Concerning Intelligent ICT Exploitation in some Maritime Business Organizations: A Pilot Study

O pametnoj uporabi ICT-a u nekim pomorskim poslovnim organizacijama: pilot-studija

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Summary

This paper examines to which extent some maritime business organizations intelligently use their Information and Communication Technology (ICT) resources. The research is done as a pilot study, since it includes relatively small number of maritime business entities from Montenegro, Albania, Croatia, Slovenia and Italy. Our intention was to indirectly check whether these organizations are ready for the adoption and routinization of novel ICT systems like e-Navigation, Maritime Cloud, e-Maritime, National/Maritime Single Window (N/MSW) etc., through assessing how intelligently they exploit existing ICT solutions. Even though all interviewed managers have evaluated knowledge, organizational culture and managerial skills as key constructs that provide the business organizations' success, the level of intelligent exploitation of the available ICT solutions is not high. This is problematic, especially if we bare in mind the necessity of making quick adaptation to the considerably more complex, sophisticated and demanding ICT solutions within the context of actual huge digital turbulence in the maritime community.

KEY WORDS

ICT intelligent exploitation
maritime business organizations
digital turbulence

Sažetak

U radu se istražuje u kojoj se mjeri neke pomorske poslovne organizacije pametno koriste ICT resursima. Istraživanje je provedeno kao pilot-studija jer uključuje relativno mali broj pomorskih poslovnih subjekata iz Crne Gore, Albanije, Hrvatske, Slovenije i Italije. Naša je namjera bila na temelju procjene pametne uporabe postojećih ICT rješenja neizravno provjeriti jesu li ove organizacije spremne usvojiti i rutinizirati nove ICT sustave poput e-Navigation, Maritime Cloud, e-Maritime, National/Maritime Single Window (N/MSW) itd. Iako svi intervjuirani menadžeri znanje, organizacijsku kulturu i menadžerske vještine ocjenjuju kao ključne, u smislu da omogućuju uspjeh organizacije, razina pametne uporabe dostupnih ICT rješenja nije visoka. To predstavlja problem, posebno ako na umu imamo nužnost brze prilagodbe znatno složenijim, sofisticiranijim i zahtjevnijim ICT rješenjima u kontekstu značajne digitalne turbulencije u pomorskoj zajednici.

KLJUČNE RIJEČI

ICT pametna uporaba
pomorske poslovne organizacije
digitalna turbulencija

1. INTRODUCTION / *Uvod*

Although about 90% of the world trade (by volume) and 60% (by value) is performed by the sea [1], maritime business and transport are lagging behind other industries in terms of digitization. The efforts at world scale are made in the direction of more intensive digitization of both ports and ships. However, there are numerous impediments connected with the differences among countries, due to the level of their economical development, along with complex, political and legal issues. There are many of non-Safety of Life at Sea Convention (SOLAS) ships. Besides, maritime community is generally more traditional oriented than other business and industry communities.

The Electronic Chart Display and Information System (ECDIS) revolutionary changed traditional way of navigation in the second half of the 1990s, and there is a tendency for its full implementation at the global level. The concept of e-Navigation is a step forward in comparison to the ECDIS navigational support system. It should provide smooth communications at bidirectional relations ships-ports-on shore safety, legal, business, industry and other entities. It should reduce risks of accidents, environmental impacts, and costs [2, 3, 4]. The Maritime Cloud is conceived in a way to support these communications by means of old, e.g., radio, Navigation Telex (NavTex), Automatic Identification System (AIS), etc., and new communication channels, e.g., VHF (Very High Frequency) Data Exchange (VDES), Navigation Data (NavDat), Narrow-Band Digital Printing (NBDP), and much more over the seas [5].

On the other side, sea ports as enablers of berth-to-berth navigation and key nodes of sea-land transportation use different

ICT solutions like: Electronic Data Interchange (EDI), Vessel Traffic Service (VTS), Vessel Traffic Management Information System (VTMIS), Port Community System (PCS), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) system, access to the Electronic Logistics Marketplace (ELM), etc. Additionally, the concepts of e-Maritime [6], National/Maritime Single Window (N/MSW) and/or Single Window Environment (SWE) are currently in the focus of maritime research community [7, 8].

All these speak in favor of rapid and huge digital turbulence in maritime community, especially for those organizations that function in transitional environments with rigid administrations and without clear development strategies. Within this context, we considered it important to do an examination of how intelligently some maritime business entities in South-Europe (Montenegro, Albania, Croatia, Slovenia and Italy) exploit presently available ICT resources, since obviously their rapid development and expansion are on the road. The research is realized with an aim to identify weak points and to propose directions for their smooth overcoming.

2. METHODOLOGY AND HYPOTHESIS / *Metodologija i hipoteze*

In some of our previous research studies we were focused on the problems of initiation, adoption and adaptation of contemporary ICT solutions in transitional environments [9, 10]. The examinations have been motivated by the users' needs and preferences in developing economies, which are usually faced with permanent reproduction of crises, and constant lack of funds for providing up-to-date, comprehensive and sophisticated ICT systems. Let us note that we were faced with scarce secondary literature resources in the field [11, 12, 13]. In such conditions, we have also considered several theories as a kind of referential framework for our research endeavors under the transitional conditions: Diffusion of Innovation (DOI) theory [14], Technology Acceptance Model (TAM) [15], Theory of Reasoned Action (TRA) [16], Theory of Planed Behavior (TPB) [17], etc.

For the purpose of this pilot study we primary used Intelligent ICT Exploiter model [18, 19, 20, 21]. Additionally, it is worth to mention that respected Information Technology (IT) experts Weill and Ross [22] claim that success in the digital economy will go to the companies that are smart about how they use ICT. Also, we have used references [23, 24] as an inspiration for conceiving our methodological framework.

Intelligent ICT Exploiter model is developed upon several basic constructs connected with business entities and ways in which they realize their businesses activities: knowledge, IT management, internal and external communications, organizational culture, ICT strategy and manager's mindset as key construct which has to bind intelligently all other components. The scheme of this model is given in Figure 1. The detail description of these constructs has been given in [18], and it helps us to set the below described hypothesis.

Information and knowledge. Knowledge is metaphorically a stair of the knowledge ladder which includes data, information, knowledge and wisdom. It is to be emphasized that there is a gap between information technology revolution, and information revolution. The primary idea of free and unlimited share of information failed, since it did not take into account the commercial dimension of the process. Today, information is shared asymmetrically, and those who control the fastest and the biggest computers set the roles [25]. Therefore, the path: data, information, knowledge and wisdom is not an easy one, and it requires considerable efforts towards achieving professional and business success. Accordingly, two most vital tasks in the modern enterprise are: (a) to speed up the creation of new knowledge by both individuals and communities, and (b) to accelerate sharing of knowledge within and across communities.

On the basis of the above stated, we set the first hypothesis in our research framework:

H1. Knowledge is of key importance for the intelligent use of ICT.

Roles and skills. This construct is based on tree pillars: IT users, IT builders and IT managers, or information-knowledge professionals. A person or management team, which communicates the needs of ICT users in direction of IT builders, is knowledge navigator or information resource manager. There are business organizations, which recognized this triangle, and which are working on filling and improving all necessary skills of their employees in this direction [26, 27]. Accordingly, we set the second hypothesis:

H2. Besides IT users and IT builders, IT managers enable more intelligent use of ICT.

Effective system. Such system can be achieved by setting and communicating the so-called Critical Success Factors (CSF) [28], and developing them steadily. The first step is to use technology to create an effective operational platform, primarily with internal information. Then, the CSFs can be widened to foster improved skills to use technology. This will start with employees, and then extend to suppliers and customers. Once when these two steps are working well, the CSFs can be broadened to encompass external information about markets, customers and competitors. After these steps comes business intelligence (see Figure 1), which enable the organizations to identify and manage risk while developing new products, services and markets, which are going to ensure the organization's future.

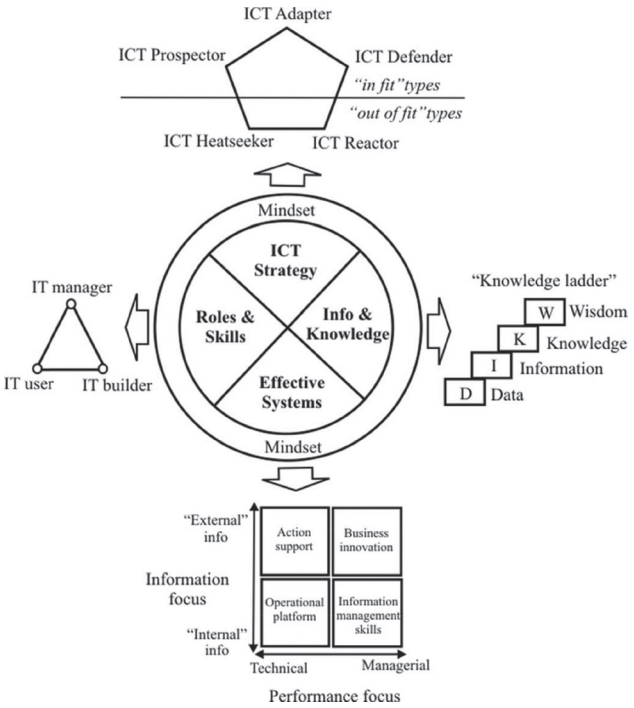

Figure 1 Intelligent ICT Exploiter model [18]
Slika 1. Model pametne uporabe ICT-a [18]

The CSFs can be condensed into the third hypothesis:

H3. Effective business systems have to manage and exploit both internal and external information.

In this context organizational culture is also of particular importance, and we analyzed it as the fourth construct in our model implied by the hypothesis:

H4. Positive organizational culture enhances intelligent use of ICT.

While there is universal agreement that it exists, and that it plays an important role in shaping behavior in organizations, there is little consensus on what organizational culture actually is. We selected several expressions that can be used in absence of an universally accepted definition [29]: "Culture is how organizations *do things*"; "Organizational culture is the sum of values and rituals which serve as *glue* to integrate the members of the organization"; "Organizational culture is civilization in the workplace", etc.

Mindset. For top manager or Top Management Team (TMT), here is used a metaphor: their role is to weave a fabric of horizontal (information, technology, people and organization), and vertical (direction, knowledge, process and climate) threads mutually intertwined. In organizations where knowledge is a core dimension, managers have frequently identified people skills as the major influence, commonly along with climate. Switching from the information-based to the knowledge-based enterprise is a major challenge for today's companies [30]. Therefore, managers have to combine well notions from several different domains: organizational behavior, human resource management, artificial intelligence, ICT, etc. Technology is invariably cited as a key enabler, but not usually a significant overall as skills and climate. TMT mindset unites all considered constructs and it affects the dependant variable intelligent use of ICT. Therefore, the fifth hypotheses should be formulated in a manner:

H5. The TMT mindset is of crucial importance for intelligent use of ICT.

ICT Strategy. It is a strategy, which has to link business and technology. It has to ensure "C" in ICT for communication, which has to be fully integrated into strategic business thinking in both technological and a human sense. It is an assessment tool to help the organization to identify its behavior regarding ICT adoption, and it has five strategic orientations, listed below.

- *Prospector:* Systematically seeks and selectively exploits relevant ICT trends to gain competitive advantage and enable entry into new markets. Prospector is willing to experiment with novel ICT.
- *Defender:* Carefully evaluates ICT investment for its efficient orientation, and applies ICT primary to reduce costs of investments and to increase communication processes rather than to open new markets. Defender is control orientated and slow to innovate.
- *Analyzer:* Operates in two types of market domain - one relatively stable and focused on efficiency, and the other where ICT plays an increasing important role. Analyzer applies different rates of technological uptake in each.
- *Heatseeker:* Sized upon ICT fashioned instead of strategically analyzing the best ICT fit for its business problems. Heatseeker is typical for an organization whose structure is in constant flux, moving to frequent new initiatives before obtaining sustained business performance.
- *Reactor:* Reactor is a characteristic for an organization where technology is not seen as a strategic tool. It responds slowly to change, and tends to view ICT applications as standalone tools.

The ICT strategies we treated as three moderate variables in our research model, since they are influenced by previously considered constructs on one side, and also they have impact on ICT intelligent exploitation on another one:

H6.a. ICT prospector, defender and analyzer strategies help intelligent use of ICT.

H6.b. ICT heatseaker supports in lower extent intelligent use of ICT.

H6.c. ICT reactor impedes intelligent use of ICT.

Since our respondents are from different environments we supposed that H6.a hypothesis worked well, depending on the particular organization and the conditions in which it operated. Heatseakers, we see as those who rarely can provide the so called "3S" (*smart*, safety and sustainable) solutions [31], while reactors might have mostly negative impacts of intelligent use of ICT in highly turbulent technological conditions.

In accordance to the above stated, as a kind of control variable in our research methodology we use a gap between technology-led potential and everyday reality [32]. On this idea we set the seventh-control hypothesis:

H7. A gap between ICT capacities and degree of their exploitation inhibits intelligent use of ICT.

Dependent variable in our model expresses in which extent examined organizations are savvy ICT exploiters. We assess it through several indirect questions and it should be covered by the eighth hypothesis in the following manner:

H8. Developed and harmonized communication between tasks, technologies and employees strengthens intelligent use of ICT.

Figure 2 shows the research framework. On the basis of realized survey we analyzed correlations between independent variables: knowledge, IT management resources, communications, organization culture and manager's mindset; moderate variables: ICT-prospector, -defender, -analyzer, -heatseeker, and -reactor; control variable: a gap between ICT capacities and exploitation; and, dependent variable: intelligent use of ICT. Through this methodological framework, we have tested our hypothesis and opened a space for further discussion(s).

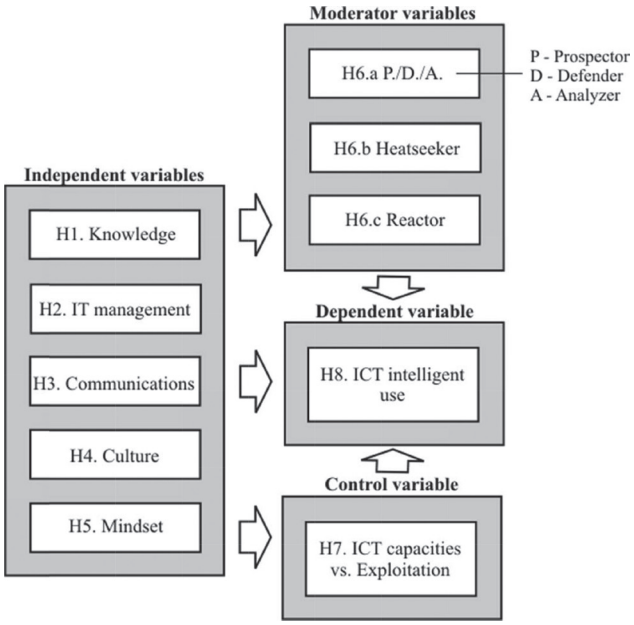

Figure 2 Research framework
Slika 2. Okvir istraživanja

3. RESEARCH RESULTS AND DISCUSSION / *Rezultati istraživanja i rasprava*

For this research, we have conceived questionnaires in accordance with the previously presented theoretical Intelligent ICT Exploiter model and proposed hypothesis. In total 20 highly qualified persons from top management teams at several maritime business institutions in Montenegro (5), Albania (2), Croatia (3), Slovenia (1), and Italy (1) were interviewed. They all have sound experiences in different maritime business sectors, high qualifications and also high level of logical thinking. Before we sent them questionnaires, we had asked several qualified persons from academia to do the semantic reviews and give us suggestions on how to improve them, i.e., how to avoid redundancies and overtax of respondents' patience. The respondents had to answer 25 questions in total. The constructs from our framework were measured with 1-5 point Likert-type multi-item scales. In addition, some questions required descriptive answers, e.g., those which concern methods of communications within the organization with the customers, and those that can help developing business strategies due to the actual flows at the maritime business market. The descriptions given by the respondents helped us also to identify which ICT strategy each organization prefered. The analysis of the obtained quantitative results was performed in SPSS (ver. 16) [33] by an Inter(R) Core™ i5 processor on 2.4 GHz (4GB RAM). Table 1 presents the descriptive statistics for the main analyzed constructs.

According to the statistical results presented in Table 1, it is clear that there is strong positive correlation (we have used nonparametric Spearman's rho, since the overall sample is small) between the dependant variable H8 (communication between tasks, technology and employees) and the moderate variable H6.a (ICT strategy: prospector, defender, or analyzer). Also there is medium correlation between H8 (communication between tasks, technology and employees), and variables H2 (roles and skills) and H3 (effective system). On the contrary, the intelligent use of available ICT is in strong negative correlation with control variable H7 (a gap between ICT capacities and use), i.e., the gap in capacities of ICT and their exploitation. In analyzing the responds, we have realized that respondents highly assessed the importance of knowledge for organizational success, as well as organizational culture and advanced managerial mindsets. However, their estimates obviously do not correspond well with the real level of intelligent exploitation of existing ICT solutions. It means that in all examined organizations more attention and efforts should be made to improve corporate knowledge, organizational culture and climate, and to refine managerial skills and mindsets. Even though dependent variable is in positive correlation with H2 (roles and skills) and H3 (effective system), descriptive results indicate that IT resource management, and internal and external communications should be improved due to the moderate correlation values. The statistics additionally show that there is a strong positive correlation between H4 (organizational culture) and H5 (managers' mindset). The similar is with H3 (internal and external communications) and H2 (roles and skills, or good functioning of IT management).

In order to refine these primary statistical analyses, we have performed factor analysis and identified variables: H2 (roles and skills), H3 (effective system), H6.a, H6.b (ICT strategies), and H8 (communication between tasks, technology and employees), as those with high factor loading values ($\lambda_j, j=\overline{1,5}$). For these selected group of variables Cronbach's alpha is 0.79, which is acceptable, while average variance extracted (AVE) is 0.543, i.e., it is over threshold (AVE>0.5), and composite reliability (CR) is 0.891, and it is also above acceptable limit (CR>0.7) [34, 35]. Values of AVE and CR are calculated by standardized formulas (1) and (2):

$$AVE = \frac{\sum \lambda_j^2}{n} \quad (1)$$

$$CR = \frac{(\lambda_j)^2}{(\sum \lambda_j)^2 + \varepsilon_j} \quad (2)$$

Where,

n - is number of selected constructs ($j=\overline{1,n}$; n=5),

λ - is factor loading, and

ε - is the error variance ($\varepsilon = 1 - \lambda$).

As a result of linear regression analysis we obtained relations between dependent variable H8, and independent ones H6.a, H6.b and H6.c. The results are presented in Table 2. The ANOVA tests in SPSS show that the linear models are significant (Significance, or p-value is in all considered cases lower than 0.05 threshold). All slopes β are positive ($\forall \beta_i \geq 0, i=\overline{1,3}$). Negative correlation between H8 and H6.c is in accordance with negative coefficient α_3 that corresponds to the independent variable H6.c, i.e., ICT reactor strategy, which is considerably less *popular* in comparison to the other analyzed ICT strategies.

Table 1 Means, standard deviations (SD) and correlations
Tablica 1. Srednja vrijednost, standardno odstupanje i korelacije

	Overall sample		Correlations in the overall sample (N=20)									
	Mean	SD	H1	H2	H3	H4	H5	H6.a	H6.b	H6.c	H7	H8
H1	4.5335	0.41074	1									
H2	4.1000	0.80459	-0.008	1								
H3	4.0500	0.56471	0.210	0.567**	1							
H4	4.3000	0.56471	-0.402	0.301	0.129	1						
H5	4.2995	0.57124	-0.284	0.287	0.021	0.793**	1					
H6.a	3.7000	0.44508	0.153	0.306	0.279	-0.022	-0.069	1				
H6.b	3.1000	0.46904	-0.036	0.202	0.450*	-0.076	-0.242	0.355	1			
H6.c	1.4000	0.78807	0.338	-0.283	-0.262	-0.041	-0.018	-0.412	-0.554*	1		
H7	2.2000	0.50262	-0.120	-0.377	-0.515*	0.0200	0.260	-0.182	-0.423	0.554*	1	
H8	3.9500	1.00525	0.072	0.474*	0.463*	-0.199	-0.187	0.562**	0.649**	-0.763**	-7.90**	1

(**p<0.01; *p<0.05)

Table 2 The linear regression analysis results
Tablica 2. Rezultati linearne regresijske analize

Independent moderator variables	$\alpha_i\left(i=\overline{1,3}\right)$	$\beta_i\left(i=\overline{1,3}\right)$	Significance	$r_i\left(i=\overline{1,3}\right)$
*H6.a	0.748	1.206	0.008 (<0.05)	0.575
*H6.b	0.475	2.479	0.004 (<0.05)	0.618
*H6.c	- 0.854	5.146	0.000 (<0.05)	0.710

*Dependant variable: H8 (communication between tasks, technology and employees)

In other words, data given in Table 2 can be used in establishing linear regressions between dependant variable H8 and independent ones Hb.a, H6.b, and H6.c. All linear relations have statistical significance (Table 2), while correlation coefficients are also high ($\forall r_i \geq 0.5, i=\overline{1,3}$). Dependant variable, i.e., the degree of intelligent use of ICT is in positive correlations with ICT prospector, defender, analyzer and heatseeker strategies, and in negative one with ICT reactor strategy. Of course, the choice of certain ICT strategy, which belongs to H6.a and H6.b sets, will depend on the individual preferences and needs of the business entities.

It is important to mention that we did not ask respondents directly in which extent ICT solutions are intelligently used in their organizations. On the contrary, we asked them about this indirectly through the questions: (Q21) To what extent the communication between tasks is developed, technologies and employees in your organization?; and, (Q22) To what extent does ICT serve as a connective tissue in your organization? We consider these as a more reliable way to get information about that how intelligently they use their ICT resources. Also, we asked the respondents about ICT strategies they prefer through the series of questions, which implied both quantitative and qualitative answers. Some of these questions are listed below:

- (Q12) To what extent is it important to carefully analyze the existing ICT solutions prior to their introduction into the organization? + Description. (→Prospector, Defender)
- (Q13) To what extent is the introduction of new ICT solutions risky for the organization? + Description. (→Prospector, Defender, Reactor)
- (Q14) To what extent do ICT solutions reduce operating costs of the organization? + Description. (→Prospector, Defender, Reactor)
- (Q15) To which extent does ICT accelerate business communications and processes? + Description. (→Prospector, Defender, Analyzer, Reactor)
- (Q16) To what extent could ICT affect the strategic development of the organization? + Description. (→Prospector, Defender, Analyzer, Reactor)
- (Q17) To what extent can the existing ICT solutions be adapted to the current business needs of your organization? + Description. (→Prospector, Defender, Reactor, Analyzer)
- (Q18) Are the latest ICT solutions also the best ones? (→Heatseeker)
- (Q19) To what extent is the way of doing business in your organization stabile? + Description. (→Analyzer), etc.

According to the given quantitative and qualitative answers, we have concluded that most of the respondents are prospectors, and also heatseekers, while almost none of them are ICT reactors. A bit surprising is that most of the respondents highly estimated the latest ICT solutions in terms that they are at the same time the best ones. This leaves space for further discussion. It is also important and promising that all of the respondents treat ICT as an important factor for providing business success. Albeit, the level in which the tested maritime organizations intelligently use their present ICT resources has a mean value of 3.95. This assessment indicates the need for further reducing the gap between technology potentials and its real use, as well as, the necessity of extended managerial skills.

The greatest maturity in the mindset and explored constructs can be noticed on the Italian side. The interviewed respondents from Albania come from the maritime company which works in cooperation with an Austrian partner. This cooperation surely supports more mature managerial mindset in the context of ICT "3S" (*smart*, safety and sustainable) use. Montenegro has for decades been in a transitional flux without clear strategic orientation and it permanently suffers the lack of funds for providing maritime ICT systems compatible with EU ones. It seems that the problem in this case is beyond the knowledge and efforts of managers. It could be overcome only through closer and more fruitful collaboration between maritime organizations, stakeholders and the governmental bodies, which are in charge of the maritime sector.

4. CONCLUSIONS / *Zaključci*

The paper points out the digital turbulence in maritime community caused particularly by new concepts such as: e-Navigation, Maritime Cloud, e-Marine, National/Maritime Single Window, etc. This requires well-prepared maritime business and industry actors in terms of the efficient use of the existing ICT solutions and their readiness to adopt new ones. In this regard we did a pilot study among several maritime organizations in Montenegro, Albania, Croatia, Slovenia and Italy (South-Europe) with the aim to evaluate how intelligently they exploit present ICT business solutions. They all highly appreciate key analyzed constructs within the methodological framework: knowledge, IT management resources, communications, organization culture, and manager's mindset. Also, they are all prospectors or heatseekers in terms of ICT strategy, but still the level of intelligent use of the available ICT solutions is not at the optimal stratum. The gap between ICT potentials and their real exploitation is still relatively high. The most promising results are gained on the Italian side, and it is not surprising, since Italy is for a long time an EU member state and enjoys certain benefits in comparison to Slovenia which is considerably smaller and less developed member state, Croatia which has just recently joined the EU (in 2013), and particularly in comparison to Montenegro and Albania which are non-EU member states. By analyzing the respondents' descriptive replies, the differences in maturity of using ICT solutions become obvious. Montenegro and Albania should use Italian, Slovenian and Croatian experiences, since they share the same Adriatic Sea market, as models in terms of transfer and progressive diffusion of good practices in the domain of ICT effective exploitation and further development. It would be desirable that these countries cooperate while

adapting common ICT solutions that would be compatible with current ICT trends in wider maritime community. This should provide them greater competitiveness at the growing, EU and global maritime market. Montenegro and Albania which lag behind Italy, Slovenia and Croatia in this context, should establish closer collaboration with stakeholders and responsible governmental bodies. It can help them overcome the existing gap between ICT potentials and their actual use in everyday reality. Further research experiments in the field should include more respondents from larger number of maritime institutions and also in-depth interviews instead of, or besides the polls. New ICT concepts like e-Navigation, Maritime Cloud, e-Maritime, National/Maritime Single Window, etc., should be explicitly included in the interviews by taking into account the respondents' attitudes towards (each of) them.

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