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Managing complexity in maritime business: understanding the smart changes of globalization

Managing
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Abstract

Purpose – This study aims to review and try to understand the importance of complexity management for maritime business to gain competitiveness in global business environment. The purpose of the study is to discuss and evaluate managing change and requirements of understanding the complexity management.

Design/methodology/approach – To find peer-reviewed journal publications, a large scientific database used by searching Web of Science and Scopus as the most relevant abstract and citation databases that provide peer-reviewed literature data for many different academic disciplines and selected papers evaluated from the maritime business context.

Findings – As a conceptual paper, the contribution of the study is to offer practical/required management applications with the help of six proposes for making better management decisions to confront future challenges to catch organizational competitiveness and success. With adaptation of complexity management, maritime stakeholders able to create an important core competency.

Research limitations/implications – The research has some limitations and further research into this area should be extended. This study is designed as a first step to provide an insight to the field and to understand the main views of the subject. Subsequently, complexity management in maritime business is a slightly deficient area of research, which offers remarkable research opportunities. First, it would be fruitful to collect qualitative data to examine the current issues and changing business environment of the maritime business. Second, it would be helpful develop quantitative models to offer practical solutions from the maritime stakeholders' point of view according to loading/discharging/transportation requirements. Future studies should deepen the subject with the help of simulation models of operations or agent based applications of stakeholder problems or vessel/ship-owner management implementations to understand changing circumstances of new business environment for the sake of managing complexity.

Practical implications – As the core point of view in strategic management; "achieving and sustaining" competitive advantage in organizations always takes an important place in organizational survival. With the help mentioned proposes stakeholders of the system could understand the ways of dealing with the complexities of new business world which enhances organizational competitiveness.

Social implications – Maritime business could be defined as a social ecosystem which has its own dynamics and customs. Socio-eco systems, like all complex systems, show unique non-linear dynamics in space and time which could be tough to define via classical quantitative methods. Organizations co-exist and co-evolve with their environment. It is possible that organizations effect their environment and gain some control over it while at the same time affected from environment and should steer the new trends.

Originality/value – The originality of the study lies in highlighting the importance of change management as a handler of complexity management for maritime business. The contribution of the paper is to indicate expected opportunities and challenges of smart changes for relevant readiness of maritime business for better management decisions, benefiting maritime business stakeholders by simultaneously enhancing effectiveness to



confront future demands to achieve organizational competitiveness. With the help of proper complexity management lenses organizations could able to create their source of competitive advantage that represents capacity to align and enable required functions under tough contextual environment.

Keywords Competitiveness, Complex systems, Organizational resilience, Change management, Complexity management, Maritime business

Paper type Conceptual paper

1. Introduction

Nowadays, organizations have to manage their operations under fierce competitive rules in ever-changing business environment with uncertain future paths (Muniz *et al.*, 2012). In organizational studies, environmental adaptation is fairly mentioned with the contingency studies from the very beginning. Environment itself has been categorizing with some contingencies in which uncertainty is one of them. One of the main reasons of determining those contingencies is to deduce the effects of environment on: managers' decision-making, strategies and structures and even performances of organizations. Understanding environment could enlighten two key points: enable requirements of change; and to get information about new trends to arrange necessary harmony in which both ensure to improve performance of the organization (Hulsmann *et al.*, 2008).

Maritime business enabling sea transportation requirements for cargoes as: with no pre-determined itineraries like tramp shipping; and for cargoes with pre-scheduled services to shippers like liner shipping (Goulielmos and Plomaritou, 2014). The stakeholders of maritime business should be explained in a wide range: ship-owners, shipping agencies, shippers, ship chandlers, and classification societies, national and international regulators like port states and flag states, port authorities and so on. Maritime business is backbone of the world economy and it improves with the progress of trade (Mengqiao *et al.*, 2015). As a unique industry maritime business shows volatile market characteristics affected from even small movements of global developments. In his inspiring book, Martin Stopford elucidate that maritime business cycles dominate the maritime market. According to Scarsi (2007) maritime business is subject to geopolitical scene in global business where maritime crises arise approximately between three and five years (Chiste and Vuuren, 2014).

Even the maritime business itself constitutes different analytic and statistical forecasting methods for future trends where it is difficult to anticipate future consistently. The stakeholders of maritime business face a variety of operational and environmental future uncertainties like economic and political developments, varying consumer demands, fierce competition and globalization (Mansouri *et al.*, 2009). These environmental uncertainties affect organizational strategies and influence organizational performance of maritime businesses. Under these circumstances managers require to modify, re-arrange and change their strategies to achieve organizational targets (McArthur and Nystrom, 1991).

Change could be defined as an output of the global world. The pressures for change in organizations have showed itself as a different form of innovative solutions as not just to technology but also to differing forms of organizational structures and processes (Lewis, 1994). Change is penetrant in organizational life (Smith, 2004) and talent of managing change could gain organizations a new way of finding organizational competence (Burnes, 1996) while dealing with environmental complexity. Environmental complexity could be defined via diversity of the environment. Different components with interacting relationships create complexities to organizations (Dooley, 2002). Those complexities, which create uncertainties, could be divided as an external complexities which arise from business environment like adapting a new regulation for doing business to a new destination,

terrorist attacks, climate change, political instability, strikes, diseases, natural disasters like tsunamis or hurricanes, changing demographic and social needs because of many established industrial nations are getting ageing have different and difficult potential to shape the way of doing business. Internal complexities which arise from inside of the environment like adapting a new technology for doing business to a new customer, applying new documentary system, etc. have also changed the way of doing business. Environmental complexity shapes the strategy making of managers (Kinra and Kotzab, 2008) and the success and survival of maritime businesses.

New trends and applications with macro and micro environmental elements shape the way of doing business. Through the medium of globalization and new technologies “Industry 4.0” has landed in the business field which could be named as a new “environmental change” for the wide range of industries. In the literature “industrial (r)evolution” has been explained in 4 phases. The first industrial revolution began with steam engines and mechanization where the second phase began via electricity and mass production and the third phase followed the computerization (Geissbauer *et al.*, 2016; Dopico *et al.*, 2016; Lasi *et al.*, 2014; Kans and Ingwald, 2016; Kagermann, 2015). And the fourth industrial revolution which represents “smart technologies” that are digitalization, Internet of Things (IoT), cloud and big data have already started as “Industry 4.0”.

Maritime business faced the prolonged effects of the economic off-peak period of 2009. Stakeholders of the maritime business are exposed to pressure of trade policies, low freight rates and increased regulatory applications. Additionally new technologies such as digitalization, increased expansion of electronic commerce gradually raised attention of the market (Review of Maritime Transport, 2017). With the appropriate use of smart technologies, maritime business will be re-shaped and re-structured. These new technologies will affect the ship-owner/shipper/customer relationships, networking, loading/unloading operations, inland haulage, and shipping navigation technologies and so on (Kagermann, 2015).

This paper makes an attempt to overview the concepts of organizational complexity along with the change management. To find peer-reviewed journal publications a large scientific database used by searching Web of Science (WOS) and Scopus as the most relevant abstract and citation databases that provide peer-reviewed literature data for many different academic disciplines (Tian *et al.*, 2018: 1093) and selected papers evaluated from the maritime business context. This study aims to review and try to understand the importance of complexity management for maritime business to gain competitiveness in global business environment. The purpose of the study is to discuss and evaluate managing change and requirements of understanding the complexity management. The originality of the study lies in highlighting the importance of change management as a handler of complexity management for maritime business. The contribution of the paper is to indicate expected opportunities and challenges of smart changes for relevant readiness of maritime business for better management decisions, benefiting maritime business stakeholders by simultaneously enhancing effectiveness to confront future demands to achieve organizational competitiveness. With the help of proper complexity management lenses organizations could be able to create their source of competitive advantage that represents capacity to align and enable required functions under tough contextual environment (Purvis *et al.*, 2016).

2. Maritime business

Shipping industry (Goulielmos and Plomaritou, 2014), shipping (Quitau *et al.*, 2018), ocean shipping or shipping business (Review of Maritime Transport, 2017), maritime transportation (De Monie *et al.*, 2011), maritime infrastructure and transportation systems

(Mansouri *et al.*, 2009), world seaborne trade (Review of Maritime Transport, 2017) and maritime business are all different statements used by literature but have the same sense of describing global maritime transport industry. Transportation demand is derived from the needs and requirements of societies, organizations and households (Moreira, 2013) and has strongly related with the growth of global trade (De Monie *et al.*, 2011) and mainly shaped by developments in global economy and trade patterns (Review of Maritime Transport, 2017). Because of the geographic absence of some products and services, maritime industry takes opportunity to meet supply and demand (Panayides *et al.*, 2015) and uses the link of ships and ports (Quitau *et al.*, 2018). As one of the most important transport mode for “international merchandise trade” (Review of Maritime Transport, 2017) maritime business become the backbone of worldwide trade and realization of supply chains (Mengqiao *et al.*, 2015) due to connecting the all parties (Yang and Hsu, 2018). The duty of maritime business is to transport raw materials, semi-finished products and required inputs for production and then transport finished goods to customers (Quitau *et al.*, 2018). A ship has supplied by a ship owner or a ship management company to carry a cargo procured by a shipper from one port to another (Goulielmos and Plomaritou, 2014). Ship types and offered maritime transportation services change according to cargoes and schedules of ships.

Maritime business is serving for sea transportation to many cargoes under two different type of shipping schedule as tramp shipping and as linear shipping. Liner shipping services serve mainly to the semi-finished and finished goods. With their scheduled services, shipping lines serve for broader geographical areas with their container ships (Liu *et al.*, 2018). Although liner shipping has brief history with launching of Ideal X as a first container vessel at 1956 (Ducruet and Notteboom, 2015) with the help of globalization container trade actualize strong growth within short period of time (Notteboom *et al.*, 2011). Tramp shipping serves to cargoes without pre-determined itineraries where liner shipping serves to cargoes with determined schedule (Goulielmos and Plomaritou, 2014). Demand for tramp shipping shaped by requirements to bulk commodities. Those commodities range from major bulk cargoes like grain or iron ore to minor bulk cargoes that vary in size. Due to heterogeneity of bulk cargoes like dry or wet, the ship sizes and specialties of ships differ, such as gearless vessels using generally for long-hauls, bulk carriers are mainly situated with different specialties to carry wide range of cargoes (Comtois and Lacoste, 2015).

Maritime business both on land and at sea not only executes transportation of goods from one place to another but also creates a world-wide business system with different maritime subsectors/stakeholders from different countries which are specialized in different parts of shipping like scrapping, ship building or ship registering etc. (Review of Maritime Transport, 2017). That world-wide maritime industry system also creates job opportunities for each country according to their expertise (Mansouri *et al.*, 2009).

From enlightenment of eighteenth-century to 2000s, world has passed fast and enormous transformation from industrialization to digitalization. The deterministic laws of Newtonian paradigm as a “clockwork universe” has been begun to challenge by systems thinking which adds organizational environment as an important element that interacts with organizations (Merali and Allen, 2011). Such factors like globalization or harsh competition elicit evolving transportation services to gain organizational success which requires strong networks (Wang *et al.*, 2016) and social webs that increase interconnectedness among stakeholders of the system with an increase complexity (Kamalahmadi and Parast, 2016). This increased interconnectedness causes problems to become even more severe and destructive. Any disruption/devastating event faced by one stakeholder as unexpected failure of the system like fire, terrorism or loss of supplier (Rajesh and Ravi, 2015) can disrupt the working order of the whole system. That increased interconnectedness also

creates turbulence and uncertainty that makes future impossible to predict (Morais-Storz and Nguyen, 2017).

Business environments affected from disasters such as man-made or natural calamities or many different developments such as short life of products and changeable customer preferences (Rajesh and Ravi, 2015) that also cause uncertainty and unpredictability (Kamalahmadi and Parast, 2016) to organizational survival and prosper. Under that risky and volatile business environment also maritime business has its own context based issues that make the system vulnerable and open to devastating event (Comtois and Lacoste, 2015). Organizations use some applications to handle macro and micro environmental problems like business continuity management, probability theory with complicated equations and calculations, risk management applications to predict and control problems. Also managers' use some popular trends strive to produce relevant answers to handle organizational problems like outsourcing, just in time applications, supplier rationalization programs (Sanchez-Rodrigues *et al.*, 2010). However, all these efforts and methods are not enough to anticipate and prevent every event that may happen to the organizations (Gimenez *et al.*, 2015). As maritime business organizations compete in severe competition in dynamic markets at highly volatile business environments; traditional ways of managing organizations could not able to answer emerging problems (Cunha and Cunha, 2006). Both the shipping markets they operate in and the differences in their national and corporate cultures make it necessary for maritime business organizations to find out relevant solutions (Coetzee *et al.*, 2016).

Devastating events cause system interruptions to a certain extent that occur from both internal risks like fire at the office or personnel outages to external risks like fluctuating exchange rates or changing local policies (Hohenstein *et al.*, 2015). Due to increasing multiple systematic linkages, those disruptions could potentially affect organizational operations and dynamics of the whole system more than expected (Hulsmann *et al.*, 2008) which creates system-wide uncertainty and volatility. The biggest problem created by uncertainty is taking control ability away from organizations (Carvalho, 2012). Increasing interdependent relations of organizations, which creates complexity at systems, and mentioned problems of global business environment, which creates extensive uncertainty, make organizations and systems even more vulnerable to any disruption whether the source of problem is man-made or natural (Devanandham and Ramirez-Marquez, 2010).

Maritime business itself has a very unique, non-linear environment which is affected by any change in the world; cyclical, dynamic, unpredictable which of all create high complexity and volatility for the stakeholders of maritime system. Maritime business economics indicate that the maritime business has cyclical and volatile environment (Goulielmos, 2017). Under the current review, the argument could be proposed as:

- P1. Maritime business has unique, volatile environment with different international stakeholders which creates complex and uncertain environment that effects the success and survival of the organizations.

3. Business environment: organizational complexity

Organizational complexity has been studying for a very long time in the management field and one of the very first studies that include environmental complexity is Emery and Trist, 1965. Some researchers determine sources of complexities as increased competition, globalization, technological/economical/political/social changes, and changing demands of customers and so on. Some others indicate the organizational results/outcomes of complexities (Vasconcelos and Ramirez, 2011).

The importance of environment to organizations come from the opportunities and challenges that offer as a chance for survival and success. Literature has been conceptualized business environment from task environment to micro-macro environment each of which has several elements and characteristics (Anderson and Tushman, 2001; Okeyo, 2014). Studies show that many authors tried to categorize the business environment into different dimensions like March and Simon (1958) as munificence or such as Thompson (1967) as heterogeneity and dynamism; Child (1972) labeling them complexity and variability, illiberality; Mintzberg (1979) described four dimensions of the environment as stability, complexity, market diversity and hostility. Dess and Beard's (1984) salient study categorizes business environment into three as dynamism, complexity and munificence (Dean and Sharfman, 1991; Anderson and Tushman, 2001; Cannon and John, 2007; Kinra and Kotzab, 2008).

Complexity of markets could be explained as a number of players, customers, technologies core processes and openness to new entrants and other external sources of change where organizational complexity could be analyzed as the amount of variety or differentiations of product lines, distribution networks, suppliers, or geographical locations of institutions (Dooley, 2002; Child and Rodrigues, 2012). Cannon and John (2007) categorize organizational complexity under three sub dimensions as a function of interacting a function of heterogeneity and a function of technical knowledge.

4. Change management

Change could be described as an order rather than anticipation for organizations which enables companies to survive in such a competitive world (Yilmaz *et al.*, 2013). Change is a very essential component of an organizational life that has an important contribution from operations of the companies to the deciding on strategically moves which also shows the vitality for organizational success. The ability to manage the change would be the determinant part of making difference in a highly innovative global environment (By, 2005). Change could even be the essential part of the life itself which could not be separated from daily life as stated by Heraclitus centuries ago by his famous expression "You could not step twice into the same river" which explains that everything is in a stable change (Kirk, 1951; Nasim and Sushil, 2011).

The difference between desired situation and current status of the organization opens the application processes of the change such as the change in external environment, new technological developments, different managerial demands, internal factors etc. where managers should always ready to manage the difficulties to expand life-span of the organization. That is a challenge for organizations to manage the required steps to organizational growth and survival (By, 2005; Walker *et al.*, 2007; Graetz and Smith, 2010). Many theories have been developed over the past years for the design and running of organizations. Traditional theoretical explanations are used to define the change which included punctuated equilibrium theory, population ecology theory, institutional theory, strategic choice theory (Smith, 2004). One of the main specialty of above theories is they try to show the application paths on their own way (Burnes, 1996). Also some models and approaches has been developed such as: Lewin's three step change model "unfreezing-moving-refreezing", Grundy's (1992) "power tools for change", Kanter *et al.*'s (1992) "Ten commandments", Kotter's (1995) "Eight step process for leading change", Hammer and Champy's (1993) "Business process re-engineering", Beer and Nohria's (2000) *theory E and theory O*, Jick's (1991) "ten-step approach" (Mento *et al.*, 2002; Smith, 2004; Eriksson and Sundgren, 2005; Graetz and Smith, 2010; Yilmaz *et al.*, 2013).

Also there is a wide variety of approaches to change which categorize change under different types such as episodic, continuous, discontinuous, intermittent, incremental, planned, emergent, revolutionary, transformational, first-order, second-order, transitional or transactional. These terms generally pertain to the scale, scope, or magnitude of change (Burnes, 1996; Smith, 2004; Dibella, 2007; Walker *et al.*, 2007; Nasim and Sushil, 2011). Organizational change has been managed by managers with the help of employees with the organizational dynamics. It is the ability of the organization and the managers to manage, control, arrange change according to get benefit to the organization (By *et al.*, 2011) where success of management of change depends on well-organized management. Change management depends on installing subcommittees, action groups and project teams to reach desired outcomes of change (Smith, 2004). Change management could be described as the period of non-stop re-visioning the organization's way of doing operations, human resource, procedures, relations to handle the "ever-changing needs of external and internal customers" (By, 2005).

Organizational change is adapting to external environment of the organizations with internal harmony by giving proper responses and solutions on global needs of uncertain future. Rising of globalization, ambiguity in supply and demand equilibrium, decline in "product and technology life cycles", different economic growth rates in the global economy, requirements of new international conventions on safety and security, different applications of port state authorities and new applications of port authorities can lead to complex network in maritime business (Sanchez-Rodrigues *et al.*, 2010). Technological developments with the help of new customer requirements force organizations to re-arrange their management and operational procedures. One of the most effective ways of handling these circumstances is creating organizational change with matching organizational capabilities (Burnes, 1996; Yilmaz *et al.*, 2013).

Change management enables some insights from the experiences of "gradual change" and "non-linear change" taking place in the business environment. Those insights provide new learning and adaptation (De Geus, 1999) options followed by organizational change which creates prerequisites for competitive advantage. Change management able to trace developments in business environments to forecast and reply events (Berkes, 2007). By applying change management toolkit, managers able to evaluate environmental flux to generate organizational base interpretation ability to affect industrial status and re-locate competitive stance of opponents (Lopez-Gamero *et al.*, 2011). With the help of change management, maritime business organizations could provide organizational resilience which able "one-step-ahead approach" that enables thinking different than rivals. Resilience is the capability of organizations which is the sum of organizations internal and external ability that could provide organizational performance (Yang and Hsu, 2018). That thinking brings competitive advantage to organizations. In such a global world being a resilient organization enables organizational survival (Lengnick-Hall *et al.*, 2011; Ruiz-Martin *et al.*, 2018) and "thrive" (Serrat, 2013). Organizational Resilience comes up as a source or competitive of this ever-changing business environment (Braes and Brooks, 2010). With the help of change management second proposition could be supposed as:

- P2. Change management could be useful to understand environmental uncertainties created by global changes for maritime business to gain competitive advantage.

5. Understanding the smart changes of globalization: challenges and opportunities to maritime business

Lately, progression in manufacturing and product development technologies change the many aspects of business environments. These changes are all the harvest of the

requirements for competitive advantage (Dopico *et al.*, 2016). As an important element in the world economy manufacturing industry has been shaped by new technologies which enables optimization, adapting changing customer needs and to the market opportunities or even to confront the challenges (Galindo, 2016). Under these requirements of competition, Industry 4.0 and new technologies could be seen as new strategic solution for competitiveness (Rennung *et al.*, 2016).

As a charming word “Industry 4.0” emerged in Germany (Dopico *et al.*, 2016) which contains the shift of manufacturing technologies into interconnected digital smart production. These are robotics, 3D printing, big data, the IoT, cloud technologies, RFID tags, simulation and virtualization models, additive manufacturing, Cyber-Physical Production Systems (Geissbauer *et al.*, 2016; Kagermann, 2015) where machines and products could interact in real time as a way or managing themselves (Galindo, 2016). Those technologies will convert and make structural changes to many industries from healthcare industry to maritime business such as new tracking and tracing systems, smart and artificial intelligence applications which have potentially change the human resource requirements and management, etc.

Digital systems have a disruptive effect on maritime business which will change the value chains and business models of organizations. With integrative value chains where maritime business organizations could make new alliances with manufacturers through smart chains and cloud technologies and will be converting to new phase of shipping while ensuring environmental friendly operations under the light of regulatory applications (Kagermann, 2015). The essence of Industry 4.0 relies under the interacting of hardware and software devices that resources, machines and humans could get in touch and work together, build complex networks and minimize the system faults (Dopico *et al.*, 2016). The working logic of IoT which originates as a types of sensor, network, communication and computing technologies (Gigli and Koo, 2011) is enabling systems and processes to be networked to form a smart environment as a social network.

The Cyber-Physical Production Systems consist of smart machines, warehousing systems and production and transportation facilities that all developed digitally and benefit from supplies-to-end customer (Kagermann, 2015). The necessary changes in this aspect to “smart applications” could be defined via two destinations as transformation under operational conditions and transformation in the technologies (Dopico *et al.*, 2016). It is important to manage revolutions which change the business manner. Interactions between heterogeneous elements will be the key source of complexity. Those interactions direct the decision making of managers (Kagermann, 2015) through managing change. The third assumption could be proposed as:

- P3.* New technological developments could change the macro and micro environment of maritime business.

Organizational complexity could be described as a response to environmental complexity and should be categorized as internal complexity that consists of core processes and technologies and external complexity that consists of customers, markets, suppliers, competitors (Dooley, 2002). Complexity creates a type of uncertainty which could harm success and survival of organizations. Organizations could follow several ways to confront those challenges such as try to fit/adapt them to the changing environment or try to effect the environment.

Adaptation is widely approved as an important survival and success way within organizational studies (Child and Rodrigues, 2012). But in many situations it could be really difficult for organizations to adapt their ever-changing and complex environment. Different

players with different interactions could make it a tough application (Chen *et al.*, 2017). A convincing assessment of dealing with complexity needs search alternate ways for organization-specific solutions via categorizing complexity attached to organization's environment and seeking ways for each element in organization to confront those complexities (Child and Rodrigues, 2012).

As a general truth, uncertainty is dangerous to organizations from many points of view that can harm investment decisions where success could be more fragile and internal/external political and power balances could create turbulence to organization (Anderson and Tushman, 2001). Consequences are not the results of a single event or a decision but by multiple decisions and interaction of those decisions that creates non-linear environment to deal (Mason, 2008). Non-linear business environments are such intertwined environments where small inputs could result large outcomes and large inputs could bring out small outcomes (McDaniel *et al.*, 2009). External environment of the organization is distinctive in determining the way of responses needed for long term survival of the organization. Change management opens a new path for managers to plan requirements of the environment. The environment of the company consists of stakeholders who are the main players of the organizational change like employees, owners, suppliers, competitors and so on. The conformity within these groups and the necessities of the global requirements shape the way of managing change organizationally (Voiculet *et al.*, 2010). The literature suggests that strategically complex organizations should apply diverse point of view to handle challenges and opportunities (Neill and Rose, 2006). Although we do not know what these technologies will bring in the future, especially IoT and big data applications could promote the quality of life which could create new opportunities to organizations (Kagermann, 2015) like enabling cheaper and faster production.

Managing uncertainty means dealing with the “unknowns”, anticipating the “unexpected” and “learning from the history” (Berkes, 2007). Managing uncertainty creates resilient thinking into organizational systems which provides “ready-to-be” approach to realize opportunities in business environment that offers managing change and environmental uncertainty. Organizational competitiveness comes from the roots of managing uncertainty, responding effectively than rivals and figuring out opportunities in business systems. Organizational resilience helps to develop such capacity throughout the barriers of uncertainty. Resilience approach provides new management understanding to reveal uncertainty, close pursuit of environmental change (Polasky *et al.*, 2011), learning and adapting easily which creates turning weaknesses into organizational chance such as digital technologies can create new opportunities for organizations (Dutta *et al.*, 2020). Managing uncertainty requires more strategic resilient thinking to catch environmental opportunities. Rather than traditional strategic approaches and applications, resilient management creates more powerful managerial understanding to create opportunities. The fourth proposition could be settled as:

- P4.* Even though, uncertainty could negatively affect maritime business; managers could realize opportunities to achieve organizational competitiveness.

New cloud technologies, smart applications, all those machine-human relational systems and integration of those systems to maritime transportation require advanced safety and security implementations. This should need accurate and reliable data flow between maritime stakeholders. The information transfer between smart systems (human-machine relations) should be more sensitive and more defenseless any of old technologies. So managers taking all these into account to enable resilient systems for the sake of organizational survival and create reliable and secure transportation systems where all

stakeholders could trust each other. Those new technologies need decentralized structure to ensure flexible transportation (transshipment facilities, shared use of transport and logistics infrastructure) and good operational networking (Kagermann, 2015).

UNCTAD's Review of Maritime Business 2018 (Review of Maritime Transport, 2018) had already warned maritime business regarding new trends which have potential to change the way of doing business. Those changes could take form in maritime business as mergers/acquisitions, decentralized organizational structures and having new technologies etc. Ship owners and managers should be aware of all global requirements of operating business in this smart world. These developments create pressures on organizations to keep pace with executing change within organizations (Eriksson and Sundgren, 2005) like new organizational structures as decentralized and divisional applications. Decision making requires high understanding of environment and business trends; managers in complex environments should take into account various parties and relationships and the effects of those relationships in a non-linear way which enables decentralized structures (Cannon and John, 2007). Successful integration of smart systems with maritime transportation and infrastructure tends to increase information-processing requirements when facing complex environment. Managers' perceived environmental uncertainty usually shape strategic routes of organizations. Decentralized decision making and divisional organizational structure will confront the requirements of complex environment. According to Ashby's (1956) law of requisite variety, organization's internal complexity should meet the organization's external complexity (Harrington, 2001). The fifth assumption of the research could be defined as:

- P5.* Smart technologies require decentralized and divisional organizational structures for maritime business to manage the necessities.

If maritime business stakeholders networked with manufacturing companies in real time that will require digital integration of structures. Besides provide information of the smart processes, digital innovation wave could enable more knowledge about people and relationships and ensure reliable machine-human working. The emerging term of "smart sea transportation" enables effective and efficient transportation to both ends (Kagermann, 2015). Integration of transportation systems in to smart systems of production requires "smart coalescence" by internet and data transfers between shipper and carrier; starts from the factory of customer until the loading of ship that includes all transshipment process with land, air and sea. Although port handling and operations already start smart applications, that could also require hole integration of maritime operations (Burnes, 2009). Smart systems just not only ensure efficient and effective production. They could also lead up innovative solution, new business models and create new services that create value for the industry. With the help of big data and analytics organizations steer the complexity via change management applications (Kagermann, 2015). Variety brings alternative paradigms and innovative solutions. There is no magic formula to work for all organizations but under the relative circumstances with the help of change management applications organizations could solve their problems (Burnes, 1996). The last proposition of the research could be arisen as:

- P6.* Change management could ensure new paradigms to confront complexities of maritime business to enhance organizational competitiveness.

6. Conclusion and future research directions

Maritime business could be defined as a social ecosystem which has it is own dynamics and customs. Socio-eco systems, like all complex systems, show unique non-linear dynamics in

space and time which could be tough to define via classical quantitative methods. Uncertainty is the insufficiency of the managers in which they could not foresee or predict future states as not only result of rapid change but arise when future could not be estimated even managers have information in hands (Anderson and Tushman, 2001). Environmental uncertainty could be defined via three important dimensions as dynamism, complexity and munificence where each has important effects on organizational strategies and performance (McArthur and Nystrom, 1991).

In reference to resource-based view, organizations could gain competitive advantage through developing unique and heterogeneous assets so as to manage those assets via complex and inimitable way (Rueda-Manzanares *et al.*, 2008). The source of uncertainty comes from some sources like demand uncertainty or technological uncertainty which might come from “smart technologies” (Anderson and Tushman, 2001). Organizations co-exist and co-evolve with their environment. It is possible that organizations effect their environment and gain some control over it while at the same time affected from environment and should steer the new trends (Mason, 2007). Also, it is possible to respond organizational complexity.

Mentioned proposes are exposed for maritime industry to understand the relationship between change management and complexity. Handling change management from the complexity perspective with the help of proposes of the study make contribution to the literature by focusing on the understanding the uncertainty and new global trends. The significant contribution of complexity to maritime business is small changes (mistakes or near misses in maritime terminology) are able to switch the environment. As a matter of course, maritime business proceeds its vital economic attendance in world trade system via involvement in national and international transportation. As a player in international trade, maritime business creates many benefits to users like place and time (Boşneagu *et al.*, 2015). With great developments throughout 20th century maritime business has been shifting many phases successfully (for more please check McConville, 2000). Through the instrument of globalization and smart technological developments, organizational change will become more vital, especially in hyper competitive businesses environment of maritime business.

P1 shows that as an industry, maritime business intrinsically has uncertain and cyclical business environment. With the new technological and *smart* developments, industry itself could be in a complex environment which threat to organizational survival. By applying change management techniques via complexity management lenses as proposed at *P6* like some management applications and tools like establishing technical barriers, adopting rules, segmenting/decentralizing, settling partnerships/licensing (Dooley, 2002), monitoring to understand upcoming events (Anderson and Tushman, 2001), engage and collaborate with stakeholders which could be leading to change and innovation (Rueda-Manzanares *et al.*, 2008).

P3 proves that new technological developments and requirements of smart advancements could change the macro and micro environment of maritime business such as using big data technologies, smart manufacturing applications or cloud systems. By using *P2*, change management applications could be used in maritime business to understand the environmental uncertainties created by global changes like sensing the changing expectations of maritime business shippers, consignees or charterers and in business manner via providing relevant information about the industry dynamics, adapting to the changing needs and requirements of the customers according to new *smart* developments, getting and sharing data from employees, receive support from risk management, crisis management and business continuity management applications.

Although, uncertainty could negatively affect maritime business as shown in *P4*; managers could realize opportunities and get benefit to organization by using new

decentralized and divisional organizational structures as proved by *P5* via providing flexibility in maritime services by achieving diversification while offering maritime business service, creating new organizational climate via positive learning and inter-organizational knowledge sharing, brainstorming and discussion with crew and operational staff, empowering the decision makers in organization and so on.

Doing their business better than rivals could enable competitive advantage (Hulsmann *et al.*, 2008) in which competition pressures organizations ready to change and manage organizational complexities. The contribution of the paper is to by using mentioned propositions maritime business organizations provide relevant readiness of changing environment, making better management decisions, benefiting organizations and customers by simultaneously enhancing cost-effectiveness and improving customer service confront future challenges as the core competence of the business. Maritime business should understand how to cope with current trends by using change management application and complexity theories. The propositions of the study are the questions and the answers of modern business environment which help to gain core competence to catch organizational success and manage better than rivals. Requirements of new business ecosystems need to accept new perspectives to solve the problems of competitive global environment.

As the core point of view in strategic management; “achieving and sustaining” competitive advantage in organizations (Teece *et al.*, 1997) always takes an important place at organizational survival. With the help mentioned proposes stakeholders of the system could understand the ways of dealing with the complexities of new business world which enhances organizational competitiveness.

This study seeks to enable a thematic understanding of the factors steering the complexity of maritime business and its relationship with change management. To conduct an extensive review of complexity studies in the maritime field, a methodical procedure for searching and selecting the reviewed articles has been applied by searching WOS and Scopus databases. To conclude; this review enables several important contributions as questions/proposes to proper understanding of change and complexity management to achieve competitive advantage. By shaping strategies and solutions from the complexity management philosophy, organizations could create competitive advantage (Carvalho *et al.*, 2012).

The research has some limitations and further research into this area should be extended. This study is designed as a first step to provide an insight to the field and to understand the main views of the subject. Since complexity management in maritime business is a slightly deficient area of research, which offers remarkable research opportunities. First, it would be fruitful to collect qualitative data to examine the current issues and changing business environment of the maritime business. Second, it would be helpful develop quantitative models to offer practical solutions from the maritime stakeholders’ point of view according to loading/discharging/transportation requirements. Future studies should deepen the subject with the help of simulation models of operations or agent based applications of stakeholder problems or vessel/ship owner management implementations to understand changing circumstances of new business environment for the sake of managing complexity.

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