On Intelligent Use of ICT in Some Maritime Business Organizations

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ABSTRACT

The paper examines to what extent some maritime business organizations use intelligently available Information and Communication Technology (ICT) solutions, and in which manners the existing gap between ICT potentials and their real use on daily basis can be mitigated. As a focus group are identified ten maritime business entities from Albania, Croatia, Italy, Montenegro and Slovenia, which share the common Adriatic Sea market. Selected representatives of these maritime organizations have advisely given responds to the questionnaire, and in such way supported identifying some core problems in the afore mentioned regard, along with deriving some recommendations towards their overcoming in the future. Better internal and external business communications are recognized as key enablers of more effective and efficient exploitation of the existing ICT solutions. Also, better knowledge, skills and organizational culture among management teams and employees are pointed out as main facilitators of more rational and fortunate usage of the ICT systems and tools.

INTRODUCTION

The term "maritime" ultimately deals with the world's ocean. The world's ocean belongs to everyone and it is an essential life support system. Among other things it: absorbs carbon dioxin from the atmosphere; generates up to half of the world's supply of oxygen; provides essential protein for nearly three billion of people; regulates global climate; provides many resources used by humans (Barth and Cowen, 2016; CIT, 2012). Besides, it enables performing more than 90% by volume and 60% by value of the world trade, since sea transportation is still the most-effective way of transporting row materials and goods around the globe (IMO, 2017).

On the other side, marine habitats, near shore ecosystems and coastal communities, face huge pressures that threaten their sustainability, as: climate change; ocean acidification; rising sea levels; variable fish stocks; natural and human-caused disasters, and much more. Albeit the fact, that the world's ocean is playing so many significant roles, the digitalization in the maritime environment legs considerably behind the digitalization in other environments. Additionally, there is a gap between available ICT maritime solutions and their real usage. Certain efforts at world scale are made in the direction of more intensive onboard and ashore digitalization. However, there are a lot of impediments on this road caused by the differences among the countries, the level of their economic development, more or less complex political, legal, and administrative barriers, etc. Moreover, maritime community is generally more traditional oriented than other business and industry communities.

1. ON MARITIME DIGITALIZATION

The Electronic Chart Display and Information System (ECDIS) has revolutionary changed traditional way of navigation during the last decade of the 1990s, and there is tendency for its full implementation at the global level. The main related problems are numerous non-Safety of Life at Sea (SOLAS) Convention ships. Furthermore, the concept of e-Navigation is to be mentioned as a steep forward in comparison to ECDIS navigation support system. International Maritime Organization (IMO) defines e-Navigation as: *"a harmonized collection, integration, exchange, presentation and analysis of marine information onboard and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment"* (Baldauf and Hong, 2016; Benton et al., 2016; Hahn et al. 2016).

Consequently, the Maritime Cloud is developing for the purpose of enabling e-Navigation wider implementation, and it is conceived in such manner to support all related communications by means of old communication channels, like: Navigation Telex (NavTex), Maritime Safety Information (MSI), Automatic Identification System (AIS), Satellite-Automatic Identification System (S-AIS), etc., and new ones, like: VHF (Very High Frequency) Data Exchange (VDES), Navigation Data (NavDat), Narrow-Band Digital Printing (NBDP), and more (Bauk, 2017).

Besides marine navigation, sea ports as enablers of berth-to-berth navigation and key nodes of sea-land transportation, along with other maritime ashore based entities, use different ICT solutions, like: Electronic Data Interchange (EDI), Port Community System (PCS), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) system, access to Electronic Logistics Marketplace (ELM), Vessel Traffic Service (VTS), Vessel Traffic Management Information System (VTMIS), etc. Furthermore, the developing concepts as e-Maritime (Morrall et al., 2016), National / Maritime Single Window (N/MSW), or Single Window / Environment (SW/E) are presently in the focus of both maritime research and business communities (Niculescu and Minea, 2016; Rodseth and Kapidani, 2017).
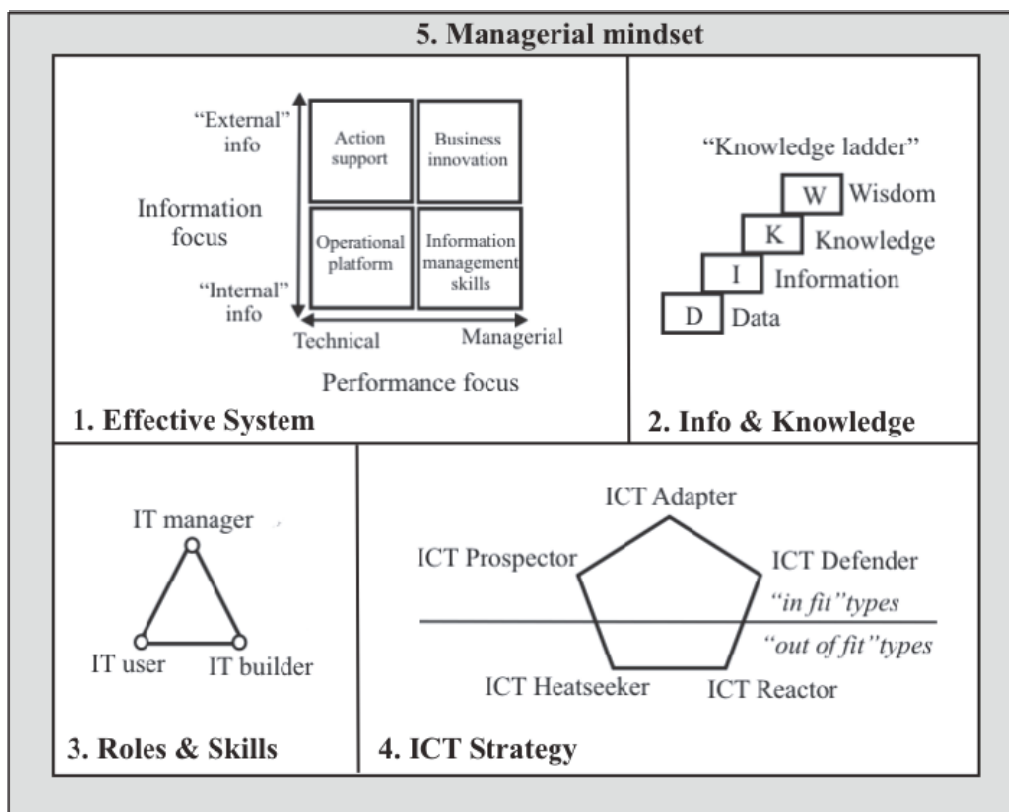
Afore stated speaks in favor of a huge digital turbulence in maritime community, especially for developing business entities, and those which function in transitional environments, i.e., in constant flux, with rather rigid administration structures and without clear development strategies. Within this context, we considered important to do an examination in terms how intelligently some maritime business entities in South-Europe, i.e., in Albania, Croatia, Italy, Montenegro and Slovenia exploit currently available ICT resources, since obviously their rapid development and expansion are on the way. The research is realized with a goal to identify weak points and to propose directions for their seamless overcoming in the nearest future.

2. RESEARCH BACKGROUND IN BRIEF

Within some of our previous research works in the domain of intelligent exploitation of contem-

porary ICT solutions, we were dealing with the problems of conceiving tailored-made ICT models for developing environments, which function in transitional economies (Bauk, 2017). In these attempts, we were faced with the lack of literature resources (Hoskisson et al., 2000; Lau, 2011; Roztocki and Weistroffer, 2015). Nevertheless, while considering intelligent adoption, implementation and routinization of the appropriate ICT models in above mentioned transitional and/or developing conditions, we have considered several theoretical frameworks, as: Diffusion of Innovation - DoI (Rogers, 2003), Technology Acceptance Model - TAM (Davis, 1989), Theory of Reasoned Action – TRA (Fishbein, 1975), Theory of Planned Behavior – TPB (Ajzen, 1991), etc. For the purpose of this pilot research study we have used the Intelligent ICT Exploiter model (Holtham and Corney, 2010; Holtham et al., 2006; Holtham at al., 2004; Stace at al., 2001). It comprises five core elements: business system effectiveness, information and knowledge, specific roles and skills, ICT strategy, and managerial mindset, which integrates the first four components. The scheme of this model is given in Figure 1.

Figure 1. A scheme of Intelligent ICT Exploiter model

Source: adapted from Holtham and Corney, 2010.

This model is based on several premises, which are listed below:

− Knowledge is of key importance for the intelligent use of ICT;
− Besides Information Technology (IT) users and IT builders, IT managers are very important and they enable more intelligent use of ICT;
− An effective business system has to manage and exploit both internal and external information;
− Positive organizational culture enhances intelligent use of ICT;

- The top management team's, or managerial mindset is of crucial importance for intelligent use of ICT;
- The appropriate ICT strategy is of core importance for effective use of ICT;
- A gap between ICT capacities and the level of their real exploitation inhibits intelligent use of ICT;

Developed and harmonized communication between tasks, technologies and employees strengthens intelligent exploitation of ICT, etc.

3. METHODOLOGY

For the purpose of this study, which is a kind of supplement to the previous research works published in the field of intensifying *smart* marine digitalization (Bauk, 2017), we have conceived a questionnaire, which should support the following hypothesis:

H1. Developed communication between tasks, technologies, and employees within a maritime organization can be achieved if there are managers' positive attitudes towards knowledge, meetings, and importance of ICT for business success.

H2. Intelligent use of ICT implies successful internal and external maritime business communications.

H3. A gap in intelligent use of ICT in maritime business organizations is caused by the lack of the appropriate knowledge, skills, and organizational culture.

In order to test above given hypotheses, ten highly qualified persons, with high logical thinking capabilities, from top management teams at several maritime organizations in Albania (2), Croatia (2), Italy (1), Montenegro (4) and Slovenia (1) were interviewed. Before we sent them questionnaires, we had asked few highly qualified persons from academia to do the semantic review and give us suggestions how to improve the questionnaire, and how to avoid redundancies and overtax of respondents' cognitive load. The respondents have to answer twenty-five questions in total. The constructs from our framework were measured with 1-5 Likert's scale (Kenzey, 2017). In addition, some questions require de-scriptive answers in order to give us better insight into the respondents' mindsets due to the examined issue. The list of selected maritime organizations and respondents is given in Table 1. The order of respondents in the following section, which contains simulation re-sults, is randomly chosen and it does not correspond to the order given in the table below.

Table 1. Respondents from the analyzed maritime business organizations

No.	Country	Organization	Respondent
1	Albania	Sigal UNIQA GROUP Austria	Sokol Kapidani
2	Albania	TCN sh.p.k.	Petri Deti
3	Croatia	Hrvatska udruga brodara – Mare Nostrum	Sandro Vidas
4	Croatia	IN2 d.o.o.	Bojan Colnago
5	Italy	Italian Coast Guard	Piero Pellizzari
6	Montenegro	Jadroagent Bar	Dragana Radović
7	Montenegro	Crnogorska plovidba a.d. Kotor	Branislav Kordić
8	Montenegro	Maritime Safety Department	Nexhat Kapidani
9	Montenegro	Maritime Safety Department	Žarko Lukšić
10	Slovenia	Actual IT	Petelin Boštejan

4. THE RESULTS OF THE LINEAR REGRESSION MODELS

In the previous section set hypothesis are tested in this section by the linear regression models in MS Excel, by means of specially imbedded ExcelModules function for this purpose. The analysis of the obtained quantitative results through the poll are performed by an Intel(R) Core™ i5 processor at 2.4 GHz (4GB RAM). Below are described proposed linear regression models, along with the corresponding numerical and graphical results.

Testing H1: Here, we have tested linear regression model established between the dependent variable (dv) and the independent variables (iv_1, iv_2, and iv_3) as follows:

dv: To what extent ICT serve as a "connective" tissue in your organization?

iv_1: In which extent do you use ICT for operational tasks within your organization (e.g., accounting operations; database of employees; database of business partners, etc.)?
iv_2: In which extent can the customers use ICT resources of your organization (e.g., your organizational web site; various on-line users' applications, etc.)?
iv_3: In which extent does ICT allow you to become familiar with the current market trends in the area of your business?

The obtained results are given in Table 2, while the comparison of the real numerical data acquired by the questionnaire (through the Likert's scale) and those obtained by the proposed multiple regression model is presented in Figure 2.

Table 2. Efficient and effective use of ICT caused by flawless internal and external communications
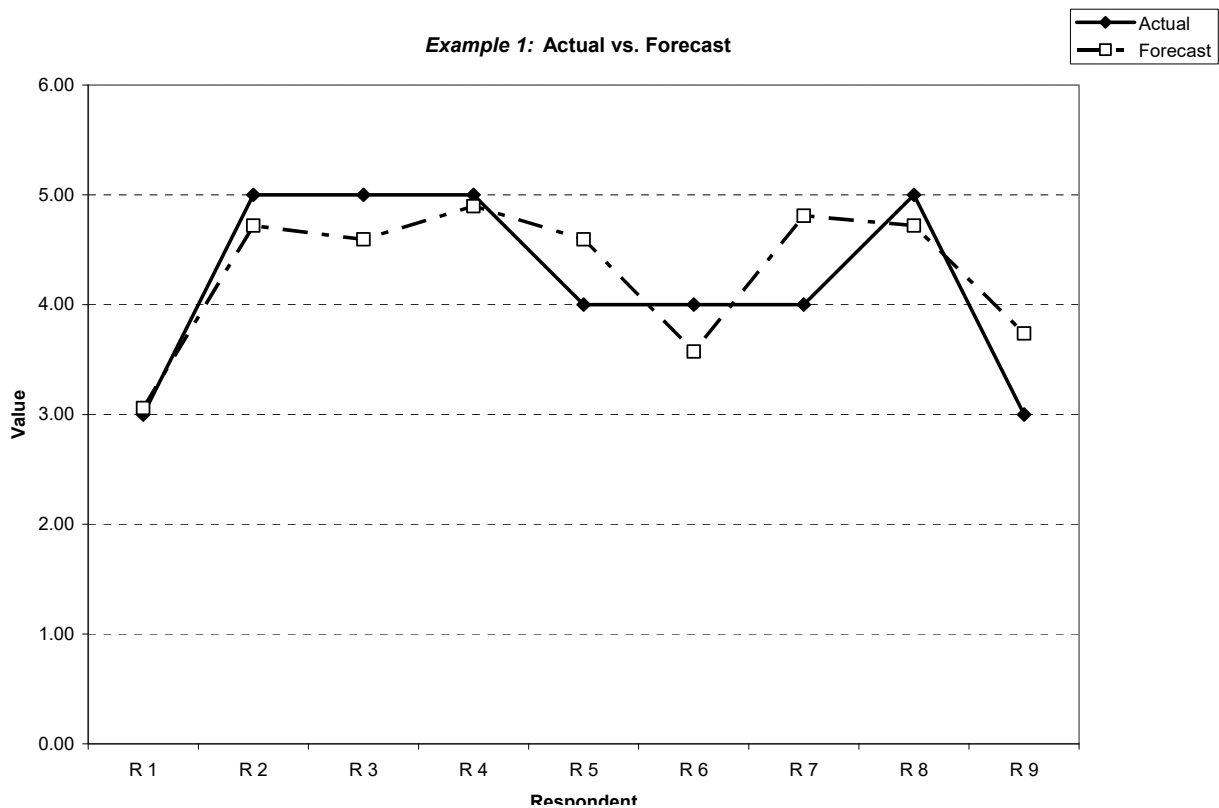
Respon-dent	dv	iv_1	iv_2	iv_3	Forecast	Error	Absolute error	Squared error	Absolute % error
R_1	3.00	3.00	2.00	4.00	3.058	-0.058	0.058	0.003	1.93%
R_2	5.00	5.00	5.00	5.00	4.720	0.280	0.280	0.078	5.60%
R_3	5.00	5.00	4.00	4.00	4.596	0.404	0.404	0.164	8.09%
R_4	5.00	5.00	5.00	3.00	4.898	0.102	0.102	0.010	2.04%
R_5	4.00	5.00	4.00	4.00	4.596	-0.596	0.596	0.355	14.89%
R_6	4.00	3.00	4.00	3.00	3.573	0.427	0.427	0.182	10.67%
R_7	4.00	5.00	5.00	4.00	4.809	-0.809	0.809	0.654	20.22%
R_8	5.00	5.00	5.00	5.00	4.720	0.280	0.280	0.078	5.60%
R_9	3.00	4.00	3.00	5.00	3.738	-0.738	0.738	0.544	24.59%
R_10	5.00	5.00	3.00	5.00	4.293	0.707	0.707	0.499	14.13%
Intercept:	1.320					Average:	MAD	MSE	MAPE
Slopes:		0.556	0.213	-0.089			0.440	0.257	10.78%
	Regression coefficients					multiple-r	0.761	r-squared	0.579

*MAD – Mead Absolute Deviation; MSE – Mean Squared Error; MAPE – Mean Absolute Percent Error (Balakrishan, 2007)

Although there is no specific rule to decide when two variables can be deemed to be highly correlated, in general, correlation coefficient magnitudes of 0.6 and greater, indicate strong relationship. In this example, correlation coefficient, i.e., multiple-r is 0.76, which indicates high correlation among considered variables. Besides, 58% of the variability in the ICT serving as a "connective" tissue in a maritime organization is explained by this multiple linear regression model. So, a good connectivity provided by the appropriate use of ICT implies suitable internal and external communications. Also, it can lead the organization towards better and more meaningful market analysis,

i.e., towards achieving business intelligence benefits. If we realize additional Anova test in SPSS Statistics (ver. 17.0) program (Coakes, 2013; Pallet, 2011), it becomes obvious that this model works as we have previously interpreted for our pilot study, but it does not have, unfortunately, statistical significance. Namely, there is a considerable difference between r square (0.579) and adjuster r square (0.135), and statistical significance is 0.135 that is greater than boundary value 0.05.

Figure 2. Intelligent use of ICT in the context of successful internal and external business communications: actual values vs. modeled ones

Testing H2: Here, we have tested linear regression model established between the dependent variable (dv) and the independent variables (iv_1, iv_2, and iv_3) as follows:

dv: To what extent is developed communication between tasks, technologies and employees in your organization?

iv_1: How much knowledge is important for successful business?
iv_2: How much meetings are important for your organization?
iv_3: How much are ICT important for the successful functioning of the organization and for its business success?

The obtained results are presented in Table 3, while the comparison of the real numerical data acquired through the questionnaire (i.e., through the Likert's scale) and those obtained by the linear regression model are presented in Figure 3.

Table 3. Relation between realizing "C" within ICT and respondents' perceptions of importance of knowledge, meetings and ICT for business success

Respon-dent	dv	iv_1	iv_2	iv_3	Forecast	Error	Absolute error	Squared error	Absolute % error
R_1	4.00	5.00	4.00	5.00	3.769	0.231	0.231	0.053	5.77%
R_2	5.00	5.00	5.00	5.00	4.346	0.654	0.654	0.428	13.08%
R_3	3.00	4.00	3.00	5.00	2.731	0.269	0.269	0.072	8.97%
R_4	5.00	5.00	5.00	5.00	4.346	0.654	0.654	0.428	13.08%
R_5	4.00	5.00	4.00	4.00	3.731	0.269	0.269	0.072	6.73%
R_6	3.00	5.00	5.00	5.00	4.346	-1.346	1.346	1.812	44.87%
R_7	4.00	5.00	5.00	5.00	4.346	-0.346	0.346	0.120	8.65%
R_8	5.00	5.00	5.00	5.00	4.346	0.654	0.654	0.428	13.08%
R_9	3.00	5.00	4.00	5.00	3.769	-0.769	0.769	0.592	25.64%
R_10	3.00	4.00	4.00	4.00	3.269	-0.269	0.269	0.072	8.97%
Intercept:	-1.038					Average:	MAD	MSE	MAPE
Slopes:		0.462	0.577	0.038			0.546	0.408	14.88%
	Regression coefficients					multiple-r	0.640	r-squared	0.409

*MAD – Mead Absolute Deviation; MSE – Mean Squared Error; MAPE – Mean Absolute Percent Error (Balakrishan, 2007)

According to the results given in Table 3, it is obvious that there is a strong correlation between dependent and independent variables in this case, and it is 0.640. Here chosen independent variables described the dependent one in the percentage of about 40%. It means that positive attitudes of the respondents towards knowledge, meetings and ICT importance for business success are not enough to describe using full potential of "C" in ICT (communication among tasks, technologies, and employees). Also, one can conclude that there are some additional factors that might be included into the model, as well. For instance, it might be organizational culture, ICT strategy, narrow specialized knowledge of IT builders, managers, and users, etc. However, this might be the subject area of further investigations in the field. If we want to go a steep further, and test the statistical significance of our model by SPSS Statistics (ver. 17.0) Anova test, then we can obtain that there is again a quite large difference between r square (0.409) and adjusted r square (0.114), while statistical significance is 0.335, which higher than 0.05. This means that the model works as we have above described for the purpose of our case study, but it is unfortunately useless in terms of statistics. To achieve the statistical significance, the second hypothesis should be modified and/or more respondents should be involved into the poll.

Testing H3: Here, we examined the relationship between a gap in intelligent use of ICT within maritime business organizations and the respondents' awareness of the importance of managers' and employees' knowledge and skills, and presence of organizational culture.
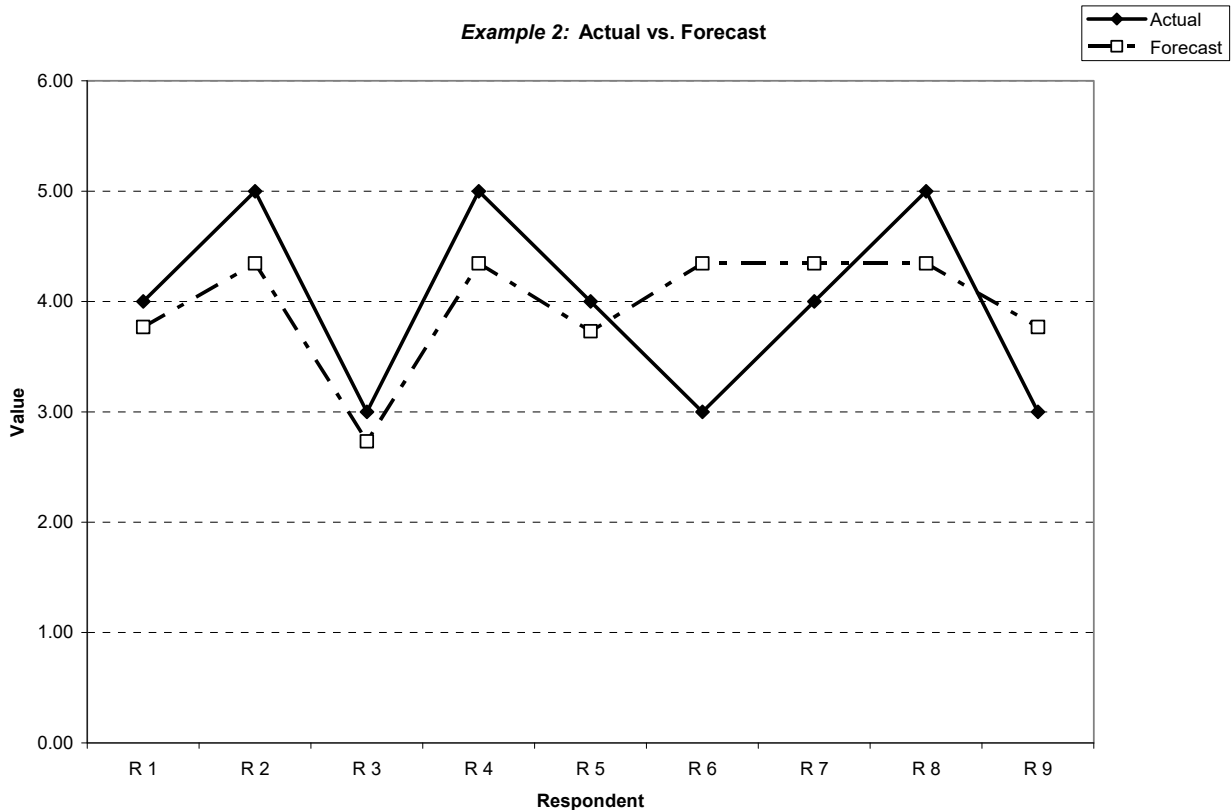
dv: To what extent there is a divergence between the ICT capacities and their real application at daily basis in your organization?

iv_1: How managerial skills are important for effective use of ICT?

iv_2: To what extension are the knowledge and skills of employees important for the efficient and effective use of ICT?

iv_3: How much positive organizational culture and climate are important for the effective use of ICT?

Figure 3. Relation between realizing "C" within ICT and respondents' perceptions of importance of knowledge, meetings and ICT for business success: actual vales vs. modeled ones

Example 2: Actual vs. Forecast

The obtained numerical results are given in Table 4, while the visual comparison of the real numerical data acquired through the questionnaires (i.e., through the Likert's scale) and those obtained by the linear multiple regression model are given in Figure 4.
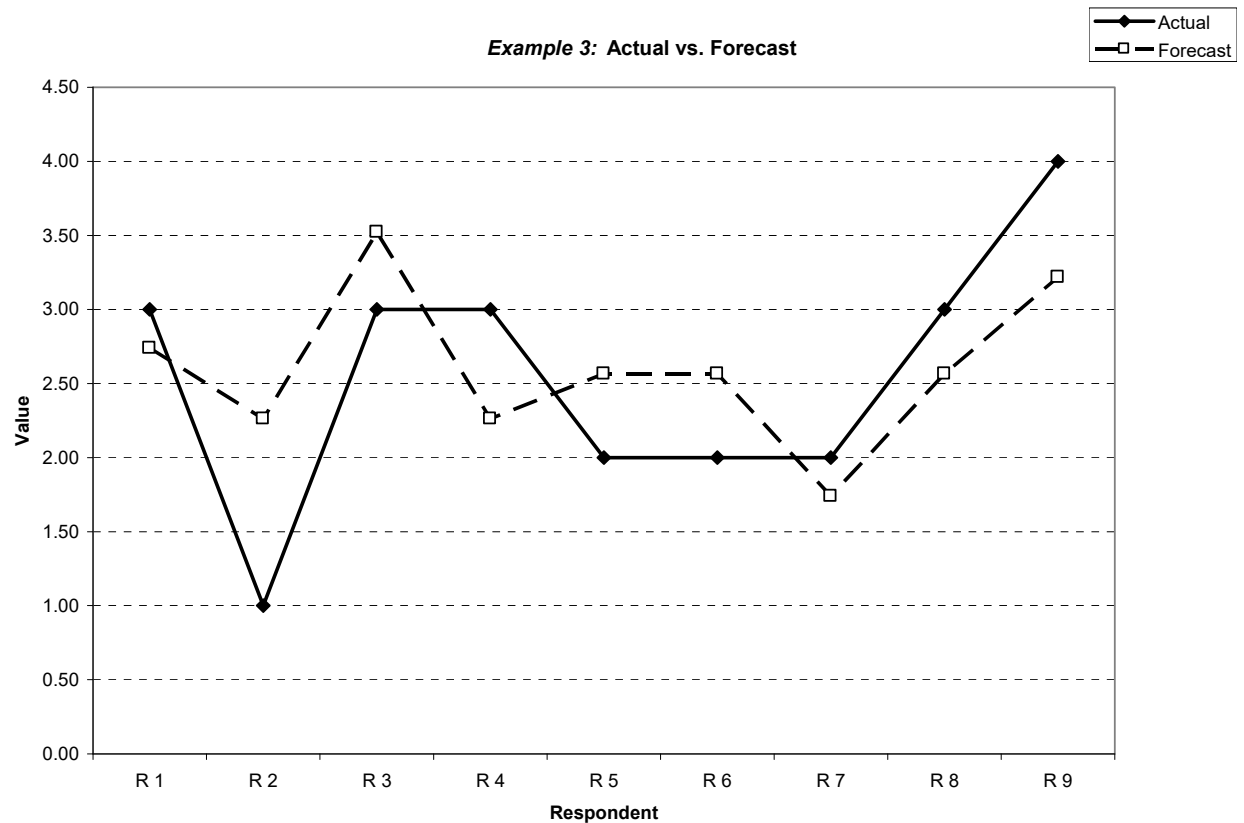
The obtained statistical results indicates that even there is a near to the strong relationship among the variables (multiple-r is 0.590), only 35% of the variability in the gap between ICT potentials and their objective use at daily basis is explained by the model. It means, that awareness of the respondents about the importance of managerial skills, employees competences and organizational culture is not enough strong to neutralize the existing gap. Real managers' and employees' skills and knowledge, along with the organizational culture implemented on the spot, are much more important, and they are the key prerogatives to reduce or neutralize currently obviously present discordance between the ICT capacities and their efficient and effective use in the analyzed maritime business organizations. However, it is not easy to measure them exactly. Like in previous cases, there is a big difference between r square and adjuster r square, and statistical significance of the model is not at the satisfying level. This invokes the need for a larger poll, or modifications of the third hypothesis in our model.

Table 4. A gap between ICT potentials and real usage caused by the lack of knowledge, skills and organizational culture

Respondent	dv	iv_1	iv_2	iv_3	Forecast	Error	Absolute error	Squared error	Absolute % error
R_1	3.00	4.00	4.00	3.00	2.739	0.261	0.261	0.068	8.70%
R_2	1.00	4.00	5.00	4.00	2.261	-1.261	1.261	1.590	126.09%
R_3	3.00	5.00	4.00	5.00	3.522	-0.522	0.522	0.272	17.39%
R_4	3.00	4.00	5.00	4.00	2.261	0.739	0.739	0.546	24.64%
R_5	2.00	4.00	4.00	4.00	2.565	-0.565	0.565	0.319	28.26%
R_6	2.00	4.00	4.00	4.00	2.565	-0.565	0.565	0.319	28.26%
R_7	2.00	3.00	3.00	4.00	1.739	0.261	0.261	0.068	13.04%
R_8	3.00	4.00	4.00	4.00	2.565	0.435	0.435	0.189	14.49%
R_9	4.00	5.00	5.00	5.00	3.217	0.783	0.783	0.612	19.57%
R_10	3.00	4.00	4.00	4.00	2.565	0.435	0.435	0.189	14.49%
Intercept:	-0.043					Average:	MAD	MSE	MAPE
Slopes:		1.130	0.304	0.174			0.583	0.417	29.49%
	Regression coefficients					multiple-r	0.590	r-squared	0.348

*MAD – Mead Absolute Deviation; MSE – Mean Squared Error; MAPE – Mean Absolute Percent Error (Balakrishan, 2007)

Figure 4. A gap in intelligent use of ICT caused by the lack of knowledge, skills and organizational culture: actual values vs. modeled ones

CONCLUSIONS

The paper considers digital turbulence in maritime sector, along with the digital divide among different industries and among developed and developing countries. In the focus are put maritime organizations, which share the Adriatic Sea market: two from Albania, two from Croatia, one from Italy, four from Montenegro and one from Slovenia. Most of them function in developing environment and they are in constant flux. On the other side, like mostly stabile might be treated those from Italy and Slovenia, since they function for a quite long period within joint European Union market and enjoy some of the corresponding benefits. Croatia has recently joined EU. Montenegro and Albania therefore leg behind Italy, Slovenia and Croatia, and they should establish closer and more efficient collaboration with responsible ministries and stakeholders in order to get better positions at growing and developing maritime market.

According to the quantitative analysis of the respondents' answers, the following can be concluded:

− All respondents are highly aware of the importance of knowledge, skills and organizational culture, but there is still considerable gap between existing ICT systems potentials and their real use in everyday business activities.
− Real knowledge and skills of managers and other employees, including organizational culture, are not generally at the satisfying level, since in most of the analyzed maritime business organizations, the ICT tools are not used in their full potential.
− In most of the analyzed organizations, internal and external communications are to be improved in order to allow achieving business success through developing and deploying business intelligence principles and analytical tolls.

On the other side, due to the analysis of the questions which required descriptive answers, we have concluded:

− Most of the respondents are heatseekers or prospectors in terms of ICT strategy. It means that they believe that the latest ICT solutions are at the same time the best ones. Or, in other words, they are mostly willing to experiment with novel ICT.
− Almost all respondents highly appreciate knowledge and skills of both managers and employees.
− They also consider important organizing trainings for employees in terms of getting more knowledge and skills when it comes to more efficient and effective exploitation of available ICT systems/tolls.
− Also, they all consider organizational culture very important for the appropriate use of existing ICT solutions and achieving business success.

Further analysis should include larger sets of both maritime business entities and respondents. Also, some modifications of the proposed hypothesis are to be considered in order to achieve statistical significance in multiple linear regression and other types of cross-correlation analysis among the variables in the model. This is very important in an attempt to ensure intelligent use of the existing ICT solutions, along with the business intelligence benefits for the developing maritime companies in the forthcoming period.

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