additional impact from the country, region and the seaport, also requires close cooperation relations with the tourism industry, which makes it possible to ensure integrating maritime transport and tourism sector in the region [11]. It can be said that in order to effectively develop cruise shipping conditions in the region, integration is needed between the shipping and tourism sector, partnerships and networks, unified marketing strategy for cruise tourism, transport systems are the main the main cruise shipping development assumptions.

Classifying cruise parameters affecting factors showed that the original classification depends on the type of factors - the shipping industry, the tourism industry factors and indicators that can be defined according to their level of integration (Figure 1). On the other side factors may also be classified according to the importance of development in terms of cruise shipping and classified as an emergency and suficient cruise conditions (Figure 2). In order to analyze the necessary and cruise conditions it is necessary to emphasize that the necessary condition is the condition without which the cruise shipping in general would be impossible, and the sufficient conditions are to ensure the effectiveness of the cruise tourism [12]. The cruise ship industry factors can be devided into a few groups - infrastructure, supra structural and service factors. There are no special infrastructural cruise shipping requirements, mostly the

harbour infrastructure parameters are suitable for the vast majority of cruise ships, however in order to get a larger number of ships in the port it is necessary to have neat embankments, mooring possibilities and also provide the necessary technical means at the port (Figure 2). On the base of cruise market analysis, it can be seen, that cruise ships are getting bigger, so the requirements of the port infrastructure is also growing and it has to be important aspect during strategic planning of sea port development [2].

Higher requirements are raised for the superstructure - existence of the terminal, performing a link between the city's infrastructure functions. Each port has its own shopping opportunities (often duty-free). Moreover, cruise tourists do not have to haul their purchases around as they go from place to place. To implement shopping at duty free shops, ports have to be equipped with specially adapted passenger terminals with sufficient goods assortment that meets the needs of the cruise ship passengers [12].

The literature analysis have found out that service factors and technical service factors can make a sea port more attractive to the development of cruise shipping from the technological viewpoint. Technical support services divided into the necessary and sufficient conditions can be assigned to each of them depending on their nature, distinguishing the integration role.

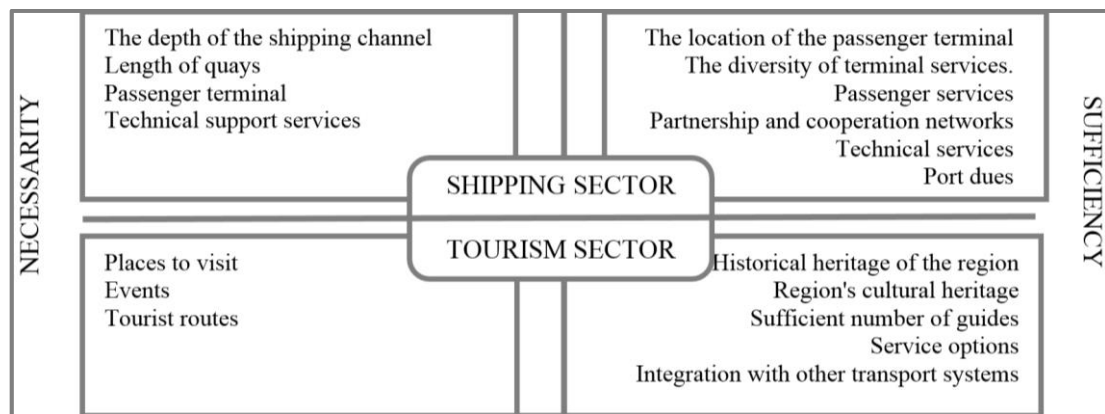


Figure 2. The necessary and sufficient conditions for cruise shipping development.

In terms of the tourism sector, it is essential for the region to be delivered as an attractive tourist object. Prerequisites - the number of tourist attractions, events, and a variety of hiking trails (Figure 2). A number of places of interest is usually delivered through the marketing communication elements such as tourism websites, advertising, online ads and etc. As shown by the Manchini study [6], places of interest impact the cruise travel, it attracts passengers to visit them during cruise ship trip. Places of interest must be linked to the region's cultural and historical heritage, as this may lead to a periodic repetition of passengers after the relevant period of time (Figure 2). Furthermore, cultural and historical heritage of the country and links to other cultures should lead into a tourism program, where places of interest can be included as thematic sightseeing [7].

As shown in Figure 2, the necessary and sufficient conditions of the tourism sector require to involve the local government for development of cruise shipping enforcement actions and activities. Local government plays an important role in improving the quality of cruise shipping by trying to make decisions that do not interfere with cruise shipping, business owners and take care of passengers transport assurance. Local authorities are directly linked to the tourism sector institutions and the development of tourism in the region. This is implemented through the tourist information centers. Most of the cruise ship passengers are guided by the desire to get to know the country, also some of them are linked to partnerships, business contacts or the need to fulfill historical-geographical knowledge. The tourism sector must ensure the complex tourists needs, this is only possible with the cooperation between local authorities, the maritime sector and the tourism sector.

In conclusion, there is a need to focus on integrated and consistent approach options in the development of cruise shipping, model factors, consisting shipping and tourism industry factors such as infrastructure, superstructure, technical services and tourism passenger transportation, attractions, events factors. As shown by the description of the factors, the seaport itself is highly important cruise condition along the tourism sector and local authorities' cooperation. By applying the multi application model it is possible to identify the direction of development of cruise shipping - cruise, cruise tourism, technical or mixed-port cruise port.

## Description of technical services for the development of cruise shipping

As shown by the analysis (Figure 3), technical services are one of the integrating components connecting the development of cruise shipping into a technological cruise complex package. The breakdown of the technical services at the cruise ship port: availability of port pilotage authorities, truck services provided by the port waters, ship support services such as bunkering, ballast water collection, fresh water supply, electricity supply, waste collection, provision of necessary medicines, also ship or its parts repair services, technical terminal equipment, various other services [10].

Service – it is a marketing element consisting of supply and competition, price and quality. According to the analysis, each technical cruise shipping service appears as a variety of services, which allows to solve a complex needs of cruise shipping (Figure 3). Technical services for cruise shipping can be divided into four groups: shipping port services, technical cruise ship services, cruise travel services, passenger services at the terminal in the port area (Figure 3). Technical cruise services consists of pilotage authority's services, harbor towage services and mooring, also services provided for the ship while in port.

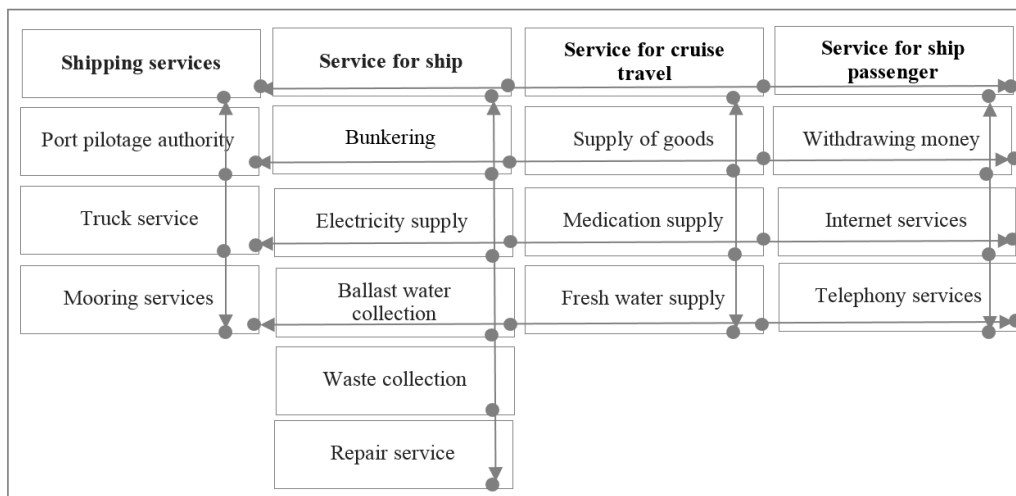


Figure 3. Classification of technical services for cruise shipping [10]

Another part of the technical services - cruise travel services (Figure 3). During the trip, cruise ship must be equipped with food, household goods and with goods sold at the duty free store. Usually such services have its own specifics and done in accordance with agreements and signed contracts. Partnership and co-operation network helps to develop supply logistics chain. Technical facilities complex within the passenger terminal consists of (Figure 3) installed cash points for money withdrawing, passenger information centers, coffee and water makers, internet facilities and other comfortable stay solutions.

Technical service improvement opportunities consists of several different evaluation criteria, of which may be constant (base) and/or variable:

- availability of the services at the port - variable criteria, depending on the type of service;
- the price - variable criteria, also dependent on the type of service;
- port dues, the base criteria:
- per passenger;
- for services;
- quality of service - variable criteria depending on the service resource efficiency and consumers' expectations.

It is important to say, that each of criterias can be calculated in three perspectives: availability, accessibility, and quality. Evaluation of technical services is important because numeric indicators can be calculated and it can be used to increase technical services' attractiveness, to plan demand of cruise shipping, to compare competitiveness of seaports in region [11]. Also indicator can be used for flexible reaction to changes in the maritime tourism market, for fixing changes in the quality of technical services, for strategical planning of cruise shipping development not only at the seaport, but in all region.

## Evaluation of technical services' level at Klaipeda State Seaport

Around 77 different cruise ships owned by 37 operators sailed in the Baltic Sea during the cruising season 2014. Half of these were smaller vessels with a maximum capacity of 1500 persons or less, including staff and passengers. Eight vessels, or 10 %, were large vessels with a maximum capacity of 4000 persons or more. Five main destinations - St. Petersburg, Copenhagen, Tallinn, Helsinki and Stockholm – account for 67 % of the cruise ship traffic in terms of calls. In total, cruise ships visited in 31 ports during 2014 [5].

Half of the 31 ports had 11 or fewer visits, 6 only one visit. In 3 ports, including Visby, large ships anchor outside the port and use shuttle boat transportation to the shore [3]. Voyages between two ports lasted commonly between 8 and 20 hours at sea, and the cruise ships stayed usually in port between 8-10 hours. The international cruise ship voyages involved in total 6,55 million person days, comparable to year-around habitation of 18 000 people. 80 % of the international cruise ship calls were intra-Baltic travels, or calls where both the previous port visited and the current port are in the Baltic Sea. There were 2252 international cruise ship calls in total [3].

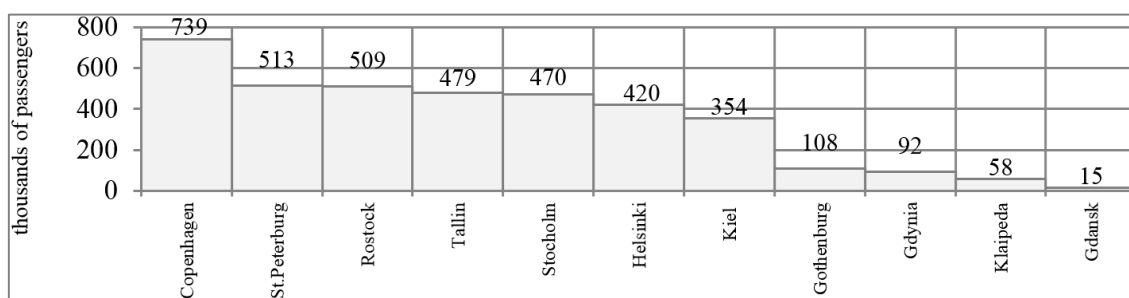


Figure 4. Top 10 of LBCN cruise shipping ports at 2014 [4]

Klaipeda has rapidly gained the popularity: currently it is an attractive seaside city with expanding maritime tourism. Cruise shipping in Klaipeda started to develop considerably, since the Cruise Vessel Terminal – in the very heart of the city – had been constructed. The first Cruise Vessel Terminal in Klaipeda State Seaport was built in 2003, beginning a new era of cruise shipping. That year, 30 cruise ships and 9 thousand cruise passengers visited Klaipeda State Seaport. In 2007, 65 cruise ships brought 37 thousand passengers to Klaipeda State Seaport. In 2014 the name of Klaipeda Seaport was found between the first ten cruise ports across the Baltic Sea marine (Figure 6). In 2014 cruise ships business generated 583 thousands EUR.

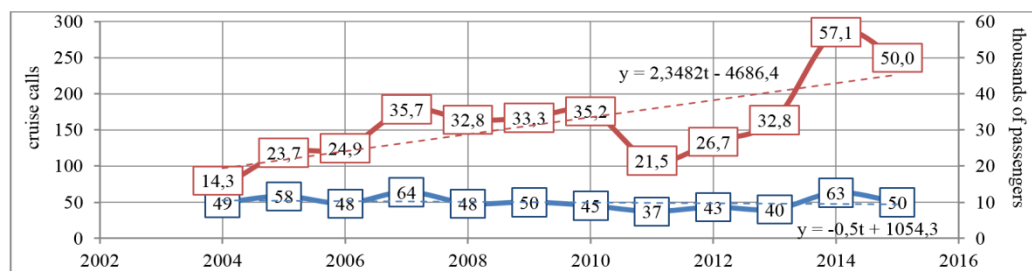


Figure 6. Cruise shipping dynamics at Klaipeda State Seaport

During the last five years 277 cruise ships visited the seaport of Klaipeda, this appears to be the smallest number of cruise ship visits between the other Baltic ports. According to the figures for 2014, it can be said that the seaport of Klaipeda is the second between the Eastern Baltic ports if to compare cruise ships visits (Figure 6). The ship and passenger dynamic trends show that over two seasons the number of cruise ships can decrease to one ship ( $y = -0,5t + 1054,3$ ), however the passengers dynamic trends ( $y = 2,3482t - 4686,4$ ) expect to grow on average up to 2,3 thousand per year.

The seaport of Klaipeda port is visited by cruise ships with high-quality service and a wide range of entertainment, hence the city and the port must offer good quality and a wide range of tourist attractions. It has been noticed that in order to attract a large amount of cruise ships it is not enough to only offer a wide range of sightseeing attractions (Table 1).

Table 1. Evaluation of cruise tourism conditions at Klaipeda Seaport

<b>Necessary conditions</b>	<b>Sufficient conditions</b>
Tourist center provides information about the international space Klaipeda region	Excursion program adapted for tourists by their language
Cruise ships in the port of Klaipeda enters from those who swimand Tallinn, and this indicates that the flow is tourists.	Twenty tourist routes
Ongoing contacts with the world's cruise lines, cooperation and exchanged experience with the best in the industry specialists.	Welcome music ensembles for the cruise ships in the port
Participation in international exhibitions and seminars, as popularized in the only Lithuanian port city.	Organized by the traditional bazaar Theatre Square, which attracts tourist's traditional Lithuanian folk art works and Lithuanian cuisine.

Klaipeda seaport allocates more funds for marketing measures in many exhibitions in order to attract more tourists, also local government is involved in increasing the levels of cruise ship growth. Klaipeda city municipality takes care of cruise passenger transport, e.g. there are special buses appointed, which take tourists from the terminal to the old town. In order to create an attractive presentation of Lithuania, the Tourism and Culture Information Center produced "Cruise Lithuania" pens, T-shirts, special city plans and also released a special publication in English called "Cruise Lithuania".

As shown in previous studies [10, 11, 12], in order to keep cruise rates in 2014, it is important to increase the number of cruise ships, and the number of tourist attractions. It turned out that this is impossible to do every year, hence there is a need to assess the technological level of services at the state port of Klaipeda and seek for an additional solutions to keep or increase cruise rates.

In order to study and evaluate the technical services levels at Klaipeda seaport it has to be done analysis of the necessary and sufficient conditions for cruise shipping. According to Table 2 there are facilities made even for the biggest cruise ship stay in the Klaipeda seaport. The terminal covers 1,2 hectares and can accommodate vessels 315 meters long with draft of 8,5 meters. This Klaipeda State Seaport terminal offers hotels, restaurants, bars, souvenir shops, currency exchange, telephone and mail services, internet, and ATMs and it is in the city center.

Table 2. Evaluation methods of infrastructure elements at Klaipeda State Seaport

<b>Necessary conditions</b>		<b>Sufficient conditions</b>
<i>INFRASTRUCTURE</i>	<i>SUPERSTRUCTURE</i>	
The depth of the navigation channel revenue is enough Depth to the old terminal berth is enough Depth to the central terminal is enough Length of berths is enough The maximum number of ships serviced at the same time is equal 2	Number of terminals is enough The old terminal throughput is enough Central terminal throughput is enough	New passenger terminal location is not sufficient Partnership and cooperation networks Technical services including variety of services in the terminal aren't sufficient Port charges are sufficient

Cruise business has grown so quickly that the Klaipeda State Seaport has built a new passenger and cargo terminal in the city center. Aiming to increase the city's competitiveness in cruise shipping and to further develop maritime tourism, Klaipeda Central Terminal was constructed in 2014. The new central terminal can simultaneously serve up to three cruise ships and up to iki 500k passengers. It also offers different lengths of berths, the most popular is the 80th quay, which is 297 m long and 10 m deep. The terminal has its negative side as it is far away from the city center, so it is not so attractive to passengers even though the local government provides vehicles to cruise passengers.

Klaipeda seaport provided or could provide a total of 14 different technical services for cruise ships and their passengers at the starting of 2015. The research found out that the most marketable technical services were port pilotage authorities' services and electricity supply services at Klaipeda seaport. Passenger services' group services such as the supply of goods and telephony services were at least in demand at Klaipeda seaport. Although the pilotage and towage services have the highest demand at Klaipeda seaport as was researched in earlier researches [4, 10]. Some of services such as cash withdrawal have high level of demand, but they are not accessible, but other services such telephony

services are accessible, but they have not high demand's frequency. That situation show the direction for development of technical services, especially in the case of services that belong to passenger group.

In the case of fully exploitation of cruise shipping possibilities at the Klaipeda seaport changes should be made not only on port settings, but also on a variety of technical services. It is important to state, that not all required technical services are provided at Klaipeda seaport, some of them just are not high-quality for low indicators of hardware performance, or the lack of efficiency of technological processes. It can be argued that the increasing of quality of provided services and starting to provide the services that are not yet available at Klaipeda seaport, it is possible to raise Klaipeda seaport technical attractiveness and thus attract more cruise ships in the port. In view of the potential changes in the ship bunkering technologies the development of Klaipeda seaport as a technology seaport for cruise shipping opportunities are high. The analysis of cruise shipping rates show that infrastructure and superstructure terms precondition successful development of cruise shipping even tough the cruise indicators are not as optimistic, as it could be. In order to answer this question, it is necessary to evaluate the technical level of service in Klaipeda State Seaport.

## Conclusions

1) The research found out that in order to develop the cruise shipping sector a necessary cooperation is required between the city, region, state authorities and the tourism sector, including the maritime port. In addition, flexible integration infrastructure and quality services must be provided. Also, the study showed that one of the cruise shipping development alternatives may be to develop technical services at the port by comparing different seaports including their technical level of services provided, service prices, also availability of services.

2) Classification of whole range of technical services for cruise shipping at the seaport justified the complex model based on summary evaluation of three perspectives for each criteria: accessibility, availability and quality. Such type of evaluation creates possibility to compare different seaports by one or many criterias and to assess the technical services' level from the cruise shipping development viewpoint.

3) The evaluation of the dynamic indicators at the cruise port of Klaipeda in 2014 showed that the number of cruise ship visits at Klaipeda seaport falls in the first top ten between the Baltic Sea Region however, the number of vessel dynamics is negative. Overall, there was a maximum number of tourists seen during the whole period, also the passenger growth remained upward.

In order to identify the key factors that make an impact, the study evaluated the tourism sector and shipping industry factors which showed that the tourism sector seeks to adapt to the tourist needs and expectations, their nationality and language. In addition, the city government resolved the issue concerning transportation between the city and the terminal, Klaipeda seaport conducts and focuses on the marketing strategies. Overall, the stability of places to visit and the decreasing number of cruise ships does not promise an intense rate of growth in the cruise shipping.

Further to the assessment of Klaipeda seaport's technical level of service it was found, that some technical services are not provided, and some technical services are not of high quality because of technological efficiency and the lack of performance indicators. The future possibilities look high if to take into the account the potential to change the ship bunkering service technologies and keep focusing on technological development at the seaport.

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