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REDEFINED DEFINITION OF THE STCW COMPETENCES

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In this paper, the authors propose a new approach to defining competences according to which a competence is a defined set of three elements: executors of the actions, on board processes and objects needed to execute a task or a decision within one process. Each of the elements has to be defined separately. Correlation between the competences' elements should be defined as well. Generic competences are of the extreme importance for the successful on board processes. Therefore, a correlation between the generic competences' elements should be defined as well. These definitions' application has been shown on the examples of professional and generic competences. As has already been mentioned, objects have become a part of the new, redefined and improved definition of competences. Objects can be divided into the ones referring to generic competences and the ones referring to professional competences. They are devices, machines, tools, persons, groups of people and concepts. They change significantly under the influence of technological development and automation, which, consequently influences the whole process as well as task executors.

Key words: professional competences, generic competences, group competences, on board team's competences, on board processes

1. Introduction

Since its entering into force, the STCW Convention has been amended several times. One of the most significant amendments as far as the seafarers' education is concerned is the introduction of the competence-based education into the Convention [1]. The competence concept was introduced into the Convention as a part of the 1995 amendments. The STCW

Convention has prescribed professional competences that refer to deck department, engine department, radio operators, different types of ships, emergency actions, safety, security, first aid and medical care and survival at sea.

There are many competence definitions and classifications in usage today. However, the basic classification of competences into generic and professional competences can be pointed out [2; 3; 4]. Generic competences are the ones needed in various everyday situations and are not necessarily profession related [5]. However, professional competences always refer to knowledge and proficiency typical for a particular profession [6].

Competences as defined by the STCW Convention are a combination of knowledge, understanding and proficiency needed for on board jobs and duties [7]. They are closely linked with nautical science concepts as well as technological development on board. Definition and explanation of generic and professional competences in the STCW Convention is not clear enough. However, a number of generic competences is present in the STCW Convention. The competences in question are *Teamwork* and *Team Management,* whereas the other generic competences have not been mentioned [8; 9]. According to the analysed literature, a special attention has been given recently to acquiring generic competences needed for jobs on board.

It is important to emphasize that competence concept has so far referred to one crew member only [8]. However, a model of defining competences could refer to a group of people i.e. to an on board team. Therefore, in a larger sense a competence can refer to the competence of an on board team which is involved in decision-making and task execution. An on board team has its own competences that are the same as one crew member's competences. They also have the same characteristics. The main difference between the on board team's competences and one crew member's competences lies in the fact that knowledge, understanding and proficiency can be differently distributed within a team [8].

Competences, prescribed by the STCW Convention, have nowadays been related to different ship function [1] and ship functions have been determined within ship departments. However, competences needed by the crew can be determined on the basis of the analysis of processes on board. It means that every operation, its executors and devices used within a process on board should be analysed [8]. It is important to emphasise that a part of the processes would be the same for various types of ships. However, processes typical for the particular type of ships should be pointed out. After this type of analysis, it would be possible to determine competences needed by the crew within a particular process. Similar analysis has already been used in the STCW Convention.

Generally speaking, operations and decisions within an on board process have a precisely determined time of execution. They can be made by one or more members of a small, middle-size or large team. If subjects are small, middle-size or large teams, interrelations between team members can be vertical or horizontal. Vertical relationships refer to formal hierarchical relationships with a defined chain of command [10], whereas horizontal relationships refer to relationships between members of the same rank/level [11], and, they generally refer to a task execution [10].

Therefore, this paper proposes a redefined approach to defining competences based on the analysis of processes on board. The approach refers not only to one crew member, but to a whole team as well. The ambiguities referring to the method of determining knowledge, understanding and proficiency within particular competences were analysed in this paper as well.

2. Competences in STCW Convention

For deck and engine department, the STCW Convention has classified competences into the ones needed at operational, management and support level. Such a classification's flaws (the ones the authors think are important) are emphasized in the text that follows and they refer to:

       1) Prescribing competences at the management and the operational level, and

       2) The method used to prescribe knowledge, understanding and proficiency.

Ad 1) Competences, as prescribed by the STCW Convention, have not been classified on the basis of the processes within a system. As for deck department, ship operations have been defined and within them, competences have been prescribed. The same operations have been prescribed at the operational and the management level, which has led to the classification of competences that is not clear enough and, that is not suitable for processes on board.

For example, competences have been determined for the operation *Navigation* at the operational and the management level, which has resulted in prescribed knowledge, understanding and proficiency at the operational level. As for the management level, new knowledge, understanding and skills, that should have already been included at the operational level, have been added.

As an example, a competence *Voyage Planning* within the operation *Navigation* was described in this paper. The first officer usually makes a voyage plan. He has to be able to do that upon completion of programmes prescribed for officers of watch on ships of 500 BT and more. Therefore, the afore-mentioned competence cannot be classified in this way since the second

deck officer has to possess all knowledge, understanding and proficiency needed to make a voyage plan from the moment he takes up that position.

The STCW Convention has prescribed knowledge, understanding and proficiency for the afore-mentioned competence at the operational and the management level, as shown in the Table 1.

Table 1. Competence *Voyage Planning*

Operational level	*Management level*
Celestial navigation - Ability to use celestial bodies to determine the ship's position	*Restricted waters*
Terrestrial and coastal navigation - Ability to determine the ship's position by use of landmarks, aids to navigation, including lighthouses, beacons and buoys, dead reckoning, taking into account winds, tides, currents and estimated speed	*Meteorological conditions*
Thorough knowledge of and ability to use nautical charts, and publications, such as sailing directions, tide tables, notices to mariners, radio navigational warnings and ships' routeing information	*Ice*
Electronic systems of position fixing and navigation - Ability to determine the ship's position by use of electronic navigational aids	*Restricted visibility*
Echo-sounders - Ability to operate the equipment and apply the information correctly	*Traffic separation schemes*
Compass – magnetic and gyro - Knowledge of the principles of magnetic and gyro-compasses. Ability to determine errors of the magnetic and gyro-compasses, using celestial and terrestrial means, and to allow for such errors	*Vessel traffic service (VTS) areas*
Steering control system- Knowledge of steering control systems, operational procedures and change-over from manual to automatic control and vice versa. Adjustment of controls for optimum performance	*Areas of extensive tidal effects*
Meteorology - Ability to use and interpret information obtained from shipborne meteorological instruments. Knowledge of the characteristics of the various weather systems, reporting procedures and recording systems. *Ability to apply the meteorological information available*	*Routeing in accordance with the General Provisions on Ships' Routeing*

Source: [7]

It is not very clear why, for example, the competence *Vessel Traffic Service (VTS) Areas is* repeated at the management level if knowledge, understanding and proficiency, for that competence, can be a part of the competence *Ability to use nautical charts, and publications, such as sailing directions, tide tables, notices to mariners, radio navigational warnings and ships' routeing information.* The above-mentioned does not mean that ship's operation *Navigation* should not consist of the operational and the management level. It means that this classification should be made according to the processes and operations on board.

Ad 2) The already existing method of prescribing knowledge, understanding and proficiency has not been standardized and is not clear enough.

For example, UKC *(Under Keel Clearance)* is important when planning a voyage. However, it has not been prescribed neither at the management level, nor at the operational level for the competence *Voyage Planning.* It has been prescribed for the competence *Manoeuvring and Ship Handling* at the operational level and for the competence *Manoeuvring and Ship Handling in all Situations* at the management level.

Furthermore, a method of prescribing knowledge, understanding and proficiency has not been standardized. For example, in some parts of the STCW Convention only knowledge, in others only understanding, proficiency or elements' identification etc. fall into the category knowledge, understanding and skills. One of the examples of the above-mentioned situation is the competence *Carriage of Dangerous Goods.* The STCW Convention has determined the following knowledge, understanding and proficiency for that competence: international regulations, standards, codes and recommendations on the carriage of dangerous cargoes. It has also included the International Maritime Dangerous Goods (IMDG) Code and the International Maritime Solid Bulk Cargoes (IMSBC) Code; carriage of dangerous, hazardous and harmful cargoes; precautions during loading and unloading and care during the voyage. To conclude, codes are not and cannot represent a competence *Carriage of Dangerous Goods,* which is the case in the described situation.

Another example is the competence *Watchkeeping and Procedures.* The STCW Convention has determined the following knowledge, understanding and proficiency for that competence: thorough knowledge of the content, application and intent of the International Regulations for Preventing Collisions at Sea, 1972, as amended; thorough knowledge of the principles to be observed in keeping a navigational watch. Knowledge, understanding and proficiency needed to prepare watchkeeping procedures have not been listed for this competence as well.

Apart from the STCW Convention's mandatory regulations, the International Maritime Organisation has recommended the IMO Model Courses usage when carrying out programmes referring to gaining competences prescribed by the STCW Convention. The institutions carrying out such programmes can use IMO Model Courses when introducing new programmes or when upgrading or improving the already existing ones. IMO Model Courses contain the curriculum, teaching goals as well as the number of hours needed to achieve the goal etc.

IMO Model Course that refers to the operational level is 7.03 (*Officer in Charge of a Navigational Watch),* whereas the one referring to the management level is 7.01 (*Master and*

Chief Mate). IMO Model Courses are only a recommendation, i.e. their usage is not mandatory. However, even IMO Model Courses have not solved the problem of prescribing competences at the operational and the management level. For example, *Integrated Navigation System* – INS and *Integrated Bridge System* – IBS are not mentioned in the IMO Model Course 7.03 [12] but in the Course 7.01 [13] . Therefore, it could happen that an institution, that applies IMO Model Courses uncritically in the programmes for officers of watch, does not include INS and IBS contents in the programmes. Moreover, it could happen that officers of watch who complete such programmes do not know the systems' basic concepts and limitations as well as how these systems work.

3. Redefined definition of competence

In order to improve the existing definition of competences and to avoid ambiguities mentioned in the text, the authors have proposed a redefined definition of competences. The redefined definition of competences, as proposed in this paper, is based on the analysis of on board processes. In a broad sense, a competence refers to the competence of a group of people – a team that executes operations, does tasks or makes decisions together. A team has its own competences that coincide with the competences of an individual. They also have the same characteristics. Major difference between a competence of a team and a competence of an individual lies in the fact that knowledge, understanding and proficiency can be differently distributed within a team.

A concept of an object has been introduced into the redefined definition of competences. In this paper, objects are devices, machines, tools, persons, teams and concepts. Objects needed to execute operations or to make decisions within one process can be divided into the ones typical for generic competences and the ones typical for professional competences. The objects change significantly under the influence of technological development and automation, which, consequently has an impact on the process as well as on the subjects.

Therefore, competences depend on the subject, on the on board process and on objects used. Taking into consideration the above-mentioned, and for the purpose of this paper, competences (C) represent a defined set of three elements:

      1) Subject (e_1)

      2) On board process (e_2), and

      3) Object (e_3).

This set of elements can be represented like this:

$$C = \{e_1, e_2, e_3\}$$

Subject is an element that does m of operations with n of objects. For the purpose of this paper, a subject can be one crew member (e.g. deck officer) or a group of people with the same goal. Depending on the number of its members, a group of people can be divided into:

     1) Smaller teams, e.g. bridge team,

     2) Middle-size teams, e.g. deck crew, and

     3) Large teams, e.g. ship crew.

An on board process is a set of operations, decisions and tasks within operations whose time of execution t has been implicitly or explicitly set.

$$e_2(t) = \{O_1, O_{2....}O_j; D_1, D_2...Dn\}\ t$$
$$\sum t_i < t_g$$

Where:

t_i – time of execution

t_g – limited time of execution

3.1. Differences between generic and professional competences

As far as generic competences are concerned, the object is usually a person, a team, a concept or a device, whereas as far as professional competences are concerned, it usually represents a device, machine or a tool[1].

Difference between professional and generic competences:

-   As far as professional competences are concerned, e_3 = an advice, number of devices, machine, number of machines, tool or number of tools.
-   As far as generic competences are concerned, e_3 = a person, team, concept or device.

This relationship is shown in Figures 1 and 2.

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[1] For the purpose of this paper, the term tool refers to an instrument (e.g. a pair of compasses, a set square); the term machine refers to every piece of equipment that turns one type of energy into the other or that carries out a mechanical work (e.g. turbine, pump, engine); device replaces complex human operations (e.g. ECDIS).
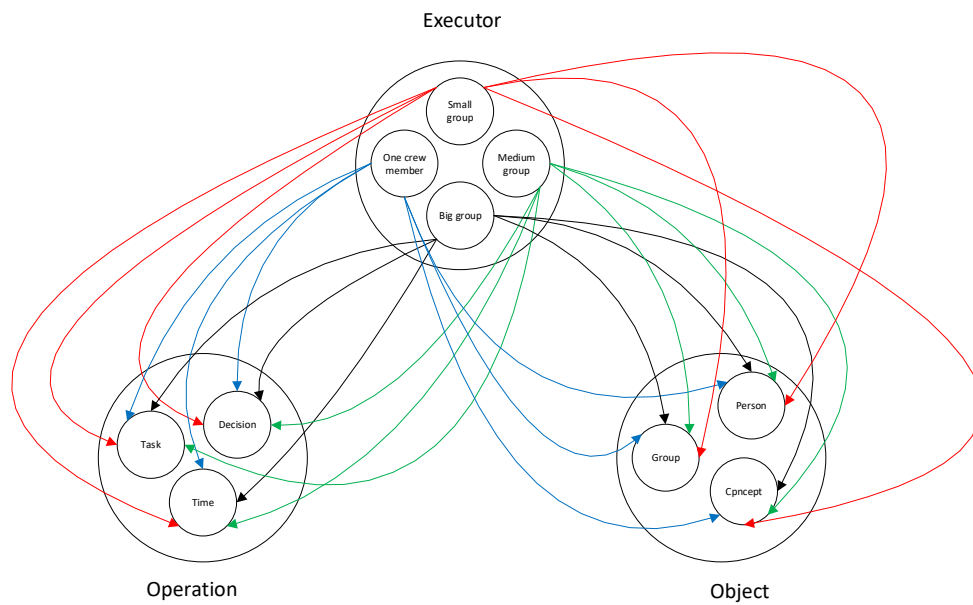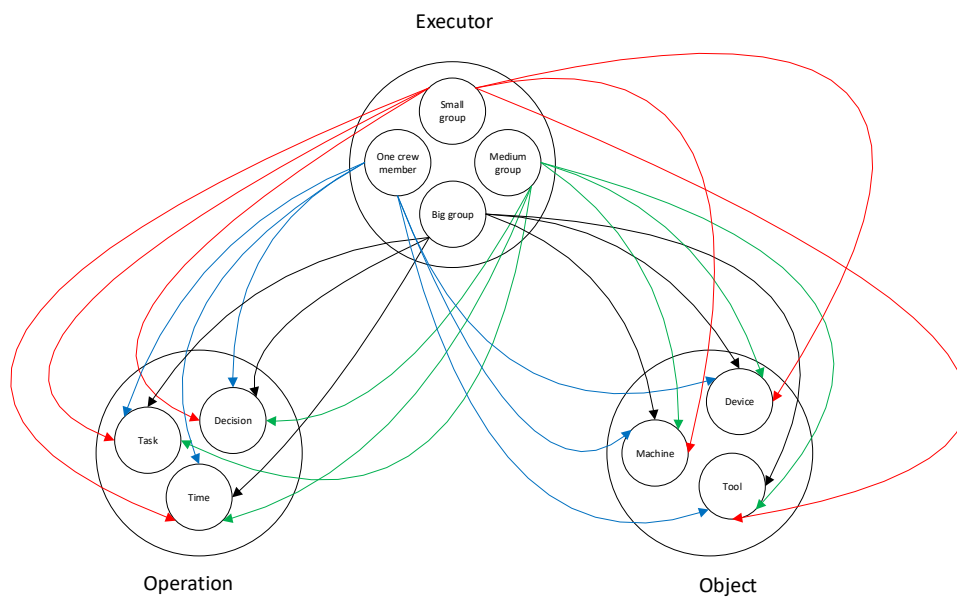
Figure 1. Generic competences

Figure 2. Professional competences

3.2. Testing the proposed definition of competences on the process called *Pilot Boarding*

The proposed definition of competences will be tested on a process called *Pilot Boarding*. This process is a part of the already existing competence M*anoeuvring and* H*andling a* S*hip in all* C*onditions* prescribed by the STCW Convention. Subjects, executing a task in this case, are

bridge team and deck crew. Objects they use are manoeuvring system, navigation system, communication system and equipment needed for pilot boarding. Bridge team and deck crew prepare themselves for pilot boarding according to the prescribed procedure on pilot boarding. Upon receiving a pilot boarding position from the authorities in charge, the bridge team has to determine ship's position, course and speed with reference to boarding time. The position is checked according to defined voyage plan and time intervals. Before reaching the agreed position, a contact with pilot boat has to be made. Pilot boarding position should be confirmed as well as boarding time and the ship's boarding side. Furthermore, the ship's speed has to be in accordance with pilot ship's demands. Manoeuvre is carried out in cooperation with a pilot boat and administration responsible for pilot's activities. Pilot boarding should be visually followed and helped. It is important to emphasize that, at the same time, the ship is being manoeuvred in restricted waters, very frequently under the influence of strong wind and currents. Therefore, it needs continuous speed and steering corrections. After the safe pilot boarding has been confirmed, the master himself manoeuvres the ship until the pilot takes charge of his advisory position.

At the same time, deck crew prepares pilot boarding station. It has to mark and illuminate boarding location, set up pilot ladder, and ensure the shortest, illuminated passage from the pilot boarding station to the bridge. The equipment used to set up pilot ladder differs on the basis of the way it has to be lowered, i.e. manually or automatically.
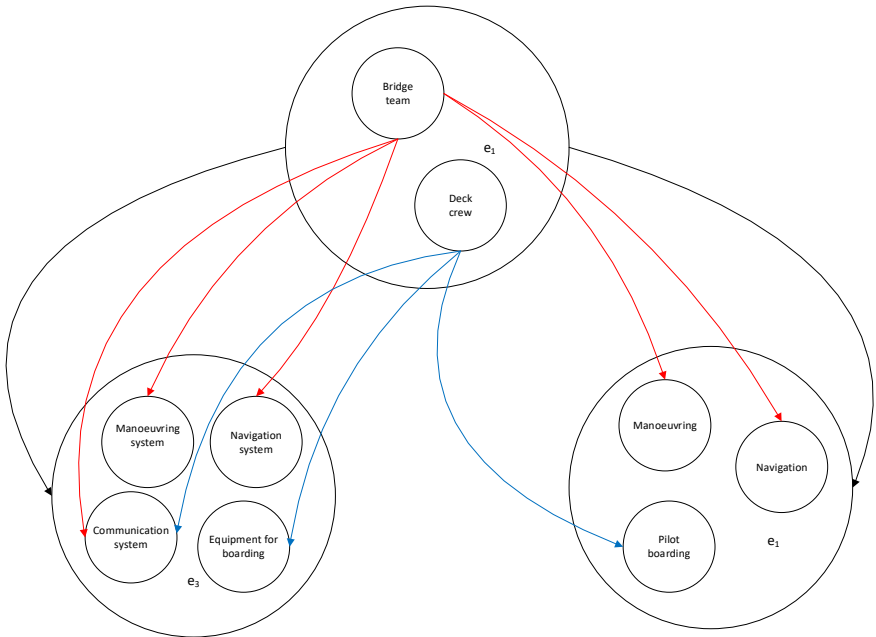
Pilot Boarding is shown in Figure 3.

Figure *3*. Pilot Boarding

In this example, the term knowledge refers to the type of objects (e.g., communication resources are the UHF resources, used for the internal communication on a ship, and VHF resources, used for the communication with pilot ship and authorities in charge). It also refers to elements the objects consist of (e.g., manoeuvring system can be divided into propulsion system and steering equipment), elements' work principle (e.g., propeller thrust) and their existing limitations (e.g., radar reflected images and photos' limitations – a false reflection could appear or, due to heavy traffic, the ship's reflection does not have to be seen). The term understanding refers to the relationship between:

1) Bridge team and manoeuvring system, navigation system, communication system and lifesaving equipment,

2) Deck crew, communication system, and pilot boarding equipment, and

3) Bridge team and deck crew.

4. Conclusion

STCW Convention's classification of competences was based on functions on board. On board processes and the accompanying equipment were not analysed at all. Competences do not have to be determined and classified on the basis of on board functions. They can be determined on the basis of the crew's environment analysis i.e. on the basis of the analysis of on board processes. Such an analysis encompasses tasks that have to be done, decisions that have to be made, their executors as well as the equipment needed to do a task or to make a decision.

In order to improve STCW Convention's description of competences, a method of determining competences on the basis of processes on board has been proposed. Activities and tasks that a master and first deck officer do, but did not perform at lower levels of responsibility should be defined more precisely. Only afterwards, competences needed at higher levels of responsibility that were not needed at lower levels of responsibility, could be determined. Furthermore, a more clear and precise listing of knowledge, understanding and proficiency referring to the particular competence should be determined.

So far, the method of prescribing competences has referred to an individual only, i.e. to a crew member. Therefore, this paper proposes a redefined approach to defining competences, which interrelates competences and processes on board as well as devices used. Moreover, a concept of an individual widens to a concept of a subject. In doing so, a subject could be an individual or a team carrying out the same process by using one or more devices. Therefore, not only

competences of a crew member should be analysed in the future, but of the whole team participating in the particular process on board.

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