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SYSTEMS FOR IMPROVEMENT OF BUSINESS INTEGRATED MANAGEMENT PROCESSES IN PORTS

Abstract: *Based on test results obtained so far, the objective relating to modern scientific methods and approaches has been defined with the intention to develop model which defines new management system integration model, by adopting necessary practical terms of real systems that most frequently circulate in maritime practice in the field of integrated management systems (IMS) in terms of safety and security of vessels and ports. The subject of research is maritime, particularly port services, by way of defining internal and external advantages through adopting integrated management systems. The research will be conducted through theoretical and applied assessments of case study analyses using example of the Port of Kotor H.Co.*

Keywords: *Integrated Management Systems, improvement, KPI, business performance management, process metrics, key performance indicators, fuzzy sets, simulation models.*

1. Introduction

Scientific objective of the research is to develop model and methodology for implementation of ***IMS*** based on case study analysis of maritime sector in Montenegro in various fields of activity as well as define strategy for improving competitiveness on the basis of simulation results from setting up of IMS.

This research will be conducted through theoretical and applied studies verified on the examle of the Port of Kotor Company (hereinafter referred to as Company).

Implementation of several management systems in maritime companies provoked a chain of discussions and dilemmas as to need, method and technique of integration. International organization for standardization (hereinafter referred to as ISO) has not presented any management system integration standard within the framework of its present standards. Experience from the maritime practice indicates that in the last ten years, integration aimed at unification of Procedures and Instructions in the companies for all types of management has not been conducted.

The subject of research is analysis and development of new model in the field of integrated management systems (***IMS***) from the point of view of their structure, basis for integration and analysis of results of its employment that should point up characteristics, reasons, benefits and problems in maritime companies (Arsovski et al., 2012b; Stefanovic et al., 2015; Arsovski et al., 2015). The "forced" approach of integration and development of integration model matching practice in

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global maritime industry have been discussed.

1.1. Objective of research and basic hypotheses

The basic initial hyphoteses of the study are:
X1 – in the quality system structure, management has not been defined in all operating systems of maritime companies (ports) due to absence of integrated management system;

X2 – it is possible to develop port service integrated management model from the point of view of quality, environmental protection, safety and security.

2. Systemic approach

Modern management founded on modern systemic approach develops innovative methodologies based on setting up effective management system with fully integrated processes. Taking into consideration that it is hard to draw distinct line between the systemic approach and the system and that sub-systems in maritime practice are often mutually dependant and operate within only one system, the objective of the research relates solely to construction of adequate conceptual model (as separeate and back-up tool for efficient solution of realistic and abstract problems faced by maritime companies which do not possess integrated management system.

As appearance, evolution and mutual upgrading of general systemic theory provide development of new approach for solving problems based on systemic or advanced scientific approach, problems generated in maritime practice call for study of the entire system (Kalinic et al., 2011).

2.1. Setting up IMS in ports – diagnosing present condition

Management process in companies in Montenegro is iterative by its nature and has cyclical character.

In the initial phase, ports generally define their systemic approach as:

- Directive or a rule of operation with accompanying modifications;
- Undefined form of general and individual problems as single entities (systems) with minimum application of modern practical and scientific tools;
- Minimum employment of systemic management theory, which does not integrate, widen or upgrade total quality management;
- Inapplicable systemic approach, through defining opportune classic approach and "behavioural superstructure" (Tauzović, 2002);
- Postulates which do not define elements of the system, relations among the elements, features of the elements and their mutual relations (example "Network of processes of the Port of Kotor") (Popović, 2012a);
- Operating instructions with minimum application of system block-diagram. That is the reason why all activities performed in business operations of maritime companies are more or less questionable.
  In practice, it is reflected in:
  - Uncertainty in achieving Policy and Objectives of Quality as driving force of activities;
  - Uncertainty that is defined in the entropy of external and internal environment in which such activities are carried out (Orlandić and Popović, 2013);
  - In necessity to set up ‘proactive management’ in external and internal environment what may lead to significant success in attaining desired targets.

2.2. Why integrated management systems

Currently, the ports of Montenegro are undergoing the smallest extent of successive installation of integrated management system.

The integration approach of the ports involves:

- Approval for making integration plan,
- Initial specification of phases,
- Adoption of business policy,
- Adoption of strategic and tactical initiatives and
- Defining set objectives.

Problem of implementation of defined integration involves:

- Identification of the integration need itself because it is evident that there is non-compliance between requirements of ISO 9001 and the conventions (SOLAS, MARPOL and LOAD LINE) on one side and state laws and obligatory procedures in ports (Orlandić and Popović, 2013) on the other.
- Lack of connection in requirements of new standard ISO 9001:2015 and management system (MS) in ports,
- Failure to define the scope of integration compared to requirements of port service users and IMS regulations.
- Subsequently set up management systems which are in collision with previously installed management systems (Pavlovic et al., 2011).

In maritime practice, ports set up integrated management systems to the smallest possible extent, bringing them down to the initial phase which is typical only by minimizing documentation and lacking defined measures for improving characteristics of the system (dinamics, stability, adaptability and so on).

2.2.1. Reasons and benefits from employment of IMS superstructure

Internal test results have given useful information (weaknesses of the system) such as:

- Processes and equipment are not able to meet required safety conditions;
- Not documented – the efficiency of the system and the processes in the Company;
- Not documented - overview of continuous improvement of the processes by way of employment of quality tools (Popović, 2012b);
- IMS does not integrate all current formalized systems focused on quality, environmental protection, health and safety (Popović et al., 2014; Rankovic et al., 2012);
- Processes and documents describing them should be integrated;

2.2.2. Setting up IMS superstructure

In the phase of selection of the project of setting up of the IMS superstructure, top management team (Board of Directors of the Port) has specified target values of total quality management (TQM), which is based on systemic approach:

- The example of analysis of questionnaires and assessment of port services after application of IMS in the Port of Kotor (Ansoff, 1995);
- Analysis and forecast of dynamics of number of passengers from vessels, on cruise voyages in reference Mediterranean ports (Popović, 2016).

2.3. Specification of the scope of integration in the Port of Kotor

Specification of scope of integration is carried out on the basis of assessments given

by port service users, internal requirements and ISM regulations.

According to (Arsovski et al., 2010), in specification of the scope of integration, the synergic model of integration (Figure 1) plays important role.

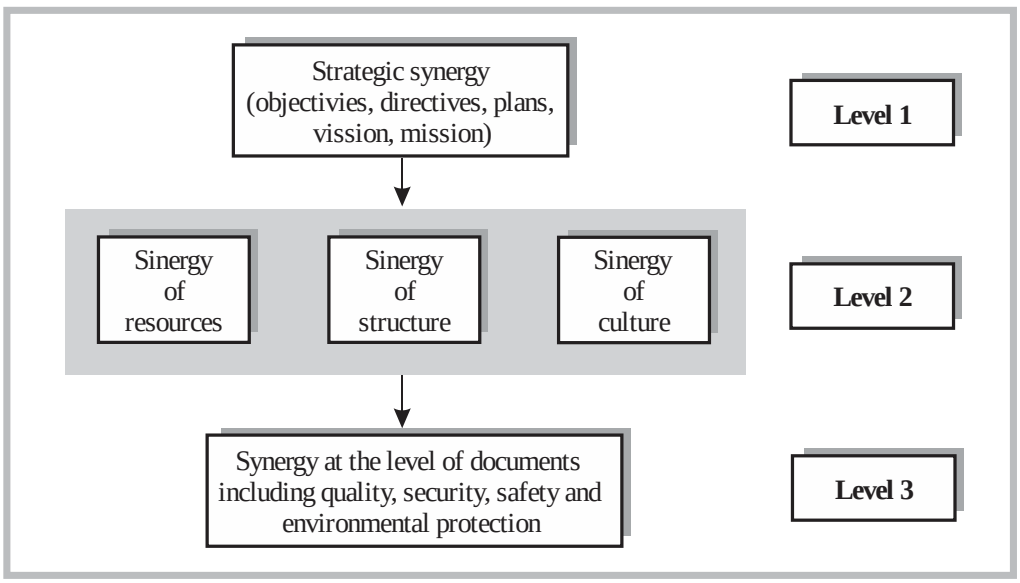

Figure 1. Synergic IMS model (Arsovski et al., 2010)

2.3.1. Setting up IMS superstructure

Problems of strategic management in maritime industries and port systems themselves are dealt with inadequate academic and expert attention. The most important reasons for this state of fact are inadequate analysis of the theory and application of advanced systemic approaches, failure to implement integrated management systems and unwillingness to accept total quality management.

Based on the above, this research as scientific task has multiple objectives due to the facts that modern technologies (Arsovski et al., 2012a; Arsovski et al., 2012c) as well as advanced procedures for solving practical problems faced by maritime industry have been used and also by offering possibility of more detailed and more efficient study not only of its particular sections but the entire maritime industry as a special uniform system.

In maritime industry, creation of strategic elements involves making relatively short-term decisions with long-term implications, what is basic feature of strategic management (Tauzović, 2001).

As each, including strategic management in maritime industry, is based on scientific researches and practically accepted procedures of solving its problems, the initial research uses modern systemic approach which comprises total quality management. This situation component represents a synthesis of the study of the specific problem, its solution and making adequate decisions.

Synergic model of integration proceeds from the *level 1* which defines strategic elements of the Port of Kotor as explained by Hoshin process of diffusion (Figure 2).

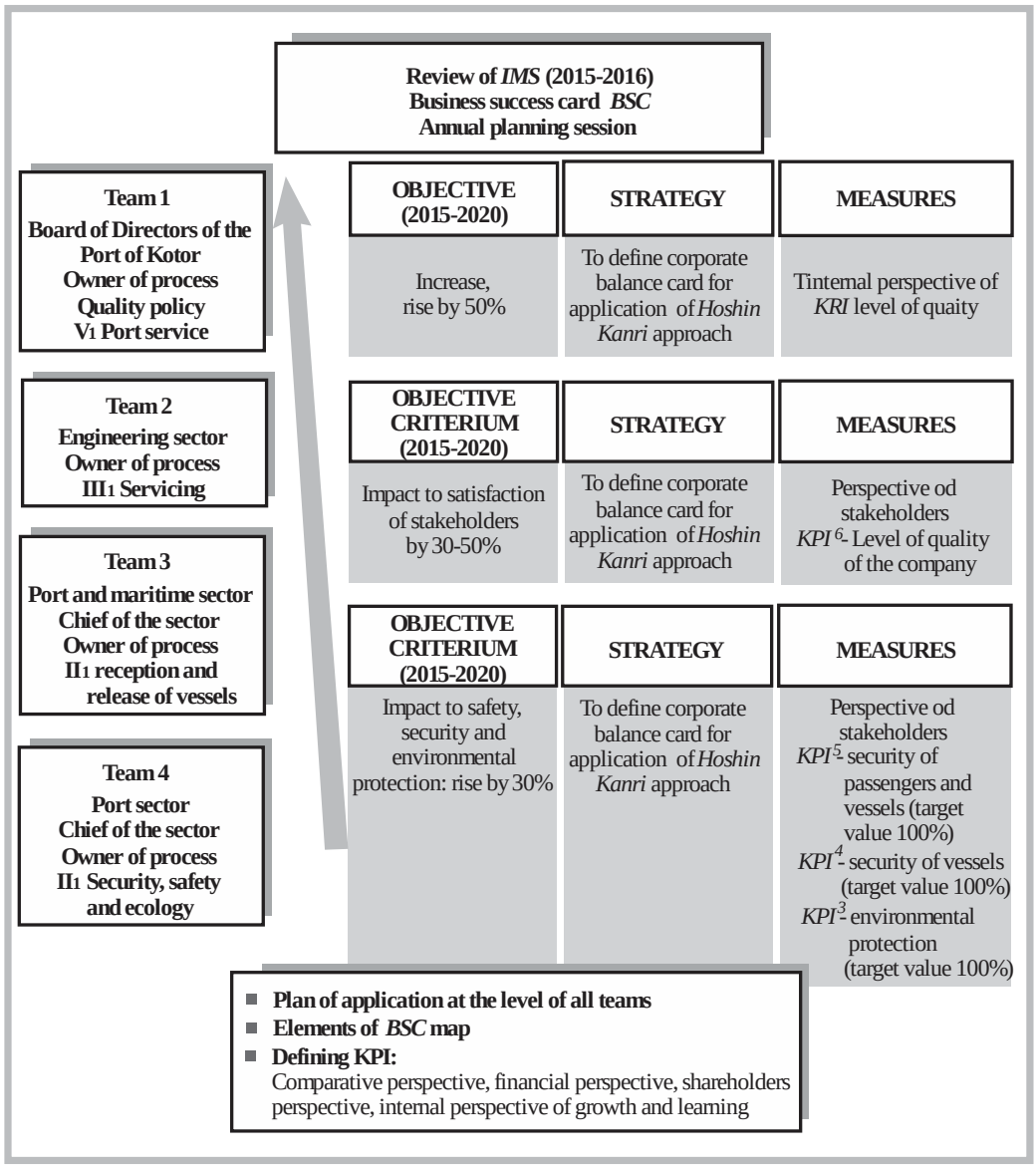

Figure 2. Hoshin's process of diffusion (Popović, 2016)

Strategic management process of the Port of Kotor (hereinafter referred to as Company) is viewed as continuous, iterative process involving analysis of the neighbourhood, orientation of the organization (mission and objectives), formulation of the strategy, implementation of strategy and strategic control (Drucker, 1991).

Steps in the strategic management process may be seen on the Figure 3.

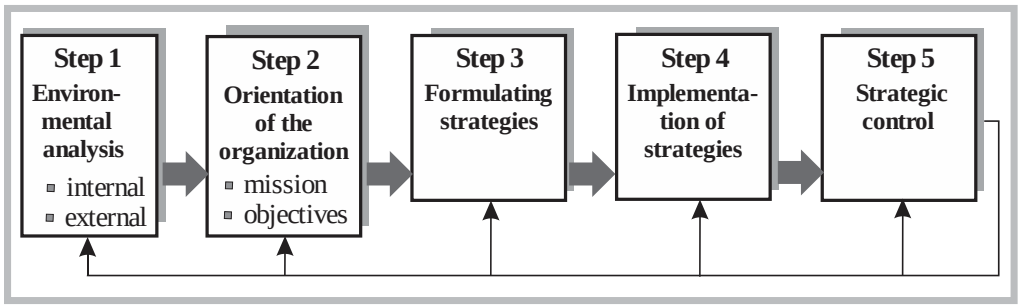

Figure 3. Main steps in the strategic management process (Arsovski, 2013)

2.4. Defining competitive synergy (SWOT analysis of the Port of Kotor and Mediterranean ports)

Synergic model of integration at *the level 2* defines competitive synergies pursuant to analytical approach (Hussey, 2002). The Port of Kotor has carried out strategic detailed testing of each segment of the Company. Actual operating abilities of the Company have been ascertained so as sensitive areas (such as dependency of the Port of Kotor on port service users), effectiveness and degree of flexibility of the Company in "facing" sudden changes on the maritime and passenger transport market.

Figure 4 shows SWOT matrix on the example of the Port of Kotor, while Figure 5 shows analysis of comparison of the average rate of number of ships. Also, Figure 6. shows SWOT matrix at the example of maritime ports in Croatia-research reproduced and modified.

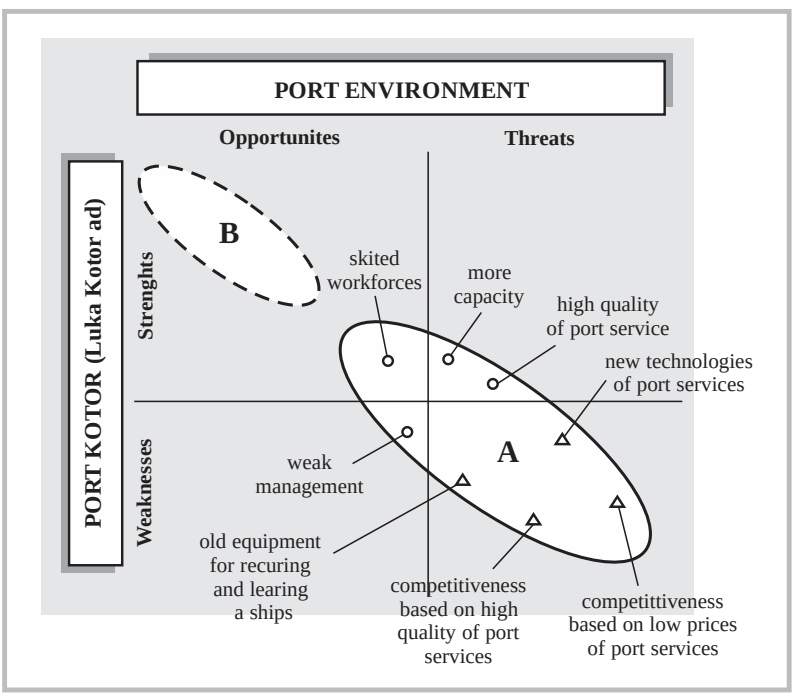

Figure 4. SWOT matrix on the example of the Port of Kotor (Popović, 2016)

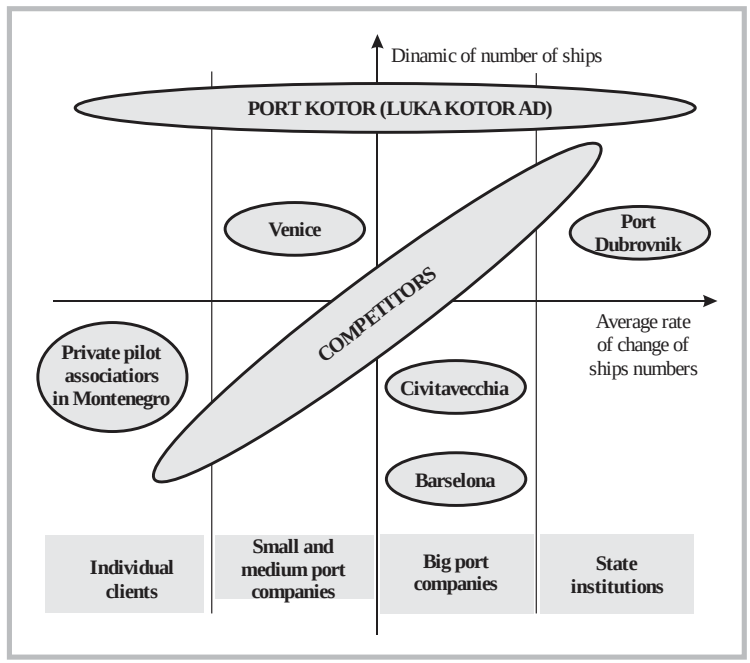

Figure 5. Analysis of comparison of the average rate of number of ships (Popović, 2016)

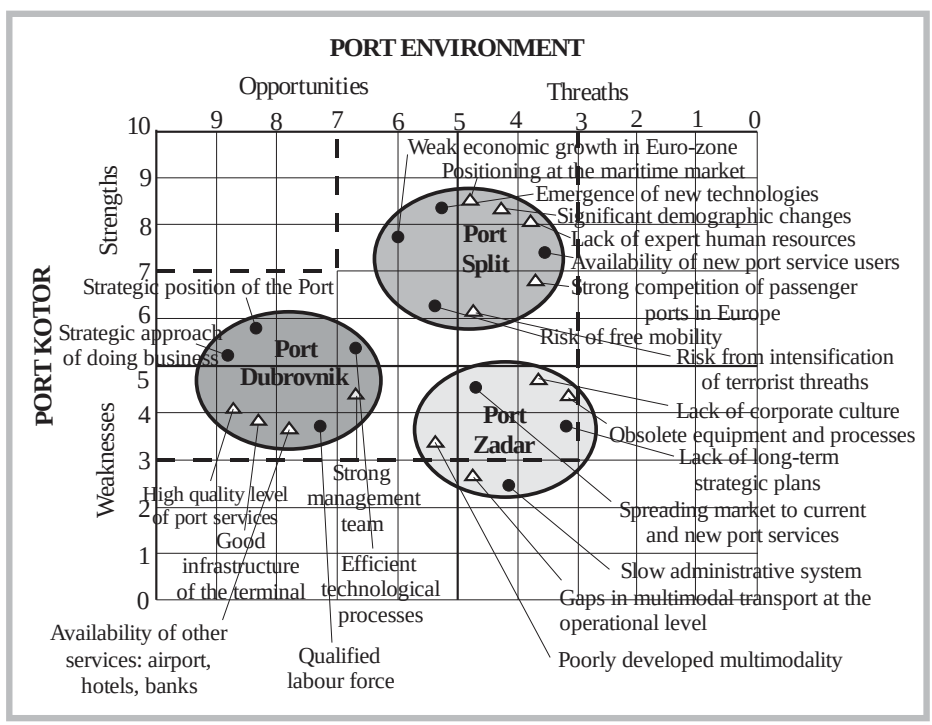

Figure 6. SWOT matrix at the example of maritime ports in Croatia-research reproduced and modified (Popović, 2016, Arsovski, 2002)

Based on the research conducted by the authors (Popović, 2016), financial and strategic objectives have been defined, pursuant to testing of the functional systems, tested competences and operating ability of the processes and technologies in the Port of Kotor and developed Mediterranean ports. In terms of the Port of Kotor, transition from area A to the area B calls for growth of competitiveness, permanent training of port personnel and upgrading of port infrastructure.

2.4.1. Analysis of the Port of Kotor competition from the aspect of comparison of the average turnover rate of vessels and passengers in reference Mediterranean ports

For the purpose of analysis and forecasts for dynamics of number of passengers from vessels on cruise voyages, comparisons have been made between the Port of Kotor and reference Mediterranean ports. Basic technique applied for defining competitive advantage in the research is SWOT analysis. Maritime strategy is drawn up by way of identification of sources of competitive advantages in the area of external threats and internal weaknesses of the Port of Kotor and those of the developed Mediterranean ports. The competitiveness analysis is conducted in four phases.

In the first phase, expert groups select ports listed in the Arrival plan of the two most frequently accommodated vessels in the Port of Kotor and in the developed Mediterranean ports (Figure 7). The research defines interaction of the Port of Kotor with the maritime market neighbourhood.

Figure 7. – Sample for analysis – large vessels „MSC Armonia“ and Celebrity Solstice (Popović, 2016)

In the second phase, representatives of the teams are formed. The teams started research by way of application of Port of Kotor IMS procedure “Acceptance and release of vessels” and data obtained by agents of the selected vessels (*Pilot card dokument*) (Popović, 2016).

In the third phase, the expert groups and team representatives assess efficiency and competitiveness of the Mediterranean ports using SWOT analysis. Representatives of the teams have conducted analytical benchmarking of port, maritime and logistic services of the Mediterranean ports. Test results of the analysis are used to pinpoint deficiencies and weaknesses and use these specific aspects as priority areas for upgrading maritime strategy.

In the fourth phase, the expert groups create strategic elements transforming them into tactical and operational projects of upgrading quality (Hutchins, 2008).

2.4.2. Analytical approach of port and logistic services of the Mediterranean ports

Generally, previously published literature treating strategy emphasizes assessment of strength and weaknesses of companies as a critical step (Hussey, 2002) (Figure 8, 9).

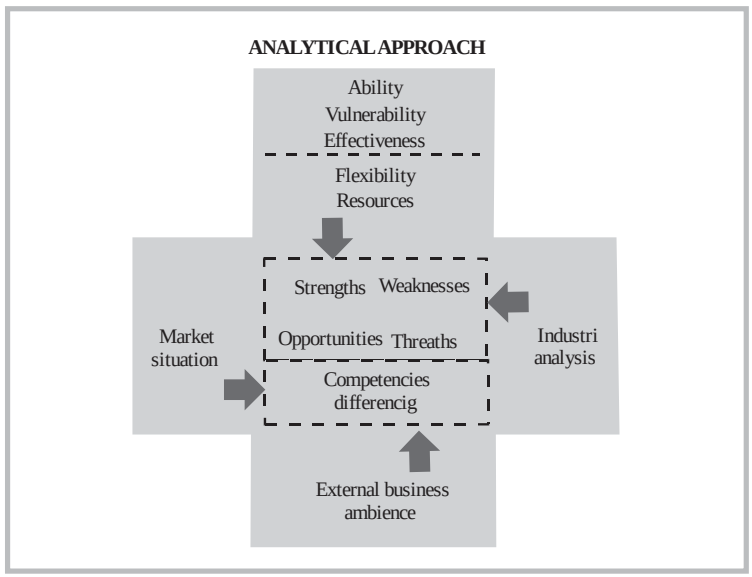

Figure 8. SWOT analysis – analytical approach (Hussey, 2002)

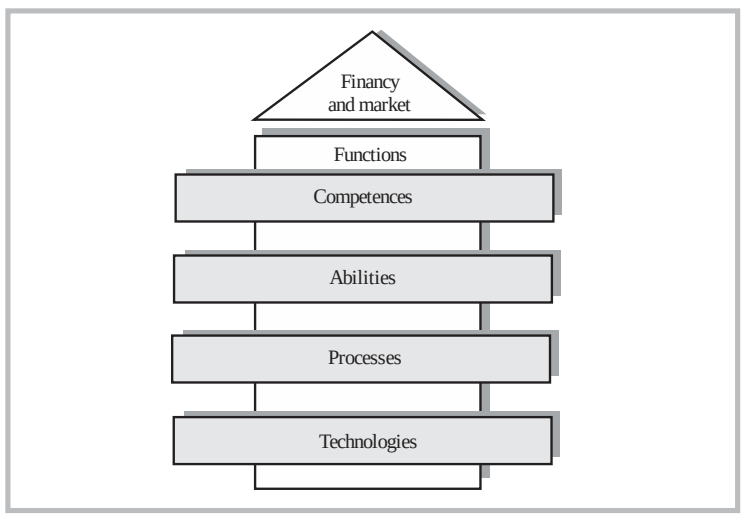

Figure 9. Testing achievements of financial and strategic objectives-reproduced and modified (Hussey, 2002)

Such researches define the profile of operating ability, or more precisely, synergy of internal and external evaluations and competency as well as capability of processes and technologies generating financial and strategic goals (Hutchins, 2008) was required. Testing of ability is based on fine differences between the approaches of substantial competency and substantial ability suggested by experts (Stalk et al., 1992).

2.4.3. Forecasts for dynamics of number of passengers and vessels–(Port of Kotor-Mediterranean ports)

The research refers to forecast of dynamics of number of passengers and vessels in the

developed Mediterranean ports and the Port of Kotor. The analysis is conducted by the correlation analysis method and it is presented by second level polynomial regression model. The method indicates that the Port of Kotor shows trend of almost constant growth at the same annual rate, while in terms of number of vessels, the model indicates growing trend with somewhat lower assessment of annual growth rate.

The Figures 10, 11, 12 bellow, show graphic presentation of port ratio compared to projection of the annual rate of turnover of number of passengers and annual rate of turnover of number of vessels:

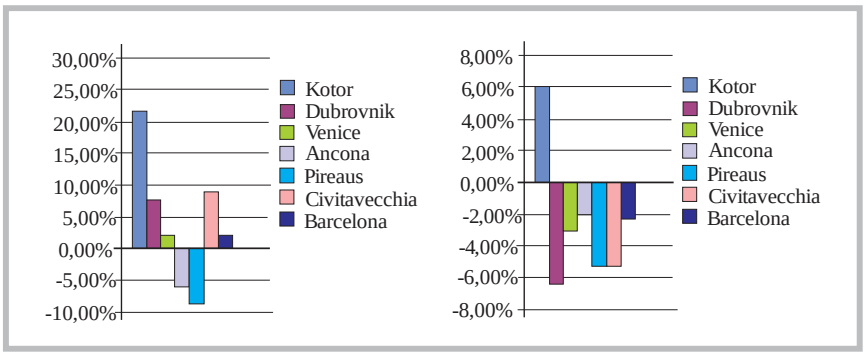

Figure 10. Annual rate of turnover of number of passengers and vessels (2010 - 2015) (Popović, 2016)

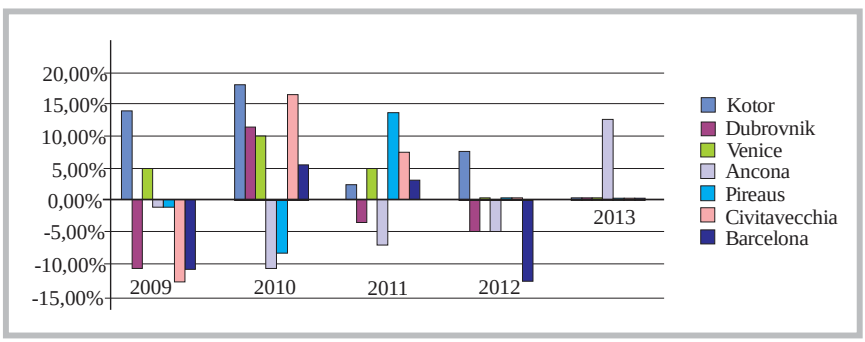

Figure 11. Average annual rate of number of vessels (Mediterranean ports 2009 - 2013) (Popović, 2016)

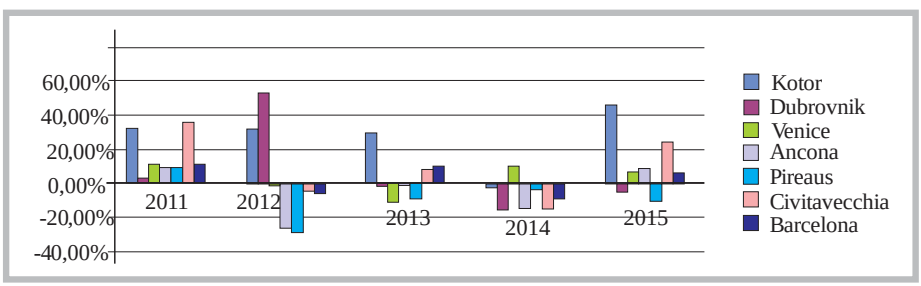

Figure 12. Annual rate of turnover in number of passengers (Mediterranean ports 2011 - 2015) (Popović, 2016)

3. IMS MODELS

Integrated management systems (***IMS***) are based on fundamental postulates of systemic and process approach, out of which integration model is generated.

3.1. Comparison among IMS models

In the relevant literature and practice there is certain number of models (Table 1).

Table 1. Comparison among ISM models (Popović, 2016; Wilkinson and Dale, 2001)

Number of integration systems		
1.	Wilkinson-Dale model (Wilkinson and Dale, 2001);	3 (***QMS, EMS, OHSAS***)
2.	Model of Karapetrović (Karapetrović and Jonker, 2003);	5 (***QMS, EMS, OHSAS, CSRMS, FMS***)
3.	Motor model (Karapetrović and Jonker, 2003);	4 (***QMS, EMS, OHSAS, CSMRS***)
4.	Model Brewer-Nash (Rocha and Karapetrović, 2005);	3 (***QMS, EMS, ISO/IEC 27001***)
5.	Synergic model (Zeng et al., 2007);	3 (***QMS***, ***EMS***, ***OHSAS***)
6.	EFQM model (EFQM, 2002);	2 (***QMS***, ***EMS***)
7.	Process model (Perović, 2008);	***n*** system, primary: ***QMS***, ***EMS***, ***OHSAS***, ***HACCP***
8.	Model: **AS/NZS 4581** (PAS 99:2006, 2006)	3 (***QMS***, ***EMS***, ***OHSAS***)
9.	TOK Tauzović's general continuum as innovative IMS (Tauzović, 2009)	*Comprehensive concept*

3.2. Application of models (EFQM QMS, EMS) in the Company

The research indicates that marine companies in Montenegro generally implement only „base IMS“ with mostly ISO 9001:2008 making the “core” of integration, while the Mediterranean ports implement other integration designs (structure so called **EFQM model European Foundation For Quality Management)** (EFQM, 2002).

The Port of Kotor has adopted and set up an integrated management system pursuant to ISO 9001, ISO 14001 specifications, two quality management systems, out of which one of is linked to environmental protection management. The systems are integrated and do not exist independently. The follow-up of the previous research is based on the analysis and development of new approach in the field of integrated management systems (IMS) from the point of view of quality, environmental protection and safety of vessels and ports.

The Company has adopted the aforementioned international standards and specifications for partial management systems.

Characteristic of application of the synergic model *(level 3)* in the Company is reflected in the following:

- In the projected independent systems;
- In setting up coherent systems of non-integrated management system components;
- In ISM concept which does not involve set of interconnected

processes that use common resources for meeting requirements of all interested parties and port service users.

The aim of the research is to prove that the Company should implement new model of integration (QMS, EMS i SMS) whose functioning should be based on:

- Cybernetic model within the procedures (ISO board 292 and series 28000 standards).
- Set of procedures and instructions defined in the Security plan of the Port;
- The phases of benchmarking process (Popović et al., 2013)
- New cybernetic model of the system so that certain elements have meaning in the process network as:
  - Input (desired behaviour of the system);
  - Output (variables that should be controlled);
  - Comparators (fault finding, differences in input/output). Example: Management parameters defined according to requirements of standards (QMS II "Port operations" security process and operation of the Port) (Popović, 2012b).

4. Model of integrated management as condition for improving quality in the Company

The Company management systems contain certain common elements that may be managed integrally, as essential unity within the entire management system.

At the organizational level of the Company, the management system itself does not fully integrate common aspects of individual systems and it is evident that duplication occurs. Activities aimed at improving quality involve:

- Defining objective which comprises common elements for improvement of effectiveness of business operations and efficiency of the Company,
- Defining common components and methodology for easy connection with demands of individual functions.
- Internal management practice, installed in one system, without separated components (for example security system of the Company, taking into consideration specific requirements related to level of confidentiality of specific elements of that system).
- Integration of partial systems of parts of management with no distinct line between individual processes and activities.

4.1. Creation of vision as quality improvement operational activity

According to researches conducted by the authors (Ansoff, 1995), Hoshin management is linked to strategic planning and **BSC** method – (*Business Scorecards*). This method is used for improvement of quality and as a method in the Company, we employ creation of vision as an operational activity to the quality policy, what implies that strategic elements (vision and mission) convert into tactical and operational projects for improvement of quality (Arsovski, 2016), what is shown on Figure 13.

The Figure 13 clearly shows that the proposed model has three key sub-models and they are: *Hoshin* planning, *Hoshin* diffusion *and Hoshin* management (control).

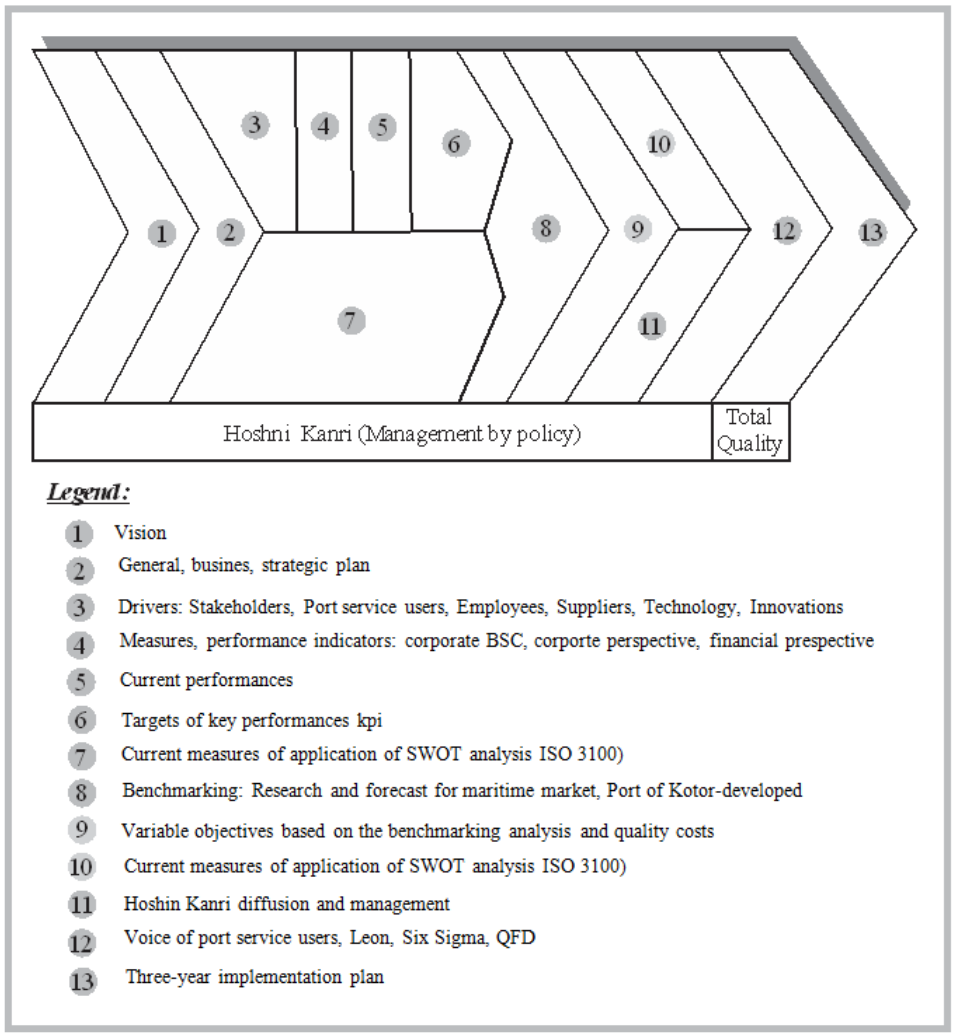

Figure 13. From creation of vision to improvement activity (Popović, 2016; Arsovski, 2016)

The phase (1-Strategy) and (2-Vision) on (Figure 13) are previously described in the reseach (Popović, 2016). The phase (3) – Drivers as phases (4, 5, 6, and 7) are also described in the previous study (Popović, 2016). The phase (8) relates to application of business intelligence which usually refers to application of benchmarking study (Figure 10 – 12).

The phase (12) is described in detail in the chapter (4), and the phase (13) is acquired by application of the project management methods based on project risks.

4.2. Application of Hoshin Kanri approach to the strategy of port service quality improvement

Based on the adopted vision, mission and business KPI, Business scorecard (Figure 14) has been defined and it adopts perspective for growth and study, internal perspective, perspective of stakeholders, financial perspective and corporative perspective (Figure 15).

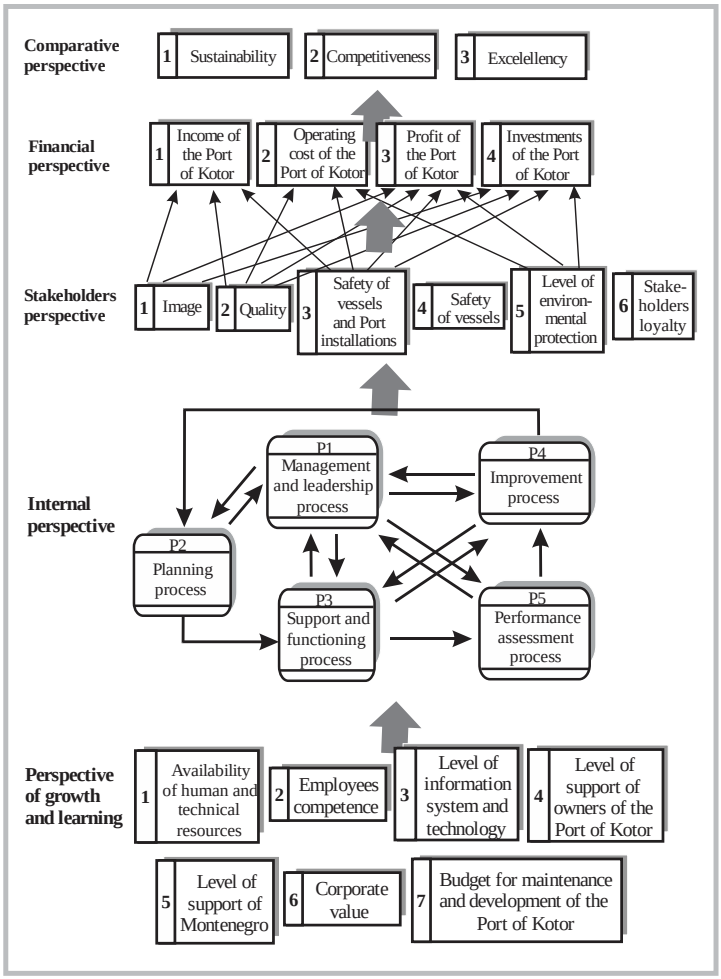

Figure 14. Business Scorecard BSCReproduced and modified (Popović, 2016; Arsovski, 2016)

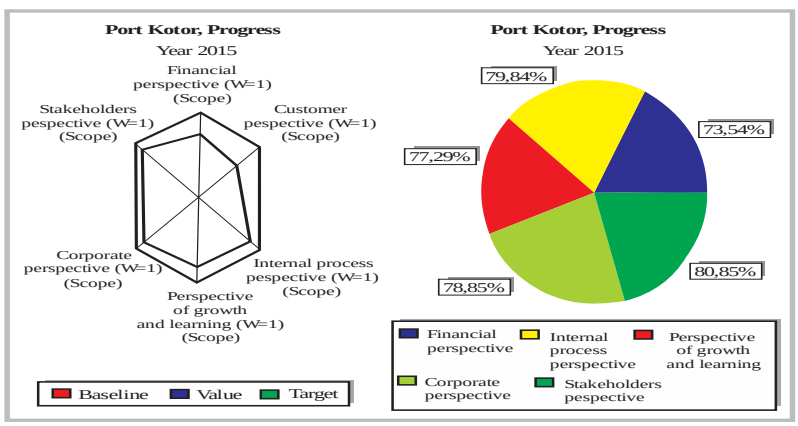

Figure 15. Defining perspectives according to Business Scorecard of the Port of Kotor (2015-2016g) (Popović, 2016)

Vision, mission and criteria have been defined in accordance with ISPS Code in a manner that defined quality objectives related to safety of passengers and vessels in the port basin of the Port of Kotor will increase by 30% and effect to satisfaction of stakeholders will increase by 30-50%.

5. Conclusions

Study of real processes and solving complex dynamic problems in maritime transport, defined as a system, calls for definition of IMS model as a total entity of defined and studied processes and problems in the Port of Kotor, together with making detailed analysis of such entities. As solution of complex problems in the maritime transport system requires employment of many methods, techniques including optimization, use of simulation model plays significant role.

Acquired experiences in maritime practice make easier for management of the Company to solve individual problems in the marine transport system (for example from the point of view of safety, security and ecology), but development of one uniform simulation-optimization model facilitates analysis of the system, optimization of its individual parts and optimization of the system as a whole.

Use of Modern Total Quality Management - MTQM as a modern systemic management approach whose aim is continuos improvement of value of port services is in progress.

The proposed IMS models represent:

- Very convenient basis for total innovative management processes of design, improvement and total management (research and management/in a stricter sense) of modern systems.
- Upgrading of the existing model or more precisely operational parts of the system of advanced operations (organizational functions) of marketing (MA), resources (RE), port operations (PO) and finances (FI).
- Basis for simulation model of uniform entities for stategic and operational management (organizational/operational) system, with some of their levels. Each level of its management makes its specific contribution to total decision-making and realization of such decisions.

Basic hypotheses have been defined at the very beginning of the research and such hypothesies have been confirmed by research.

After theoretical and applied research, the following facts have been determined:

X1 – In the quality system structure in Montenegro, management in all working systems of maritime companies (ports) has not been defined due to absense of integrated management system;

- even developed Mediterranean ports face serious problem of integration of various management systems within the existing business strategies. Employment of Hoshin Kanri approach gives opportunity to transform this strategy into the IMS strategy, which defines key processes related to quality.
- Simulation model provides, through innovative management, satisfaction of requirements of port users and loyalty of managers (for example employees in the Port of Kotor). Continuous improvement of modern management through IMS model provides new innovative management information and modern explanation of procedures in the marine ports practices. Total process (procedure) of management model is based on Systemic theory of management, as a practical theory, which as the beginning

"elevates" real data, through information and knowledge, to the level of theory and after that "transforms" it into concepts.

X2 – it is possible to develop integrated port service management model from the point of view of quality, environmental protection, safety and security.

- integrated management model allows review of the existing processes during execution of port services or more precisely to obtain timely and proper information to Port Authority, managers and ship- and port security officeres so as to engage themselves in decision-making and operational activities. Based on KPI values, decision-makers may determine which processes are critical or which processes face bottlenecks and critical points from the point of view of quality, environmental protection and safety.
- Employment of the Systemic management theory principle, port service integrated management model for quality, environmental protection and safety allowed formulation of definition for modern (innovative) management of maritime companies through defined processes of effective and efficient union of (modern) operational (organizational) functions and (modern) functions of management. Simulation model may be used together with (practical and theoretical) innovative systemic methodology of total port service management.
- Employment of IMS model allows analysis and provides synthesis of the marine port management concept, which specifies systems of execution of strategic and operational part of management, and also the system of organization (operational) execution of port services. In the model, the main factors are competitiveness (why), quality (what) and flexible efficiency (how), what enable that sustainability and innovative management secure the right things (what–quality/timely effectively) and properly (how - profitable/flexibly efficient) from the point of view of environmental protection and safety.

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