KNOWLEDGE MANAGEMENT AT MARITIME HIGHER EDUCATION INSTITUTIONS

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Abstract: Knowledge management as a process was defined first time in 1991 and during last two decades was considered as one of the most important processes in all organizations where knowledge is created, captured, stored or shared. Beyond any doubt, maritime higher education institutions (MHEI) belong to the type of organizations where the knowledge management is the most important process. However, the knowledge managed by these institutions may belong to several different frameworks. The most important are: professional knowledge as required by STCW Convention and pedagogical knowledge implemented in learning processes. In this paper, the knowledge management options at MHEIs are presented. Particular attention is paid to two fundamental knowledge frameworks managed in every MHEI. The paper also presents differences and similarities regarding knowledge management at institutions, members of the IAMU, participating in IAMU PAES project development and its implementation.

1 INTRODUCTION

According to the Oxford Dictionary, knowledge includes facts, information, and skills acquired through experience or education, the theoretical or practical understanding of a subject. In a philosophy, it is considered as true, justified belief, certain understanding..

The first attempts to capture knowledge, especially experts' knowledge, happened during 1980's when expert systems entered into the focus of many researchers. According to [6], an expert system is a computer system that emulates the decision-making ability of a human expert. In most cases, the knowledge was represented as a set of facts and their relations whereas the facts are quantitative or qualitative characteristics related to an object.

As modern human societies advanced, the knowledge has become much more important. In the early 1990's knowledge was recognized as important business asset, firstly in high-tech companies and lately practically in all entities, either business-oriented or not. Approximately, at the same time, the knowledge management was recognized as a distinctive management process, highly important for overall success of any social entity. One of the first definitions of knowledge management was offered up Davenport [2] who defined it as "the process of capturing, distributing, and effectively using knowledge." Today, there are many definitions of the knowledge management, mostly reflecting the standpoint and goals of the person proposing it. Girard identified more than one hundred different definitions of knowledge management [3].

In this paper, the knowledge management is understood as the process of creating, sharing,

using and managing the knowledge and information of an organization [3]. It is understood that this definition clearly includes all processes taking place in higher educational institutions, including those offering maritime programs.

Knowledge is usually categorized into two types – tacit and explicit knowledge [9]. Tacit knowledge is subjective knowledge and mostly based on personal experience. As such, it also includes cognitive skills, i.e. it is a mixture of facts, relations, beliefs, intuition, and mental models as well as technical skills and emotions. Consequently, in most cases it cannot be easily expressed in words, sentences, number or formulas, etc. On the other side, the explicit knowledge is objective and rational; it can be documented and transferred to others through various media. It can be much more easily expressed and codified, if required.

According to [10], knowledge is created through "knowledge conversion" i.e. through interactions between the explicit knowledge and the tacit knowledge. According to the authors, knowledge is first created within the individuals and then transmitted to other individuals, i.e. group. The process [9] consists of socialization (individuals share experiences), externalization (the conversion of tacit knowledge), combination (articulation of newly created knowledge), and finally internalization (converted to new tacit knowledge).

Knowledge management processes may be defined as those processes that create, share and use available knowledge base of an entity. The complete body of knowledge of an institution is the subject to different knowledge management processes and it is recognized as its institutional intellectual capital. According to [8] intellectual capital consists of three distinctive constituents: structural capital, relational capital and human capital. Structural capital consists of supportive infrastructure, processes, and databases of the organization that enable human capital to function. According to the [7], relational capital is the value inherent in a company's relationships with its stakeholders and other important constituencies. It also includes knowledge, capabilities and procedures developed from relationships with external agents. Magrassi defined human capital [8] as "the knowledge and competencies residing with the company's employees" and defines organizational intellectual capital as "the collective know-how, even beyond the capabilities of individual employees, that contributes to an organization."

It is beyond any doubt that intellectual capital of any higher educational institution is its most important constituent. As an example, the Journal of Intellectual Capital, volume 19, 2018, devoted a whole issue to the intellectual capital in education. It is equally valid for maritime higher educational institutions. In that respect, a particular attention to knowledge management and intellectual capital has to be paid by the MHEIs, particularly IAMU member institutions because they offer not only BSc, but also MSc and PhD programs.

As a part of the Peer-Assisted Evaluation Scheme project, supported by IAMU, the authors of this paper have visited MHEIs in several countries (Canada, Croatia, Nederland, Philippines, Turkey) where the proposed scheme has been implemented in various forms. Based on the collected data it is quite clear that implemented knowledge management procedures are very different in their scope and goals, while all institutions implement the same knowledge frameworks, i.e. STCW Convention as the professional basis, and student-centred outcome-based education. Accordingly, the following findings are based on experience acquired during the above-mentioned visits. In that respect, authors would like to thanks once again the hosting institutions for their support, patience, dedication and the learning opportunities.

2 MHEIs AND KNOWLEDGE MANAGEMENT

In all the visited countries, the internal structure of the MHEIs is more or less the same as in other higher educational institutions in that same country. According to [1], it seems that it is more harmonized in countries where the government bodies responsible for education exercise their full authority over all higher educational institutions, and in particular in countries where institutions are financed from the public sources.

On the other hand, the internal structures of MHEIs in different countries vary very much. The main differences from the knowledge management standpoint are as follow:

- Participation of the faculty members in R&D activities (human capital development), either within the maritime or related fields, in some countries it is mandatory for most of the faculty members. On the other hand, in some countries faculty members are expected to devote all their time and efforts only to teaching activities, with no or very limited time to be spent on any form of knowledge formation.
- In some countries MHEIs considerably invest in developing relational capital, mostly through relations with students' associations, shipping companies, alumni, other stakeholder, while in other the majority of relational activities are aimed to the active students as the primary stakeholders.
- In some countries institutions' management consider knowledge management as a core part of their duties. Such countries consider the extending knowledge base and ability of the institution to participate or even to influence global or regional processes as an important part of institutional activities (for example, participation at IMO Sub-committee meetings or in international research programs).

The body of knowledge maintained by MHEIs covers, but is not limited to two subject areas. The first one is the professional (maritime) body of knowledge, mostly covered by the STCW Convention, while the other contains general educational competencies (academic body of knowledge). In addition to these two clearly distinguished bodies of knowledge the institutional body of knowledge might contain some other subject areas, in most cases connected with dominant R&D activities such as consultancies, project management activities, and dedicated training programs.

In all visited institutions the structural knowledge (structural capital) is clearly codified in a form of different rules and regulations, and in particular within the ISO 9000 documents. In some countries, these documents are fully digitized and available to all staff members as real working documents. It has to be emphasized that significant part of the structural knowledge may be imposed by the government body responsible for educational institutions (for example, through accreditation or recognition processes). Usually, this part of the structural knowledge is highly codified.

Contrary to the previously mentioned, relational knowledge (relational capital) is codified in much less extent. The parts of the relational knowledge that were found codified in several institutions are the actual relation with alumni and with shipping companies as the most important external stakeholders. It seems that relational capital highly depends on personal qualities of the most prominent staff members, and as such even if codified cannot be easily transferred.

The procedures aiming to maintain the professional body of knowledge have not been recognized. In all the institutions that were visited, it has been assumed that a valid Certificate

of Competency is adequate proof of professional expertise. However, there are certain requirements that may be accepted as updating activities, for example, embarkation on board training/merchant ships for a certain period of time, certain training courses (i.e. ECDIS), etc.

Activities aiming to maintain the academic body of knowledge are even more unregulated. In most cases, academic training takes place before or immediately after the first employment in an institution, and typically lasts for a few weeks, but there are cases that training lasts only few days following IMO Model Course. Periodic refreshment or an upgrade of academic body of knowledge, especially for staff members having maritime background, is provided only occasionally. In countries where you may commonly find significant differences between salaries on board and in an institution are common, the situation is even more demanding because it is not easy to find seafarers with management experience and willing to join an institution, and any additional pressure actually decreases their number.

It seems that the need to define knowledge management procedures in MHEIs is still not clearly recognized, although knowledge accumulation and knowledge transfer are the core part of any educational institution. However, in all institutions visited, a number of knowledge management activities have been recognized although they have not been codified.

4 GLOBAL STANDARDIZATION OF MARITIME HIGHER EDUCATION INSTITUTIONS' KNOWLEDGE MANAGEMENT

Initially, standardization of the maritime body of knowledge firstly appeared at regional levels, in the North Sea countries as well as in Mediterranean countries. Probably the process started in 18th and 19th century, or even earlier. At the beginning, it was mostly through exchange of good practice and spontaneous standardization of working procedures and later on through codified knowledge[1].

Modern standardization began with adoption of the International Convention on Standards of Training, Certification and Watchkeeping (STCW) in 1978. At the time, most of the merchant ships were relatively small ships, the implemented technology was simple, control functions were relatively primitive, and whole transport system was significantly under-optimized with considerable fail-safe areas to be used in case of necessity. The major step forward happened in 1995 when the first set of amendments to the STCW Convention was adopted. A second set of amendments was adopted in 2010. These amendments considered new ship design concepts but also significant advances in different fields, mostly those dealing with automation, control and optimization of different processes as well as with human resource management.

Probably the most important step forward has been introduced by the mentioned amendments where the specifications of minimum standards of competence for different levels of responsibility and functions on-board have been set-up. Standards are presented in tables with four columns specifying the following: Competence (Column 1), Knowledge, understanding and proficiency (Column 2), Methods for demonstrating competence (Column 3), and Criteria for evaluating competence (Column 4). The way that competencies are described clearly refer to Bloom's taxonomy and learning outcomes as main criteria for evaluating the successfulness of the educational process. In that respect, it is worth noting the

[1] Codified knowledge include books, regulations, rules, manuals, guideline on good practice and any other source containing transferable knowledge.

following:

(1) The Competence tables only use Knowledge, Understanding and Proficiency to describe the particular competency. Typical verb references denoting higher-level of learning outcomes (Analysis, Synthesis, and Evaluation) are not used. For example, the verb to analyse is used only in connection with analysis of information obtained radar information. Based on that, one may easily conclude that body of knowledge described in the tables contains only simple, repetitive tasks, i.e. tasks that do not require thorough understanding of underlying processes or any higher-level competency.

(2) The Competence tables do not contain any significant reference to generic (transitional) competencies. For example, the TUNING project [11] described more than 30 generic competencies to be developed and assessed. The only exceptions are the requirements to use the English language for effective communication, leadership and teamwork skills. It has to be emphasized that creative (instrumental) competencies (such as analytical thinking, systemic thinking, critical thinking, creative thinking, problem solving, time management, etc.) are not mentioned.

One may easily conclude that seafarers trained strictly in line with minimal requirements of the STCW Convention will have very tough times if confronted with problems or situations for which they are not specifically trained.

On the other hand, tables of competencies cover quite a wide body of knowledge, and one can argue that it was not possible to specify precisely all the competencies required, especially taking into the account the multitude of jobs and circumstances the seafarers are facing every working day. This is particularly true if recent developments are taken into account (large and highly complex ships, in particular cruisers, containers, LNG carriers, new technologies, highly automated or even autonomous ships, etc.). However, this argument actually emphasizes the importance of generic competencies, in particular those giving the ability to react reasonably in circumstances he or she has never experienced before. Moreover, those competencies are deliberately left out from the tables of competencies. Following the same reasoning, it is easy to conclude that a person fully trained in accordance with given tables of competencies shall not able to assume management positions on particularly sophisticated ships. In fact, the industry has already recognized the situation and tried to solve the problem by introducing a number of specialized trainings, carried out either in-house or by using external trainers. For example, Gundić et al. counted more than 60 different training programs provided for the management positions on LNG ships in addition to competencies acquired in accordance with STCW Convention [4].

In order to ensure harmonized implementation of the STCW Convention, IMO[2] "has designed the series of courses to help implement this Convention and, further, to facilitate access to the knowledge and skills demanded by increasingly sophisticated maritime technology". Each model courses include the Course Framework, General Outline, Detailed Outline, Instructor Manual, Evaluation, and Assessment. Even after a brief look, it is clear that although IMO has done much effort to harmonize the structure of the model courses there are great differences between those model courses. The main differences detected in different model courses are as follows:

[2] http://www.imo.org/en/OurWork/HumanElement/TrainingCertification/Pages/ModelCourses.aspx

(1) Model courses cover a wide range of educational activities, from those covering management positions (for example Model Courses 7.01 up to 7.04), those covering the subjects required for certain on-board duties (Model Course 1.14 Medical First Aid) or duties on certain ships (Model Course 1.03 Advanced training for chemical cargo operations), all the way the duties that are not part of the Convention at all (Model Course 3.09 Port State control).
(2) Several model courses have their compendiums, but not all of them. Several compendiums provide the whole body of knowledge from their field (excellent example is Model Course 1.05 Advanced Training for Liquefied Gas Tanker Cargo Operations).
(3) Model courses without compendium still require prepared course material that is done by each teacher delivering the course.
(4) Some model courses are well conceptualized with the appropriate and detailed guidance notes while others use only general statements and bulleted statements (draft Model Course on Use of Leadership and Managerial Skills, to be approved during HTW meeting in 2018).
(5) Older model course mostly do not use Bloom's taxonomy to describe the target learning outcomes. However, some of them provide very detailed teaching material.
(6) Some model courses uses Bloom's taxonomy but in a very different way. For example, in one model course students (deck and engine officers educating for certificates at management level) are required to "create a management framework based on the aspects of human nature" after listening just few hours of the course.

Regarding the use of Bloom's taxonomy in model courses, it is worthy to mention the submission from China to 2018 IMO HTW Sub-committee meeting, under the title "Proposal on development of an Action Verb Taxonomy for the Detailed Teaching Syllabus applicable to IMO model course development and revision". The proponent calls for unified use of Bloom's taxonomy in different model courses. It is interesting that meaning of the term Proficiency in the tables of competency is extended, and includes not only Application but also Analysis, Synthesis, and Evaluation. It is very questionable whether the definition of the word Proficiency includes reflective knowledge, as defined in the Bloom's taxonomy, and whether such addition can be supported by actual body of knowledge defined in the STCW Convention.

In recent years, the number of model courses proposed for validation to IMO is increasing. For example, in 2014 only five model courses had been proposed while this year (2018) eleven model courses were prepared by Secretariat and proposed to IMO HTW Sub-committee for validation. Many of these model courses are actually revisions of their previous version, but many are also recently developed. In that respect, and having in mind that model courses are predominately pedagogical documents one can ask whether HTW Sub-committee is actually qualified to approve such documents or not, especially taking into account that in many countries model courses are usually taken as mandatory documents [5].

Although majority of model courses cover professional body of knowledge, several model courses cover academic body of knowledge. Probably the most important model courses in that respect are Model Course 6.09 Training course for instructors. It is interesting to follow development of this model course over years. First edition was published in 1991, than the major revision in 2001, and finally the last one in 2016. First edition had 64 pages, the second

one 73 and last one had 82 pages. However, the first edition had the Compendium on 163 pages, the most significant parts being: 3) Development of a learning system, course design, 4) Development of an instructional strategy, 5) Course evaluation and assessment of participants, and 6) Course planning, organization and conduct. According to the new structure, 2016 revision include, a new Part E - Evaluation and Assessment, and significantly extended list of reference materials. Part D – Instructor Manual was changed and significantly reordered by (from 58 pages in 2001 to 32 pages in 2016) excluding some teaching methods and nearly all case studies. Together with Model Course and Compendium, the authors of the first revision also created presentations for each session, specific guidance for teachers and several worksheets and handouts for each session. It seems that authors of the new revisions deliberately decided to offer only the guidance and require of those who will deliver the course to develop their own teaching materials in accordance to the needs. However, the Model Course 6.10 Train the Simulator Trainer and Assessor (2012) retained Compendium on 98 pages and actually has much more practical advices that Model Course 6.09.

It can be concluded that STCW Convention and the accompanied model courses, although not consistent across different subject areas, quite precisely cover professional body of knowledge to be taught in higher maritime institutions. Probably, the additional harmonization of the content of the model courses will be provided in the future. Academic body of knowledge, although having the considerably smaller scope, should be developed beyond standards defined in Model Course 6.09.

When talking about the higher maritime institutions offering education at university level, the level of education specified in STCW Convention and accompanying documents is not enough. Additional efforts should be paid in order to include additional generic competencies and reflective knowledge in the provided programs, in addition to the competencies defined in STCW Convention. In that respect, knowledge management principles, methods and procedures can be useful.

4 CONCLUSIONS

Maritime higher education institutions build their activities on basis of two different bodies of knowledge: professional knowledge, as outlined in the STCW Convention and related sources, and academic body of knowledge. Although not clearly identified, MHEIs have implemented all the important knowledge management procedures: knowledge accumulation and knowledge transfer. Following that, it may be concluded that MHEIs can significantly improve their processes by applying more structured implementation of the knowledge management principles.

STCW Convention as well as the associated model courses, although not consistent across different subject areas, quite precisely cover professional body of knowledge to be taught at maritime education institutions. However, generic competencies, identified as highly required for management positions, are excluded in STCW Convention (apart from few exceptions). Therefore, MHEIs, especially those providing education beyond BSc level, should consider including more generic competencies in their curricula. In addition, despite the efforts of IMO in last few years to harmonize content and methodology used in different model courses, the existing model courses still contain a significant number of inconsistencies, ranging from differences in used terminology up to very different ways of presenting the body of

knowledge. Consequently, MHEIs should be careful when implementing IMO Model Courses, as they only present the minimal standard, not the target level appropriate for university education or required for technologically innovative ships.

Academic body of knowledge, although having relatively smaller scope when compared to professional body of knowledge, is considered not so important and not systematically developed in many MHEIs. Furthermore, there are only few model courses dealing with academic body of knowledge where only the fundamental body of knowledge are presented. Therefore, MHEIs, in particular those offering programs beyond BSc level, should consider implementation of academic standards beyond those defined in STCW Convention and associated model courses.

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