Journal of Defense Resources Management

Vol. 14 Issue 1(26)/ 2023

BRASOV - ROMANIA

Journal of Defense Resources Management (JoDRM) is currently indexed in the following prestigious international databases and catalogs:

- Ulrich's Global Serials Directory
- Directory of Open Access Joumals (DOAJ)
- EBSCO - Intemational Security & Counter-Terrorism Reference Center
- ProQuest
- Central and Eastem European Online Library (C.E.E.O.L.)
- Cabell's Directory of Publishing Opportunities
- Cengage GALE
- ERIH PLUS (European Reference Index for the Humanities and Social Sciences)
- WORLDCAT
- Karlsruhe Virtual Catalog (KVK)

ISSN: 2068 - 9403
eISSN: 2247 - 6466

CONTENTS

PREPARING FOR AND PRACTICING MISSION COMMAND IN THE CONTEMPORARY MILITARY ENVIRONMENT

Cezar VASILESCU

Regional Department of Defense Resources Management Studies,
Brasov, Romania

Today's military environment requires many states to find ways to develop capabilities to fight a high-intensity conventional war, to protect and to fight with scattered forces under the conditions of an effective adversary threat to include air attacks and modern missile technology. Simultaneously, modern disruptive technology could deny command structures the ability to maintain constant communication with their forces on the ground. Such situations in which subordinates are unable to communicate easily with their superiors might create the risk of losing the fight initiative or the chance to seize opportunities while awaiting new orders. These factors emphasize the importance of creating military units that can fight autonomously, with limited guidance from higher levels of command, by properly exercising Mission Command (MC) principles. The main goal of this paper is to analyze the role of education as an enabler to an easier adoption of Mission Command philosophy, to formulate recommendations regarding the establishment of a proper organizational culture that favors MC and to highlight the complexity of implementing MC in practice.

Key words: *Command, Military education system, Leadership*

1. INTRODUCTION

Today's military environment requires many states to find ways to develop capabilities to fight a high-intensity conventional war (usually against a technically superior adversary), to protect and to fight with scattered forces under the conditions of an effective adversary threat to include air attacks and modern missile technology. Simultaneously, modern disruptive technology (such as electronic warfare and cyber-attacks) could deny command structures the ability to maintain constant communication with their forces on the ground.

Such situations in which subordinates are unable to communicate easily with their superiors might create the risk (if the subordinate simply waits for new commands) of losing the fight initiative or the chance to seize opportunities while awaiting new orders.

Moreover, the nature of war is characterized by uncertainty (fog of war), unpredictability, dynamic change and constant confrontation of players' wills and characters. These factors emphasize once more the importance of creating military units that can fight autonomously, with limited guidance from higher levels of command, by properly exercising Mission Command (MC) principles.

The main goal of this paper is to analyze the role of education as an enabler to an easier adoption of Mission Command philosophy, to formulate recommendations regarding the establishment of a proper organizational culture that favors MC and to highlight the complexity of implementing MC in practice.

2. AN EDUCATIONAL PERSPECTIVE ON MISSION COMMAND

In order to prepare a large military system to be able to adopt and actively apply/implement mission command, we need to prepare a comprehensive action plan, with education and training as a major component.

As General Dempsey mentioned in his influential white paper [1],

"Leaders must be taught how to receive and give mission orders, and how to clearly express intent. Students must be placed in situations of uncertainty where critical and creative thinking and effective rapid decision making are stressed. Training must replicate the chaotic and uncertain nature of military operations. Training must place leaders in situations where fleeting opportunities present themselves, and those that see and act appropriately to those opportunities are rewarded... Training must reinforce in commanders that they demonstrate trust by exercising restraint in their close supervision of subordinates."

With a view to the aforementioned quote, the military education system must shift leader education and training from an approach that "focuses on teaching doctrinally approved solutions to one that equips leaders and subordinates - future commanders, staff officers and subordinates (Figure 1) with solid fundamental skills and builds expertise in critical thinking and problem solving" [2].

Fig. 1 Target audience for military education system
Source: Authors' own conception

Within the framework of Mission Command concept, the triad mentioned earlier is supposed to possess/exercise the following qualities and responsibilities:

Commander (Idea)

- Commands, establishes policy, plans, and programs;
- Concentrates on collective training;
- Is primarily involved with unit operations, training and related activities;
- Pays particular attention to the unit capability and readiness;
- Creates conditions (makes time and other resources available), so the staff officers can do their job.

Staff officer (Implementation)

- Conducts the daily business within established orders, directives and policies;
- Focuses on individual training;
- Is primarily involved with training and leading soldiers and teams;
- Ensures each member is well trained, highly motivated, ready and functioning;
- Follows orders of officers and NCOs in the support channel.

Subordinates (Execution)

- Disciplined, physically and mentally tough;
- Trained and proficient in warrior tasks and drills;
- Maintains arms, equipment and yourself;
- Carries out assigned duties to standard to the best of his/her abilities.

Based on those required qualities, commanders, staff officers and subordinates are supposed to put them in practice, by adopting the MC philosophy as the driving force behind the operating concept (Manoeuvre warfare) (figure 2). In consequence, regardless of the situation, MC is meant to provide the overarching basis for leadership and command.

necessary to achieve the mission's end state. In the same way, it is unlikely that anyone will comprehend the commander's intentions without clarity. Better education is the way to provide leaders and subordinates with understanding and clarity of purpose. [4]

In the following paragraphs we will seek to identify potential

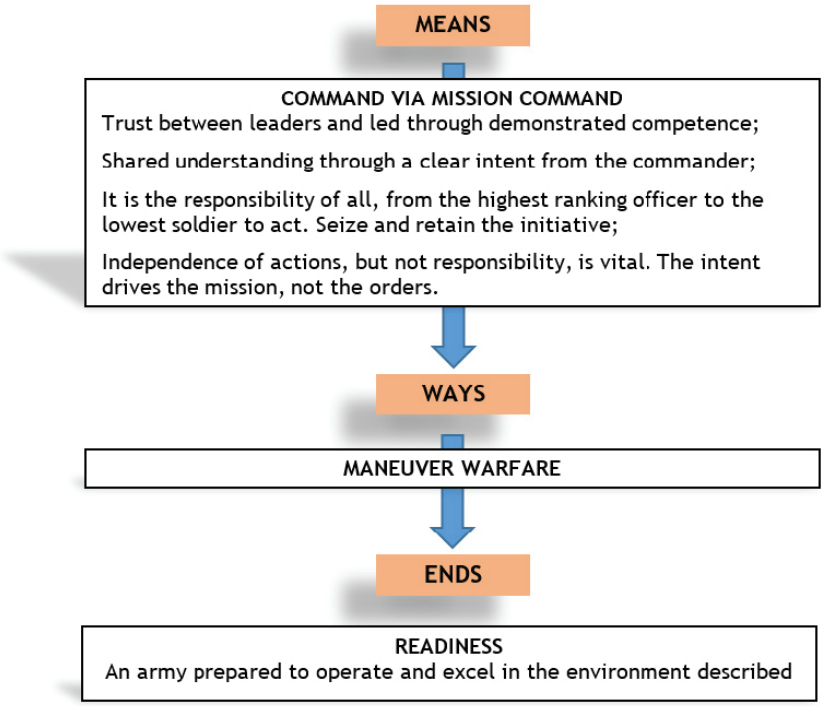

Fig. 2 Mission Command logic map
Source: adapted after [3]

For mission command to work, understanding and clarity of purpose are the two key components. A commander is unlikely to be able to issue an order that solves the current issue without understanding what is

requirements for way education and training is conducted within the military education system, derived from mission command principles. Our research will focus on identifying:

- the characteristics that leaders and subordinates should possess in order to easily adhere and apply MC principles in their daily activity;
- the qualities/competencies that the graduates of military institutions should earn, maintain and reinforce throughout of their career;
- the teaching approaches compliant with the MC principles, which will favour the creation of an environment that encourages peer-to-peer and discovery learning;
- the disciplines (within the curricula) and examples of teaching points (within the syllabi) which may contribute to the creation of the required mental pattern needed for practicing Mission Command.

First we will enumerate the identified characteristics needed for leaders and subordinates to easily adhere to MC in practice.

1. Competence
   - The training and education that takes place both in military educational institutions and in units provides commanders and subordinates with skills that allow them to achieve professional competence.
   - Repetitive, realistic and challenging training creates common experiences that develop teamwork, trust and mutual understanding.
   - Young commanders should complement their institutional and organizational training and education through their own continuous self-development
2. Mutual trust
   - Trust is based on leader's personal qualities such as professional competence, character and commitment.
   - Exercising leadership through personal example, in accordance with the principles and values of the armed forces.
   - Two way communication and the interaction between commander, subordinates and soldiers is essential.
3. Common understanding
   - Begins with military education, which instills a common approach in conducting operations, a common professional language and a common understanding of the principles of mission command.
   - Requires critical and creative thinking, exchange of ideas, opinions and recommendations based on expertise, experience and intuition without fear of repercussions.

- This includes sharing ideas that contradict the views of high-ranking people. Successful commanders listen to new ideas and counter-arguments.

4. Intention of the commander
   - Commanders write and communicate their intention in a clear and concise format (no longer than 3-4 sentences) that lower-level commanders can remember and understand.
   - The intention of each commander finds its roots in the intention of the commander two levels above.
   - Subordinates should use their judgment and initiative within the limits set by the commanders' intention.
5. Mission orders
   - Mission orders are directives that emphasize to subordinates the results to be attained, not how they should achieve them.
   - The tasks of the subordinate units include all the standard elements (who, what, when, where and why) with a special emphasis on purpose (why).
   - Subordinates are accountable to their commanders for the use of delegated authority, but commanders remain solely responsible and accountable for actions over which subordinates exercise delegated authority.
6. Disciplined initiative
   - Promote a climate of command that encourages initiative, and requires commanders which accept risk and the mistakes of subordinates made in good faith.
   - Subordinates are required (not only allowed) to exercise disciplined initiative in the absence of orders, or when current orders no longer fit the situation or when unforeseen opportunities or threats appear.
   - Subordinates should know that their decisions will be supported by their commanders.
7. Acceptance of risks
   - The risk should be compared to the perceived benefit, the importance of an objective, the time available and the anticipated costs.
   - Waiting for the perfect information and timing can increase the risk or close a window of opportunity.

Based on the requirements identified until now, there are several qualities/competencies that the graduates of military educational institutions should possess, maintain and reinforce throughout of their career (Table 1).

Table 1. Knowledge, skills and attitudes required for MC

Leaders	
Should be capable of	• Comprehending multifaceted and sometimes blurred problems; • Making effective decisions under uncertain conditions with a reduced amount of information.
Should possess	• Enhanced individual decision-making skills; • Critical and adaptive thinking; • Enhanced familiarity and cohesiveness; • Imagination and independence; • Strong character; • Virtues such as loyalty, honour, and courage; • Ability to summarize complicated situations in brief messages.
Should	• Gain respect and trust by obeying the law, respecting the ethics of the military, applying the principles of military leadership and demonstrating technical and tactical expertise; • Lead through a combination of personal example, persuasion and coercion; • Direct leadership within the command decreases as the level of command increases; • Are legally and ethically responsible for the decisions they make or do not make, as well as for the actions, achievements and failures of their subordinates.
Are required to	• Take responsibility for decisions, show loyalty to subordinates, inspire and direct the forces and resources allocated to a proposed goal; • Establish a successful team climate, demonstrate moral and physical courage in the face of adversity; • Provide vision, professional competence, personality and will, character and ethical standards, courage and conviction in battle, trust and teamwork.

Source: Authors‘ own conception

The teaching approaches themselves should respect the principles of mission command, by creating an environment that encourages peer-to-peer and discovery learning under the facilitation of a teacher, making sure that the students take ownership of learning and enabling participants to realize that they are part of a larger organization (Figure 3).

According to the proposed teaching approach, if students make mistakes while acting in good faith, they should undergo nothing more than corrective tutoring. In this respect, the principles of andragogy/ pedagogy state that an individual usually learns more from a well-intentioned mistake, critically and constructively reviewed, than from be encouraged to "blindly" apply a prescribed and memorized process.

In relation with disciplines that should be included in Curriculum and Syllabus, it is our strong opinion that teaching the contents of Mission Command as a separate learning subject (discipline) is not enough. A comprehensive approach is needed in order to create a mental pattern, enabling the graduates to easily adhere to and internalize it.

Such a change in mental way of thinking and also in further practice within a large Enterprise as the military system is a complex, but not unattainable challenge. To understand how and where the educational system may intervene we should analyze the organizational culture model proposed by Schein [5]. Three levels of culture were identified: artifacts (the mission, the organizational structure, and for military organizations, the doctrine), espoused beliefs and values (written/ unwritten ideologies, ideals, and goals), and basic underlying assumptions.

Schein suggests that even the first level is the most visible aspect

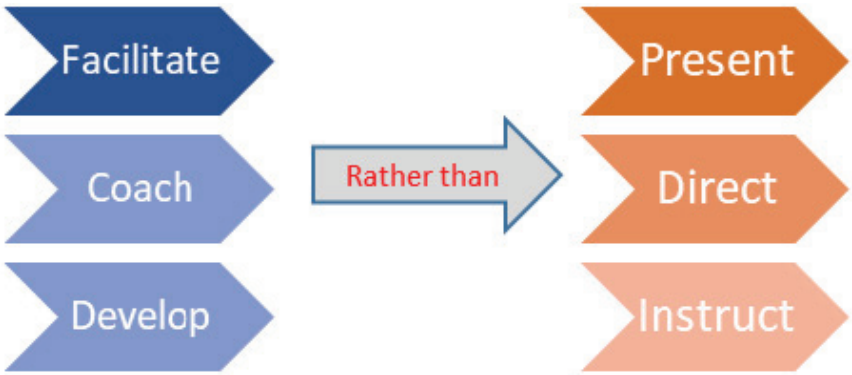

Fig. 3 Desired instructor's teaching approaches
Source: Authors' own conception

of the organizational culture (and the easiest one to be identified we may add), it has the least impact on how people think and act. He advocate that the next level has a much stronger and more direct impact on an organization's true beliefs and ways of thinking. This line of reasoning guide us to the conclusion that addressing beliefs and values through the educational process (to create ideals and goals) is the proper approach for a Mission Command ready mindset.

In Table 2, we are proposing a non-exhaustive list of disciplines and teaching points which content may contribute to the graduates' necessary mindset needed for practicing Mission Command. The list was developed based on the author's personal experience and the actual curricula of educational programs which are currently running in the institutions within the Romanian military educational system.

Table 2. Examples of disciplines and teaching points that contributes to MC

Disciplines	Teaching points
Decision making theory	• Decisions under certainty • Decisions at risk • Decisions under uncertainty • Building decision models • Structuring decision problems • Responsibility and risk assessment in defense establishment
Workforce management, Organizational theory, Performance management	• Human resource management: skills, roles and responsibilities • Managing the transformation of the military organization • Integrated human resource management: roles and responsibilities of military managers and leaders • Performance and motivation in human resource management • Culture and organizational climate • Group and team dynamics in the military organization • Motivation and performance management at group / team level

Disciplines	Teaching points
Workforce management, Organizational theory, Performance management	• Workforce recruitment and selection • Evaluation and personal / professional development of employees • Personnel compensation and loyalty systems • Disciplinary procedures and punitive measures • Rewards and sanctions as performance influencing factors • Strategic communication within the organization • Organizational culture - models and implications • The importance of professional and organizational development
Ethics and leadership	• Leadership styles - implications for the military organization • Change leadership within the military organization • Ethics and leadership: dimensions and variables specific to the military organization • Organizational tools for the promotion of ethical behavior and decision-making

Source: Authors‘ own conception

3. AN ORGANIZATIONAL PERSPECTIVE ON MISSION COMMAND

In the following paragraphs we will seek to identify the enablers of mission command, translated in a series of recommendations for military organizations themselves.

Commanders should adopt a culture of debate encouraging subordinates’ independent thinking and allowing them to challenge superiors when appropriate. Individual initiative (employed with good intentions and for good purposes) should to be considered superior to the traditional military discipline and not viewed as insubordination. The goal should be to obtain a critical mass of subordinate leaders which possess the ability to act independently, have the confidence to choose and to execute the proper course of action even if it involves risks, as long it follows the general framework of commander’s intent [6].

In terms of organizational culture, higher-level commanders should be comfortable with giving away control and authority to junior leaders and setting conditions for effective decentralized operations consistent with the doctrine of

mission command, while the majority of junior leaders must possess a predisposition towards action and accept necessary risks associated with leading and fighting in complex and uncertain environments against determined and adaptive enemies. Within the military Enterprise, the preferred organizational culture is the one that rewards leaders and soldiers who act and penalizes those who don't.

From an organizational point of view, the military system should be designed to reinforce values (such as trust, professionalism, and initiative) supported by fair, transparent and effective processes of selection, education and training, promotions and rewards. In practice, the disproportionate amount of time spent on administrative types of work compared to other might create improper incentives for leadership and career advancement. There is a high possibility that the idea of being a successful officer to be equated with administrative rather than tactical skills and therefore promotions to be consequently determined by how well paperwork is completed by an individual rather than his capacity for leadership and combat.

The military system is one of the most conservative ones in terms of imposing strict hierarchical relations and applying Standard operation procedures (SOP), and for a good reason - projecting stability, resilience and strength [7]. For this reason it is our belief that in order to achieve the aforementioned enablers and implement the recommendations in practice it is not enough to simply teach Mission Command principles, or to simply present the lessons learned derived from the implementation of the concept in certain countries. What may work in a certain country may simply not function in another. It is possible or appropriate to apply the same approach twice and obtain similar (comparable) results only under exactly the same conditions, but we must assume that the circumstances will vary and change.

One potential approach for the MC philosophy to be internalized by the military organism is to emphasis its national character, based on the fact that there are specific national differences that affect certain aspects of the organizational culture (such as culture of participation and empowerment). Certain ways are demonstrating the existence of a natural link between mission command and the national particular culture of command or recalling the memory of great national commanders who had successfully utilized it intuitively.

4. THE COMPLEXITY OF IMPLEMENTING MISSION COMMAND IN PRACTICE

Due to its successful historical implementations and obvious advantages, mission command is widely adopted as a military doctrine by several countries. However, in practice MC is not always easy to be

achieved, because the key enablers of mission leadership (building trust, promoting initiative and autonomy, learning from successes and failures, and practicing mission-oriented leadership in all aspects of the profession) are impacted by a variety of factors such as: large number of personal, cultural, technological, and organizational restrictions of the military enterprise.

To achieve the intended results it is important to cultivate a culture in which the philosophy of mission command permeates all aspects of military life. Military culture is known for a rigid conformity to norms and subordination of members. Based on real life systematic observations, we can state that not all commanders appreciate initiatives, even if they have the potential to produce positive results. They might feel deeply uncomfortable in the face of uncertainty and seek to exert a high degree of control over even minor details of an activity. Some of them may feel undermined by individual initiatives and see them as a threat to their authority.

The core of mission command are human relations. There is a certain tension induced by the practice of mission command in connection with the hierarchy of the organization, between superiors and subordinates. Emphasis on subordinates‘ decision-making capacity and initiative, favoring autonomy and flexibility is in apparent opposition with the “order based” command practiced by superiors (an alternate name given to detailed command, which usually implies micro-management approaches).

However, mission command and detailed command should be viewed as complementary and there should not be in principle any contradiction between them. There are situations (or types of activities) when one approach is considered to be more appropriate than the other. To exemplify such situations/activities when detailed command/mission command is required, we can mention: Peacetime vs wartime or administrative tasks vs combat training.

In peacetime, much of the officers‘ day-to-day work consists of administrative tasks. Since much of the administrative work is loosely regulated by law and usually the decision is centralized, this tends to create a mismatch between how officers can manage the day-to-day work and how they are supposed to handle it during actual combat. Even so, mission command still needs to be encouraged and exercised in peacetime activities to be operational in wartime.

Mission command philosophy can sometimes being perverted and used by leaders to hide their lack of expertise or as an excuse to avoid responsibility for failure [8]. Such a perception can be commonly encountered among junior leaders or subordinates. Also, higher commanders are less likely to tolerate failure (despite their claims to the contrary) as they might place more value on projecting a positive

external image of the operations carried out under their direction.

In terms of the length of a command (the amount of time spent in the same leadership position), this is also a potentially significant obstacle to the exercise of mission command. In military systems that apply rotation after three years for different command positions, this time interval:

- Is often considered too short to fully master the position requirements and build mutual trust with subordinates by developing enough personal relationship;
- Might encourage a tendency to go for tried and tested solutions stipulated in regulations, which may not be ideal, but at least are not wrong.

In principle, from the commander‘s point of view, all initiatives should be encouraged, even those that seem to be not optimal, in order to promote self-confidence and empowerment of subordinates. An immediate result of this transfer of authority is the enhancement of the subordinate’s freedom to act and the additional time given to the leader to think strategically, not focusing on micromanaging the activities [9].

With the current development and adoption of new technologies in the field of information and communication systems (e.g. advanced command systems), if it’s improperly exploited may create the premises for micromanagement. In theory, these technologies can foster mission command if utilized as a mean of facilitating communication of the commander‘s intentions and ensuring the shared understanding by the subordinate leaders of the operational situation. In practice, because technology make easier for commanders to closely monitor developments on the ground and see detailed movement of their troops, this may create the temptation for direct interference with the work of subordinates or step by step management using modern sophisticated communication devices.

5. CONCLUSIONS

Mission Command existence could be briefly checked through the assessment of several indicators:

- Understanding of the local mission and adherence to higher intent;
- Mutual trust based on professional competence;
- Excellent communication based on shared understanding of doctrine;
- High value on learning in training and education;
- Tolerance for well-intended mistakes;
- A predilection for action and initiatives;
- Responsibility linked to authority;
- Belief in the ability of individuals to make sound judgment calls.

On a much greater scale, the efforts to institute Mission Command could

be a trigger for a larger organizational transformation, materialized in doctrinal development, improved officer training and education and finally an improved battlefield performance.

However, the military system should do more to successfully adopt MC as its overarching command philosophy, by clearly distinguishing it from the command-and-control war fighting function and by strongly articulating that the concept is the essence of its doctrine.

Referring again Schein's organizational culture model, the military body's artifacts must accurately reflect the kind of culture it is attempting to adopt. It is not enough to write new policy documents [10], changes must be made at the level of officers (and NCOs) military education and training programs, which contribute to the formation the beliefs and values of leaders and subordinates.

If we fail to change through education the foundation of basic assumptions and organizational culture in the military, Mission Command will remain just a trendy leadership philosophy, rather than a concept applied in practice.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

REFERENCES

[1] Martin, E. Depmsey. *Mission command white paper,* April 2012, https://www.jcs.mil/Portals/36/Documents/Publications/missioncommandwhitepaper2012.pdf. Accessed 25 Jan. 2023

[2] Vandergriff, Don. The Basics: *Developing Leaders for Mission Command*, https://thestrategybridge.org/the-bridge/2014/5/20/the-basics-developing-leaders-for-mission-command, May 2014, accessed 9 Nov. 2022

[3] Matzenbacher, Brett. The U.S. Army and Mission Command Philosophy versus Practice, *Military Review*, March-April 2018, p. 65.

[4] Nicholas, Murray. The Role of Professional Military Education in Mission Command, *Joint Force Quarterly* no. 72, p. 11, NDU Press, 2014

[5]. Schein, H. Edgar, *Organizational Culture and Leadership*, San Francisco: John Wiley & Sons, 2010, pp. 66-69, iBooks.

[6] *Army Doctrine Publication 6-0: Mission Command*, U.S. Army, Washington, D.C., 2012, p. 1-13, https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN18314-ADP_6-0-000-WEB-3.pdf, accessed 26 January 2023

[7] Andreski, Stanislav. Conservatism and Radicalism of the Military, *European Journal of Sociology*, vol. 2, no. 1, 1961, pp. 53–61. JSTOR, http://www.jstor.org/stable/23998331, accessed 9 Nov. 2022.

[8] Nilsson, Niklas. Practicing mission command for future battlefield challenges: the case of the Swedish army, *Defence Studies*, 20:4, pp. 436-452, 2020

[9] Shamir, Eitan. *Transforming Command: The Pursuit of Mission Command in the U.S., British and Israeli Armies*, Stanford University Press, 2011, p. 39.

[10] Johnston, Paul, Doctrine is not Enough: The Effect of Doctrine on the Behavior of Armies, *Parameters 30*, no. 3, 2000, pp. 30–39.

CHINA'S *THREE WARFARE* STRATEGY. ORIGINS, EVOLUTION, APPLICABILITY

Cosmina NECULCEA

PhD Student, "Carol I" National Defense University, Bucharest/ „Henri Coandă" Air Force Academy, Brașov, Romania

The Information Age is characterized not only by new challenges, but also by a new set of criteria in defining victory. Joseph Nye, the father of the concept of soft power, observed that, in the 21st century, conflicts are more about the victory of narratives than armies. States like China or Russia, two ambitious powers, took this matter seriously, being the first to ask themselves questions about ***What*** *war is and* ***whether it is possible*** *to win without engaging into battle? In 2003, China adopted the Three Warfare Strategy/ 3Ws, a strategy that practically reinvented the understanding of war, and by combining the three types of warfare (psychological, public opinion and legal), it helped and continues to help China meet its goals. In China's view, this strategy represents a force multiplier, aimed at ensuring its domestic development, regional importance of the state, expansion as a global power and increasing influence at international level. The purpose of this article is to identify the origins and foundations of this strategy and the manner in which it produces effects.*

Key words: *information age, three warfare strategy, influencing actions, mass media, public opinion, legality.*

1. FROM *UNRESTRICTED WARFARE* TO *THREE WARFARE STRATEGY*

In 1999, three years before the terrorist attacks of September 11, 2001, the Chinese Colonels Qiao Liang and Wang Xiangsui published their work *Unrestricted Warfare*, which was well received in the United States and other NATO countries. In addition, it provided the community of researchers the impression that it is a book that summarizes the Chinese military strategy and provides a way to understand it - the scientometric indicators of the citation of this work in its 1999 edition, but also in the 2002 edition, published at the Pan American Publishing Company, in Panama, with the subtitle *China's Master Plan to Destroy America*, are proof of its wide reception. One of the possible factors that influenced the reception of the book was the very detail that the Chinese military left the impression of having "prophesied" the World Trade Center attacks, inducing the feeling that "were not a random act perpetrated by independent agents" (Santoli:2002, p.vii).

At the time of its original publication, the book emphasized that no country is capable of defeating a superpower like the United States of America, and presented methods of weakening such a superpower by using unconventional means, inclusive of controlling the banking system, the media, or the natural resources. In other words, the work illustrated how a nation like China can take on a technologically superior adversary through a variety of means, including the so-called *political warfare*, taking up the fundamentals of Sun Tzu's paradigm. (Codevilla and Seabury: 2006, p.151). In fact, for each of the levels of confrontation, there is a correlation with the Western military thought, in turn influenced by the military thought of Sun Tzu. The concept of *political warfare* is equivalent to the *grand strategy* concept proposed by B.H. Liddell Hart, even though the Chinese authors refer to the more recent work *Grand Strategy: Principles and Practices* by John M. Collins (Qiao & Wang:1999, p.197), defining it in the converging terms of Grand War – War Policy [dazhan – zhance]: "We call it 'war policy' because strategy at this level mainly involves the political stratagems for warfare" (Qiao & Wang:1999, p.197).

The strategy of a total war described in this book, considered the new art of Chinese warfare, reveals that according to Chinese military tradition, there is no sector of life that is "*outside the sphere of war*" (Spalding:2022). The paper highlights that the Chinese state was preparing to confront the US and other allies through *asymmetric* or *multidimensional* attacks in all areas of social, economic or political life. Not coincidentally, this book was seen by Americans as *China's Master Plan to Destroy America*. However, the book was not a plan for a war against the West, but rather a call for innovative thinking about future warfare, being, basically, "*a collection of tactics, techniques, and procedures that have been used over time and will be used by future adversaries*" (Van Messel: 2005, p.iii), compensating for inferiority to the adversary through a variety of methods other than the military confrontation. The first part of the book, entitled *On New Warfare*, consisting of chapters 1-4, describes how the nature of war has changed, while the second part, *A Discussion of New Methods of Operation*, brings to light new strategies and ways of thinking in conducting military operations so as to achieve success.

The purpose of the paper is clearly stated in the introduction, with the authors providing the following arguments: "*The purpose of Unrestricted Warfare is to analyze and show how war has fundamentally changed and how future wars will be won*." (Baughman:2022) And the evolving nature of war is described by the two authors with the following phrase: "*If we acknowledge that the new principles of war are no longer "using armed forces to compel*

the enemy to submit to one's will", but rather are "using all means, including armed forces or non-armed force, military and non-military, and lethal and non-lethal means to compel the enemy to accept one's interests" (Liang and Xiangsui:1999, p.7)

This assessment led to the development of the Three Warfare strategy (sānzhǒng zhàn fǎ (三種戰法), officially adopted by the Central Military Commission in November 2003, which, in international perception, can be viewed as *three wars, three tactics*, or *three methods of combat*. (Behrendt:2022)

2. 3Ws – *HYBRID WARFARE WITH CHINESE CHARACTERISTICS?*

Drawing an analogy with the Russian perspective and considering the roots of hybrid warfare, Mark Thomas, author of *The Chinese Roots of Hybrid Warfare* concludes that the first to ask the questions, "*What is modern warfare? What should the army be prepared for? How should it be armed?*" (Thomas:2022) were precisely the two authors of *Unrestricted Warfare*, predicting the changing nature of warfare 14 years before Gerasimov did. (Gerasimov:2013). It is true that Qiao and Wang's projection predates the American perspective on hybrid warfare (Mattis & Hoffman:2005; Hoffman:2007), which is why Thomas' perspective becomes compelling. *Unrestricted Warfare* depicts modern warfare through the presence or even absence of hackers, commercial or financial transactions, where the mass-media becomes an extremely powerful weapon. All actions take place in an *extended domain view* (Liang and Xiangsui:1999, p.118) and not in a battlefield where lethality takes precedence. "*Everything is changing*" (Liang and Xiangsui:1999, p.134) or "*all friendship is in flux; self-interest is the only constant*" (Liang and Xiangsui:1999, p.38) are just two of the findings made by the two authors to highlight the changing nature of war, especially in the Information Age.

On the same note, Gerasimov also concludes in his first article in which he assumes the concept of hybrid war: "no matter what forces the enemy has, no matter how well-developed his forces and means of armed conflict may be, forms and methods for overcoming them can be found" (Gerasimov:2016, p.29). As far as China is concerned, the Chinese maritime militia or the so-called *Blue Men* (named in relation to the Russian Green Men, as Moscow's special forces deployed in Crimea, in 2014, were called) are the epitome of the Chinese doctrine of hybrid warfare, as they combine both conventional military operations (when operating in tandem with the Chinese naval forces) and unconventional operations (by masquerading as Chinese fishermen attacking vessels transiting or operating in the South China Sea). An example of how they act consists precisely in the dual status of Chinese fishermen

who can very easily switch from the status of civilian fishermen to active military personnel and vice versa, depending on the adopted military scenarios (Miracola:2018). Also, the Chinese hybrid warfare is applied at both strategic and tactical levels. For example, Beijing adopts the so-called *salami-slicing strategy* by carrying out non-linear operations, in order to slowly and progressively gain more and more territories (Romaniuk & Burgers:2021, p.34). At the same time, we recall China's unconventional techniques for gaining and controlling more and more territories. At the tactical level, we mention the so-called *cabbage tactics* (sometimes extended to a higher level of military art, as *cabbage strategy*) which refers to the deployment of all maritime forces (conventional and non-conventional) to physically encircle the contested islands and block all types of access to the respective islands (TruOng-Minh Vu & The Phuong Nguyen:2019, p.87). First, actions in the South China Sea and beyond give the Chinese state the image of an aggressive, expansionist and hegemonic state. On the other hand, the way China conducts information warfare actions, through the 3Ws, demonstrates that the Chinese state sees this strategy as a tool to continuously deter adversaries. At the same time, this strategy "*led to the image of a China that relates to Information War as a hybrid war with Chinese characteristics*" (Clarke:2019) Therefore, this strategy is a component of hybrid warfare.

3. PUBLIC OPINION WARFARE, PSYCHOLOGICAL WARFARE AND LEGAL WARFARE

In Chinese military writings, beginning with Sun Tzu and ending with this work by Qiao and Wang, achieving information superiority is considered a prerequisite for achieving and maintaining battlefield supremacy. Contrary to this perspective, for example, in the Romanian specialized literature, the issue of information supremacy was approached only tangentially. Based on this projection, for example, Colonel Adrian Lesenciuc (Lesenciuc:2014, p.138), proposed a principle formulated in accordance with the projection of Liddell Hart's principles, more precisely: "do not allow the interruption of communication flows among own troops during military operations"[2]. Through the 3Ws, the People's Liberation Army seeks to ensure victory before entering battle. In other words, the strategy according to which one can subdue one's enemy without fighting, can be achieved by influencing the behavior of the opponent, by using non-kinetic means, which are not only limited to wartime but can also be operated in peacetime.

Fig.1 Three Warfare Strategy

All elements of the 3Ws are *interdependent*, *complementary* and *inseparable* (Behrendt:2022) because public opinion warfare creates an environment conducive to psychological and legal warfare, legal warfare creates the basis for psychological and public opinion warfare and psychological warfare creates the tools to implement the public opinion warfare and legal warfare. The war of public opinion aims at the manipulation of public opinion in order to raise the morale of own troops and weaken the morale of the opposing troops (the action does not exclude propaganda means) and involves the appeal to classic media as well as to new media (social networks). Yusheng (Yusheng:2015, p.1020) draws attention to the fact that, recently, the concept of Qiao and Wang began to be replaced by that of *public opinion struggle*, which involves the use of public opinion as a weapon. Psychological warfare is defined along the same lines as in Western doctrines, explicitly including propaganda (Yusheng:2015, p.1021), aiming to reduce the enemy's will to fight. Legal warfare is a completely different concept from the other two, which may have a counterpart in Western doctrines in *Media Ops* and *PsyOps*, assuming "struggles for achieving legal principle superiority, the political initiative, and military victory through means and methods such as legal intimidation, legal strikes, legal counterattacks, legal restraints, legal sanctions, and legal protection, using laws as weapons, based on strategic intent and operational tasks of the Central Military Commission." (Yamaguchi et al., 2022)

Since the 1990s, China has treated law as yet another weapon and, according to the 3Ws, this weapon is used to *deter, attack, counter-attack, coerce and sanction* (Charon & Jeangène Vilmer:2021, p.49). Through this type of warfare, China wants to create the appearance of legitimacy, even in the case of the use of armed force, portraying the actions of the adversaries as illegitimate.

4. 3Ws AS APPLIED BY CHINA

4.1. 3Ws against Taiwan

The best example of psychological and cognitive warfare is the influence operations against the island of Taiwan. These operations involve the spread of

fake news through cyberspace, social media activities, fake news, propaganda, etc. Taiwan is seen by Beijing as a rebel province and is a target of its 3Ws strategy. The island also poses a threat to the Chinese Communist Party, especially in the ideological sphere, as the success of Taiwan's democracy contradicts the thesis promoted by the Chinese authorities that "*societies based on Confucianism are incompatible with liberal democracy*" (Behrendt:2022). The issue is extremely current and is the subject of debates at the highest level. For example, at the 20th Congress of the Chinese Communist Party, President Xi Jinping stated: "Resolving the Taiwan question is a matter for the Chinese, it is a matter that must be resolved by the Chinese" (Davidson & Graham-Harrison:2022). In China's perception, Taiwan is an inseparable territory and constitutes *a primary interest* where China seeks to win through the *win without fight* method, through actions carried out in the cognitive sphere (Rosen:2022). To attack Taiwan, China resorted to the 3Ws, particularly through the efforts of the 311 Base, whose headquarters is located in Fujian, Fuzhou Province, considered a front-line base directly responsible for the public opinion warfare, psychological warfare or legal warfare, since 2011 (Yamaguchi et al., 2022). In other words, the Three Warfare strategy embodies real operations in the cognitive domain, and "the three warfare strategy is expected to be the effective tool, as long as the operations in the cognitive domain are intended to degrade the adversary's cognition, emotions, and will" (Yamaguchi et al.,2022). At the psychological level, China has constantly threatened Taiwan with a military invasion in the event of a unilateral declaration of formal independence from Beijing, with the Chinese spreading fake news to undermine Tsai Ing-wen's political agenda (Szeto:2022). Therefore, China is using the warfare of public opinion to create confusion and undermine the trust of the Taiwanese people in the government and public institutions. Over time, China has tried to influence every round of elections in Taiwan, including the 2020 elections, but despite disinformation and influence operations carried out by the Chinese state, Tsai Ing-wen, the representative of the Democratic Progressive Party, a skeptical group in relation to the Beijing's policy and the principle promoted by the Chinese - "one country, two systems" -, won the elections for the position of president of the state (Allen-Ebrahimian: 2020). China's actions against Taiwan are not the only ones that can fit into the 3Ws strategy, and the warfare of public opinion is not the only way that the Beijing administration has manifested itself in relation to the Taipei government and the population of the island in the western Pacific Ocean. Examples of legal warfare directed against it can be: (1) the one waged through a series of legislative measures including the anti-secession law invented by

China, in 2005, which specifically targets the *rebellious island*, whereby any proclamation of Taiwan's independence would amount to a declaration of war on Beijing; (2) the official Chinese narratives, which include the speech given in 2019 by the Chinese president, as the supreme commander of the armed forces, who promised "China will not give up the use of force to combat Taiwan independence fighters" (Damian:2019), stating that the independence of the island of Taiwan would be a *disaster* and (3) adding a paragraph in the Constitution of the Chinese Communist Party, regarding *the firm opposition and deterrence* of the independence of the Taiwanese state, as well as showing the intention to rule the island in the future, by implementing the policy of *one country two systems*. (ProTV, 2022)

4.2. 3Ws in South China Sea

The implementation of the 3Ws concept has also been realized through the territorial disputes in the South China Sea, involving the islands, coastline and various boundaries in the Gulf of Tonkin. The construction of artificial islands, such as the Spartly or Paracel Islands, started decades ago, initiated by Vietnam and the Philippines, to which China was added - which built more islands in the period 2014-2016 than all the others had built throughout their history, placing military equipment on them - serves on the one hand to control some disputed areas, on the other hand to exert permanent pressure in the area (Valencia:1988, 438-443; Marlay:1996, 195-210). The main victims of this pressure are precisely the states that started the construction of the islands and which, without the US support, could not prevent the Chinese state from expanding its military arsenal in the area (Advincula Jr.:2014, 51-65). An example of the implementation of the legal warfare is the one practiced by the Beijing administration that extended its sovereignty over the Paracel Islands due to interests such as the access to resources, maritime rights and rivalry with the US (Buszynski:2012, 139-156), building the city of Sansha on Yongxing Island in the aforementioned archipelago and claiming rights to a significant maritime territory.

The actions in the South China Sea have been described by the two previously mentioned techniques, such as the salami-slicing strategy, by conducting non-linear operations to slowly and progressively gain more and more pieces of land, or the so-called cabbage tactic, which refers to the deployment of all maritime forces (conventional and non-conventional) to physically encircle the disputed islands, to block all types of access to the islands. China perceives the information operations as a lever that produces deterrent effects in the South China Sea, clearly and intentionally producing confusion on the entire conflict spectrum: peace – crisis – war and maintaining, in the spirit of the Clausewitzian doctrine, this confusion useful for its

own manifestations. Public opinion warfare aims to influence both domestic and international public opinion in order to support the Party's goals and discourage adversaries from taking contrary actions. (Halper:2013, p.28) In the South China Sea, the 3Ws strategy was used to manipulate perception and mindset so as to set the conditions of the operating environment in China's favor. (Halper:2013, p.31).

4.3. 3Ws in India

The 3Ws strategy has been used extensively against India as well. With a common border of 3,200 km, largely contested by both sides, China continued the wars of the 1960s: the one won in 1962 and the one lost in 1967 (which is not mentioned in official documents) with propaganda measures, with psychological actions that contribute to the highlighting of certain aspects convenient to China's own policy, maximizing successes and minimizing or denying losses. The opposing perspective is radically different – we mention, for example, the 2017 study by Indian researchers Rajagopalan and Biswas (2017, 120-139), who also shed light on the current perspective of the Chinese policy after the current president, Xi Jinping, took power – and this reflects, on the one hand, the difference in perspective, on the other, the extent of the Chinese propaganda. In the relation between China and India, the Chinese state has often resorted to disinformation or propaganda, or other tools of psychological operations such as misleading, media campaigns through posts on social media platforms such as Facebook (META), Instagram or Twitter.

The repertoire of Chinese actions against India also includes violations of the Indian airspace by Chinese helicopters or shows of force by both sides. The 2017 Doklam plateau crisis (Panda:2017) intensified the conflict (even if the plateau is not directly disputed by India), and China's reaction, in line with the legal warfare it designed, built a village, Pangda, 2 km from Bhutanese territory, close to Doklam (Westcott:2021, 7-32). Another example of the 3Ws is the crisis in the Galwan valley, in the Himalayan region of Ladakh, which resulted in casualties on both sides, but which was not confirmed by China until four months after the end of the conflict (Kaura:2020).

5. CONCLUSIONS

Through the new mode of confrontation that exceeds the classical warfare and applying it to the entire spectrum of actions: peace - crisis - war, China uses advanced technologies to achieve effects similar to those of real military engagements. While the West uses technology to make operations more efficient, China uses technology to defeat within the confines of the 3Ws concept, not actually engaging in combat, except for the situations where it is absolutely necessary (see e.g. , the case of Galwan Valley). In Chinese view, waging war against a

well-equipped enemy entails avoiding direct confrontation and adopting a confrontational approach in the cognitive sphere. The Three Warfare strategy represents the essence of the Chinese "political warfare", being a combination of actions of influence, information, cyber operations or economic pressure, but which do not exclude violent confrontations. From this point of view, 3Ws is a replica, or rather the original, in relation to which the Russian hybrid war (hybridnaia voina) is expressed. This strategy has the role of undermining the adversary's confidence, inducing a sense of inferiority or intimidating him, without resorting to military force. But this strategy is not only limited to the foreign environment, but is also used in the domestic environment, both to influence the perception of own public opinion and to control narratives or even to impose or brutally repress own policy. (Gershanek:2020, p.67) The 3Ws strategy represents a significant shift in the understanding of warfare and remains an important component of China's information warfare strategy, continuing to evolve (Kania:2016). This does not mean abandoning *hard power*, which continues to be a powerful deterrent but may no longer be as effective or sufficient.

I believe that in order for one to truly understand what this strategy represents, it must be understood as a *complex doctrine of information operations* that contributes to the redefinition, reconsideration, and recontextualization of warfare.

NOTES

[1] With reference to Liddell Hart, the Chinese officers define the concept of strategy and find out what the limits of its application are in this sense, in relation to the concept of the Chinese military strategy, which exceeds the classical framework of definition: "Liddell Hart [British officer and military theorist] defined the word strategy as "the art of using military means to achieve political objectives." From this, we can see that the concept of means covers a lot of territory, on numerous levels, with overlapping functions, and thus it is not an easy concept to grasp. Only by expanding our field of vision and our understanding of means, and grasping the principle that there is nothing which cannot be considered a means, can we avoid the predicament of being confronted with too many difficulties to tackle all at once and being at wit's end when we employ means." (Qiao & Wang, 1999, 137)

[2] Both the principle itself, and especially the explanation that the Romanian officer brings to the principle he proposes, and which is useful in understanding the false framing of *Unrestricted Warfare* in the Sun Tzu paradigm: "But the purpose of this formulation of the principle is not the principle itself, but signaling the fact that the nomological determination of military actions does not require a nomological hierarchy, but a repositioning outside the Clausewitzian deterministic limits, in a paradigm of openness. In this horizon, "continuous peace" (our alternative to "continuous war") is sometimes interrupted by the occasional manifestation of violence in order for it to return to better conditions of manifestation." (Lesenciuc:2014, p.138). This work by Qiao and Wang, in agreement with the Clausewitzian projection of China's military strategy, falls within this paradigm, just as the Russian hybrid warfare (*ghibridanaia voina*) assumes exactly the same thing.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

REFERENCES

[1] Advincula Jr., Julian V. (2014). China's Leadership Transition and the Future of US-China Relations: Insights from the Spartly Islands Case. *Journal of Chinese Political Science.* 20. 51-65.

[2] Allen-Ebrahimian, Bethany. (2020, 10 January). China steps up political interference ahead of Taiwan's elections. *Axios* [online]. URL: https://www.axios.com/2020/01/10/china-disinformation-taiwan-presidential-election [accessed on 29 March, 2023].

[3] Baughman, Josh. (2022). „"Unrestricted Warfare" is Not China's Master Plan". *China Aerospace Studies Institute* [online] URL: https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/CASI%20Articles/2022-04-25%20Unrestricted%20Warfare%20is%20not%20China's%20master%20plan.pdf. [accessed on 29 March, 2023].

[4] Behrendt, Paweł. (2022). San Zhong Zhanfa or Three Warfares. Chinese Hybrid Warfare. *Boym Institute* [online] URL: https://instytutboyma.org/en/san-zhong-zhanfa-or-three-warfares-chinese-hybrid-warfare. [accessed on 29 March, 2023].

[5] Buszynski, Leszek. (2012). The South China Sea: Oil, Maritime Claims, and U.S. – China Strategic Rivalry. *The Washington Quarterly.* 35:2. 139-156.

[6] Charon, Paul, & Jeangène Vilmer, Jean-Baptiste. (2021). *Les Opérations d'influence Chinoises. Un moment machiavélien.* Paris: l'Institut de recherche stratégique de l'École militaire (IRSEM).

[7] Clarke, Michael. (2019). China's Application of the 'Three Warfares' in the South China Sea and Xinjiang. *National Security College* [online]. URL: https://nsc.crawford.anu.edu.au/sites/default/files/publication/nsc_crawford_anu_edu_au/2019-05/chinas_app_of_the_3_warfares_in_xj_and_scs.pdf. [accessed on 29 March, 2023].

[8] Codevilla, Angelo, and Paul Seabury. (2006). *War: Ends and Means.* Washington DC: Potomac Books, Inc.

[9] Damian, Vasile. (2019). China "se pregăteşte pentru război" şi ameninţă Taiwan-ul. *Radio France International* [online]. URL: https://www.rfi.ro/special-paris-108223-china-se-pregateste-pentru-razboi-si-ameninta-taiwan-ul. [accessed on 29 March, 2023].

[10] Davidson, Helen & Graham-Harrison, Emma. (2022, 16 octombrie). Xi Jinping opens Chinese Communist party congress with warning for Taiwan. *The Guardian* [online]. URL: https://www.theguardian.com/world/2022/oct/16/xi-jinping-speech-opens-china-communist-party-congress [accessed on 29 March, 2023].

[11] Gerasimov, Valerii [Герасимов Валерий]. (2013, 27 February). Ценность науки в предвидении Новые вызовы требуют переосмыслить формы и способы ведения боевых действий (Ţennosti nauki v predvidenii). *Военно-Промышленный Курьер/ Voenno-Promîşlennîi Kurier*. 8 (476).

[12] Gerasimov, Valery. 2016. "The Value of Science is in the Foresight. New Challenges Demand Rethinking the Forms and Methods of Carrying out Combat Operations" *Military Review* online]. URL: https://www.armyupress.army.mil/Portals/7/military-review/Archives/English/MilitaryReview_ 20160228_ art008.pdf. [accessed on 29 March, 2023].

[13] Gershaneck, Kerry K. (2020). Political Warfare. The People's Republic of China's Strategy "to Win without Fighting". *Journal of Advanced Military Studies.* 11: 1. 64- 93.

[14] Halper, Stefan. (2013). Overview and Analysis of the Three Warfares. Part 1: Definition Of The Three Warfares. *Cryptome* [online]. URL: https://cryptome.org/2014/06/prc-three-wars.pdf. [accessed on 29 March, 2023].

[15] Hoffman, Frank. (2007). *Conflict in the 21st Century: The Rise of Hybrid Wars.* Arlington, VA: Potomac Institute for Policy Studies.

[16] Kania, Elsa. (2016, 15 august). The PLA's Latest Strategic Thinking on the Three Warfares. *CIMSEC* [online]. URL: The PLA's Latest Strategic Thinking on the Three Warfares | Center for International Maritime Security (cimsec.org) [accessed on 29 March, 2023].

[17] Kaura, Vinay. (2020). India's Relations with China from the Doklam Crisis to the Galwan Tragedy. *India Qaurterly: A Journal of International Affairs.* 76: 4.https://doi.org/10.1177/0974928420961768

[18] Lesenciuc, Adrian. (2014). *Introducere în arta militară.* Foreword by Col Traian Anastasiei. Brașov: The Printing House of "Henri Coanda" Air Force Academy.

[19] Marlay, Ross. (1996). China, the Philippines, and the Spartly Islands. *Assian Affairs: An American Review.* 23:4. 195-210.

[20] Mattis, James N. & Hoffman, Frank. (2005). Future Warfare: The Rise of Hybrid Wars. *US Naval Institute Proceedings.* Vol.131 no.11.

[21] Miracola, Sergio. (2018). Chinese Hybrid Warfare. Italian Institute for International Political Studies (ISPI) [online]. URL: https://www.ispionline.it/en/pubblicazione/chinese-hybrid-warfare-21853. [accessed on 29 March, 2023].

[22] Panda, Ankit. (2017). The Political Geography of the India-China Crisis at Doklam. Explaining the political geography at the center of a serious India-China standoff in the Himalayas *The Diplomat* [online]. URL: https://thediplomat.com/2017/07/the-political-geography-of-the-india-china-crisis-at-doklam. [accessed on 29 March, 2023].

[23] Qiao Liang & Wang Xiangsui. (1999). *Unrestricted Warfare.* Beijing: PLA Literature and Arts Publishing House.

[24] Rajagopalan, Rajeswari Pillai and Biswas, Arka. (2017). India–China Relations under Xi Jinping: An Indian Perspective. *China: An International Journal 15*(1), 120-139.

[25] Romaniuk, Scott N. & Burgers, Tobias. (2021). The South China Sea as an Echo Chamber of Chinese Foreign and Security Policy. In Gordon Houlden, Scott N. Romaniuk & Nong Hong (eds.), *Security, Strategy, and Military Dynamics in the South China Sea. Cross-Narional* Perspectives. Bristol: Bristol University Press.31-62.

[26] Rosen, Stephen Peter. (2022, 28 noiembrie). Winning Without Fighting. *The Bulwark* [online]. URL: https://www.thebulwark.com/winning-without-fighting/ [accessed on 29 March, 2023].

[27] Santoli, Al. (2002). Introduction. In Qiao Liang & Wang Xiangsui. (2002). *Unrestricted Warfare. China's Master Plan to Destroy America.* Panama: Pan American Publishing.URL: https://archive.org/details/unrestricted-warfare-20180705162603/page/n5/mode/2up [accessed on 28 March, 2023]

[28] Spalding, Robert. (2022). *War Without Rules. China's Playbook for Global Domination.* Nw York City: Sentinel.

[29] Szeto, Winston. (2022, 8 March). Taiwan fighting disinformation campaign amid island's support for Ukraine, top diplomat says. *CBC News* [online]. URL: https://www.cbc.ca/news/canada/british-columbia/taiwan-top-envoy-vancouver-china-disinformation-ukraine-russia-1.6376321 [accessed on 29 March, 2023].

[30] Thomas, Mark. (2022). The Chinese Roots of Hybrid Warfare. *CEPA* [online]. URL: https://cepa.org/article/the-chinese-roots-of-hybrid-warfare. [accessed on 29 March, 2023].

[31] Truong-Minh Vu & The Puong Nguyen. (2019) Navy-Coast Guard Emerging Nexus: The Case of Vietnam. In Ian Bowers & Swee Lean Collin Koh (eds.), *Grey and White Hulls. An International Analysis of the Navy-Costguard Nexus.* New York: Palgrave MacMillan. 73-94.

[32] Valencia, Mark J. (1988). The Spartly Islands: Dangerous ground in the South China Sea. *The Pacific Review*, 1:4. 438-443.

[33] Van Messel, John A. (2005). *Future War Paper, Unrestricted Warfare: A Chinese doctrine for future warfare?* United States Marine Corps, School of Advanced Warfighting, 2076 South Street, Quantico, Virginia 22134-5068: Marine Corps Combat Development Command. https://apps.dtic.mil/sti/citations/ADA509132.

[34] Westcott, Stephen P. (2021). Seizing a Window of Opportunity? The Causes and the Consequences of the 2020 Sino-Indian Border Stand-off. *Journal of Asian Security*. 8:1, 7-32.

[35] Yamaguchi Shinji, Yatsuzuka Masaaki & Momma Rira. 2022. *NIDS China Security Report 2023. China's Quest for Control of the Cognitive Domain and Gray Zone Situations.* The National Institute for Defense Studies 5-1 Ichigaya Honmura-cho, Shinjuku-ku, Tokyo 162-8808 Japan. http://www.nids.mod.go.jp/publication/chinareport/pdf/china_report_EN_web_2023_A01.pdf

[36] Yusheng, Xiao. (2015). *Zhongguo gongchandang jundui zhengzhi gongzuo shi (A History of the Chinese Communist Party's Military Political Work)*, vol. 1. Beijing: Military Science Press.

[37] ***. (2022, 8 November). Xi Jinping: China se va concentra pe pregătirile pentru război și va intensifica exercițiile militare. *Pro TV* [online]. URL: https://stirileprotv.ro/stiri/international/xi-jinping-china-se-va-concentra-pe-pregatirile-pentru-razboi-si-va-intensifica-exercitiile-militare.html. [accessed on 29 March, 2023].

KENYA-UGANDA TRANSBOUNDARY DISPUTE RESOLUTION MECHANISMS WITH REGARD TO PROMOTION OF BILATERAL ECONOMIC SECURITY MANAGEMENT

Masoud MWINYI*, Elijah Onyango Standslause ODHIAMBO**

*Ministry of Interior & Coordination of National Government, Kenya National Police Service, **Bomet University College (BUC), Kenya Department of Arts, Governance and Communication Studies

Transboundary disputes over Lake Victoria between Kenya and Uganda concern resources in the marine zone. This transboundary conflict has had a negative impact on managing economic security since it has not been adequately addressed in resolutions. This study evaluates the strategies for resolving transboundary disputes between Kenya and Uganda in light of strengthening bilateral economic security management. The study was influenced by the structural-functionalist philosophy, social conflict, and John Burton's theory of conflict resolution. The research design used in the study was descriptive. The samples were chosen using simple random sampling methods and purposive sampling techniques. Philosophically, the work provided a foundation for future research and helped us comprehend transboundary issues and how to manage them. Findings indicated that mediation and conciliation were the most used mechanism in resolving disputes in Lake Victoria. However, this approach has not reach zenith as far as managing dispute between Kenya and Uganda is concerned. The study recommends that, sensitization programs tailored towards effective dispute management be put into place and awareness programs disseminated along contested boundaries. In this regard, economic security management will be bolstered well.

Key words: *Bilateral economic security, dispute resolution mechanisms*

1. INTRODUCTION

Lake Transboundary disputes with regard to It is not a recent development to manage the economic security that comes with natural resources. Northeast Asian nations are nevertheless embroiled in enduring maritime and transboundary conflicts that have so far resisted resolution. These latent conflicts persist even if they are not necessarily aggressive or violent and contribute to obstruct peaceful resolution [1].

In Eastern Africa, where tensions are high and possible natural resource finds on lakes are frequent, border delimitation disputes are widespread. Transboundary disputes over Lake Victoria have already appeared. A good example of this is the dispute that erupted in 2009 between Kenya and Uganda over the latter's right of access to Lake Victoria's fishermen. Others include border clashes between Uganda and the Democratic Republic of the Congo (DRC) over the oil-rich Lake Albert region, which occurred in 2008, and the border incident between Eritrea and Djibouti in 2007. These instances show that border disputes are becoming more common. Along with the possibility of armed conflict, undelineated, porous, and uncontrolled borders are being used for nefarious cross-border activities that put national sovereignty at risk and disturb regional politics. Local communities are excluded from possibilities to profit from the exploitation of the natural resources in their area in these transboundary conflicts, which heightens the level of hostility. By denying access rights to less powerful people who might be disregarded in the administration of these resources by interested countries, the economic worth of Lake resources is put at risk [2]. Okumu's [3] paper summarizes how Lake Transboundary disputes effect economic security management. While the author's study examines the issue of improved management of transboundary resources, it disregards discussing the management of stakeholders' economic security.

Economic security is jeopardized as some parties' access rights to the resource decline. To settle the disagreement, officials from the various ministries of the three countries; Specifically, Kenya, Uganda, and Tanzania met in November 2008 and decided to mark Lake Victoria's borders with light beacons. However, little progress was made until fighting broke out over Migingo Island in 2009, which nearly led the two neighbors to war. Migingo, one of the several islands in Lake Victoria, is just about half an acre in size and is made up mostly of bare rocks. However, it is situated in a fish-rich area of the lake and is a significant source of livelihood for thousands of Kenyan

fishermen, particularly in western Kenya along Lake Victoria. This indicates that those who depend on fishing in Lake Victoria have had their economic well-being affected by the transboundary issue. Were (4) contends that:

"The utilization of the natural resources of Lake Victoria as regional commons is, however, pursued at the behest of vested local and national interests including those of external actors based in the Eastern Africa region, Americas, Europe and Asia. The combined actions of local and external actors have impacted negatively on the size and quality of the stock of the natural resources of the Lake. National interests thus tend to have an overbearing influence on the magnitude of resource exploitation and to a great extent are largely driven by the ever-growing global and regional forces of demand for the resources of the lake. Lake Victoria thus suffers not only from a conspiracy of convergence and divergence but also conflicting national interests and regional demand for its resources."

Despite dangers to their economic stability, Uganda and Kenya have unable to reach a consensus on how to demarcate Lake Victoria in order to establish the territorial limits of each state there. This goes to the heart of both nations' foreign policies and ties. Okoth [5] argues that despite the fact that there are various definitions of Kenyan foreign policy, they are all significant since Kenyan foreign policy is dynamic. Okoth [6] defines foreign policy as the set of tools at a nation's disposal to shape its behavior beyond its borders and promote territorial integrity inside and between nations. Okoth's claim, however, does not fundamentally address economic security in the international relations between the two countries.

Obonyo et al. [7] advised that: "Cartography should always be used to settle territorial disputes between countries instead of going to war" in their proceedings article : "Cartography as a tool for Conflict Analysis & Resolution for Migingo Island Ownership Dispute."

Further, Okoth *et al* [8], in their book "*Peace Security and Development in the 21st Century Africa,"* reaffirms the importance of peace for East African Economic Integration. Both Kenya and Uganda are included in discussions about economic security. Thus, there is a lack of research on the potential threats to economic security posed by transboundary disputes over the very economic value of transboundary resources. Mechanisms for resolving cross-border disputes between Kenya and Uganda are analyzed in terms of their potential to strengthen bilateral economic security management.

1.1. Statement of the Problem

Disputes over Lake Victoria's resources are a classic example of resource utilization over the long term, involving not just private parties but also state institutions and local populations as the issue has expanded to include fishing access [9]. Were [10] explains that the fair distribution of Lake Victoria's water supplies was never an issue before a confluence of forces turned it into one. The proliferation of the issue followed the establishment of fish processing plants along the beaches of the lakes in Kenya and Uganda. Despite the adoption of severe containment measures, particularly from the Ugandan side of the lake, there is an increase in fishing pressure and a drop in catches in Kenya and Uganda, resulting in economic risks exacerbated by intense competition over shared resources, such that some stakeholders are refused access to fishing. As a corollary, unsettled maritime boundaries can easily disrupt bilateral relations and even global stability. Local economies that rely on the Lake's fisheries could be harmed if disputes over ownership or use of fishing spots escalate. As a result, the recurring violence, the murder of fishers, and the falling catches of Nile perch are all signs of ineffective management of the economic security of these shared lake resources [11]. For instance, the Kenyan and Ugandan governments' co-management of Lake Victoria is only one example of a dispute settlement process that has yet to produce significant results. This research evaluates the effectiveness of transboundary conflict settlement processes between Kenya and Uganda in fostering mutually assured economic security.

1.2. Objective of the Study

To assess Kenya-Uganda transboundary dispute resolution mechanisms with regard to promotion of bilateral economic security management

1.3. Research Question

What are the transboundary dispute resolution mechanisms between Kenya and Uganda with regard to promotions of bilateral economic security management?

1.4. Justification of the study

1.4.1 Academic Justification

A number of scholarly works have examined the transboundary conflict between Kenya and Uganda over Lake Victoria. Were [12] study situates the controversy over transboundary natural resource management within a political and international affairs framework. His research examines how the state, ideology, and power imbalance surrounding Lake Victoria's resource management and exploitation affect the concepts of transboundary natural resource management.

Wekesa [13] criticizes that view by stating that the Lake Victoria conflict is more than just a fight over Kenyan and Ugandan sovereignty; it also shows how declining economic fortunes have a significant impact on political responses in the region. The Migingo conflict revolves around fishing and, more specifically, the decline of fish populations in Migingo Lake. As a result of the present fish shortage, the fishing sector in Kenya and Uganda is struggling. The Nile Perch of Lake Victoria is in high demand, both domestically and abroad, but there are currently not enough to meet the demand. Okumu [14] agrees that the dumping of industrial and urban effluent from Kisumu, Kampala, and Mwanza into the lake poses the greatest threat to the lake's resources. This type of fishing is responsible for the depletion of a wide diversity of marine species. In contrast to prior research that has concentrated on transboundary natural resource management and the politics surrounding disputes in border areas, the present investigation has instead centered on the management of economic security in connection to transboundary conflict.

1.4.2. Policy Justification

Several studies have examined the transboundary conflict between Kenya and Uganda over Lake Victoria. Were [15] suggests policy guidelines for managing transboundary resources by situating the conflict around such management in a political and international affairs framework. On the other hand, Okumu [16] and Wekesa [17] research investigated the political security component of this transboundary disagreement, hence centering their attention on intestate relations in the EAC region. The cited works center on dispute resolution strategies backed by regional bodies like the East African Legislative Assembly (EALA), which recognized a bilateral issue between Kenya and Uganda [18]. Instead of delegating border management to political elites and the central government, these policies exclude the communities that are on the front lines of border control. While earlier research has focused on transboundary natural resource management and political security concerns, this study instead examined broader dispute management procedures or policy guidelines between Kenya and Uganda, with a focus on economic security management.

1.4.3. Philosophical justification

Natural resource existentialism provides the theoretical foundation for this research. As a matter of fact, resource exploitation and consumption have occurred throughout Kenya and Uganda's history, with exploiters adopting a

cornucopian perspective, the belief that resources are inexhaustible, and hence, the contention to own. In contrast to ages past, when exploitation was limited to a certain region, today's exploitation is a worldwide phenomenon. There are suggestions, for instance, that overfishing has altered the Lake Victoria environment by wiping off some fish populations.

As a result, the significance of this study cannot be stressed enough. The study is important because it laid the groundwork for further investigation and contributed to our knowledge of transboundary disputes and their management.

2. LAKE VICTORIA TRANSBOUNDARY DISPUTES AND ECONOMIC SECURITY MANAGEMENT BETWEEN KENYA AND UGANDA

Land disputes can be broken down into two distinct types: territorial functional disputes and positional issues. When one country lays claim to territory that legally belongs to another, a territorial conflict arises. This form of disagreement can be further subdivided into irredentist and non-irredentist conflicts [19].

The African states that accepted the preexisting colonial boundaries in principle and hence desired the maintenance of the status quo were regarded as having a non-irredentist policy. This unfortunately did not preempt boundary issues, as some disputes occurred due to interpretation of papers delimiting the borders and their specific physical position. On the other hand, positional border conflicts occur when the borders of two states are ambiguous. The Lake Victoria controversy fits in this category. The cite boundary classification on boundary conflicts is however flexible as the various categories can also be turned into any of the other boundary types. This research classifies transboundary disputes as positional conflicts. While this conflict may be a contributing factor to the aforesaid issue 20, it is not investigated in this study how the dispute has affected economic security management of the Island. Transboundary disputes between Kenya and Uganda are thus mostly territorial in nature. Kenya-Uganda transboundary disputes are the most intricate, most extensive and historically charged of all border disputes. Natural resources, such as water, rivers, and the transportation network, as well as ethnicity, language, religion, culture, and a sense of belonging, have traditionally been brought up [21].

Ojo [22] contended that the border between Kenya and Uganda was one that severed ties between peoples who had previously shared a common cultural background. Luyha, Iteso, Sabaot, Pokot, and Luo communities were all divided by the

border. When Uganda and Kenya gained their independence in 1962 and 1963, respectively, they faced substantial difficulties in managing their borders on both a global and domestic scale. Ochwada [23] asserts that the OAU charter put a lot of emphasis on the idea of territorial integrity and not getting involved in the internal affairs of member states. Sovereignties of nations and made-up national political communities had to be established, and inherited borders provided the perfect framework for doing so. In contrast to other studies that have concentrated on economic security management, this one is narrowly focused on border control.

Kenya and Uganda have not only complied with the 1964 Organization of African Unity resolution to retain the status quo of the borders they received upon independence, but they have also adhered to the survey and demarcation made following the 1926 Colonial Order. However, there is no international boundary agreement between the two nations. Aseka [24] believes that territorial transformation is typically a difficult process, with significant economic consequences for all parties involved, including local residents, regional economies, the global economy, and the particular governments involved.

The resources of Lake Victoria are contested territory because of a failure to properly define, demarcate, and maintain the border between the two countries. The British colonial authority paid less attention to the line between Kenya and Uganda than it did to the borders with Belgian Congo, German Tanganyika, Italian Somalia, and Ethiopia, according to the history of Kenya and Uganda. It was possible for Kenya and Uganda to unite since both countries had previously been administered by the British as part of the East Africa colony and Protectorate. Territorial transfers occurred between the two countries between 1902 and 1970 for a variety of reasons, including tribal unity and administrative ease. Therefore, the lack of economic security management is of concern to the vast majority of stakeholders, and it is this factor that has led to the conflict at the border [25].

Therefore, autonomous regimes avoided making any policy choices that could deal with cross-border issues and people by maintaining the legality of these borders as territorial markers and separators, citing the sovereignty argument as their rationale. However, the statist policy decision was unrealistic because of the porous character of borders, which is visible in the normal economic, cultural, and political activity of border communities. Culture clashes along the border sparked a variety of informal (and sometimes clandestine) activities that undermined the authority of the state and cut off its ability to collect taxes [26].

As a result of these concerns, both Kenya and Uganda are eager to establish their respective claims to the lake's resources, which are used by roughly 200 persons (mostly fishers) and include a docking station for the profitable fishing point that stretches well into Uganda's territory. The ongoing conflict over the tiny one acre piece of island is symptomatic of the deeper ramifications generated by the contentious legacy left behind by the British colonialists who drew the boundaries between Uganda and Kenya. Although colonial administrative boundary lines served their purpose at the time, they are now obsolete [27]. While it is true that globalization has altered the role of borders, the findings of this research do not suggest that this has jeopardized the security of our economic resources.

Therefore, the transboundary conflict between Kenya and Uganda over Lake Victoria's resources has an impact on the ineffective management of economic security to some level. However, competition over dwindling fish stocks in Lake Victoria is a major source of contention over the lake's resources because of the negative impact on economic security that this trend has. The situation has escalated since the state plays such a vital role in allocating resources. The abundance of Nile perch fish and the strategic location of the islands on Lake Victoria are two of the main factors that have caused the lake to become a source of conflict. This poses a threat to the more over 35 million residents of the region's riparian villages whose economic well-being is directly dependent on the lake [28].

2.1. Transboundary Dispute Resolution Mechanisms and Bilateral Economic Security

According to Ikome [29], a major contributor to political instability and dispute between African nations is the sloppy drawing of boundaries between them. The original colonial borders have been debated for a while, but no one in power can seem to come to an agreement. To avoid the potential anarchy and instability that could result from boundary contests, it was decided to maintain the status quo [30]. Nonetheless, border disputes have persisted across the continent over the course of the previous century due to the porous nature of borders and the absence of appropriate delimitation and demarcation. According to Karen and Hooge [31], cross-border disputes in Africa are difficult to resolve because of the region's unequal distribution of resources. The Horn of Africa, the Great Lakes region, and West Africa have all seen national disputes due to poor governance. According to Karen and Hooge [32], one of the

key reasons why regional integration in Africa is progressing so slowly is that countries there tend to overlook border areas while providing infrastructure and core state services.

Therefore, there is a growing connection between regionalism and dispute settlement since regions are developing their own dispute settlement mechanisms to compete with international organizations. In terms of regional courts, this trend could not be clearer. Common legal issues may find resolution in regional courts. Countries and peoples all over the world have voiced concerns about the disproportionate power of European and American actors in international organizations. Countries might develop their own independent legal system with the help of regional courts. To many, the establishment or expansion of a regional court's jurisdiction is a necessary component of any credible regional institution, a sign of political will, and an assurance that the current dedication to regional organization is distinct from past attempts at regional organization that ultimately failed. Indeed, the rise of a new type of international organization (IO) – the general-purpose organization – is a necessary condition for judicialization. IOs are general-purpose jurisdictions since they deal with a wide variety of issues for a limited number of transnational communities of states [33]. They cover a wide range of issues and have far-reaching policy implications, from culture and the environment to human rights and migration. They may even address issues of trade and security. General purpose IOs are characterized by open-ended obligations, which can be made more clear with the assistance of supranational courts [34].

Article 33(1) of the United Nations Charter does not prioritize the many means of peacefully resolving international conflicts. However, negotiation is the primary method for resolving any international conflict. Practically speaking, discussions between the parties involved in a disagreement are called "negotiation," and it is by far the most common method of conflict settlement. This method of diplomatic conflict resolution stands out from others since it does not involve a neutral third party. Typically, negotiations are handled through established diplomatic channels (foreign ministers, ambassadors, etc.) Negotiation is used to try to avoid disagreements from occurring in the first place, and it is also commonly employed as a first step in other forms of dispute settlement.

In the Free Zones of Upper Savoy Case, the French government invoked the principle of rebus sic

stantibus (things as they are) and emphasized that the principle does not permit unilateral repudiation of a treaty on the grounds that it is no longer in effect. Switzerland, on the other hand, contended that there was disagreement over this theory and denied the existence of a legal right to the termination of a treaty due to altered circumstances that could be enforced by decisions of a qualified tribunal. The Permanent Court of Arbitration (PCIJ) noted that diplomatic conversations should have clarified the nature of a dispute before it could be the basis for legal action.

Moreover, if there is a will and negotiating is flexible, it can be completed quickly. However, negotiations are not always the best strategy to resolve international conflicts. Since impartial third parties rarely participate in talks, there is no fair mechanism for settling contentious matters of truth. This also means that there are few brakes on a disputed state's ability to make outrageous assertions, especially in situations when it has substantial bargaining strength. In addition, states have the option of denying the existence of a dispute and often attach conditions to any negotiations. If parties to a disagreement refuse to engage in any form of communication, it is manifestly impossible to negotiate. When states have serious disagreements, they often break diplomatic connections. This is especially prevalent after resorting to violence. Some well-known instances are the breach in ties between the United States and Iran after the 197918 seizure of the embassy in Tehran and the split in ties between Britain and Argentina following the invasion of the Falkland Islands in 1982. If there is a large difference between the parties' viewpoints in negotiations and no shared interests to bring them closer together, progress will be slow. When there is a disagreement over territory, for instance, the party in control may feel there is no need to negotiate. This may be the reason why Uganda prefers not to negotiate a resolution to the issue over Migingo Island. There can be no substantive compromise in a disagreement where one side insists on its legal rights while the other side, realizing the weakness of its legal position, seeks settlement on some other ground. It may be challenging to negotiate a procedure, such as an agreement to refer the disagreement to arbitration, without appearing to favor one party over the other. The dispute between Kenya and Uganda over Migingo Island could be heard and decided by the East African Court of Justice (EACJ), but the court lacks the expanded jurisdiction necessary to do so at this time.

3. CONCEPTUAL FRAMEWORK

Wasike and Odhiambo [35] state in their paper A critique of the efficacy of theories in understanding sociopolitical phenomena that everyone employs theories, whether or not they realize it. The use of causal explanations is essential while conducting data analysis. Nonetheless, theories frequently lack the clarity required to formulate and implement judgments. Therefore, policymakers tend to disregard the significance of theories. The intricacy of modern international politics defies reduction to any one theory.

Theories of international relations attempt to shed light on the aims and timing of governments' foreign activities. There are several parts to a theory. They diagnose, forecast, prescribe, and assess. But Smith [36] maintains that not all theories can be used to make predictions or provide simple explanations. They reveal the range of options open to us as agents of change. Our ethical and practical horizons, as well as our capacity to explain the world, are defined by these frameworks. For instance, according to international relations theory, politicians who had lost control of events were partly to blame for the outbreak of war because of their misinterpretations, miscalculations, and recklessness.

3.1. Social Conflict Theory

Social conflict theory has its origins in the writings of Karl Marx [37]. This theory examines social conflicts through the lens of class differences, highlighting the competition between social groupings for limited resources. Dominance by one group over another is seen as the most crucial factor in maintaining social order in this idea. Conflicts, both actual and potential, exist in every community.

The hypothesis helps shed light on how the wealthy in society exploit the weak and gain access to Lake Victoria's resources. Dispute, complement, conflict, power, inequality, and exploitation are essential ideas refined by this viewpoint. According to Karl Marx, the fundamental conflict of interest between a society's dominant and subordinate sectors grows in proportion to the pace or degree of inequality in the allocation of comparatively available or scarce resources. When the underclass (the proletariat) learns more about how the system really works, they may begin to doubt the fairness of how resources are now divided up.

This theory has been challenged for a number of reasons, including its clear political intentions and the fact that it places too much focus on inequality and separation while ignoring the fact that individuals of a society can become united through

shared values and interdependence. Another criticism is that, like structural functionalism, it has a very macro perspective on society and ignores the micro-level realities of social life [38].

3.2. The Structural-Functionalist Theory

Parsons [39] is a strong advocate for this line of thought. The theory seeks to clarify the origins of both healthy (resulting in positive outcomes for both individuals and society as a whole) and unhealthy (contributing to the opposite) social interactions amongst various social components (meaning having negative consequences). The importance of social consensus, social order, structure, and function are emphasized.

According to the structural-functionalist idea, people will conform to the established order of things in any given society or organization. Disagreement and instability are brought about by any organizational restructuring. Then, to keep things steady for everyone involved, conflicts should be kept to a minimum. The theoretical framework is reflective of a systemic approach in which all components have a specific purpose. According to this theory, disagreement is pathological; it spreads like a disease through a society and undermines its ability to function normally. This method focuses on elements that will keep the organization functioning smoothly and harmoniously [40].

According to structural-functionalist theory, our social lives are directed by social structure, which are relatively stable patterns of social behavior [41]. This theory views society as a complex system whose pieces work together to produce solidarity and stability. The workings of a society can be deduced from its social structure, which is best described in terms of social function.

3.3. John Burton's conflict resolution theory

Burton [42], the founder of the University of London's Centre for the Analysis of Conflict, after organizing problem-solving workshops in Cyprus and Sri Lanka, contributed to the global dissemination of conflict mediation techniques. Based on a synthesis of the fundamental ideas that make up "human needs theory," Burton developed a framework for analyzing and resolving disagreements.

The premise of this study is that the termination of violent conflict is contingent upon the satisfaction of fundamental human needs. Burton recognized eight universal wants and added a ninth based on the work of American sociologist Paul Sites. The standards that were ultimately embraced included things like control, justice, stimulation, sense of purpose, general acceptability, and logic. Additional requirements for Burton were the need to guard one's social standing. Burton called these wants "ontological needs" because he believed they were universal to

all humans and would be pursued no matter what the cost.

Instead of a disagreement about principles that may be negotiated on, as he defined a "dispute," a "conflict" is an action involving one or more of these basic human needs. Burton distinguishes conflict resolution from conflict management and conflict settlement, two related but distinct concepts. Burton argues that while settlement might help alleviate some of the symptoms of conflict, resolution can address the root causes of the underlying tensions.

The literature on conflict resolution provides a synopsis of the various methods available for dealing with disagreements. Conflicts can be settled in a number of ways, including through force, avoiding conflict altogether, arbitration, adjudication, negotiation, mediation, compromise, and reconciliation. Reconciliation is the most cooperative and mutually participatory approach, whereas coercion is the least. Which of these two approaches – coercion or reconciliation – was more successful in ensuring the economic security of Kenya and Uganda? The research showed that there was a wide variety of methods to reconciliation, and that Kenya and Uganda would profit the most from pursuing it.

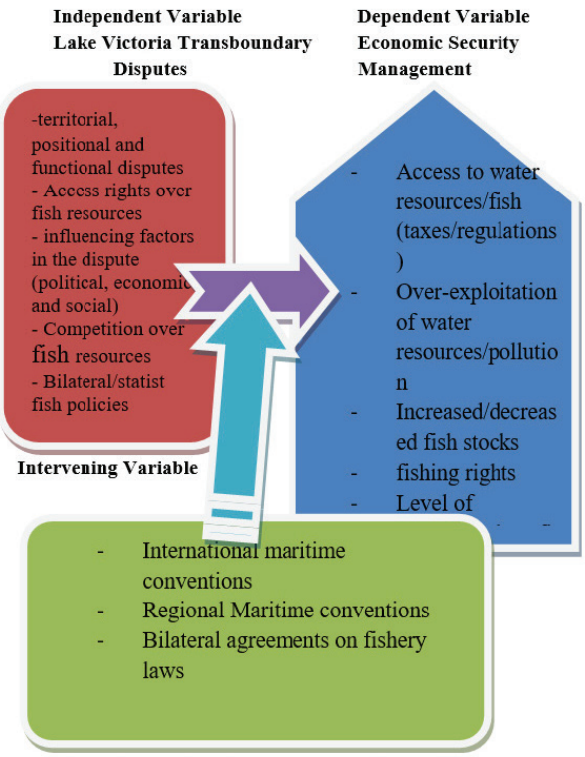

Fig.1 Showing Interaction of Variables
Source: Researcher, 2022

4. RESEACH METHODOLOGY

4.1. Research Design

The nature of Lake Victoria transboundary disputes and the management of economic security between Kenya and Uganda were examined using a descriptive study design. A descriptive survey collects data at a certain point in time to describe the nature of an existing condition or to discover the relationship between specific events. According to Mugenda and Mugenda [43], descriptive survey data are gathered via questionnaires and an interview schedule. The objective of descriptive research is to provide an accurate description of certain phenomena, such as transboundary disputes and economic security management. It also describes the impact of frequency or occurrences on the proportion of a population's members who share particular beliefs or characteristics.

4.2. Research Area

Lake Victoria is the second-biggest freshwater body in the world and the largest in Africa, with a surface area of 68 800 km2. The majority of the lake, 35 088 km2 (51%), is located in Tanzania, followed by 29 580 km2 (43%), and 4128 km2 (6%), respectively, in Uganda and Kenya. The length of the lake's shoreline is 3,450 kilometers: 1,150 kilometers (33 percent) are in Tanzania, 1,750 kilometers (51 percent) are in Uganda, and 550 kilometers (16 percent) are in Kenya. The lake's fishery is dominated by three species: Nile perch (Lates Niloticus), Nile Tilapia (Oreochromins Niloticus), and Mukene/ Dagaa/ Omena (Ratrineobola argentea), however there is an emerging haplochromine fishery, particularly in the Tanzanian portion of the lake. As follows is how the captures are utilized: Nile Perch is exported at a rate of almost 50%, Nile Tilapia is utilized mostly for domestic consumption and regional exports, and Dagaa is used predominantly in the manufacturing of animal feeds at a rate of roughly 70% [44].

Fishing occurs in coastal locations, however Nile Perch fishermen are venturing into deeper waters with diminished catches. The lake has 1,535 landing locations, 76,929 fishing canoes, and 219,919 fishermen. The fishery is open to fishermen from the fishing towns, as well as those from the rest of the country, so long as they meet the necessary requirements, such as registering with Beach Management Units, possessing authorized fishing equipment, and paddling seaworthy canoes. Kenya and Tanzania prohibit non-citizens from possessing fishing canoes, however in Uganda, non-citizens can pay a specific charge to obtain a fishing license [45].

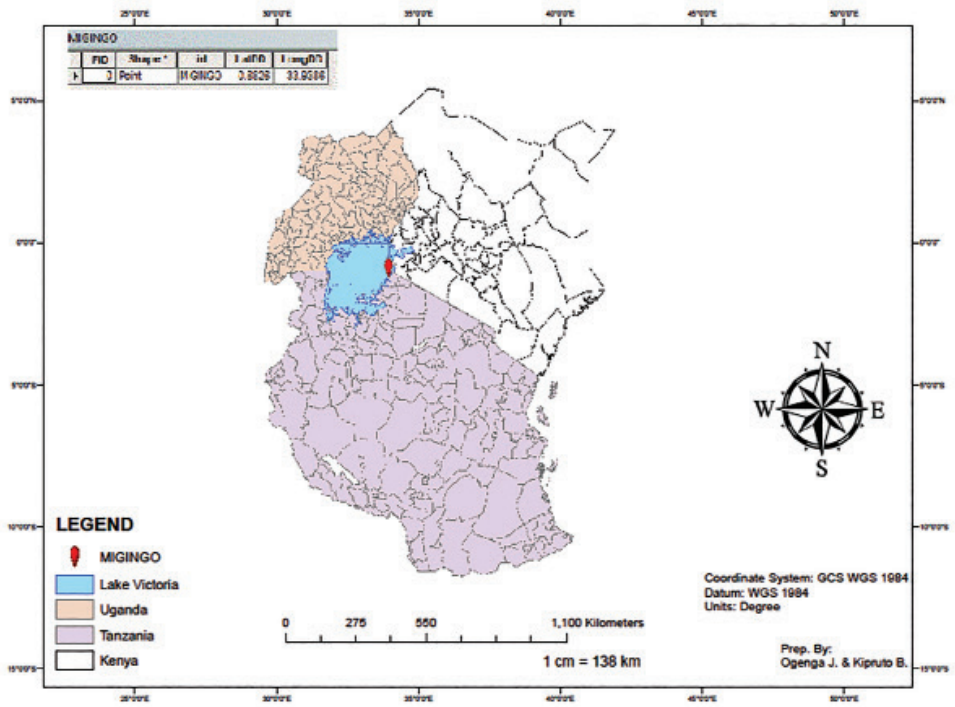

Fig. 2 Map of Study Area
Source: Researcher, 2022

4.3. Sampling Strategy and Sample size Determination

The researcher utilized the formula provided by (Mugenda and Mugenda [46] to determine the sample size. While determining the sample size of subgroups, the Borg and Gall formula [47] was utilized.

188 informants were assigned to government officials (security personnel and directors of intergovernmental organizations). The sample size was determined using a simple random sampling technique; the lottery method. This is the most popular and straightforward way. In this method, each object was numbered on a separate sheet of paper of the same size, shape, and color. In a box, they were folded and mingled. A selection will be made blindfolded. This was done until the target sample of 98 humanitarian officers and 98 government officers was collected. After acquiring 196 from fishermen and fish merchants, the researcher distributed them in Lake Victoria using purposive sampling. Simple random sampling is a suitable technique since it assured that all sampled fishers, fish sellers, security officers, and directors of

intergovernmental organizations had an equal chance of being included in the samples that generated data with a statistically established margin of error [48].

4.4. Data Collection Methods

Primary data was collected from the field through structured questionnaires, interview guides, observation checklists, focus group discussions, and document analysis. The researcher was able to circumvent the weakness that arises from employing a single data gathering approach by utilizing multiple data collection methods [49]. The researcher collected both primary and secondary data types to provide insight into the interaction between quality management systems (numerical and string data). The researcher visited the sampled community and provided a concise explanation of the study's purpose. The researcher gathered secondary data by analyzing relevant books, conflict journals, international marine laws on water resources in EAC, and internationally linked legislations and government papers. The researcher attempted to investigate whether the nature and intent of the aforementioned documents would provide further insight on the effects of transboundary disputes on economic security management.

4.5. Data analysis and presentation

The researcher purified the data by listing, removing errors, examining extreme results, and editing to ensure consistency. The results from the group survey were analyzed using SPSS Version 27. A descriptive statistical analysis was conducted on the variables. The qualitative data was examined by combining emerging themes from interviews with key informants, topic analysis, and cut-and-paste techniques on the transcripts of focus group discussions. Utilizing descriptive statistics such as frequencies and percentages, quantitative data was evaluated. The study's findings were presented in the form of frequency tables, pie charts, bar graphs, and narratives.

5. DATA ANALYSIS AND PRESENTATION

5.1. Management mechanisms used in managing disputes in Lake Victoria (Migingo and Mageta Islands)

The study sought to evaluate the management mechanisms employed in managing disputes in Lake Victoria. Out of 355 respondents,171 (48.17%) stated that mediation and conciliation were the most used mechanism in resolving disputes in Lake Vvictoria.Besides,111(31.27%)

respondents reasoned that negotiation and consultation were the mechanism employed in resolving dispute in Lake Victoria while 73 (28.2%) averred that arbitration and adjudication were the mechanisms employed. The results are illustrated in figure 3.

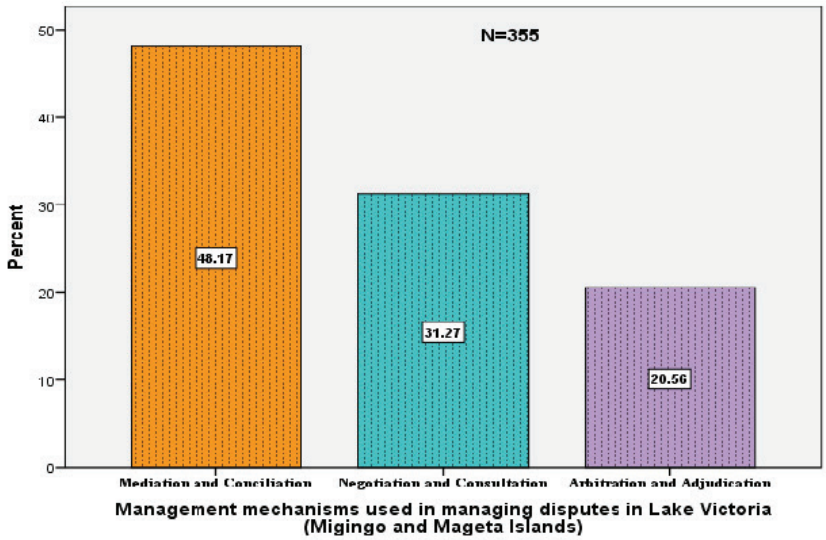

Fig. 3 Management mechanisms used in managing disputes in Lake Victoria (Migingo and Mageta Islands)
Source:Field Data, 2022

These findings were supported by one of the key informants who averred that:

'We want a neutral party to mediate over Migingo dispute, Kenyan Government, Ugandan government all have vested interest, even Tanzanian government has also been involved in this dispute. In the past ministerial delegation from both countries have played a significant role in reducing the tensions however they have failed to invite non-partisan parties to mediate over this matter. We have had International arbitration bodies giving advisory on how to handle this dispute. Besides, negotiation and consultative meetings have been conducted. What is lacking, despite numerous efforts in the past,is political good will between Kenyan and Ugandan government. As a corollary, "cooperation through joint mechanism in the form of commission is a critical necessity if the aims are to accomplish equal, rational, and

non-harmful exploitation of the international watercourse." (Key Interview with Inspekta based at Migingo Island on 6/8/2022).

To underpin these views, Olivia [50] argued that diplomatic options available for peaceful conflict resolution according to the findings include mediation, negotiation, dialogue, arbitration, among others. Some of the respondents might have interchanged the two concepts namely dialogue and negotiation to mean one. Because diplomatic options like Negotiation, Mediation, Arbitration and Dialogue they have almost the same meanings, this could explain the high percentages of the two.

5.2. Effectiveness of management mechanisms of dispute in Lake Victoria

The study sought to assess whether management mechanisms of dispute resolution in Lake Victoria are effective. Out of 355 respondents, the study found out that 31 (8.7%) stated that management mechanisms were very effective, while 51 (14.37%) reasoned that management mechanisms were effective. Besides, 252(70.99%) stated that management mechanisms were less effective and 21 (5.92%) were not sure whether management mechanisms are effective or not. The results are illustrated in figure 4.

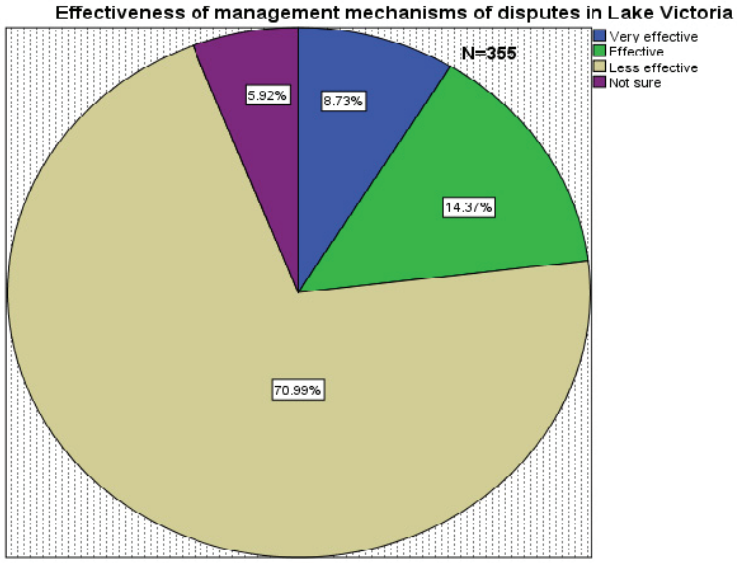

Fig. 4 Effectiveness of management mechanisms in dispute resolution in Lake Victoria
Source: Field Data, 2021

In support of the foregoing results, one of the key informants averred that:

Our counterparts have superior boats for patrol which they use to arrest Kenyan fishermen when they trespass in their waters. We need the Kenyan government to bring superior boats to aid our officers in patrol and arresting Ugandan and Tanzanian fishermen. These fishermen steal our fishing nets, baits and fish. The measures put so far to resolve these disputes have not borne fruit and therefore there is need for better mechanisms adopted resolve this dispute.(Interview with one of the BMU officials at Mugabo Beach,Muhuru Bay,7/8/2022.)

Stakeholders in Kenya's fisheries have linked the lack of effective management by formal and informal organizations and the significant dependence on these resources to the widespread poverty felt by the country's coastal communities. Key management challenges include the widespread use of harmful fishing gear, such as small meshed nets, and the increasing number of fishermen [51].

The Department of Fisheries is responsible for overseeing Kenya's marine fisheries. However, the bureau's capacity for monitoring is inadequate. It was discovered, for instance, that despite a prohibition on beach seines and other forms of harmful fishing gear, the department lacks the necessary resources, such as patrol boats, to effectively enforce the ban. It was determined that there is just one boat in Shimoni, and its purpose is to travel the entire southern shore. There are too many fishing hotspots for just one boat to reach them all. Also, the department lacks sufficient funds to pay for things like boat fuel. As a result, given the constraints of the available funds, the ship remains permanently moored. The officers stationed at the several locations can't enforce the law without the cooperation of the fishermen, so they have to rely on their goodwill. Therefore, the department needs to be equipped with sufficient patrol boats and funding to enable them to patrol at least the inshore seas, where the majority of damaging fishing devices are utilized. In addition, more fish scouts and fisheries officials are required to supervise the incoming catch from all of the landing sites.

5.3. Whether dispute resolution mechanism focus on historical roots to Migingo and Mageta Island's fishers' plight

The study sought to assess whether dispute resolution mechanism focused on historical roots to Migingo and Mageta Island's fishers' plight.Out of 355,231 (65.07%) stated that dispute resolution mechanism focused on historical roots while 124 (34.93%) stated otherwise.The results are illustrated in figure 5.

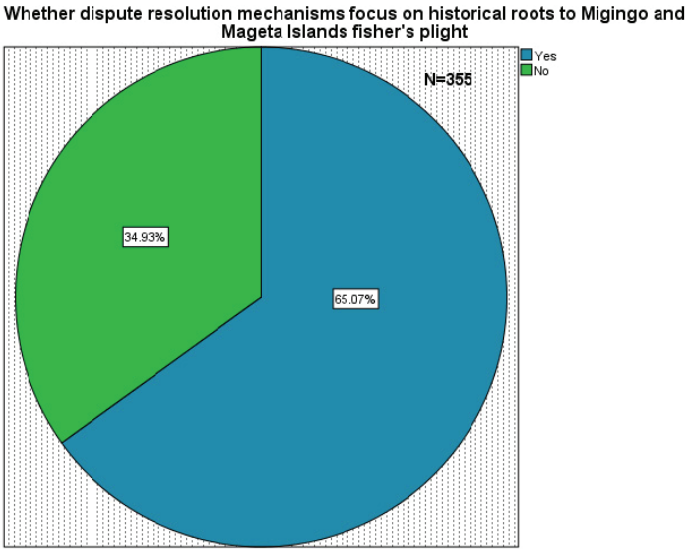

Fig. 5 Whether dispute resolution mechanism focus on historical roots to Migingo and Mageta Island's fishers' plight
Source: Field Data, 2021

Migingo Island has been the source of contention between Kenya and Uganda since 2004. To rephrase, ever since its colonization in 1926, Kenya has occupied and exercised full sovereignty over the little island. If you skim over some of the writings on the topic, you might get the impression that the conflict between the two States has only arisen in the last decade, perhaps as a result of competition for fish and water resources between citizens of the two countries. This disagreement, however, has deeper roots than just competition over fish supplies. It has political and historical undertones. To date, Ugandan authorities have formally claimed eight Lake Victoria islands that were formally a part of Kenya. Idi Amin Dada, the president of Uganda, took control of Sigulu Island in the early 1970s [52]. Sigulu is the largest and most important of the islands, home to a population of around 10,000 people, most of whom are of Banyala (Luyha) descent.

Those from the Luo ethnic group hailed primarily from Sakwa, Bondo, Uyoma, and Yimbo, while those from the Suba region hailed primarily from the twin islands of Rusinga and Mfangano. Since the early 1970s, Kenyan inhabitants of Sigulu have been able to become naturalized Ugandan citizens, allowing them to vote and hold office in the Ugandan government and in

the Samia Bugwe and Bugiri districts of Eastern Uganda. As Mzee Jomo Kenyatta's administration in Kenya did not issue any diplomatic protests against the annexation, the Kenyan government effectively consented to it. James Osogo, a former member of Parliament for Budalangi and a long-time cabinet minister, was the only person to publicly object to Uganda's annexation of Sigulu Island. Lolwe, Wayami, and Remba are only a few of the other islands that were annexed in a similar fashion [53]. In 1976, President Idi Amin attempted to redefine the borders between Kenya and Uganda, which is instructive to remember. Before the colonial redrawing of borders, Amin claimed all of Kenyan districts that are now part of Kenya to be part of Uganda. Amin claimed that the boundaries of these areas included Naivasha. In his opinion, these regions were the most fertile in all of Kenya and were responsible for creating the vast majority of the country's wealth. However, President Jomo Kenyatta's threat to cut off Uganda's supplies through the port of Mombasa finally got him to back down.

In a subsequent speech, President Amin remarked that Uganda has no designs on annexing any part of the land of her neighbors. He said he had faith in the Organization of African Unity (now the African Union) and that, as its Chairman, he was aware of the OAU July Resolution of 1964, which solemnly affirmed that all member States promised themselves to maintain the borders existing on their achievement of independence. Amin claimed that he possessed a legal agreement signed by the British Colonial Secretary of State Herbert Asquith, transferring some parts of Uganda to Sudan in 1914 and to Kenya in 1926. He emphasized that he was merely informing his people of the pre-colonial boundaries and was not campaigning for war or advocating for changes. 5 Given this context, it is important to understand the political and historical context of the ongoing dispute between Kenya and Uganda over the possession of Migingo Island.

6. SUMMARY AND CONCLUSIONS

The study sought to assess the management mechanisms employed in managing disputes in Lake Victoria. Out of 355 respondents, 48.17% stated that mediation and conciliation were the most used mechanism in resolving disputes in Lake Victoria. Besides, 31.27% respondents reasoned that negotiation and consultation were the mechanism employed in resolving dispute in Lake Victoria while 28.2% averred that arbitration and adjudication were the mechanisms employed. The study concludes that, dispute management mechanisms have been in existence and that mediation and conciliation

are the best mechanism employed by the disputants. However, this approach has not reach zenith as far as managing dispute between Kenya and Uganda is concerned.

7. RECOMMENDATIONS

The study recommends that, sensitization programs tailored towards effective dispute management be put into place and awareness programs disseminated along contested boundaries. In this regard, economic security management will be bolstered well.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

REFERENCES

[1] Lee, S & Forss, A., (2011). *Dispute Resolution and Cross-border Cooperation in Northeast Asia: Reflections on the Nordic Experience*, Institute for Security and Development Policy. Stockholm Nacka, Sweden.

[2] Okumu, W. (2010). *Resources an Border Conflicts in Eastern Africa", 4 Journal of Eastern African Studies*; 279-297.

[3] idem

[4] Were, E. M. (2016). Conflict of Interest in Exploitation and Utilisation of Transboundary Natural Resources on Lake Victoria, *Journal of African Conflicts and Peace Studies* Volume 3 Issue 1: Conflict *Prevention & Management* Article 1 EME Publishers.

[5] Okoth, P. G., (1999). Historiography of Kenya's Foreign Policy. *African Review of Foreign Policy*, 1 (1), pp. 65-88.

[6] Okoth, P. G. (2010). *Kenya and the Contemporary World Order*.

[7] Obonyo, S., Odhiambo, E.O.S & Ogallo, S.N. (2010) in their published proceedings "Cartography as a tool for Conflict Analysis & Resolution for Migingo Island Ownership Dispute". Centre for Disaster Management and Humanitarian Assistance. Masinde Muliro University of Science & Technology. May 13th -14th, 2010. (ISBN: 9966-779-10-8). *Pp.310-319* Kakamega: Masinde Muliro University of Science and Technology Press.

[8] Okoth, P.G., Matanga, F.K, & Onkware, K. (201).East African Economic Integration in the Context of post-Modern Pan-Africanism.In: *Peace Security and Development in the21st Century Africa: Theory and Practice*. P G Okoth, FK Matanga, Kennedy, Onkware (2018) (Eds). Nairobi: Finesse Publishing Ltd.

[9] Owino, O. (2019). The Implication of Conflict over Fishing in Lake Victoria on Uganda- Kenya Relationship (2003-2018).Unpublished Master's thesis, United States International University

Africa.

[10] Were, E. M. (2016). Conflict of Interest in Exploitation and Utilisation of Transboundary Natural Resources on Lake Victoria, *Journal of African Conflicts and Peace*

Studies Volume 3 Issue 1: Conflict *Prevention & Management* Article 1 EME Publishers.

[11] Warui, D.N. (2013). East African Community and Conflict Settlement: A Case of Migingo Island, University of Nairobi Press

[12] Were, E. M. (2016). Conflict of Interest in Exploitation and Utilisation of Transboundary Natural Resources on Lake Victoria, *Journal of African Conflicts and Peace Studies* Volume 3 Issue 1: Conflict *Prevention & Management* Article 1 EME Publishers.

[13] Wekesa, P. W. (2010). "Old Issues and New Challenges: The Lake Victoria Controversy and the Kenya_Uganda Borderland.' *Journal of Eastern African Studies* 4, no. 2 (2010): 331-40.

[14]Okumu, W. (2010). *Resources an Border Conflicts in Eastern Africa", 4 Journal of Eastern African Studies*; 279-297.

[15] Were, E. M. (2016). Conflict of Interest in Exploitation and Utilisation of Transboundary Natural Resources on Lake Victoria, *Journal of African Conflicts and Peace Studies* Volume 3 Issue 1: Conflict *Prevention & Management* Article 1 EME Publishers.

[16]Okumu, W. (2010). *Resources an Border Conflicts in Eastern Africa", 4 Journal of Eastern African Studies*; 279-297.

[17] Wekesa, P. W. (2010). "Old Issues and New Challenges: The Lake Victoria Controversy and the Kenya_Uganda Borderland.' *Journal of Eastern African Studies* 4, no. 2 (2010): 331-40.

[18] Warui, D.N. (2013). East African Community and Conflict Settlement: A Case of Migingo Island, University of Nairobi Press

[19] Saadia, T. (1969). The sources of Status Quo and Irredentism Policies,Widstrand C.G.' African boundary problems' (Uppsala: Almqvist&WiksellsBoktryckeri Atiebolag, 1969) p.101 -102 .

[20] Kornprobst, M. (2002).The management of Border Conflicts In African Regional – Sub Systems: Comparing West African and the Horn of Africa 'The journal of Modern African Studies, Vol.30, No.3. (Sept., 2002)pp.383

[21] Warui, D.N. (2013). East African Community and Conflict Settlement: A Case of Migingo Island, University of Nairobi Press

[22] Ojo, O.J.C. (1985). International Actors. In African International Relations, ed. J.C.

[23] Ochwada, H. (2004). "Rethinking East African Integration: From Economic to Political and from State to Civil Society." Africa Development 29, no. 2.

[24] Aseka, M. (2005).Pitfalls of Ideology, Social Policy and Leadership in Africa. Nairobi: New EME Research Initiatives & Publishers.

[25] Aseka, M. (2005). Pitfalls of Ideology, Social Policy and Leadership in Africa. Nairobi: New EME Research Initiatives & Publishers.

[26] Ochwada, H. (2004). "Rethinking East African Integration: From Economic to Political and from

State to Civil Society." Africa Development 29, no. 2.

[27] Owino, O. (2019). The Implication of Conflict over Fishing in Lake Victoria on Uganda-Kenya Relationship (2003-2018).Unpublished Master's thesis, United States International University Africa.

[28] Ibidem

[29]Ikome, F.N., (2012)."Africa's International borders as potential sources of conflict and future threats to peace and security", Paper No.233, Institute of Security Studies.

[30] Ibidem

[31] Karen J. A and Hooghe, L. (2016). "Regional Dispute Settlement Systems" in Tanja A. Börzel/Thomas Risse (eds.), Oxford Handbook of Comparative Regionalism (Oxford: Oxford University Press, 2016:538-558).

[32] Ibidem

[33] Goertz, G. and Powers, K. (2012). "Regional Governance: The Evolution of a New Institutional Form". Paper presented at a Workshop on an International Organization Database,Wissenschaft szentrum für Sozialforschung, Berlin, February 23–24.

[34] Hooghe, L., Bezuijen, J., Derderyan, S., and Coman, E. (2014). The Rise of Supranational Courts in International Organizations. Unpublished manuscript.

[35] Wasike, S. & Odhiambo, E. O. S. (2016). A critique of the usefulness of theories in explaining socio-political phenomenon. Published by *Asian Journal of Basic and Applied Sciences, 3 (1)*, 29-33.Vol. 3, No. 1, 2016 ISSN 2313-7797 http://www.multidisciplinaryjournals.com/ajbas-vol-3-no-1-2016/

[36] Smith, S. (1996) Positivism and Beyond. In: Smith, S., Booth, K. and Zalewski, M., Eds., International Theory: Positivism and Beyond, Cambridge University Press, Cambridge, 11-44. https://doi.org/10.1017/CBO9780511660054

[37] Marx, K (1983). The Communist Manifesto. Penguin Harmondsworth, London.

[38] Macionis, J. (1997). Sociology. Sixth Edition. Upper Saddle River, New Jersey: Prentice Hall.

[39] Parsons, T. (1957).'The Distribution of Power in American Society', World Politics 10: 123–143.

[40] Macionis, J. (1997). Sociology. Sixth Edition. Upper Saddle River, New Jersey: Prentice Hall.

[41] Ibidem

[42] Burton, J. (1966). Conflict and Communication: The Use of Controlled Communication in International Relations, 1966, p. 15.

[43] Mugenda, O.M., Mugenda, G.A (2003). Research Methods: Quantitative and Qualitative Approaches. African Center for Technology Studies (ACTS)-Press.

[44] Kolding, J., van Zwieten, P., Marttin, F., Funge-Smith, S., & Poulain, F.

(2019). Freshwater small pelagic fish and fisheries in major African lakes and reservoirs in relation to food security and nutrition. FAO Fisheries and Aquaculture Technical Paper No. 642. Rome, FAO. 124 pp. FAO. Licence: CC BY-NC-SA 3.0 IGO.

[45] idem

[46] Mugenda, O.M., Mugenda, G.A (2003). Research Methods: Quantitative and Qualitative Approaches. African Center for Technology Studies (ACTS)-Press.

[47] Gall, M. D., Gall, J. P., & Borg, W. R. (2007). Educational Research, 8th Edition. Boston: Pearson Education, Inc.

[48] Mugenda, O.M., Mugenda, G.A (2003). Research Methods: Quantitative and Qualitative Approaches. African Center for Technology Studies (ACTS)-Press.

[49] Denzin, N. (1989).The Research Act, Chicago: Aldine.

[50] Olivia, O. (2019).Unpublished Thesis "The Implication of Conflict over Fishing in Lake Victoria on Uganda-Kenya Relationship (2003-2018). United States International University Africa

[51] United Nations Institute of Peace (2007). Natural Resources, conflict and conflict resolution. A publication of United Nations Institute of Peace, Washington, DC, (September).

[52] Musinguzi, B. (2011).The Day Idi Amin Wanted to Annex Western Kenya" The East African (Nairobi, 10 September 2011 www.theeastafrican.co.ke/news (accessed 26th May, 2021).

[53] Ibidem

THE EFFECTS OF COMPENSATION, CAREER DEVELOPMENT, AND ORGANIZATIONAL CULTURE ON SOLDIERS' MOTIVATION TO ATTEND THE OFFICER FORMATION EDUCATION (*DIKTUKPA)* FOR NCO RESOURCE OFFICERS MEDIATED BY STRATEGIC LEADERSHIP

Umar SANTOSO[*], Willy ARAFAH[**], Sarfilianty ANGGIANI[**]

[*]Doctoral Student, Trisakti University, Grogol petamburan, Jakarta-Indonesia 11440
[**]Lecturer Staff, Trisakti University, Grogol petamburan, Jakarta-Indonesia 11440

This study analyzed how compensation, organizational culture, and career development the motivation of NCO soldiers in attending Diktukpa through Strategic leadership as a mediating variable. This study addressed the research gap by involving Strategic leadership as a mediating variable to the direct and indirect effects of compensation, organizational culture, and career development on NCO students' motivation. This quantitative study employed Structural Equation Modeling (SEM) on Amos software 26. Data for this study were obtained from 340 randomly-selected NCO students. This research established the existence of a favorable relationship between soldier salary, career advancement, and organizational culture and soldiers' motivation to participate in Diktukpa as well as strategic leadership. A positive influence was also found in Soldier compensation, career development, and organizational culture on the motivation of Strategic leadership as a mediating variable. The results indicated the direction of evaluation and sound personnel planning that should be taken into account when hiring or accepting officers from non-commissioned officer sources, including pay, career development, organizational culture, and strategic leadership. It is important to boost NCO pupils' motivation for personal growth. The impact of strategic leadership on soldiers' motivation is presented in this study in connection to pay and career advancement. . This study provides relevant insights into the current conditions and factors that included compensation and career development, Strategic leadership in influencing the motivation of the soldiers.

Key words: *Motivation, Compensation, Organizational Culture, Strategic leadership, Career, Officer Formation Education (Diktukpa)*

1. INTRODUCTION

Organizations that are well-developing require an ideal number of members. In the Navy organization, the need for first-level officer personnel continues to increase as the organization is developing at a rapid pace. At the present, the number of First Officers *(Pama)* only fulfilled 40-50% of the number of *Pama* personnel requirements. Navy officers are trained through three resources: Navy Academy alumni, Officers Career Soldier Alumni, and *Diktukpa* Alumni or Non-Commissioned Officers. One way to meet the needs of the First Officer (Pama) is to have more prospective students from the Non-Commissioned Officers or *Diktukpa*. However, Non-Commissioned Officers seem to have low motivation to attend *Diktukpa*, despite *Diktukpa* being an excellent career advancement opportunity.

In an organization, motivation has a favorable and considerable impact on job satisfaction [1]. Internal and external factors might cause the decline in number of soldiers who attend *Diktukpa*. The internal factor is related to low self-motivation, while external factors include organizational culture, career development patterns of NCO resource officers, and compensation set by the organization. Adequate work compensation can encourage the members of an organization will positively affect their motivation level [2]. Substantially, every organization expects to advance their organizational culture, understand how organizational culture is enforced, encourage organizational innovation, and foster the career development of its members [3].

A successful career is the actualization and development of students‘ motivation to build professional careers [4]. Employee engagement and professional satisfaction are therefore enhanced through career development. Employees might be motivated by career growth and organizational support to overcome and lessen the effects of demanding employment [5]. Motivation can be assessed from workers' beliefs and perceptions, as well as through their behaviour, including choice of activities, level and quality of task engagement, persistence, and performance through Strategic leadership. Strategic leadership improves the self-development of employees by increasing their motivation [6]. Thus, the effect of compensation on motivation among employees to attend education and training to advance their Career Development remains unknown.

This study examined the impact of salary, career development, and organizational culture on soldiers' motivation to attend Diktukpa, which was mediated by strategic leadership, in order to address this issue. This

quantitative study was performed using the cross-sectional design. Data from this study were analyzed using Structural Equation Model (SEM) on Amos 26. SEM analysis examined the value of the fitting model as the value of goodness of fit and measured the significance level of the relationship between variables. Data were collected from 340 navy soldiers as samples, representing a population of 1200. This research provides a more comprehensive appeal to the motivation of soldiers in attending *Diktukpa*. This study addressed the research gap in this topic by engaging Strategic leadership as a mediating factor in strengthening the direct influence on motivation in implementing education as well as indirect influences between compensation, organizational culture, and career development.

This article consists of several sections. Section two discusses the topics of salary, professional advancement, company culture, strategic leadership, and incentive for enrolling in Diktukpa. The third section describes the method of this study. The fourth section explains the results and findings, including descriptive statistics, hypothesis test results, and mediation test results. The fifth section presents the discussions consisting of hypothesis analysis and synthesis of research results. The sixth section shows the conclusions, limitations and recommendations.

2. LITERATURE REVIEW

Compensation, Strategic leadership, and motivation to attend *Diktukpa*

Employees with high motivation tend to show good performance as well. Studies conducted by [7]–[9] demonstrate how remuneration has a positive and considerable impact on work motivation. Purba & Sudibjo (2020) Added that compensation favorably affects employee motivation. It has been also identified as one of the factors that affect employee performance [11].

Syahruddin et al., (2021) this study sought to ascertain the following: (1) the impact of state defense education on employee discipline, (2) the impact of state defense education on work motivation, (3) the impact of state defense education on work motivation through work discipline, (4) the impact of compensation on work discipline, (5) the impact of payment on work motivation, (6) the impact of compensation on work motivation through work discipline, and (7) the impact of employee discipline on work motivation [12]. Masaga et al. (2019), elucidate how the board of directors' strategic leadership is an important moderating factor in the relationship between the executive compensation system and the performance of commercial

bank workers [13]. Mulyani et al. (2020), provide data showing that variables related to leadership and compensation have a combined 52 percent impact on work motivation variables [14]. Tannady & Sitorus (2017) Also mentioned the potential impact of leadership and salary on work motivation [15].

H1: Job compensation affects the motivation of Non-Commissioned Officers to attend Diktukpa.

H2: Compensation affects Strategic leadership to attend Diktukpa.

H3: compensation effect on the motivation of Non-Commissioned Officers to attend Diktukpa through Strategic leadership.

2.2. Career development, motivation, and Strategic leadership of NCO to attend Diktukpa

Human resource development serves as a career development that will affect (a) the role of the employee in the planning process (career management). According to Stone & Davis in Kaswan & Akhyadi (2015), some factors affect one's performance in goal setting. Successful Career planning has the motivation from within, and the drive to work hard to achieve the goals [16]. Motivation is a complex entity that stimulates the emergence of many theories and models [17], [18]. Alkaabi et al., (2017) demonstrate the importance of self-efficacy, competence beliefs, task value and motivation, self-determination, and goal orientation in educational motivation [19].

In their research Marbun et al. (2022), explained that while career development and leadership style have a favorable impact on performance, leadership does not affect motivation [20]. Meanwhile, Zaini & Kurnianingsih (2022) explained how career growth has a favorable and significant impact on worker motivation and performance [21]. Additionally, leadership and career advancement have a favorable and considerable impact on worker performance. In another study, Ahmad et al. (2022) discussed how factors such as personal motivation and influences might affect professional development and future preparedness for strategic leadership [23]. Khalid et al. (2017) explained that Strategic leadership is influential in gaining inspiration and motivation to be successful and have excellent career development [24].

H4: career development affects the motivation of Non-Commissioned Officers to attend Diktukpa

H5: career development affects Strategic leadership of Diktukpa.

H6: Career development affects the motivation of Non-Commissioned Officers to attend Diktukpa through Strategic leadership.

2.3. Organizational culture motivation, and Strategic leadership NCO on Diktukpa

Shao (2019) used theory of Strategic leadership to develop a theoretical model that explores the impact of senior executive leadership behaviour on strategic alignment IS-Business in the context of assimilation Enterprise Systems (ES) [25]. Organizational culture is seen as a critical moderator in research models based on contingency theory. According to empirical analysis's findings, organizational culture acts as a limiting factor between motivation and strategic leadership. Sewang (2013) concluded that job happiness is significantly influenced by leadership, corporate culture, and work motivation [26]. Munawaroh et al. (2021) Additionally, it was stated that organizational culture and strategic leadership have a major impact on business success, while motivation has a significant impact on competitive strategy but not on business performance [27]. Saluy et al. (2022) identified that corporate culture has a favorable impact on employee motivation, whereas leadership had no impact on employee motivation [23].

H7: organizational culture affects the motivation of Non-Commissioned Officers to attend Diktukpa.

H8: organizational culture affects Strategic leadership of soldiers in attending Diktukpa.

H9: organizational culture affects the motivation of Non-Commissioned Officers to attend Diktukpa through Strategic leadership as a mediating variable

2.4. Strategic leadership and the motivation of Non-Commissioned Officers to attend Diktukpa

Work motivation is an essential factor in achieving job satisfaction [28]. The increasing demand for higher intrinsic motivation and inadequate top-tier human resources require organizations to prioritize the enhancement of work motivation to attain their objectives while maintaining the satisfaction of their members [29]. Effective leadership practices involve behaviours that inspire and direct efforts towards accomplishing organizational goals by communicating a vision that heightens employee awareness of the significance of organizational values, mission, and outcomes, as highlighted by Johan et al., (2021).

According to Cortes & Herrmann (2021), Strategic leadership focuses on synthesizing constructs and categorizing executive behavioural

motivations and putting in order a large number of enterprise-level constructs influenced by strategic leaders [31]. Therefore, leadership strategies are increasingly recognized in the business administration literature as an important antecedent of motivation [32].

H10: Strategic leadership influence on the motivation of Non-Commissioned Officers to attend Diktukpa

3. METHODOLOGY

This comparative causal investigation was carried out to examine the facts that might be the causes based on the data in order to analyze the potential causal links. A quantitative technique was used to analyze the data to determine how organizational culture, career development trends, and educational remuneration, all of which are mediated by strategic leadership, affect student motivation. The cross-sectional design was used, and 5-point Likert scale [33] was also employed: 1 - Strongly Disagree; 2 - Disagree; 3 - Undecided; 4 - Agree; 5-Strongly Agree.

The population for this study comprises Non-Commissioned Officers of the Navy, consisting of 1200 personnel who have undergone or will undertake further education officers. A proportional stratified random sampling was employed to group the population into subgroups or strata based on similarity and then randomly select members from each stratum to create representative samples [34]. This approach prevents the impacts of population heterogeneity and ensures an accurate representation of the population [35]. The sample size was determined using Slovin's formula as follows [36].

n = sample size
N = population
e = *sampling error* 5%

The sample in the study is part of the population, namely as many as 340 personnel serving the Education and Training Command *(Kodiklatal)*, Work Unit *(Satker)* and Main Command *(Kotama)* who proposed, the Department of Education of the Navy and several other related parties to be selected as samples using Proportional stratified random sampling technique.

The data analysis process involves several steps. First, the

returned questionnaires are selected for completeness, and only filled questionnaires are used in the study. The data is then tabulated, and respondents' answers are scored and categorized into three class intervals: high, medium, and low, based on the Mean value (M) and standard deviation value (SD). The Mean value (M) and standard deviation value (SD) are calculated using the SPSS program. The second step in the data analysis process involves using the Structural Equation Modeling (SEM) method. The Amos 26 software is used for structural analysis. The next analysis is to evaluate the suitability of the model by assessing various criteria for the goodness of fit. This includes evaluating Chi-Squares, Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), and Root Mean Square Error (RMSR) as recommended by [37]. A thorough evaluation of the model's suitability is crucial to ensure accurate and reliable results.

4. RESULTS

4.1. Descriptive Statistics

The distribution of respondents' responses to questions about compensation variables, career growth, corporate culture, strategic leadership, and motivation was described in this analysis. The frequency distribution of the responses and the mean values for each variable served as the foundation for the analysis. The following classification was used to determine the limits of class intervals:

Table 1. The average category of respondents

Interval	Category
4.20	Very High
3.40	Height
2.60	Moderate
1.80	Low
1.00	Very Low

Table 2. Result of Descriptive Analysis of Each variable

Variables	Mean	Category
Compensation	3.28	Moderate
Organizational Culture	4.30	Very High
Career Development	4.30	Very High
Strategic leadership	4.14	Height
Motivation	4.14	Height

Table 2 displays the results of the descriptive analysis for each

variable. Respondents rated two variables, Career Development and Organizational Culture which scored a very high of 4.30. Two other variables, Strategic leadership and Motivation scored high of 4.14. Compensation scored moderate of 3.28. These results suggest that the students in the *Diktukpa* education program perceive their compensation as high, either during or after the completion of their education. In addition, the study highlights the significant roles of organizational culture, career development, and Strategic leadership play in the education of Non-Commissioned Officer naval resources.

4.2. Hypothesis test results

Hypotheses of this study were statistically tested using SEM processing to identify significant relationships between variables as shown by a critical ratio (c.r) and the significance probability of each relationship between variables [38]. The following are results of hypothesis testing using AMOS test:

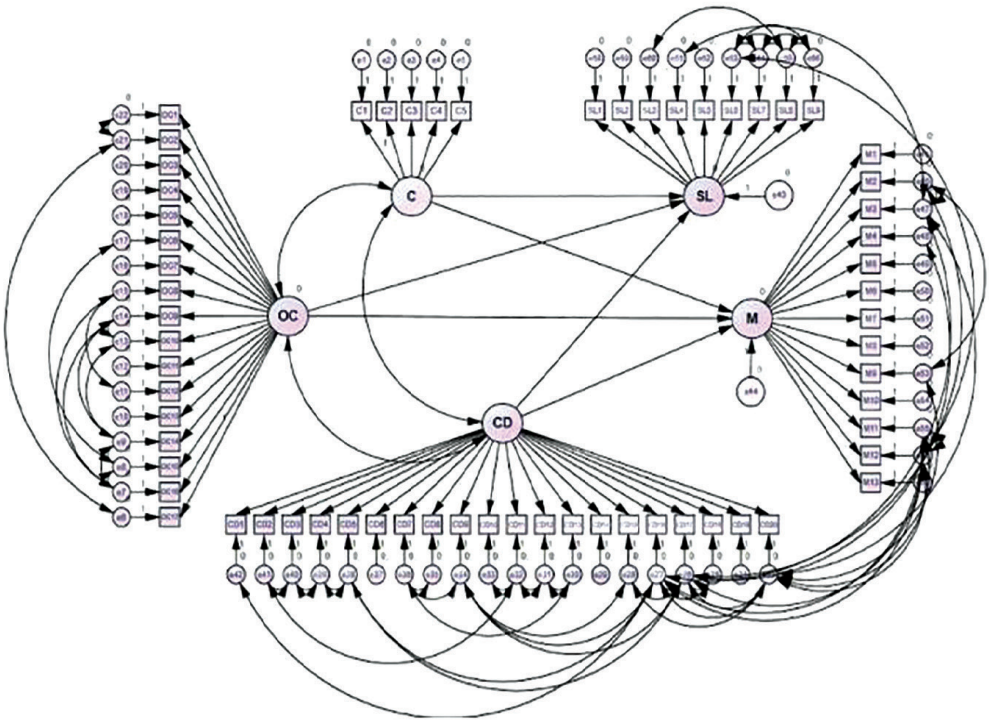

Fig. 1 Structural Equation modelling in research

Table 3. *Regression Weight* Variables of direct influence

No	Hypothesis	Variable	Estimate	C.R	P
1	H1	K → M	,103	2.478	***
2	H2	K → SL	,155	3.043	***
3	H4	PK → M	,377	4.329	***
4	H5	PK → SL	,775	9.500	***
5	H7	BO → M	,176	3.333	***
6	H8	BO → *SL*	,182	3.139	,002
7	H10	SL → M	,422	5.222	***

Table 3 presents the structural equation models that have been generated as seen in Fig. 2.

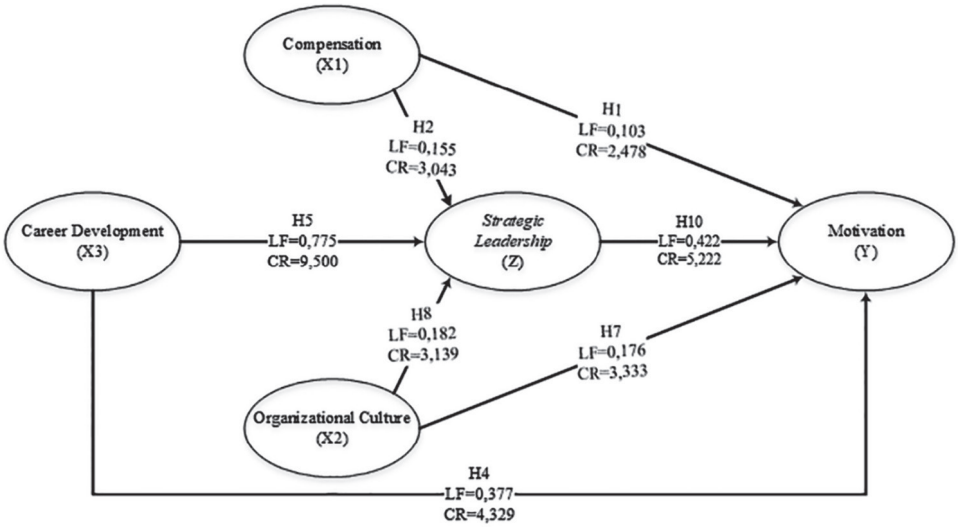

Fig. 2 Results of Structure Equation Modelling analysis

Fig. 2 shows that motivation is influenced by compensation (0.103 x compensation), the value of Strategic leadership is influenced by compensation of (0.155 X compensation), the value of the soldier's motivation is influenced by the career development of soldiers of (0.377 X career development), the value of Strategic leadership influenced by career development (0.775 X career development), motivation influenced by organizational culture (0.176 X organizational culture), value Strategic leadership influenced by the organizational culture of (0.182 X organizational culture) and

motivation is influenced by Strategic leadership by (0.422 X Strategic leadership).

4.3. Mediating Variable Testing Results.

with values smaller than 5%. The Sobel test had a value of 8.538, which was greater than 1.96, indicating that there is a significant influence of Career Development (X3) on Non-Commissioned Officers' motivation

Table 4. The results of Sobel test analysis on indirect influence variables

No	Hip	Variable	In	Sb	Sat	Test Value			Ket
						Sobel	Aronian	Goodman	
1	H3	*K→SL→M*	.109	.035	0.140	9.607	9.604	9.611	accepted
2	H6	*PK→SL→M*	0.016	0.072	0.042	8.538	8.535	8.541	accepted
3	H9	*BO→SL→M*	0.024	0.064	0.046	13.15	13.15	13.17	accepted

Table 4 shows the hypothesis testing of the third hypothesis using mediation analysis, as presented. The Sobel test was used to determine the indirect effect, and the p-value column showed good results for all tests, including Sobel (0.03), Aroian (0.03), and Goodman Test (0.03), which had values lower than 5%. The Sobel test value of 9.607 was greater than 1.96, indicating that compensation (X1) has a significant effect on Non-Commissioned Officers' motivation (Y) through Strategic leadership (Z) as a mediating variable. Therefore, we can conclude that compensation has an indirect effect on motivation through Strategic leadership as a mediating variable.

The results in the p-value column for hypothesis 6 were good for all tests, including Sobel (0.02), Aroian (0.01), and Goodman Test (0.02), (Y) through Strategic leadership (Z) as a mediating variable. Therefore, we can conclude that Career Development has an indirect effect on motivation through Strategic leadership as a mediating variable.

5. DISCUSSIONS

Hypothesis 1

The findings presented in Table 3 show that the remuneration variable significantly affects the motivation of Navy Non-Commissioned Officers to attend Diktukpa as evidenced by the significant P-value of 5% at and the rating loading factor of 0.103, CR value of 2.478, and CR value. Therefore, to make a more effective policy, various aspects of compensation for Non-Commissioned Officer soldiers who are prospective students of the Navy should be taken into consideration.

Thus, **Hypothesis 1 (H1) is accepted.**

This study supports the results of prior studies. Muhammad (2018) conducted a study on 400 employees of PT Hamatestsu Indonesia, while Yusril (2017) involved 451 permanent employees of PT Otsuka Indonesia across ten departments [39]. Hypothesis 1 showed the direct effect of compensation on motivation. The path coefficient was 0.227, with significance (sig. t = 0.040). Therefore, H1 which states that providing better compensation can increase employee motivation is accepted. Similarly, Susanto (2016) studied how salary and leadership affect employee motivation, while Erwinsyah et al., (2015) determined at PDAM Tirta Musi Palembang how compensation affects employee motivation [8], [40]. From these studies, it can be inferred that providing compensation can increase the motivation of soldiers to attend *Diktukpa* education.

Hypothesis 2

Table 3 based on a large P-value of 5%, a rating loading factor of 0.155, and a CR value of 3.043, it can be seen that the remuneration variable has a significant impact on strategic leadership. Policies made in the Navy should consider various aspects of compensation for Non-Commissioned Officer soldiers who are prospective students of the Navy. Thus, **Hypothesis 2 (H2) is accepted.**

According to Naim & Lenka (2020), Strategic leadership plays a crucial role in facilitating employee development by motivating them to enhance their skills and offering opportunities to realize their full potential. The decisions made by the board of directors, as noted by (Samimi et al., 2020), have a significant impact on resource allocation and long-term commitment implications for the organization. Strategic leadership, particularly radical change, is considered the most critical determinant in enhancing organizational performance through employee motivation [41]. Compensation, as noted by Busenbark et al. (2016), can align the interests of the CEO (Strategic leadership) and shareholders. However, the literature in this area is fragmented due to the existence of theoretical fault lines, which rarely incorporate theories beyond specific domains. It can be inferred that the compensation of soldiers in carrying out *Diktukpa* education may affect the effectiveness of Strategic leadership [42].

Hypothesis 3

Mediating variable testing indicated the presence of the effect of compensation (X1) on the motivation (Y) of Non-Commissioned Officers through Strategic leadership (Z) as a mediating variable. The Sobel test proved the indirect effect, thus then **Hypothesis 3 is accepted.**

Research by Widodo (2017) intends to investigate the impact of pay, leadership, and organizational culture on employee performance through work motivation. The impact of variable remuneration, leadership, organizational culture, and motivation on employee performance was demonstrated in this study in a favorable and substantial manner. Research by Timsal & Malik (2015) demonstrates that wage packages are the most important factor affecting the effect of compensation policies on motivation levels. In their research Mulyani et al. (2020) describe how salary and leadership, separately and combined, either directly or indirectly, have a favorable impact on both motivating variables. Masaga et al. (2019), explain their research that executive compensation to bank performance has the same correlation to Strategic leadership. According to this study's findings, troops' attendance at Diktukpa is driven by remuneration, not strategic leadership.

Hypothesis 4

As seen in Table 3, the career development variable for Non-Commissioned Officers in the Navy has a significant impact on the motivation of Navy Non-Commissioned Officers in attending Diktukpa. This is supported by the loading factor value of loading factor = 0.377 with CR = 4.329 and P = significant at α = 5%. **Therefore, hypothesis 4 is accepted.**

Putri (2019) found that career development has a positive and significant impact on work motivation. Similarly, Umar (2015) and Susilo *et al*., (2018) also discovered a beneficial relationship between professional growth and work motivation, which results in increased motivation levels. Muogbo, (2013) Additionally, it was discovered that highly motivated workers can considerably enhance their performance since contented workers are more dependable and positive in their attitudes. The success of an organization depends on having motivated personnel. Therefore, providing good career development opportunities for personnel in the form of *Diktukpa* program will improve soldiers; motivation to continue their education.

Hypothesis 5

Table 3 explains that career development of Non-Commissioned Officers of the Navy has an influence on Strategic leadership as shown by the value loading factor = 0.775 with CR = 9.500 and P = significant at α = 5%. Therefore, **Hypothesis 5 (H5) is accepted.**

Naim & Lenka (2018), outlined how the business places a strong emphasis on mentoring, strategic leadership, information sharing, and social media as a reflection of its long-

term commitment to professional development Y generation. Norman et al. (2018) also discussed specifically the gap in the creation of sustainable opportunities for learning, Strategic leadership, a sense of connection and dialogue between tutors and organizations, the creation of systems for recording and recording learning, and empowerment. Younas & Bari, (2020) defined Strategic leadership as the ability of leaders to create a vision and influence others by making the right decisions to keep the organization sustainable and offer effective career development for employees.

Hypothesis 6

The results of the data analysis showed the influence of Career Development (X3) on the motivation (Y) of Non-Commissioned Officers mediated by Strategic leadership (Z). Fig. **2** and Table 4 present the results of the sobel test, where the indirect effect was found significant. Hence **Hypothesis 6 is accepted.**

In the study conducted by Marbun et al. (2022), the influence of leadership was minimal on drive. Though employee performance was positively impacted by both career advancement and leadership style. On the other side, Zaini & Kurnianingsih, (2022) found that leadership and career development have a simultaneous positive and significant impact on employee performance, and that both have a positive and significant impact on work motivation. Dermawan et al., (2018) suggested that managers effectively lead their subordinates, and provide encouragement, guidance, counselling, control, and exemplary leadership while maintaining honesty and firmness. Ahmad et al. (2022) also stated that one's personality, characteristics, and motivation are crucial aspects to be taken into consideration in determining future Strategic leadership and career development. Khalid et al. (2017) emphasized the importance of Strategic leadership in inspiring and motivating employees to excel in their career development. Therefore, the well-planned career development program is expected to positively influence motivation with the mediation of Strategic leadership, ultimately benefiting both organizations and personnel in their Officer formation education.

Hypothesis 7

Table 3 explains that organizational culture influences the motivation of Non-Commissioned Officers soldiers in attending *Diktukpa* Navy program. The *rated loading factor* = 0.176 with CR = 3.333 and P = significant at $\alpha = 5\%$ showed that **Hypothesis 7 (H7) is accepted.**

Wahab (2008) defines organizational culture as a set

of beliefs and values that are understood, adopted, and practised by an organization. Organizational behavior guidelines are based on organizational culture. Sutoro (2020) argued that corporate culture affected how people behaved to achieve goals through a process of arousal, direction, and maintenance. Pujiastuti et al. (2018) discovered a favorable and considerable impact of company culture on personnel motivation. Higher levels of employee work motivation are the result of improved company culture. Giantari & Riana, 2017) studied the impact of organizational culture on employee performance and job motivation at Klumpu Bali Resort Sanur using 52 employees as samples. The findings of the study support the finding of Bhatti *et al*., (2020), It shows a link between company culture and both organizational productivity and employee performance. Similarly, Fernandes & Maupa (2018) in Makassar that company culture has a favorable and considerable impact on employees' motivation. Therefore, a good organizational culture that supports education is likely to increase the motivation of NCO soldiers in attending *Diktukpa*.

Hypothesis 8

As seen in

Table 3 organizational culture influences Strategic leadership as shown by the rated loading factor = 0.182 with CR = 3.139 and P = significant at α = 5%. Thus **Hypothesis 8 is accepted.**

Ogbeibu et al., (2017) examined the impact of good attitudes from top management towards employee creativity in the Nigerian manufacturing industry. They argued that a positive organizational culture could act as a catalyst for economic development and modernization by creating multiplier effects [59]. Employee creativity, as defined by (Amabile & Pillemer, 2012; Ogbeibu *et al*., 2017), involves the production of new and innovative ideas that challenge existing ideologies and offer new solutions [58], [60]. Additionally, Obeidat & Al Thani (2020) stated that Strategic leadership develop better comprehension of the organizational environment and culture [61]. Therefore, a supportive strategic leadership environment and a favorable organizational culture can help the education and training program be implemented successfully.

Hypothesis 9

Sobel test indicated that organizational culture (X2) affects the motivation (Y) of Non-Commissioned Officers mediated by Strategic leadership (Z). Fig. **2** and Table 4 show that the indirect effect is proven significant, therefore **Hypothesis 9 is accepted.**

Naim & Lenka (2018) defined The capacity of a person to define a strategic vision, think strategically, and inspire others to build a sustainable future for the organization is known as strategic leadership [49]. Younas & Bari (2020) noted that the interaction between managers and leaders within an organization is related to strategic leadership, while proposed that distributing strategic leadership can include defense-related subjects like resilience, university information, and mentoring in a learning framework [51], [62]. Shao (2019) revealed that the association between motivation and strategic leadership was modified by organizational culture [25], while Samimi et al. (2020) examined how followers are affected by and perceive strategic leaders' leadership approaches [31]. Munawaroh et al. (2021) noted that corporate culture and strategic leadership both significantly affect business success and motivation [27], while Saluy et al. (2022) illustrated how leadership and corporate culture have a positive impact on employee motivation [23]. As a result, strategic leadership can have an impact on motivation when organizations and members are encouraged to carry out and attend officer formation education efficiently.

Hypothesis 10

Table 3 explains that Strategic leadership influences the motivation of Navy Non-Commissioned Officers. It can be shown by rated loading factor = 0.422 with CR = 5.222 and P = significant at $\alpha = 5\%$. It implies **Hypothesis 10 is accepted.**

Strategic leadership refers to the ability of decision-makers in forming the future, align individuals with a shared vision, and inspire them to succeed despite obstacles [63]. This phenomenon has been studied and discussed across various sectors such as the military, business, and education. Stamevska & Stamevski (2020) asserted that strategic leaders need to have a strong passion for work beyond monetary and power-driven incentives [64]. They also need to be goal-oriented. Likewise, Bose & Ndegwa (2019) found Strategic leadership positively affected organizational performance through motivation [65]. Cortes & Herrmann (2021) highlighted the fact that executive behavioral motivations are categorized and constructs are synthesized as part of strategic leadership [66]. This study analyzed and summarized prior research on the impact of strategic leaders, such as chief executive officers, senior management teams, and boards of directors, on innovation. It also provided a framework to drive future studies in this crucial field.

CONCLUSIONS

This study used strategic leadership as a mediating variable to examine the impact of pay, career advancement, and organizational culture on soldiers' motivation to attend Diktukpa. The data demonstrates that the motivation of Navy Non-Commissioned Officers to attend Diktukpa is significantly influenced by compensation. Strategic leadership is impacted by compensation as well. Strategic leadership creates organizational agility that enables quick response to changes in a highly competitive environment. Soldier performance is also somewhat influenced by compensation, leadership, organizational culture, and motivation.

Compensation, career development, and organizational culture of Student Non-Commissioned Officers in the Navy can be improved through various methods including improvement of knowledge, capabilities and attitudes, initiative and innovation through various training and education. Second, the results of this study provide good personnel evaluation and planning direction that the admission or recruitment of officers from Non-Commissioned Officer or *Diktukpa* sources take into account the compensation, career development, organizational culture, and Strategic leadership to improve their interest in NCO Navy for self-development. This study offers significant theoretical contributions as it clarifies the relationship between compensation and career development in the Strategic leadership of military personnel.

FUTURE WORK

Future researchers are encouraged to address the limitation of this present study. Since this study on this matter is relatively new, future researchers need to evaluate the proposition of career development as a significant predictor of students' motivation. Second, this study discussed strategic management, thereby Strategic leadership is included as a variable. Third, there are certain limitations to the method and sample size of this study. This quantitative study only measured the relationships between variables based on numerical data. Whereas, qualitative study is a more explorative approach than measuring relationships between variables that should be applied in future studies. Fourth, the subjects of this study were Non-Commissioned Officers and soldiers who can attend *Diktukpa*.

Future researchers are recommended to analyze different types of data in determining the motivation for career development and education of Non-Commissioned Officers of the Navy. They can also carry out an in-depth interview to

gain data related to the relationship between the type of leadership and educational motivation to enrich the literature on this issue (Delphi, Grounded theory, etc.). Finally, new variables can be included in future studies.

ACKNOWLEDGEMENT

This research was supported by Trisakti University and Indonesian Navy. We thank our colleagues from Navy Officers who provided insight and expertise that greatly assisted the research. This article is original research and has not been published elsewhere.

REFERENCES

[1] Reskantika, R., Paminto, A., and Ulfah, Y., Pengaruh gaya kepemimpinan dan budaya organisasi serta motivasi terhadap kepuasan kerja dan komitmen organisasi, Jurnal Manajemen, vol. 11, no. 2, pp. 195–202, 2019.

[2] Sembiring, J. H., and Prasetio, A. P., Pengaruh kompensasi terhadap motivasi kerja karyawan di Biznet Networks, Jurnal Mitra Manajemen, vol. 2, no. 4, pp. 263–272, 2018.

[3] Imran, M., Ismail, F., Arshad, I., Zeb, F., and Zahid, H., The mediating role of innovation in the relationship between organizational culture and organizational performance in Pakistan's banking sector, Journal of Public Affairs, no. June, 2021, doi: 10.1002/pa.2717.

[4] Spivak, Y., Omelchenko, S., Petrova, M. M., Kurinna, S., and Kurinnyi, I., Socio-Pedagogical Conditionsof Future Social SpecialiststTraining for Successful Professional Career, International Journal of Higher Education, vol. 10, no. 4, p. 1, 2021, doi: 10.5430/ijhe.v10n4p1.

[5] Chin, T., Li, G., Jiao, H., Addo, F., and Jawahar, I. M., Career sustainability during manufacturing innovation: A review, a conceptual framework and future research agenda, Career Development International, vol. 24, no. 6, pp. 509–528, 2019, doi: 10.1108/CDI-02-2019-0034.

[6] Naim, M. F. and Lenka, U., Organizational learning and Gen y employees' affective commitment: The mediating role of competency development and moderating role of strategic leadership, Journal of Management and Organization, vol. 26, no. 5, pp. 815–831, Sep. 2020, doi: 10.1017/JMO.2018.19.

[7] Kusuma, Y. B., Bambang, S., and Musadieq, M. A., Pengaruh Kompensasi terhadap Motivasi Kerja, Kepuasan Kerja dan Kinerja Karyawan (Studi pada Karyawan (Studi pada Karyawan Tetap PT. Otsuka Indonesia di Lawang, Malang), E-Journal Ilmu Administrasi, vol. 9, no. 1, pp. 43–56, 2015.

[8] Susanto, Y., Kepemimpinan dan Kompensasi Pengaruhnya terhadap Motivasi Kerja serta Implikasinya pada Kinerja Karyawan Koperasi Simpan Pinjam di Kota Palembang, Jurnal Manajemen dan Bisnis Sriwijaya, vol. 14, no. 4, pp. 450–470, 2016.

[9] Muhammad, A., Pengaruh Kompensasi terhadap Motivasi Kerja di PT Hametetsu Indonesia, Jurnal Ilmu Administrasi, vol. 3, no. 1, pp. 426–433, 2018.

[10] Purba, K., and Sudibjo, K., The Effects Analysis of Transformational Leadership, Work Motivation and Compensation on Employee Performance in PT. Sago Nauli, Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences, vol. 3, no. 3, pp. 1606–1617, 2020, doi: 10.33258/birci.v3i3.1091.

[11] Mahardhika, R., Pengaruh Motivasi Kerja Terhadap Kinerja Karyawan (Survei Karyawan Pada PT. Axa Financial Indonesia Sales Office Malang), Universitas Brawijaya, 2013.

[12] Syahruddin, S. M., Nugraha, S., Kurnia, H., and Yusriadi, Y., Increasing Work Motivation with State Defense Education and Compensation through Employee Discipline at the XI/ Hasanuddin Military Regional Parent Regiment Educational Institution, Proceedings of the International Conference on Industrial Engineering and Operations Management, 2021.

[13] Masaga, B., Arasa, R., and Nzioki, S., The Moderating Effect of Strategic Leadership on the Relationship between Executive Compensation and Performance of Commercial Banks in Kenya, The International Journal of Business & Management, vol. 7, no. 9, pp. 127–140, 2019, doi: 10.24940/theijbm/2019/v7/i9/bm1909-027.

[14] Mulyani, S. R., Sari, V. N., and Sari, M. W., Model of employee motivation and cooperative performance, Utopia y Praxis Latinoamericana, vol. 25, no. Extra1, pp. 232–242, 2020, doi: 10.5281/zenodo.3774631.

[15] Tannady, H., and Sitorus, T., Role Of Compensation, Organization Culture, And Leadership On Working Motivation Of Faculty Member (Study Case: Universities In North Jakarta) | Semantic Scholar, IOSR Journal of Business and Management, vol. 19, no. October 2017, pp. 41–47, 2017, doi: 10.9790/487X-1910034147.

[16] Kaswan, and Akhyadi, A. S., Pengembangan Sumber Daya Manusia Dari Konsepsi, Paradigma, dan Fungsi sampai Aplikasi. Bandung: Alfabeta, 2015.

[17] Chaudhary, N., Role of motivation in talent retention and increasing productivity. Suresh Gyan Vihar University, 2014.

[18] Rizwan, M., Tariq, M., Hassan, R., and Sultan, A., A comparative analysis of the factors effecting the employee motivation and employee performance in Pakistan., International Journal of Human Resource Studies, vol. 4, no. 3, pp. 35–49, 2014.

[19] Alkaabi, S. A. R., Alkaabi, W., and Vyver, G., Researching Student Motivation, Contemporary Issues in Education Research (CIER), vol. 10, no. 3, pp. 193–202, 2017, doi: 10.19030/cier.v10i3.9985.

[20] Marbun, F., Sudiarditha, I. K. R., and Susita, D., The Influence of Leadership Style and Career Development as Mediated by Work Motivation: Case of Hospital Employee Performance, The International Journal of Social Sciences World, vol. 4, no. 2, pp. 358–370, 2022.

[21] Zaini, Z., and Kurnianingsih, L., The Influence of Work Motivation, Leadership, and Career Development on Employee Performance at the Human Resources Development Center for Air Transportation, Curug Tangerang, IJESS International

Journal of Education and Social Science, vol. 3, no. 2, pp. 55–63, 2022, doi: 10.56371/ijess.v3i2.100.

[22] Ahmad, R., Ngah, A. H., and Mohamed, A. M., Examining the Linkage between Transformational Leadership Styles and Succession Planning Programs in Malaysian Public Universities, International Journal of Public Administration, vol. 00, no. 00, pp. 1–14, 2022, doi: 10.1080/01900692.2022.2105355.

[23] Saluy, A. B. et al., Motivation Moderating the Influence of Organizational Culture and Leadership on Employment Performance, WSEAS Transactions on Environment and Development, vol. 18, no. June, pp. 662–670, 2022, doi: 10.37394/232015.2022.18.63.

[24] Khalid, S., Rehman, M., Muqadas, F., and Rehman, S., Women Leadership and Its Mentoring Role Towards Career Development, Pakistan Business Review, no. October, pp. 649–667, 2017, [Online]. Available: https://www.researchgate.net/publication/320416789.

[25] Shao, Z., Interaction effect of strategic leadership behaviors and organizational culture on IS-Business strategic alignment and Enterprise Systems assimilation, International Journal of Information Management, vol. 44, pp. 96–108, 2019.

[26] Sewang, A., The Influence Of Leadership Style, Organizational Culture, And Motivation The Job Satisfaction And Lecture's Performance At College Of Darud Dakwah Al Irsyad (DDI) At Est Sulawesa, International Journal of Management and Administrative Sciences (IJMAS), vol. 3, no. 5, pp. 8–22, 2013.

[27] Munawaroh, M.et al., The Effect of Strategic Leadership and Organization Culture on Business Performance: An Empirical Study in Indonesia, Journal of Asian Finance, Economics and Business, vol. 8, no. 6, pp. 455–0463, 2021, doi: 10.13106/jafeb.2021.vol8.no6.0455.

[28] Nugroho, Y. A., Hutagalung, D., Asbari, M., Supriatna, H., and Novitasari, D., Mempertahankan Kinerja Karyawan UMKM: Analisis Pengaruh Managerial Coaching dan Motivasi Intrinsik, Value: Jurnal Manajemen Dan Akuntansi, vol. 16, no. 2, pp. 54–68, 2021.

[29] Admiral, G., Chidir, Asbari, M., Supriatna, H., and Novitasari, D., Linking Employee Coaching, Team Commitment and Performance: Evidence from Indonesian MSMEs., International Journal of Social and Management Studies, vol. 2, no. 4, pp. 22–34, 2021.

[30] Johan, M., Budiadnyana, G. N., Admiral, M., Asbari, and Novitasari, D., Kepemimpinan Karismatik dalam Perspektif Karyawan UMKM: dari Motivasi Intrinsik hingga Tacit Knowledge Sharing, Edumaspul: Jurnal Pendidikan, vol. 5, no. 1, pp. 598–613, 2021.

[31] Samimi, M., Cortes, A. F., Anderson, M. H., and Herrmann, P., What is strategic leadership? Developing a framework for future research, Leadership Quarterly, no. October, p. 101353, 2020, doi: 10.1016/j.leaqua.2019.101353.

[32] Anggraeni, A., Hasna, S., Novitasari, D., and Asbari, M., Pengaruh Pelatihan Kerja dan Motivasi Kerja Terhadap Prestasi Karyawan pada PT. Agrindo Maju Lestari., Jurnal Bisnis Manajemen dan Akuntansi, vol. 2, no. 1, pp. 1–18, 2020.

[33] Joshi, A., Kale, S., Chandel, S., and Pal, D. K., Article no.BJAST.2015.157 Opinion Article Joshi et al, vol. BJAST, no. 4, p. 157, 2015, doi: 10.9734/BJAST/2015/14975.

[34] Bhardwaj, P., Types of sampling in research, Journal of the Practice of Cardiovascular Sciences, vol. 5, no. 3, p. 157, 2019, doi: 10.4103/jpcs.jpcs_62_19.

[35] Timalsina, R., S. K.C., Rai, N., and Chhantyal, A., Predictors of organizational commitment among university nursing Faculty of Kathmandu Valley, Nepal, BMC Nursing, vol. 17, no. 1, pp. 1–8, 2018, doi: 10.1186/s12912-018-0298-7.

[36] Edward, Y. R., and Purba, K., The Effect Analysis of Emotional Intelligence and Work Environment on Employee Performance with Organizational Commitment as Intervening Variables in PT Berkat Bima Sentana, Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences, vol. 3, no. 3, pp. 1552–1563, 2020, doi: 10.33258/birci.v3i3.1084.

[37] Rossi, R., Murari, A., Gaudio, P., and Gelfusa, M., Upgrading model selection criteria with goodness of fit tests for practical applications, Entropy, vol. 22, no. 4, pp. 1–13, 2020, doi: 10.3390/E22040447.

[38] Joensuu-Salo, S., Sorama, K., Viljamaa, A., and Varamäki, E., Firm performance among internationalized smes: The interplay of market orientation, marketing capability and digitalization, Administrative Sciences, vol. 8, no. 3, 2018, doi: 10.3390/admsci8030031.

[39] Yusril, M., Pengaruh Kompensasi Terhadap Motivasi Kerja, Kepuasan Kerja, Dan Kinerja Karyawan, Jurnal Ilmiah Mandala Education, vol. 3, no. 1, pp. 288–300, 2017.

[40] Erwinsyah, M., Wadud and Kurniawan, M., Pengaruh Kompensasi terhadap Motivasi Kerja Karyawan PDAM Tirta Musi Palembang, Jurnal Ilmiah Ekonomi Global Masa Kini, vol. 6, no. 1, pp. 13–17, 2015.

[41] Wang, G., Holmes, R. M., Oh, I. S., and Zhu, W., Do CEOs Matter to Firm Strategic Actions and Firm Performance? A Meta-Analytic Investigation Based on Upper Echelons Theory, Personnel Psychology, vol. 69, no. 4, pp. 775–862, Dec. 2016, doi: 10.1111/PEPS.12140.

[42] Busenbark, J. R., Krause, R., Boivie, S., and Graffin, S. D., Toward a Configurational Perspective on the CEO: A Review and Synthesis of the Management Literature, Journal of Management, vol. 42, no. 1, pp. 234–268, 2016, doi: 10.1177/0149206315618448.

[43] Widodo, D. S., Pengaruh Budaya Organisasi, Kepemimpinan Dan Kompensasi Melalui Motivasi Kerja Terhadap Kinerja Pegawai, Jurnal Manajemen Motivasi, vol. 13, no. 2, pp. 896–908, 2017.

[44] Timsal, A., and Malik, A. Q., Impact of compensation policy on the motivation level of employees: empirical evidence from the University Teachers of Pakistan, South Asian Journal of Banking and Social Science, vol. 1, no. 1, pp. 33–50, 2015.

[45] Putri, W. A., Pengaruh Pengembangan Karier Terhadap Motivasi dan Dampaknya Terhadap Kinerja Karyawan (Studi Kasus di PT. Barata Indonesia (Persero)

Gresik), Jurnal Ilmu Manajemen, vol. 7, no. 2, pp. 1–10, 2019.
[46] Umar, A., The Effect of Motivation and Career Development Against Employees Performance and Job Satisfaction of the Governor Office South Sulawesi Province, Indonesia, International Journal of Management Sciences, vol. 5, no. 9, pp. 628–638, 2015.
[47] Susilo, C. I., Prasetyo, I., and Riswati, F., Pengaruh Budaya Organisasi dan Pengembangan Karir terhadap Kepuasan Kerja Prajurit Melalui Motivasi Kerja di Satuan Kapal Amfibi Koarmatim, Jurnal Manajerial Bisnis, vol. 1, no. 2, pp. 138–153, 2018.
[48] Muogbo, U. S., The Impact of Employee Motivation on Organisational Performance (A Study of Some Selected Firms In Anambra State Nigeria), International Journal Of Engineering and Science (IJES), vol. 2, no. 7, pp. 70–80, 2013.
[49] Naim, M. F.and Lenka, U., Development and retention of Generation Y employees: a conceptual framework, Employee Relations, vol. 40, no. 2, pp. 433–455, 2018, doi: 10.1108/ER-09-2016-0172.
[50] Norman, L., Rankin-Wright, A. J., and Allison, W., It's a Concrete Ceiling; It's Not Even Glass': Understanding Tenets of Organizational Culture That Supports the Progression of Women as Coaches and Coach Developers, Journal of Sport and Social Issues, vol. 42, no. 5, pp. 393–414, 2018, doi: 10.1177/0193723518790086.
[51] Younas, M., and Bari, M. W., The relationship between talent management practices and retention of generation 'Y' employees: mediating role of competency development, Economic Research-Ekonomska Istrazivanja, vol. 33, no. 1, pp. 1330–1353, 2020, doi: 10.1080/1331677X.2020.1748510.
[52] Dermawan, P., Susilo, H., and Aini, E. K., Pengaruh Gaya Kepemimpinan Situasional Terhadap Kinerja Karyawan Dengan Motivasi Kerja Sebagai Variabel Intervening (Studi Pada PT Anugerah Sinergi Raya), Jurnal Administrasi Bisnis, vol. 60, no. 2, 2018.
[53] Wahab, A. A., Anatomi Organisasi dan Kepemimpinan Pendidikan. Jakarta: Alfabeta, 2008.
[54] Sutoro, Pengaruh Budaya Organisasi terhadap Motivasi Kerja Pegawai BPSDM Provinsi Jambi, Jurnal Ilmiah Universitas Batanghari Jambi, vol. 20, no. 1, pp. 104–112, Feb. 2020, doi: 10.33087/jiubj.v20i1.863.
[55] Pujiastuti, E. A., Umam, and Khairul, M. R., Pengaruh Budaya Organisasi Terhadap Kinerja Karyawan Dengan Variabel Pengaruh Budaya Organisasi Terhadap Kinerja Karyawan Dengan Variabel, IAIN Surakarta, 2018.
[56] Bhatti, A., Rehman, S. U., and Rumman, J. B. A., Organizational capabilities mediates between organizational culture, entrepreneurial orientation, and organizational performance of smes in Pakistan, Entrepreneurial Business and Economics Review, vol. 8, no. 4, pp. 85–103, 2020, doi: 10.15678/EBER.2020.080405.
[57] Fernandes, A. A. R., and Maupa, H., The Effect of Organization Culture and Technology on Motivation, Knowledge Asset, and Knowledge Management, The Eletronic Library, vol. 34, no. 1, pp. 1–5, 2018.

[58] Ogbeibu, S., Senadjki, A., and Tan, L. P., The diffusion of creative ideas: A dark side perspective of trustworthiness perception, In The 19th Malaysian Finance Association Annual Conference (MFAC), pp. 70–88, 2017.

[59] Akume, A. T., and Abdullahi, Y. M., Challenges and Prospects of Effective Industrial Conflict Resolution in Nigeria, Journal of Social Science, vol. 36, no. 2, pp. 199–208, Aug. 2013, doi: 10.1080/09718923.2013.11893188.

[60] Amabile, T. M., and Pillemer, J., Perspectives on the Social Psychology of Creativity, The Journal of Creative Behavior, vol. 46, no. 1, pp. 3–15, Mar. 2012, doi: 10.1002/JOCB.001.

[61] Mishael Obeidat, A., and Ben Hamed Al Thani, F., The Impact of Strategic Leadership on Crisis Management, International Journal of Asian Social Science, vol. 10, no. 6, pp. 307–326, 2020, doi: 10.18488/journal.1.2020.106.307.326.

[62] Thornton, K., Walton, J., Wilson, M., and Jones, L., Middle leadership roles in universities: Holy Grail or poisoned chalice, Journal of Higher Education Policy and Management, vol. 40, no. 3, pp. 208–223, 2018, doi: 10.1080/1360080X.2018.1462435.

[63] Felfe, J., and Schyns, B., Romance of leadership and motivation to lead, Journal of Managerial Psychology, 2014.

[64] Stamevska, E., and Stamevski, V., Decisions and skills of the strategic leaders, Economics and Management, vol. XVII, no. 1, pp. 140–146, 2020.

[65] Bose, E. N., and Ndegwa, P., Strategic Leadership and Organizational Performance of Directorate of Criminal Investigations in Nairobi County, Kenya, International Journal of Current Aspects, vol. 3, no. V, pp. 166–185, 2019, doi: 10.35942/ijcab.v3iv.69.

[66] Cortes, A. F., and Herrmann, P., Strategic Leadership of Innovation: A Framework for Future Research, International Journal of Management Reviews, vol. 23, no. 2, pp. 224–243, 2021, doi: 10.1111/ijmr.12246.

ANALYTICAL HIERARCHY PROCESS AND TOPSIS APPROACH TO STRATEGY DETERMINATION OF DEPO LEVEL MAINTENANCE FOR SUBMARINE

BENY BUDHI SEPTYANTO, I NENGAH PUTRA, ARIES SUDIARSO

Indonesia Defense University

Defense Industry Policy Committee (DIPC) and PT.PAL Indonesia projects have not yet determined a strategy in determining the implementation of submarine maintenance. Availability of the budget in carrying out maintenance and repair of submarines is one of the obstacles that is quite difficult in carrying out scheduled and planned maintenance of the defense equipment. On the other hand, if a policy is implemented to carry out continuous maintenance, it will result in a very high maintenance budget burden. Based on the current conditions and several previous studies, this study aims to provide an analysis of development strategy priorities in determining submarine maintenance. This study uses the MCDM Hybrid Technique approach combining the Analytical Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods. While the AHP method is applied in screening decision criteria and determining the weight of each decision criterion, the TOPSIS method is used in ranking alternative maintenance strategies. Based on the results of the study, the criteria for the maintenance strategy on the Submarine showed that the safety level criterion (C4) had the highest weight of 0.201 with a CR of 0.097. Then the Technology Use criterion (C3) weights 0.143 as the second criterion. The resource availability criterion (C7) is the third criterion with a weight of 0.135. While the Operational Time criterion (C5) weights 0.056 as the criterion with the smallest weight. Submarine-02 with the Medium category maintenance strategy. Submarine-03 with a medium-level maintenance strategy weight 0.633. Furthermore, Submarine-01 and Submarine-04 are currently still in the Corrective level maintenance category with respective weights of 0.279 and 0.344.

Key words: *Maintenance Level, Submarine, TOPSIS (Technique for Others Reference by Similarity to Ideal Solution), Analytical Hierarchy Process (AHP).*

1. INTRODUCTION

The availability of the budget for carrying out the maintenance and repair of the warship is one of the obstacles that are quite difficult for the Indonesian Navy to carry out scheduled and planned maintenance of its defense equipment. This is because the Plan Maintenance System (PMS) requires a relatively large amount of money and a long enough time to support its programs. So that in practice the PMS schedule that has been set is often missed and what happens next is that as long as a system/part has not been damaged, the component will continue to operate. The period on the submarine is determined by the implementation of the maintenance and repairs carried out. Thus operational demands and expectations change both strategically and tactically over their lifetime (Muinde et al., 2014). Submarine maintenance is carried out at three separate levels based on the resources and capabilities required to perform maintenance: Organizational, Intermediate, and Depot levels (Saravanan & Kumar, 2020).

Lifecycle maintenance includes depot maintenance, intermediate maintenance, and organizational-level maintenance. Depot maintenance, or D-level, includes "overhaul or complete rebuild of parts, assemblies, subassemblies, and final goods, including the manufacture of parts. This level of complex repairs is carried out in a depot-level facility, such as a shipyard. Any work that requires the boat to be out of the water (e.g. in drydock) is typically D-grade maintenance (Goossens & Basten, 2015). This study aims to provide an analysis of depot-level maintenance determination to support the readiness of sea operations for submarine. This study used the Analytical Hierarchy Process (AHP) and TOPSIS method approach. The AHP method is used to determine the selected criteria for carrying out maintenance at the depot level. The TOPSIS method is used to analyze the priority of the Submarine class in determining Depo level maintenance.

2. LITERATURE REVIEW

Onboard maintenance systems as described by Seiti et al. (2017), it is necessary to use risk evaluation in the maintenance selection strategy for ship engine systems. Desember et al. (2020), in their research also suggested the need for a prioritization process in the Submarine Maintenance, Repair, and Overhaul (MRO) development strategy. Resobowo et al. (2014), in their research also explained the selection of variables that affect the maintenance of Submarine. Asuquo et al. (2019), also proposed strategic multi-attribute group

decision-making (MAGDM) for selection of appropriate and concise maintenance strategies using qualitative and quantitative integrative approaches. Jimenez et al. (2020), proposed the development of predictive maintenance solutions in the shipping industry based on computational artificial intelligence models using real-time data. Kimera & Nangolo (2020), propose a review of maintenance practices, tools, and parameters for marine mechanical systems that can be classified as plant, machine, and equipment (PME). Jeong et al. (2018), proposed a new decision-making process used to compare the performance of ships with diesel-electric hybrid propulsion or conventional propulsion systems with an analytical hierarchical method approach. Animah & Shafiee (2021), proposes choosing the right maintenance strategy for various critical engines found in the ship's engine room. Emovon (2016), describes the use of hybrid MCDM techniques in prioritizing maintenance strategies for ship systems with the analytical methods used, namely Delphi, AHP and TOPSIS methods. Goossens & Basten (2015), in his research, investigated the maintenance of policy selection (MPS) through the use of the Analytic Hierarchy Process (AHP). Emovon et al. (2018), in their research presents the selection of appropriate maintenance strategies for ship engine systems and other related ship systems with the MCDM model. However, several previous studies have not discussed specifically related maintenance strategies for this type of submarine, where the condition of existing submarine systems and buildings is different from ships on water.

2.1. Maintenance Theory

Maintenance is most commonly defined as all activities aimed at maintaining a system or returning it to the condition deemed necessary for it to function as intended. Other definitions include maintenance objectives such as providing services to enable an organization to achieve its goals and maintain the ability of the system to provide services. Although the definition is quite broad, five specific maintenance responsibilities are generally recognized:

a. Maintain assets and equipment in good condition, properly configured, and safe to perform their intended function;
b. Perform all maintenance activities including preventive, predictive, and corrective maintenance, repairs, design modifications, and emergency maintenance efficiently and effectively;
c. Preserving and controlling the use of spare parts and materials;
d. Commissioning of new plants and factory expansion;
e. Operate utilities and save energy

Technical maintenance can be divided into several levels, starting from the strategic level to the operational level. At each level, decisions are made about, for example, what the maintenance objectives are, which maintenance concept to apply, which maintenance policy to choose, and so on.

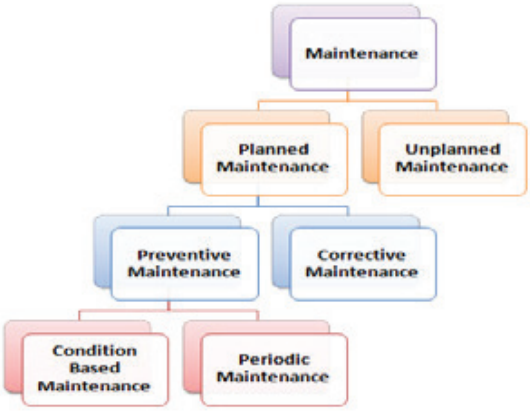

Fig. 1 Maintenance Philosophy. Source: Goossens & Basten (2015)

2.2. Ship Maintenance

Maintenance is considered at the early stages of ship design. Each component in the ship is scheduled to be maintained separately in the maintenance scheduling plan to maximize the function of the ship. A ship can be ready if all of its main components are operational, such as propulsion, power, air conditioning, and cargo engines. If any of the major components are not operational, the ship will be classified as not ready, and maintenance will be required. In the marine industry, ship maintenance and ship repair can be completed in two different ways. First, it can be done at a ship repair site when the ship is scheduled for dry dock to survey underwater passages. Second, when is the time for the classification survey (Goossens & Basten, 2015).

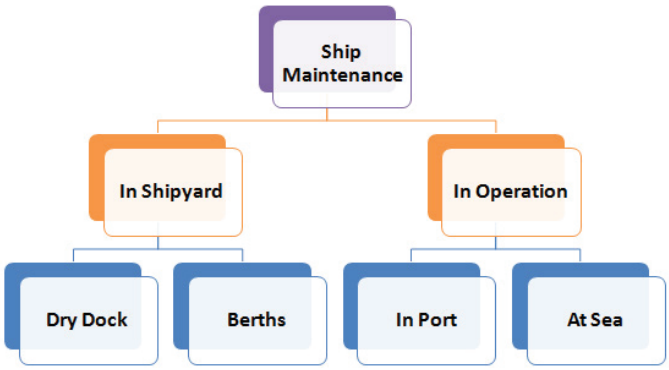

Fig. 2 Ship Maintenance. Source: Alhouli (2011)

Ship maintenance, like maintenance in other industries, usually uses two types of policies, namely corrective maintenance policies and preventive maintenance policies. A fault maintenance policy is usually done without preventive maintenance, except for essential lubrication and making minor adjustments. Preventive maintenance involves maintenance to reduce the number of breakdowns and can be either time- or condition-based maintenance (Alhouli et al., 2017).

2.3. Analytical Hierarchy Process (AHP)

AHP describes complex multi-factor or multi-criteria problems into a hierarchy, according to Saaty, a hierarchy is defined as a representation of a complex problem in a multi-level structure, where the first level is the goal, followed by the factor level, criteria, sub-criteria, and so on down to the next level. the last of the alternatives with a hierarchy of a complex problem can be described in groups which are then arranged into a hierarchy as the problem will appear more structured and systematic. One of the main advantages of AHP that differentiates it from other decision-making models is that there is no absolute consistency requirement. So that the existing problems can be felt and observed, but the completeness of the numerical data does not support the modeling of problems quantitatively (Saaty, 1990).

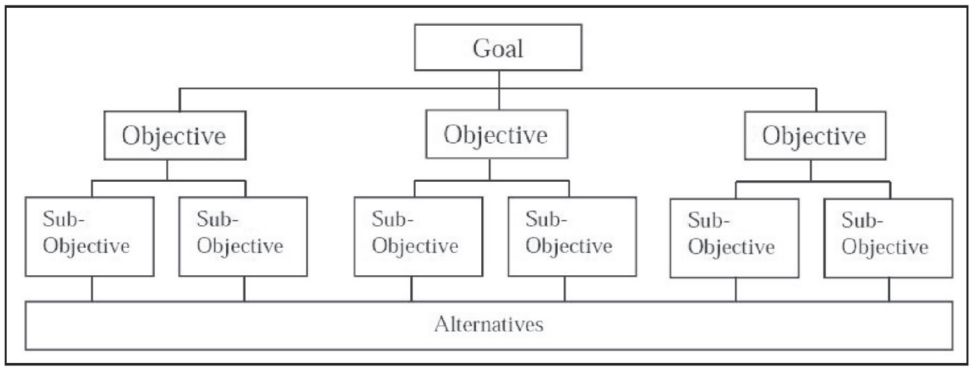

Fig. 3 AHP Structure.
Source: Saaty (1990)

7 pillars that are used and must be considered in AHP modeling (Saaty, 2012), including:

a. The ratio scale is a comparison of two values (a/b) where the values a and b are the same type (unit). The ratio scale is a set of consistent ratios in the same transformation (multiplication with positive constants). A set of values (in the same units) can be standardized by normalizing so that units are no longer needed and these objects can be more easily distinguished from one another.
b. Pairwise comparisons. Pairwise comparisons are made to provide relative weights between criteria and/or alternatives, so that the priority of those criteria and/or alternatives will be obtained. There are three approaches to sorting alternatives or criteria, namely relative, absolute, and benchmarking. The approach is used for critical general criteria. The absolute approach is used at the lower level of the hierarchy where there is usually a quantifiable detailed description of each criterion. In the benchmarking approach, the alternatives are compared with known reference alternatives, then the alternatives are sorted according to the results of the comparison.
c. Conditions for the sensitivity of the eigenvectors. The sensitivity of the eigenvectors to changing criteria limits the number of elements in each comparison set. This requires homogeneity of the elements concerned. Change must be by selecting a small element as a unit and asking what effect it has on the larger element.
d. Homogeneity and clustering. Clustering is used when the differences between elements are more than one degree, to slowly widen the fundamental scale, eventually increasing the scale from 1 to 9 to infinity. This is especially true for relative measurements.
e. Synthesis. Synthesis is applied to a ratio scale to create a unidimensional scale to represent the overall output, using additional weighting.
f. Maintaining and reversing the order of weighting and order in the hierarchy is affected by the addition or change of criteria or alternatives. Often there is a phenomenon of order reversal (rank reversal), especially in relative measurements. Sequence reversal is intrinsic

to decision making as is the order-preserving condition.

g. Group consideration. Group judgments must be carefully and mathematically integrated. With AHP, it is possible to take into account the experience, knowledge, and strengths of the individuals involved.

TOPSIS (Technique for Others Reference by Similarity to Ideal Solution)

TOPSIS (Technique For Others Reference by Similarity to Ideal Solution) is a multi-criteria decision-making method introduced by Yoon and Hwang (1981) in Do et al. (2020). This method uses the principle that the chosen alternative must have the shortest distance from the positive ideal solution and the farthest from the negative ideal solution from a geometric point of view (Do et al., 2020). Determining the relative proximity of an alternative to the optimal solution is done by calculating the Euclidean distance. The TOPSIS method considers the distance between the positive ideal solution and the negative ideal solution by taking the relative closeness value to the positive ideal solution (Teniwut et al., 2019). The steps of the TOPSIS method are as follows (Chen, 2019):

a. Define the problem to be solved with the TOPSIS method.

b. Make a decision matrix according to the problem to be solved, then normalize the matrix with the equation.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad [1]$$

Where rij is the normalized matrix of the problem base matrix, with i = 1,2,3,....m, and j = 1,2,3 ... n. While xij is the basic matrix to be normalized. For each i denotes a row of the matrix, and for each j denotes a column of each matrix.

c. Normalize the rij matrix using weight ratings so that a normalized weight rating matrix is obtained, the equation used is as follows y ij = w i xr ij ……..…… (2) where y ij is the weighted rating matrix, wi is the i weighted rating , and rij is the normalized result matrix in the second step. For i = 1,2,..., m, and j = 1,2, .., n. In this case, the rating weight must be determined based on the number of decision variables being resolved.

d. Determine the positive ideal solution (A+) and Negative Ideal Solution (A-) based on the weighted rating

matrix values in step 3. The following equation is used to find positive ideal solution values $A+ = (y\ 1+, y\ 2+,\ldots, yn+)$..(3) and to find negative ideal solution values use the following equation $A -=(y\ 1-, y\ 2-,\ldots, yn-)$ under the condition:

$$y_i^+ = \begin{cases} \max y_{ij} : \text{if } j \text{ is cost attribute} \\ \min y_{ij} : \text{if } i \text{ is profit attribute} \end{cases} \quad [2]$$

$$y_i^- = \begin{cases} \max y_{ij} : \text{if } j \text{ is the profit attribute} \\ \min y_{ij} : \text{if } i \text{ is the cost attribute} \end{cases}$$

e. Determine the distance between the weighted values of each alternative to the positive ideal solution and the negative ideal solution. To determine the distance between the weighted values of each alternative to the positive ideal solution, the following equation is used:

$$D_i^- = \sqrt{\sum_{i=1}^{n} (y_{ij} - y_i^-)^2} \quad [3]$$

While to calculate the distance between the weighted values of each alternative to the negative ideal solution, the following equation is used:

$$D_i^+ = \sqrt{\sum_{i=1}^{n} (y_i^+ - y_{ij})^2} \quad [4]$$

f. The last step is to calculate the preference value for each alternative with the equation:

$$V_i = \frac{D_I^-}{D_I^- + D_I^+} \quad [5]$$

3. METHODS

Based on the type classification and analysis, this research is qualitative research with descriptive statistics. A descriptive statistical approach is used in providing an assessment in the form of numbers from research observations and testing of research objects of people or observable behavior (Filimonau & Perez, 2019). Data processing is a process consisting of input activities, process activities, and output activities (Samrin et al., 2021). In this study, data processing was assisted by Microsoft Excel and Expert Choice software. The steps in this research for data analysis include defining the problem and determining the desired solution. In this stage determine the problem to be solved in a clear, detailed, and easy to understand manner. Determine the criteria related to the determination of maintenance on the submarine, create a hierarchical structure starting with the main goal. After compiling the main goal as the top level, the hierarchical level below it will be arranged and creating a pairwise comparison matrix that describes the

relative contribution or influence of each element on the goals or criteria at the level above it. There is a flow chart in this research as shown in Fig. **4**.

4. RESULTS

4.1. Determination and weighting of the strategy criteria

At this stage, the weighting of the criteria is used to provide ranking to the criteria used. Giving a value to each criterion followed by pairwise comparisons to find out the priority weight of each criterion. This criterion was obtained from the results of content analysis of some of the previous literature which was supported by expert opinion. In determining the weight of the criteria, namely calculating the total value of the overall criteria for each criterion as shown in **Table 1** below.

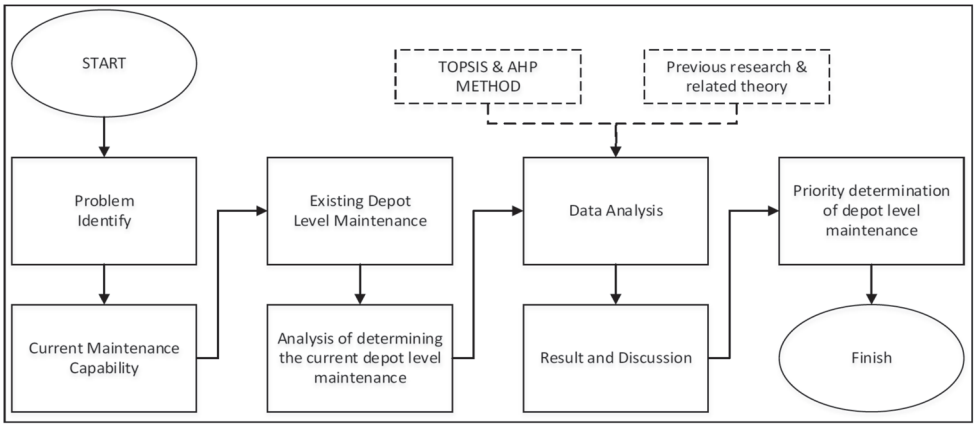

Fig. 4 Research Flowchart

Table 1. Submarine Maintenance Level Criteria Data

CODE	CRITERIA	CODE	CRITERIA
C-1	Characteristics	C-5	Operational time
C-2	reliability	C-6	Cost
C-3	Technology use	C-7	Availability of resources
C-4	Security level	C-8	Human Resources

The next step is to calculate the weight of the criteria from the pairwise comparison matrix between criteria. The form of

Table **2** pairwise comparison assessment.

Table 2. Pairwise comparison matrix for each criterion of the experts

	C1	C2	C3	C4	C5	C6	C7	C8
C1	1	1	1/3	1/2	2	3	1	1/2
C2	1	1	1	1	3	2	1/3	1/2
C3	2	1	1	1/2	2	2	1	2
C4	2	1	2	1	2	2	3	2
C5	1/2	1/3	1/2	1/2	1	1/3	1/2	1/2
C6	1/3	1/2	1/2	1/2	3	1	2	2
C7	1	3	1	1/3	2	1/2	1	2
C8	2	2	1/2	1/2	2	1/2	1/2	1

Table 3. The value of the weight of the criteria for the maintenance level of the submarine

Criteria	C1	C2	C3	C4	C5	C6	C7	C8	Weight
C1	1	1	1/3	1/2	2	3	1	1/2	0.112
C2	1	1	1	1	3	2	1/3	1/2	0.124
C3	2	1	1	1/2	2	2	1	2	0.143
C4	2	1	2	1	2	2	3	2	0.201
C5	1/2	1/3	1/2	1/2	1	1/3	1/2	1/2	0.056
C6	1/3	1/2	1/2	1/2	3	1	2	2	0.116
C7	1	3	1	1/3	2	1/2	1	2	0.135
C8	2	2	1/2	1/2	2	1/2		1	0.112
CR = 0.097									1,000

Table 4. The value of weight and ranking on the submarine maintenance level criteria

NO	Criteria	Weight	rank
1	Characteristics	0.112	7
2	Reliability	0.124	4
3	Technology use	0.143	2
4	Security level	0.201	1
5	Operational time	0.056	8
6	Cost	0.116	5
7	Availability of resources	0.135	3
8	Human Resources	0.112	6

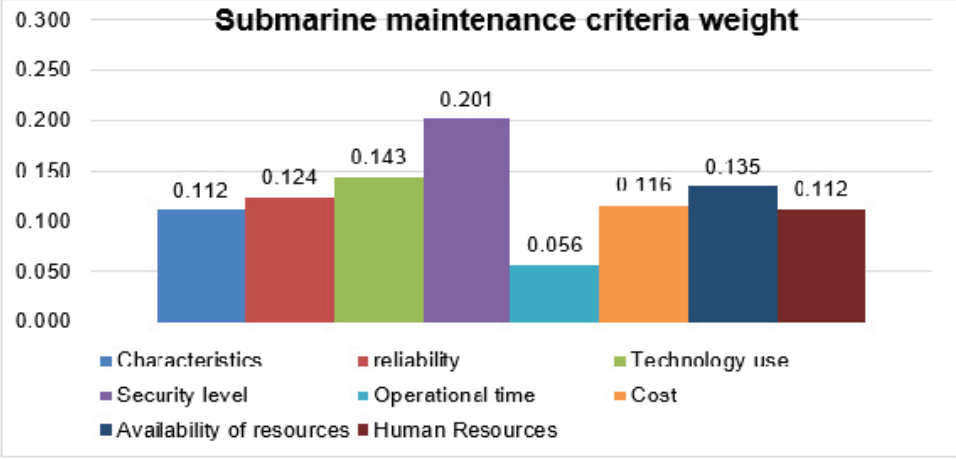

Fig. 5 Histogram of the weight value of the criteria

Analysis of the Priority Strategy for Submarine Maintenance Strategy

In this case the determination of the level of maintenance of the submarine was carried out using a random survey of related stakeholders. From the results of the survey, seven criteria were obtained which were taken into consideration in the strategy for selecting the improvement level which would later be used as calculations using the TOPSIS method.

The TOPSIS calculation steps in this study are as follows:

a. Build a decision matrix.

In the decision matrix, the matrix column states the attributes, namely the existing criteria, while the matrix rows state the alternatives. The decision matrix design can be seen in Table 5.

Table 5. Paired Decision Matrix

Criteria Weight	**0.112**	**0.124**	**0.143**	**0.201**	**0.056**	**0.116**	**0.135**	**0.112**
alternatives / criteria	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
Submarine-01	4.5	4.0	4.0	3.6	4.3	3.9	4.8	3.1
Submarine-02	4.2	3.8	3.8	3.1	4.4	4.0	4.5	3.2
Submarine-03	4.2	3.7	4.0	3.3	4.1	3.8	4.6	3.4
Submarine-04	3.9	3.7	3.9	3.7	4.0	3.9	4.4	3.0

The next step is to determine the preference weight of each criterion used in the TOPSIS method. The preference weight is obtained from the results of the analysis of how important these criteria affect the results. The greater the influence, the greater or vice versa, the smaller, the smaller the value.

Table 6. Criteria Preference Weight

Alternative / criterion	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
Divider	8,892	8,885	8,885	5,545	8,000	9021	9,634

b. Normalized matrix calculation.

Calculation results based on Table 5 and Table 6 are then used to obtain the results of the decision matrix normalization by calculating the performance rating of each Ai alternative on each Ci criterion. The results of normalization (R) can be seen in

Table **7**. Normalization Matrix, which has been calculated according to the normalized performance of each alternative on the criteria.

Table 7. Normalized Decision Matrix Calculation

Alternatives	C1	C2	C3	C4	C5	C6	C7	C8
Submarine-01	0.506	0.506	0.478	0.496	0.500	0.499	0.519	0.577
Submarine-02	0.450	0.478	0.478	0.586	0.500	0.554	0.519	0.433

Alternatives	C1	C2	C3	C4	C5	C6	C7	C8
Submarine-03	0.506	0.478	0.506	0.406	0.500	0.471	0.467	0.577
Submarine-04	0.534	0.535	0.535	0.496	0.500	0.471	0.493	0.384

c. Weighted normalized matrix calculation.

This step is carried out by multiplying each row of the matrix from each coordinate matrix with the importance weight of each selection criterion or determining the level of repair of the submarine. The result of the multiplication will be the value of the weighted normalized decision matrix in Table 8.

Table 8. Weighted Normalized Decision Matrix Calculation

Alternatives	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
Submarine-01	0.056	0.063	0.069	0.100	0.028	0.058	0.070	0.064
Submarine-02	0.050	0.059	0.069	0.118	0.028	0.064	0.070	0.048
Submarine-03	0.056	0.059	0.073	0.082	0.028	0.055	0.063	0.064
Submarine-04	0.060	0.066	0.077	0.100	0.028	0.055	0.067	0.043

d. Determine the Positive Ideal Solution Matrix (A+) and Negative Ideal Solution (A-).

Positive ideal solutions (A+) and negative ideal solutions (A-) can be determined based on the normalized weight rating. The positive ideal solution (A+) can be calculated as follows. This step is carried out by finding the smallest and largest values of each matrix column in Table 9.

Table 9. Distance Between Positive and Negative Ideal Solutions

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A+	0.050	0.066	0.069	0.082	0.028	0.064	0.063	0.064
A-	0.060	0.059	0.077	0.118	0.028	0.055	0.070	0.043

e. Calculating the Distance of Positive Ideal Solution (D+) and Negative Ideal Solution (D-).

Table 10. Preference Weight of Each Alternative

NO	D+	D-
1	0.022	0.030
2	0.041	0.017
3	0.014	0.043
4	0.032	0.020

a. Perform weighting and ranking.

After getting the relative closeness value, the final step is to rank the alternatives that have been calculated. As Tabel 11 below.

Table 11. Alternative Ranking and Determination of Maintenance Strategy.

NO	RESULTS	WEIGHT	RANK	MAINTENANCE LEVEL
1	Submarine-01	0.279	4	CORRECTIVE
2	Submarine-02	0.776	1	MEDIUM
3	Submarine-03	0.633	2	MEDIUM
4	Submarine-04	0.334	3	CORRECTIVE

Based on Table 11 be concluded that the results of calculations using the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) method it is obtained that the first rank with a weight of 0.776 is Submarine-02 with the Medium category maintenance strategy. Submarine-03 with medium level maintenance strategy weights 0.633.

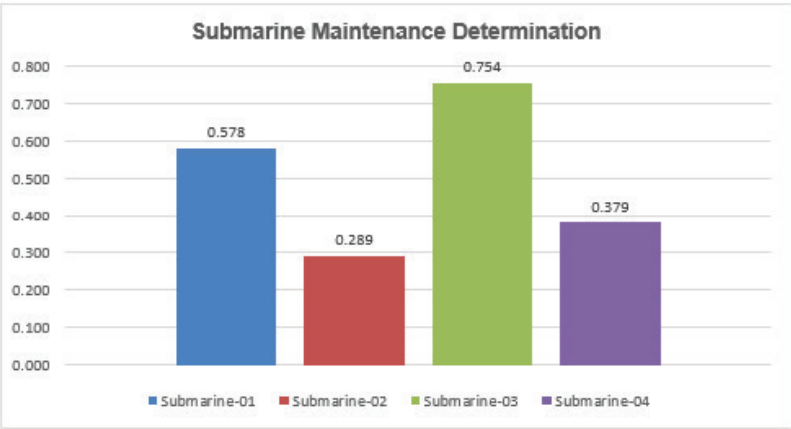

Fig. 6 Histogram of Submarine maintenance strategy determination

Based on the results in Table 11 and Fig. **6**, it can be identified that Submarine-01 and Submarine-04 are currently still in the Corrective level maintenance category with respective weights of 0.279 and 0.344.

5. DISCUSSIONS

Based on the research results, the criterion for the level of safety (C5) in determining the maintenance strategy is the criterion with the highest weight, namely 0.201. Security can be defined as a state of risk that is acceptable to society. In this regard, to assess the current level of ship safety, it is necessary to measure the risk level of the world's fleet of operations, thereby estimating and assessing the basic risk contributors, namely the frequency of maritime accidents and the extent of their consequences (Eleftheria et al., 2016). The safety level of the ship is greatly influenced by the age, size, and type, at the very time of carrying out the maintenance. When data on ship characteristics is available, the possibility of the ship being involved in an accident while carrying out maintenance can be predicted (Li et al., 2014). The criterion with the second largest weight is the use of technology (C3) in maintenance of 0.143. The nature of the industry makes integration of the latest technological advances complicated. This is due to the very high adjustment needs because each ship meets very specific requirements (Zacharaki et al., 2022). Availability of resources (C7) is the factor with the third highest weight of 0.135. According to Ren et al. (2021), maintenance scheduling refers to the detailed arrangement of maintenance tasks during the recommended period while considering environmental conditions, availability of resources.

Types of submarine that have to carry out mid-level repairs, namely Submarine-02 and Submarine-03. Treatment strategy evaluation includes identifying the most appropriate treatment strategy for different machines with maximizing importance through consideration of a set of constraints. A suitable maintenance strategy not only enhances the organization to compete with others but also leads to maximum profit (Seiti et al., 2017). In the corrective level maintenance strategy, there are two types of submarine, namely Submarine-01 and Submarine-04. Preventive and corrective maintenance costs are estimated to optimize maintenance. The output is a maintenance plan that will aim to reduce ship operating costs. It should be noted that maintenance planning can result in redesign of ship structures (Garbatov et al., 2018).

6. CONCLUSIONS

The research results show that, safety level criteria (C4) has the highest weight of 0.201 with a CR of 0.097. Then the Technology Use criterion (C3) weights 0.143 as the second criterion. The resource availability criterion (C7) is the third criterion with a weight of 0.135. While the Operational Time criterion (C5) weights 0.056 as the criterion with the smallest weight. Second, Submarine-02 with the Medium category maintenance strategy. Submarine-03 with a medium-level maintenance strategy weight 0.633. Furthermore, Submarine-01 and Submarine-04 are currently still in the Corrective level maintenance category with respective weights of 0.279 and 0.344.

6.1. Future Work

In the final stage of the research, several suggestions can be given for further research, namely: a) Subsequent research can propose how the level of consistency of decisions when decisions are taken; b) research can consider an analysis of the risk calculation of the maintenance strategy and propose alternative strategies to be used if the main strategy cannot be implemented.

ACKNOWLEDGEMENTS

The authors are very grateful for the support of the Indonesian Defense University which has provided the necessary resources to carry out this research. The authors also thank the anonymous reviewers and the journal's editorial board for their many insightful comments, which have significantly improved this article. Also, this article is original research and has not been published elsewhere.

REFERENCES

[1] Muinde, P. M. Muchiri, P. M. and Ikua, Bernard W., *Maintenance Strategy Selection using Analytical Hierarchy Process: A Case Study*, Journal of Sustainable Research in Engineering, vol. 1, no. 4, pp. 21–29, 2014.

[2] Saravanan, M.and Kumar, D. B., *A review on navy ship parts by advanced composite material*, Materials Today: Proceedings, vol. 45, no. xxxx, pp. 6072–6077, 2020, doi: 10.1016/j.matpr.2020.10.074.

[3] Goossens, A. J. M. and Basten, R. J. I., *Exploring maintenance policy selection using the Analytic Hierarchy Process*; *An application for naval ships*, Reliability Engineering and System Safety, vol. 142, pp. 31–41, 2015, doi: 10.1016/j.ress.2015.04.014.

[4] Seiti, H., Tagipour, R., Hafezalkotob, A., and Asgari, F., *Maintenance strategy selection with risky evaluations using RAHP*, Journal of Multi-Criteria Decision Analysis, vol. 24, no. 5–6, pp. 257–274, 2017, doi: 10.1002/mcda.1618.

[5] Desember, I. G. K. H., I. Putra, N. A. and Deni, D., *Strategi Maintenance, Repair Dan Overhaul (Mro) Kapal Perang Tni Al Dalam Mendukung Kesiapan Operasi Laut Di Fasharkan Lantamal V Surabaya*, Jurnal Teknologi Daya Gerak, vol. 3, no. 2, pp. 96–114, 2020, [Online]. Available: https://jurnalprodi.idu.ac.id/index.php/TDK/article/view/832.

[6] Resobowo, D. S., Buda, K. A., and Dinariyana, A., *Using Sensitivity Analysis for Selecting of Ship Maintenance Variables for Improving Reliability of Military Ship*, Academic Research International, vol. 5, no. 2, pp. 127–139, 2014, [Online]. Available: www.savap.org.pk127www.journals.savap.org.pk.

[7] Asuquo, M. P., Wang, J., Zhang, L. and Phylip-Jones, G., *Application of a multiple attribute group decision making (MAGDM) model for selecting appropriate maintenance strategy for marine and offshore machinery operations*, Ocean Engineering, vol. 179, no. February, pp. 246–260, 2019, doi: 10.1016/j.oceaneng.2019.02.065.

[8] Jimenez, V. J., Bouhmala, N., and Gausdal, A. H., *Developing a predictive maintenance model for vessel machinery*, Journal of Ocean Engineering and Science, vol. 5, no. 4, pp. 358–386, 2020, doi: 10.1016/j.joes.2020.03.003.

[9] Kimera, D.and Nangolo, F. N., *Maintenance practices and parameters for marine mechanical systems: a review*, Journal of Quality in Maintenance Engineering, vol. 26, no. 3, pp. 459–488, 2020, doi: 10.1108/JQME-03-2019-0026.

[10] Jeong, B., Oguz, E., Wang, H., and Zhou, P., *Multi-criteria decision-making for marine propulsion: Hybrid, diesel electric and diesel mechanical systems from cost-environment-risk perspectives*, Applied Energy, vol. 230, no. April, pp. 1065–1081, 2018, doi: 10.1016/j.apenergy.2018.09.074.

[11] Animah, I. and Shafiee, M., *Maintenance strategy selection for critical shipboard machinery systems using a hybrid AHP-PROMETHEE and cost benefit analysis: a case study*, Journal of Marine Engineering and Technology, vol. 20, no. 5, pp. 312–323, 2021, doi: 10.1080/20464177.2019.1572705.

[12] Emovon, I., *Ship System Maintenance Strategy Selection Based on DELPHI - AHP - TOPSIS Methodology*, World Journal of Engineering and Technology, vol. 4, pp. 252–260, 2016, doi: 10.4236/wjet.2016.42024.

[13] Emovon, I., Norman, R. A., and Murphy, A. J., *Hybrid MCDM based methodology for selecting the optimum maintenance strategy for ship machinery systems*, Journal of Intelligent Manufacturing, vol. 29, no. 3, pp. 519–531, 2018, doi: 10.1007/s10845-015-1133-6.

[14] Alhouli, Y., *Development of Ship Maintenance Performance Measurement Framework to Assess the Decision Making Process to Optimise in Ship Maintenance Planning*, Anesthesiology, vol. 115, no. 3, pp. 1–225, 2011, [Online].

Available: http://www.ncbi.nlm.nih.gov/pubmed/22023399.

[15] Saaty, T. L., *How to make a decision: The analytic hierarchy process*, European Journal of Operational Research, vol. 48, no. 1, pp. 9–26, Sep. 1990, doi: 10.1016/0377-2217(90)90057-I.

[16] Saaty, T. L., *The seven pillars of the analytic hierarchy process*, International Series in Operations Research and Management Science, vol. 175, pp. 23–40, 2012, doi: 10.1007/978-1-4614-3597-6_2.

[17] Do, A. D. et al., *Evaluation of lecturers' performance using a novel hierarchical multi-criteria model based on an interval complex neutrosophic set*, Decision Science Letters, vol. 9, no. 2, pp. 119–144, 2020, doi: 10.5267/j.dsl.2020.1.003.

[18] Teniwut, W. A., Hamid, S. K., and Makailipessy, M. M., *Selecting top fisheries sub-sector in each sub-district for sustainable development of archipelagic region in Indonesia: A hybrid fuzzy-MCDM approach*, Decision Science Letters, vol. 8, no. 4, pp. 393–410, 2019, doi: 10.5267/j.dsl.2019.6.001.

[19] Chen, P., *Effects of normalization on the entropy-based TOPSIS method*, Expert Systems with Applications, vol. 136, pp. 33–41, 2019, doi: 10.1016/j.eswa.2019.06.035.

[20] Filimonau, V. and Perez, L., *National culture and tourist destination choice in the UK and Venezuela: an exploratory and preliminary study*, Tourism Geographies, vol. 21, no. 2, pp. 235–260, 2019, doi: 10.1080/14616688.2018.1490342.

[21] Samrin, Hasrul Azwar Hasibuan, Rahmat Hidayat, and Rusiadi, *Formulation Of Blue Ocean Strategy Developing A Bamboo Small Business In Binjai City,* International Journal of Science, Technology & Management, vol. 2, no. 5, pp. 1644–1651, 2021, doi: 10.46729/ijstm.v2i5.319.

[22] Eleftheria, E., Apostolos, P., and Markos V., *Statistical analysis of ship accidents and review of safety level*, Safety Science, vol. 85, pp. 282–292, 2016, doi: 10.1016/j.ssci.2016.02.001.

[23] Li, K. X., Yin, J., and Fan, L., *Ship safety index*, Transportation Research Part A: Policy and Practice, vol. 66, no. 1, pp. 75–87, 2014, doi: 10.1016/j.tra.2014.04.016.

[24] Zacharaki, N., Dimitropoulos, N., and Makris, S., *Challenges in human-robot collaborative assembly in shipbuilding and ship maintenance, repair and conversion (SMRC) industry,* Procedia CIRP, vol. 106, pp. 120–125, 2022, doi: 10.1016/j.procir.2022.02.165.

[25] Ren, Z., Verma, A. S., Li, Y., Teuwen, J. J. E., and Jiang, Z., *Offshore wind turbine operations and maintenance: A state-of-the-art review,* Renewable and Sustainable Energy Reviews, vol. 144, no. August 2020, 2021, doi: 10.1016/j.rser.2021.110886.

[26] Garbatov, Y., Sisci, F., and Ventura, M., *Risk-based framework for ship and structural design accounting for maintenance planning,* Ocean Engineering, vol. 166, no. July, pp. 12–25, 2018, doi: 10.1016/j.oceaneng.2018.07.058.

UNMANNED AERIAL VEHICLE RECONNAISSANCE FLIGHT IN THE ENERGY SAVING MODE

Azad Bayramov

Institute of Control Systems, Baku, Azerbaijan

The targets and vehicle objects tracking on the ground and control by use of UAV are two well-studied problems. However, most of the papers focused on the quality of detection of moving targets from one or more UAVs and did not mention energy efficiency. This article discusses the problem of minimizing the energy consumption of a UAV performing a reconnaissance mission, with the maximum number of observed objects on the ground. The mathematical formalization of the problem is considered. The condition for minimizing the UAV energy consumption is formulated. An objective function is obtained, which must be minimized to solve energy saving problem. The energy-informational efficient mode of operation of the UAV is considered. Criteria for minimizing UAV power consumption have been developed and considered.

Key words: *unmanned aerial vehicle, minimization of energy consumption, reconnaissance flight, monitoring, ground facilities.*

1. INTRODUCTION

In recent years, there has been a widespread use of unmanned aerial vehicles (UAVs) in various fields, including the military. The invention of lightweight materials, low-power machines, and high-performance processors has led to the creation of flexible flying robots - UAVs. They can be used in various applications such as vehicle tracking, traffic control, and fire detection [1]. UAVs can fly autonomously at different altitudes and are usually equipped with sensors for monitoring the environment and communication devices for communicating with other UAVs or central stations.

The problem of ground target tracking and vehicle control has been well studied. However, most of the works focused on the quality of detection of moving ground targets from one or more UAVs and did not mention the energy efficiency of the flight, minimizing energy consumption. The authors propose in more detail methods for constructing a control strategy, thanks to which good visibility of targets on the

ground is maintained.

When carrying out reconnaissance operations for monitoring moving and stationary objects on the ground with the help of UAVs, one of the important tasks is the choice of an energy-saving UAV flight mode [2,3,4]. This is achieved by various methods and means. In this case, we will consider monitoring the movement of vehicles (objects) or stationary targets using a UAV using broadside (wide-angle) lenses. This provides simultaneous monitoring of several mobile or stationary objects along the path of movement.

It is assumed that the UAV has a maximum viewing angle and a maximum range beyond which the UAV cannot detect an object on the ground. The UAV flies as high as possible to control a larger area and detect more objects. However, the higher the UAV flies, the more energy it consumes. But at the same time, the UAV completes the monitoring of all mobile and stationary objects faster. In order to optimize energy consumption and task completion time, the UAV itself regulates the flight altitude.

Thus, it is required to optimize the energy consumption, the UAV flight altitude and the UAV task execution time. This paper gives a mathematical formulation of the problem of minimum energy consumption under the condition of observing the maximum number of objects and the optimal UAV flight altitude.

2. FORMULATION OF THE PROBLEM

Let assume that the system is represented as a 2-dimensional terrain with X and Y axes. A set of objects

$$M=\{M_1,M_2,\ldots,M_n\}$$

can move by randomly with a speed of $v_i, \forall\, i \in [1,n]$ along X and Y axes; here n is a number of the objects M on the ground which monitored by UAV.

The length of the path of movement of objects is equal to S_0, the area of view of the UAV camera on the ground is equal to S_j at the height of the UAV flight h_j.

Each UAV is equipped with a camera aimed at the ground. The camera has a maximum viewing angle θ. The field of view is a cone with height h and angle θ. The flat surface of the cone represents the observation area, and every target M_i located in this area can be observed by the UAV. The UAV can move up or down to increase or decrease the size of the surveillance area.

The height of the UAV can be controlled by controlling the power level of the engines. Accordingly,

the larger h, the greater the energy consumption. The energy consumption of the UAV at any time τ is equal to $E_\tau = m \cdot g \cdot h_\tau$ (1)

Here, m is an UAV's mass, g is the acceleration of gravity, and h_τ is UAV height at time τ. The initial amount of energy is equal to E_0. The flight of the UAV is limited by the minimum height h_{min} and the maximum height h_{max}, that is, $h_{min} < h < h_{max}$.

It is necessary to build a model for optimizing the UAV flight mode in such a way as to control all n objects along the path S_0 with a minimum energy consumption E_τ.

Let assumed that each object on on the ground (h = 0) $M_i \in M$ is characterized by its coordinates (X_{Mi}, Y_{Mi}). At every moment of time τ the UAV is localized in (x, y, h), when the distance between UAV and object on the ground M_i (h=0) which is observed, is equal

$$D_{Mi}^{xy} = \sqrt{(X_{Mi} - x)^2 + (Y_{Mi} - y)^2}$$

Let's set the variables that determine the conditions for observing the object M_i on the ground.

Each UAV has an overview, which is a circle on a plane with a radius r_h. The higher h, the longer the radius r_h. Then the conditions for observing the object will be

$$\delta_{xyh} = \begin{cases} 1, if\ UAV \in (x, y, h) \\ 0, if\ UAV \notin (x, y, h) \end{cases} \quad (2)$$

$$\sigma_{Mi} = \begin{cases} 1, if\ M_i \in \{M_{UAV}\} \\ 0, if\ M_i \notin \{M_{UAV}\} \end{cases} \quad (3)$$

determined as follows:

That is, if the UAV is (x, y, h), a point with coordinates,

then $\delta_{xyh} = 1$, if is not located, then $\delta_{xyh} = 0$. If the object M_i is observed by UAV, then σ_{Mi}=1, if is not observed, then σ_{Mi}=0.

The value h belongs to the interval of (h_{min}, h_{max}) and the projection of the flight area is a rectangle with length x_{max} and width y_{max}. The time range $[\tau_{min}^{Mi}, \tau_{max}]$ is connected with each object $M_i \in M$. This means that the object M_i is located at the beginning at the point with coordinates (X_{Mi}, Y_{Mi}), and it must be observed in the time domain specified in the corresponding time range.

The mathematical formulation of the problem of the minimum energy consumption under the condition of observing the maximum number of objects is presented below. Let $\Delta\tau$ is the time interval at which the mobile object M_i reaches a new position. Then, using (1,2,3), we write the condition for minimizing energy consumption in the following form:

$$min\left[\frac{\tau_e - \tau_s}{\Delta\tau}\left(mg\sum_{(x,y,h)} h\delta_{xyh}\sum_k \sigma_{Mk}\right)\right] \quad (4)$$

here, M_k – is a number of objects are observed by UAV in given moment of the moment of photography.

The objective function (4) to be minimized is the total energy consumption. It is assumed that, moving along the monitoring trajectory, only in one position the UAV photographs the number of objects M_k. Using the functional (4) for a specific case of UAV reconnaissance flight, it is possible to optimize monitoring conditions, flight altitude and UAV power consumption.

It should be noted that when minimizing function (4), the following restrictions must be used:

- the UAV is in no more than one position at the time of photographing;
- if the viewing radius of the target on the ground is less than the distance between the targets, then it is assumed that one target is observed;
- each target on the ground is observed by one UAV;
- when calculating, the initial and final time of UAV observation are taken into account.

The considered mathematical model assumes that the number of UAVs can be infinite. When the UAV moves to another position, it is replaced by another one. This hypothesis simplifies the model and does not affect the solution, since the goal is to minimize the overall energy consumption.

It should be noted that the problem of the optimal location of flying UAVs is formulated as a binary optimization model characterized by a large number of variables and constraints. Therefore, it is not possible to determine the optimal solution of model (4), in a limited time. Since the solution process takes a very long time even for a small amount, it is mandatory to use a heuristic approach to determine a feasible solution.

3. ENERGY-EFFICIENT UAV COMMUNICATION AND TRAJECTORY OPTIMIZATION

In [5], another method of energy-efficient UAV flight is considered. The UAV is assumed to be flying horizontally at a fixed height, and an energy-efficient communication between the UAV and the ground terminal is studied by UAV trajectory optimization, which takes into account both the communication capacity and the UAV power consumption. To this end, the fixed-wing UAV energy consumption model is first considered as a function of UAV speed, direction and acceleration.

Further, without taking into account the consumption of radiation energy and signal processing, the energy efficiency of UAV communication is determined as the total number of transmitted bits of information, normalized to the energy of UAV movement. The UAV flight path in a circle is considered, in which the flight radius and UAV speed are jointly optimized to maximize energy efficiency. In addition, an efficient design is proposed to maximize the energy efficiency of the UAV. The proposed designs provide a significantly higher energy efficiency of communication with the UAV.

Thus, for the optimal distribution of the UAV energy balance, it is necessary to optimally choose the flight path and the order of communication. It should be noted that the end product of reconnaissance UAVs is the amount of information collected during the flight. That is, as noted in [6], the UAV must operate in an energy-informational efficient mode of operation. In this work, a methodology has been developed for calculating the optimal regime parameters that provide an energy-information-efficient UAV operation mode.

The proposed method is based on the representation of the UAV as a cybernetic system powered by an electric battery and provides for a two-stage optimization of the UAV operation mode:

1. Carrying out optimization in order to determine the mode of energy-efficient functioning. The UAV is presented as a system consisting of cybernetic, physical and energy subsystems. Indicators of the energy-efficient mode of subsystems are introduced: x_1 - cybernetic; x_2 - physical; x_3 - energy; criterion of the energy-efficient mode Ψ_{extr}; criterion of energy-information-efficient UAV operation mode φ_{extr}. The following operations are carried out here:

1) Calculation of quantities of x_1, x_2, x_3;

2) Calculation of the criterion of Ψ_{extr} by the given expression

$$\Psi_{extr} = \Psi(x_1, x_2, x_3)$$

2. Determining the conditions for the energy-information-efficient mode of operation. Here the criterion φ_{extr} is determined by the given expression

$$\varphi_{extr} = \varphi(\Psi_{extr})$$

For the analysis, the well-known result is used that the energy consumption of the physical part of the UAV has a minimum of the flight speed. The well-known expression for the discharge of the battery capacity from the load current is also used. As a result of the research, a quadratic equation was obtained, the solution of which made it possible to

determine the optimal value of the load current on the battery.

4. THE CRITERIA FOR MINIMIZATION OF UAV ENERGY CONSUMPTION

There have been considered and offered many options for saving energy consumption. In order to achieve a solution to this problem, various criteria for an energy-saving UAV flight are considered. These criteria are discussed below. As a result of the research and review of existing literature (see, for example [2,3,4]), the following criteria for minimizing energy consumption during UAV flight have been developed and are proposed:

1) UAV flight should be as low as possible, the higher the flight of the drone, the lower the air density, and the lower the lift, in order to compensate for this, it is necessary to increase the thrust, and this leads to an increase in energy consumption;

2) Most tactical UAVs fly at altitudes up to 1500 m. Considering that the air density changes by only 0.09% up to a height of 1000-1500 m, it is possible to quickly reach cruising speed when climbing, while energy consumption will be optimal;

3) After completing the task, when the UAV returns to the base, if possible, the gentlest descent from a given height at a minimum speed should be made;

4) One of the important criteria is the optimal flight during barrage (reconnaissance flight) with the choice of the shortest trajectories between given objects on the ground that are to be investigated;

5) When developing a flight task, choose such modes, in which the flight occurs, if possible, with uniform rectilinear motion, with the least curvature of the trajectory, with fewer turns;

6) When performing a reconnaissance flight, in which the task is to examine (photograph) some objects on the ground, it is recommended to use a wide-angle lens. This achieves the possibility of covering more objects in the frame with one shooting (see figure 1).

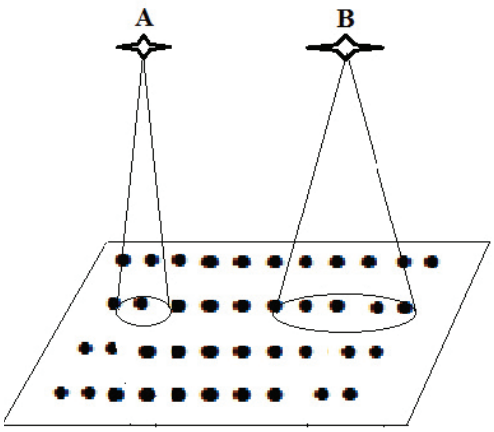

Fig. 1. The possibility of covering more objects in the frame with one shooting

In option **A**, when one object is surveyed, the number of surveys is equal to the number of objects on the ground. In this case, the UAV must fly around all objects and take pictures every time. With option **B**, when several objects are being surveyed at the same time, the number of surveys is less than with option **A**. In this case, the UAV flies along the optimal trajectory with a cone-shaped view of all the intended objects on the ground, avoiding repeated coverage of targets. Therefore, in mode **B**, energy consumption is less. Drone flight according to option B is more energy-saving. Photographing each object individually on the ground takes more time than photographing a group of objects at the same time. Therefore, the flight lasts longer.

7) It is proposed to optimize the power of the radio transmitter, designed for data transmission. The more powerful the radio transmitter, the greater the power consumption.

8) Energy efficient planning by a system of several UAVs that track events and objects on the surface of the earth. UAVs themselves adjust their height so that each time they cover more or less objects. This self-control is achieved by radio communication between the UAVs and results in energy savings of up to 150% compared to the case when the UAVs are placed statically.

9) Joint optimization of both energy efficient (capacity) radio communication and UAV flight path.

10) Optimization of the operation of a reconnaissance remote sensing UAV flying in an energy-information-efficient mode, when information is transmitted using special filters.

11) The use of faster processors will allow the UAV to complete missions quickly and therefore save energy. This is because most of the UAV's energy is consumed by the motor, hence faster calculations can reduce mission time and energy accordingly. Improvement is achieved up to 5 times.

12) Planning the UAV monitoring path in such a way as to minimize the UAV power consumption. The bottom line is to minimize the amount of course change and maximize the amount of straight flight range, this will reduce the power consumption of the UAV.

13) To reduce the power consumption of the UAV, limit the number of UAV flight adjustments while still keeping the target in the camera's field of view.

14) Application of energy-efficient brushless DC motors for UAVs with electric motors. The use of these drives leads to a decrease in the dimensions and weight of the UAV and to a decrease in power consumption.

Thus, the paper notes the importance of choosing an energy-saving UAV flight mode. In order to minimize energy consumption, 14 criteria for UAV flight modes were considered and proposed to save energy consumption. Experiments have shown that savings of up to 500% can be achieved in some cases.

5. CONCLUSIONS

Thus, the paper considers the problem of minimizing the energy consumption of a UAV performing a reconnaissance mission. The condition for the minimum energy consumption with the maximum view of objects on the ground is set. The mathematical formalization of the problem is considered and the functional is obtained, which must be minimized to determine the optimal monitoring conditions, flight altitude and UAV power consumption. This approach can be applied to a wide range of problems. The energy-informational efficient mode of operation of the UAV is considered. Criteria for minimizing UAV power consumption have been developed and considered.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

REFERENCES

[1] A.A. Bayramov Unmanned Aerial Vehicles Application For Military GIS Tasks Solution. Automated Systems in the Aviation and Aerospace Industries. IGI Global, PA, USA, 2019. Eds. S.Tetiana, Y.Sikirda, N.Rizun, D. Kucherov, K.Dergachov. 453 p. Chapter 10. pp. 273-296. DOI: 10.4018/978-1-5225-7709-6

[2] A.A. Bayramov Journal of Defense Resources Management. Vol. 13, Is.2, (25). 2022. P. 113-118.

[3] A.A. Bayramov An energy-efficient path planning for UAV. Proceedings of the scholarly abstracts European Academic Science and Research. No. XXVIII (2022). "EASR" SciPub.de. April 2022. P.19. E-ISSN 2789-195X

[4] A.A. Bayramov Minimization of energy consumption for unmanned dynamic object. International Ankara Congress on Scientific Research IV. The Proceedings Book April 1-3, 2022 Ankara/TURKEY. P.513. ISBN: 978-625-7464-82-6.

[5] Yong Z., Zhang R. Energy-efficient UAV communication with trajectory optimization, IEEE Transactions on Wireless Communications, 2016, vol.16 pp. 3747-3760. DOI: 10.1109/TWC.2017.2688328

[6] Zulfugarli P.R. Methodology for calculating indicators of energy-information-efficient mode of operation of remote sensing unmanned aerial vehicles // Transactions of MAI. 2021. Is. № 117. p.1-14.

USING WEBPAGES AS CRYPTOGRAPHIC KEYS IN A ONE-TIME PAD SYSTEM

Farman MAMMADOV*, Elkhan SABZIEV**

*National Defence University, Military Scientific-Research Institute, Baku, Azerbaijan, **Azerbaijan National Academy of Sciences, Control Systems Institute, Baku, Azerbaijan

Nowadays, in order to ensure its confidentiality, it has become necessary to take additional measures during the transfer of information from one place to another through modern network technologies. In the symmetric encryption algorithms developed for this purpose, the sensitive aspect is the secrecy of the information used as a cryptographic key. In this paper, the problem of sending the key to the parties and the solutions proposed for this purpose were analyzed, and information about one-time pads and their features were provided. In this research, an approach for using web pages as a one-time cryptographic key is proposed. At the same time, a method of identifying and agreeing to use web pages and social network posts as cryptographic keys has been developed.

Key words: *cryptography, symmetric encryption, encryption algorithms, cryptographic key, one-time pad*

1. INTRODUCTION

Threats to the critical infrastructure of institutions responsible for the security system are real in every state. With the progress in data exchange the usage of information technologies for sending, storing and processing information in modern armies, as well as its spread to all the spheres of life has led to the strengthening of the interest of cyber attackers (criminals), and the unauthorized access and modification of information by third parties are increasing day by day.

Information security is data protection, processing, uninterrupted operation of complex infrastructures, combined by the joint application of various information and communication technologies, hardware and software, methods of combating other cyber threats, and various means of information protection.

Secure exchange of information is always important in organizing confidential communication.

A person who is serving in another country for the security interests of his country is needed reliable communication to protect himself and information from being intercepted, as well as sending relevant information to their home country and to continue his activities by receiving new missions.

Currently, the use of information technologies in various spheres, including unlimited access to the Internet anywhere in the world, opens up new prospects for the transfer of confidential information.

The info-communication industry offers various approaches to information security, and to the protection of information, containing confidential data, mainly within the interests of both the state and private sectors. During the exchange of information, containing confidential data, via electronic means, the main method of protecting it is the use of cryptographic products and solutions.

During cryptographic encryption, digital information, required for sending and protecting, is sent after being transformed into an incomprehensible form by means of an encryption algorithm and a specific key. The encryption algorithm is believed to be well-known, while decryption of encrypted information can be carried out by the use of a cryptographic key known only to the sending and receiving parties. That is why the crypto key plays a significant role in the exchange of confidential information, and symmetric encryption algorithms offer many approaches, algorithms, various methods, schemes, and solutions related to its creation, delivery to parties, storage, and modification of the crypto key.

The article analyzes the problem of sending a cryptographic key to the parties and the proposed solution methods for this purpose, as well as provides information on one-time pads and their features. The research paper proposes an approach for using web pages as a one-time cryptographic key. At the same time, a method of identifying and agreeing to use web pages and social network posts as cryptographic keys was developed.

2. PROBLEM OF SENDING A CRYPTOGRAPHIC KEY TO THE PARTIES

The most important parameter in ensuring reliable communication is the maximum level of protection of the cryptographic key and its secure delivery to the parties. In symmetric encryption methods, it is desirable to update the key regularly in order to increase the durability of the cryptosystem. In many cases, when there is a need to update the key, it is thought that its delivery to the

parties is the weakest point of the cryptosystem.

Various methods related to the topic were developed in the literature. As an example, the numbered form of rows and columns of the Polybius square (Gasimov: 2009, p.173), binary codes for image (Alqad: 2019; Shumay:2018), an agreed book (Gasimov:2009, p.189; Lele:2014; Ristanovic:2008), various files (Wang:2008; Wang:2010) and a memorized poem (Gasimov:2009, p.173) can be used as keys. The idea of using a web page as a cryptographic key is not provided in these and other methods, including classical steganographic methods (Aliguliyev:2006; Gasimov:2009, p.255). This part will cover some algorithms that can be applied during the exchange of a crypto-key.

In (Hussain:2008), S.M.Hussain və H.Al-Bahadili, using the key based random permutation (KBRP) method, proposed a new, efficient, functional, password-based algorithm that generates a key resistant to cryptanalysis. The KBRP method (Hussain:2008) provides the generation of a particular permutation of a given size ***N*** out of ***N*** permutations based on a given primary key. Here ***N*** indicates the required encryption key length. The algorithm consists of a computational stage in five steps – the first three spets involve the use of the KBRP method, and the next two steps involve the key generation and verification of cryptanalysis resistance.

So, in the first step, an array of ***N*** elements is compiled using the primary key. To do this, the ASCII values of the primary key are taken and stored in an array consecutively. If the length of the primary key is less than ***N*** starting from the value of the first element of the array, the missing massive elements are added consecutively and in pairs. At the completion of the first step, a summing operation modulo ***N+1*** is performed with each element so that the values of all elements of the array are numbers from 1 to ***N***.

The second step is to get rid of repeated values by replacing them with the value of "0" and keeping only one value out of these repeated values.

In the third step, the values "0" of the array are replaced with nonzero values in the range 1 to ***N***, which are not exist in the array. This completes the generation of a particular permutation of a given size ***N***.

At the fourth step, in order to convert the array values to "0" and "1", a modular operation with 2 is performed with them.

In the fifth step, in order to ensure that the number of "0" and "1" in the key is not equal, the extra bit is selected and replaced by another. To do this, 8 bits are taken from the key consecutively and the "0" and "1" contained in these 8 bits

are counted. If the numbers of "0" and "1" are equal, the bit at position 5 is replaced by another one. Thus, the key required for encryption is generated.

As already mentioned, the algorithm is based on the primary key, and key generation becomes possible only after that. In this case, there is a need for a preliminary agreement between the parties regarding the key or its preliminary sending to the parties.

In (Ghrare: 2018), S.E.Ghrare, H.A.Barghi və N.R.Madi propose a new encryption method based on a hidden encrypted symmetric key. While using this method, a key is generated based on the plaintext and is sent to the other party by hiding inside the cipher. Thus, this method also solves the problem of distributing the key to the opposite party. First, the plaintext is divided into two equal parts to generate a key. Then the first half is assigned to K_1, and the second half is assigned to K_1. One of the keys is encrypted through the other to get the final K key. The final key K is equal to half the length (number of symbols) of the plaintext. The user decides whether the K key will be generated based on K_1 or K_2. The plaintext is encrypted and hidden inside the key cipher by any of the steganographic methods. The other party first separates the key from the cipher using an agreed steganographic method and obtains the plaintext by performing a decryption operation. The encryption and decryption operation is performed according to the formulas (1) and (2):

$$C = E(K, M) = (M + K) \bmod 26, \quad (1)$$

$$M = D(K, C) = (M - K) \bmod 26. \quad (2)$$

Here, C – encrypted content sent, M – text of confidential information, E and D – encryption and decryption algorithms, respectively, K – cryptographic key, **26** – the number of letters in the English alphabet.

The method of S.E.Ghrare and others analyzed above provides the preparation of the plaintext key and sending it to the other party using steganography. The algorithm's main advantage is that each encryption operation is performed using a different and distinctive key. This can be classified into the class of one-time pads.

The approach proposed in (Pal: 2014) by S.Pal və P.Paul is based on the use of a human fingerprint in cryptography. Here, first, in a classical manner, the plaintext is encrypted with a certain key using the relevant algorithm. Then the biometric data of the sender's fingerprint is combined with the key. Finally, the ciphertext and the combined information of the key with the fingerprint are mixed and sent to the other party. During the decryption, the ciphertext and the key are separated from each other using fingerprint images stored in a

database of the receiving party, and decryption is performed on the basis of the relevant algorithm.

While using the algorithm, additional fingerprint-reading equipment is needed. At the same time, sending the primary key in combination with a fingerprint makes it necessary for the fingerprint of the person who encrypted the information to be available for the other party to perform decryption. If the fingerprint is not found in the relevant database or there is any problem with fingerprint reading, decryption becomes impossible. This can be considered the weakest point of the algorithm.

In (Akhila: 2016), V.A. Akhila, C.Arunvinodh, K.C. Reshmi and others present a new encryption method known as brain wave cryptography. The proposed approach is based on the use of brain waves or signals resulting from the human brain's neuron activity (nervous system) in generating an encryption key. Here it is said about generating a secret key, that can be used as a cryptographic key, from brain signals or developing a secret key with the help of brain waves. Due to the fact that brain waves have some of the most powerful biometric properties compared to other biometric means, the security of the key can be enhanced. The research paper also highlights the idea of solving the problem of the Online Brain Computer interface (BCI), as well as the idea that an independent component of interest (ICi) can be automatically selected by taking a certain area of the brain. During the generation of the encryption and decryption keys, a person is given some tasks on analyzing the brain signal. In this case signals from five parts of the brain (central, parietal, motor, occipital, and frontal) are seized by sensors and digitized. Then an independent component analysis (ICA) is used to independently suppress artifacts (artificial and extraneous signals) in the Electroencephalogram (EEG) recordings. ICA decomposes EEG signals into statistically independent components or sources and then is followed by the removal of artificial signals. After performing independent component analysis few components are selected as independent component of interest which is used for further processing. To take an average of frontal components of different EEG signals, a special procedure is repeated for all other parts of the brain (central, motor, parietal, occipital components) and is predefined as reference ICi. The obtained "ICi" is used while generating the encryption key.

With the help of the proposed approach, data storage security is ensured and implemented directly without using any medium for

the secret key. The decryption of information becomes possible only to those who encrypted it, and special equipment is needed.

In (Monrose: 2001), F.Monrose, M.K.Reiter and others propose a device that can generate a secure secret key using a primary password voiced by a person. In the proposed approach, the voiced primary password is first digitized. Then the obtained audio signals are sequentially divided into 10-millisecond parts and taken as 30-millisecond fragments. For each signal fragment, a frame of 12 units of power spectrum coefficients is determined. The frames of coefficients that contain pauses of silence at the start, middle, and end of the utterances are removed in order to achieve good results. The proposed approach uses an bit attribute descriptor to ensure specificity in case the same utterance is voiced by a relevant person. The attribute descriptor is obtained by dividing the frames of the coefficients into consecutive frames or segments. During key generation, frames or segments are stored in a database inside the device to determine the uniqueness of the primary password and the person who uttered it. Data storage in the database is carried out using the vector quantization method. During the vector quantization, clusters of vectors and parts are determined in a vector (in this case, a frame or segment) set of a given acoustic field. The central points of clusters are called centroids. The centroids are encoded in the database and the distances between them are stored. Each time the secret key is generated, the correspondence between the primary password and the addressing person is checked by matching with the information in the database. In the course of the research, 20 centroids were quantized for each person and the primary password. The device was tested with 250 passwords uttered by 50 users. Empirical evaluations show that the reliability and entropy (randomness and uncertainty) of the generated key can be high with the right chosen parameters. The created system has demonstrated resistance to cryptanalysis even when all the information used during generating and verifying the key, as well as the device was intercepted by attackers.

Special devices are used for encryption in a cryptosystem based on a primary password voiced by a person, and since it is performed depending on the person, its use for data protection is considered more appropriate.

In (Gupta: 2014), R R.Gupta və J.Anchal propose an algorithm for generating keys and encrypting images using DNA sequences. First, a special gene sequence of length ***4n*** is selected from the gene bank

in order to generate a cryptographic key. The start and end points of the sequence are chosen randomly. Then the chosen sequence is divided into substrings, and each substring is converted into a binary code using DNA coding. When coding DNA, it implies the participation of DNA bases (***A***- adenine, ***G*** - guanine, ***C*** - cytosine, ***T*** - thymine) in a paired form, where ***A*** and ***T*** are complementary, and ***G*** and ***C*** are complementary, as well as their denotation in the form of a binary number system (00, 01, 10, 11). Mathematically, if there is a total n number of substrings then the binary number generated from the DNA sequence is denoted as ***N***.

The next step is to expand the key. Elements of the key sequence are encoded into the DNA sequence using the DNA encoding method. The resulting DNA sequence is copied into substrings, then substrings are generated in each string. The first string is subdivided into the substrings of length ***4n*** and the division takes place from the first character. Similarly, the division of the second string takes place leaving the first character. The division is done with the third and fourth strings leaving the first two and first three characters. From all the strings only the substrings of length ***4n*** are chosen as the expanded key. For example, let the gene sequence selected from the gene bank to create a cryptographic key be ***ACT CCT GCT ACAT ATC***. In this case, the key extension will be like this:

ACTC/CTGC/TACA/TATC
A/CTCC/TGCT/ACAT/ATC
AC/TCCT/GCTA/CATA/TC
ACT/CCTG/CTAC/ATAT/C

Each substring is again denoted as a number. This completes the key expansion stage.

In the 3rd step, a pseudo random sequence is generated. If there are $M \times N$ pixels in the image to be encrypted then it is required to generate the pseudo random sequence of length MN. For this purpose, a 256-byte key, ***K*** and array ***S***, is chosen. The array ***S*** is filled with numbers from 0 to 255, i.e.

$$s[0] = 0, s[1] = 1, \dots, s[255] = 255$$

Now a 256-byte temporary array ***T*** is created and the values of ***K*** are copied into ***T*** and the remaining positions of ***T*** are filled again with the values of ***K***.

In order to generate the pseudo random sequence

$$Z = \{z[0], z[1], \dots, z[MN]\}$$

of length ***MN***, the following periodic operation is conducted:

$j = 0;$
$for\ i = 1\ to\ MN$
$for\ j = 0\ to\ 255$
$j = (j + s[i] + t[i])\ mod\ 255$
$z[i] = j\ mod\ 8$
$s[i] = s[j]$

In the last step, the encryption process is performed. Encryption is carried out in the Cipher Blok Chaining (CBC) mode. In CBC mode, randomly chosen 8–bit information is generated as a result of performing the ***XOR*** operation with bits with the first block of the plaintext and the first pixel values and is called the initialization vector (IV). At first, the pixel values of the original image are chosen as a matrix and converted into a one dimensional ***P*** sequence to be used for the encryption process. The following formula (3) is used to perform encryption.

The formula (4) below is used to perform the process of converting each value of sequence ***C*** into the DNA code.

where

$p_i \in P = \{p_0, p_1, p_2, \dots\dots\dots, p_{MN-1}\}$

– pixel values of the original image,

$k_i \in K = \{k_0, k_1, k_2, \dots\dots\dots, k_{n-1}\}$,

– key values,

$C = \{c_0, c_1, c_2, \dots\dots\dots, c_{MN-1}\}$

– the values of the original cipher, ***DnaAdd*** – function of the addition operation by the method of summing binary numbers, ***Comp*** – the function of checking binary numbers participation in the paired form while DNA encoding, ***Rotate*** – the function of rotating to the left in the direction of the DNA code, the number of bits rotated at iteration is equal to the value of the pseudo-random sequence.

This completes the encryption operation, and an sequence is generated.

During the decryption operation, the sequence is converted into a two dimensional matrix, and the image encrypted in the form of a DNA code is converted from binary to decimal pixel values.

3. ONE-TIME PADS IN CRYPTOGRAPHY

The use of one-time pads in computer systems is based on a device proposed in 1917 by Gilbert Vernam and patented (Elizabeth:1982, p.86; Smart:2004) during this period. Verman, an employee of the American Telephone and Telegraph Company, designed an encryption device based on the Baudot code and used in telegraphic communications.

$$c_i = \begin{cases} [IV \oplus p_0] \bmod 2^8, & i = 0 \\ [(c_{i-1} \oplus k_{i \bmod n}) \bmod 2^8], & 1 \le i < MN \end{cases} \quad (3)$$

$$x_i = \begin{cases} DnaAdd\left(c_1, Comp\left(Rotate(c_{MN})\right)\right), & i = 1 \\ DnaAdd\left(c_i, Comp\left(Rotate(x_{i-1})\right)\right), & 2 \le i \le MN \end{cases}$$

In the code Baudot each symbol is denoted as a combination of five marks and spaces, thus 32 symbols can be encoded. Each symbol of the encoded was collected in two modules with marks of the key.

The cryptographer of the US Army, Major Joseph Mauborgne, proposed the idea of applying the keys used in the device designed by G. Vernam only once (Gasimov:2009, p.86). By the use of these electrical signals, it was the first automated multi-digit substitution cipher in which the key length was equal to the length of the source text (Menezez: 2001, p.246). With this came the ideology of one-time pads, which never were broken.

Despite the existence of infinite computing resources of cryptosystems, including modern multicore computers, security is guaranteed perfectly, unconditionally or theoretically, when decryption is impossible. Despite how simple it may sound, the requirements for a cipher to be unconditionally secure are tremendous (Paar: 2010, p.36). The use of one-time pads in encryption is a great example. Keys, whose length is equal to the length of the text required to be encrypted, randomly generated, periodically non-recurring, non-guessable, as well as known only to the sender and recipient of information, are called one-time pads (Elizabeth:1982, p. 86). In cryptography, unconditional security can only be ensured by using one-time pads. In other cases, no encryption systems are considered completely secure (Menezes: 2001, pp.42-43).

One-time pads and running keys belong to non-periodic and streaming-encryption systems (Elizabeth: 1982, p.136) and are used in symmetric algorithms (Paar:2010, p.51).

The symbols (sometimes bits) in the key must be generated in a completely random sequence, the key must be known only to the parties involved in the transfer of information, the length of the key must be equal to the length of the plaintext, and each key must be used only once (Paar: 2010, p.37). One-time pads must be held by both parties and destroyed after each use.

The security of most cryptosystems is based on the generation of non-guessable values in algorithms. The random generation of these quantities or information bits is ideal in algorithms and protocols. It is impossible to simultaneously ensure the above-mentioned, as well as store one-time pads required to encrypt large amounts of information, manage them during intensive information exchange and transfer them to the parties without anyone's awareness.

Taking into consideration the complexity of the requirements for using keys only once, they are rarely used in practice (Paar: 2010, p.38). But in practice, one-time keys were widely used by Russian agents operating in foreign countries in the XX century (Menezes: 2001, p.47). After World War II, the security of the direct communication channel organized between Moscow and Washington during the Cold War was also ensured by the use of one-time pads (Menezes:2001, p.21).

As already mentioned, one-time pads were widely used by the Soviet Union during World War II. There was sometimes a lack of one-time pads due to the urgent demand for information sharing, and there were examples of keys being used two or more times because of an insufficient number of keys. As a result of the fact that the American and British counterintelligence kept all the lines of information sharing under control, and some keys were used more than once, secret Russian correspondence began to be uncovered. After this event in 1946, the Russians had to change their encryption system. Only 2,900 pieces totaling 5,000 pages out of the hundreds of Russian correspondences collected between 1941 and 1946, could be read during the next 25 years (Boneh:2015). The spread of Internet technologies in the modern era removes existing limitations on the development or generation of one-time pads.

4. PROPOSED APPROACH

In the method proposed in the article, the cryptographic key is located in a publicly available global Internet environment, and the web page to be used as the key is agreed in advance. It is proposed to take a cryptographic key from a certain section or part of the web page, which the parties agreed on in advance. Posts on social media pages might be used for the same purpose. The process for determining the web page or post in a social network to be used may be different. The website and the page of this website must be coordinated in order to use the web page as a key. For the same purpose, while coordinating social network pages, the social network, social network page, and post that will be used as a key must be determined.

The following sequence can be used to determine a web page. The parties specify the time when one of the sites with daily information postings is most frequently updated. Updating refers to the permanent publication of information on sites with a dynamic structure. Because every update of such sites leads to a new additional web page. That's why information sites and posts shared on social networks are more in line with this requirement. Thus, every day dozens of information are posted on information sites, which are displayed on a new web page. The table 1 shows the amount of information posted on some information sites in a day.

Table 1. Amount of added information in some web sites

Web site	Amount of added information
azertag.az	244
trend.az	140
report.az	252
day.az	174
moderator.az	155
apa.az	240
musavat.com	174
qafqazinfo.az	114
oxu.az	177
haqqin.az	102
ria.ru	350
lenta.ru	480

Table 1 provides information that the amount of data added daily to active sites in most cases exceeds a hundred. The amount of information on some sites is more than two hundred, and on some it is possible to post more than three hundred pieces of information. The amount of information posted on information sites varies from country to country depending on the political, economic, social, military, as well as regional and international situation. It is obvious that the frequency of adding webpages is not the same on all sites and does not always happen at the specified interval. Also, some active sites can only add one page per day. Anyway, it is not difficult to identify sites with a high frequency of updates.

According to electronic resources, the number of websites currently available on the Internet is over 1.13 billion. However, the number of active sites is only 18% of existing sites. It is reported that the number of sites created daily around the world is more than half a million or 250 thousand. 62.3% of existing websites provide information in English, 7.5% in Russian, and 3.8% in Turkish and Spanish. The Persian language is in next fifth place with 3.5% (Huss: 2023).

Given the frequency of updates, it is recommended to agree on which web page of the selected site and on which date information will be exchanged. So the approval process is predicted to be more memorable.

Various techniques can be applied in selecting a web page. For instance, it is possible to choose a cryptographic key from the data posted on the day of the exchange of information on a pre-agreed site. It is considered more memorable in a key approval process. To do this, we can agree that some information corresponding to this hour is taken as a key, taking into account the time when the most news is posted on the specified site. For example, a web page that posts one of the 1st, 2nd, 3rd, or other matched site news at a specified hour can be selected. It is

also possible to transfer information before the agreed time. In such a case, it can be agreed to take the news of the same hour a day earlier. If there is a need for more intensive, that is, more than one piece of information transfer during the day (that is, more than one piece of information is sent), then the specified news of the next hours or one of the subsequent news of the hour can be used as a cryptographic key. The web page to be agreed as the cryptographic key may be selected among the pieces of information posted on the site in previous periods. For example, one of the web pages where the information of the agreed hour posted one, two, three, etc. days ago can be retrieved and used. For the same purpose, it is possible to periodically set weekly, monthly, annual intervals.

The use of social network posts as a cryptographic key in the encryption of text-type data is slightly different from that of web pages in terms of their approval process. So, if posting information on sites increases the number of web pages, then text posts on social networks usually do not increase the number of web pages. However, it is possible to use text information posted in social networks as cryptographic keys in the method proposed in the research paper.

The agreement process for the use of social network posts as a cryptographic key includes the social network platform, the social network page and the publication on this page.

To agree on a cryptographic key from information posted on social networks, one of the open source pages on any social network must first be selected. Social network pages may be owned by individuals, corporate organizations, or official government agencies. It does not matter who owns the pages listed in the key selection.

The next component of agreeing a cryptographic key from social network pages is post-identification. The main difference and almost a disadvantage of choosing social networks as a cryptographic key from web pages is that their interface is made in the form of a news feed. In other words, there is no structured archive of social media posts. Therefore, it is not relevant to use old social network posts as a cryptographic key. Given this, it is recommended to use posts shared in social media within the last week as cryptographic keys for text encryption.

Once the website, web page of that site, as well as the social network page publication have been agreed upon, the next step is to determine which part of the text information or publication posted on the selected web page will be accepted as key. Text taken from a web page can be used as is. However, in this case, the resistance of the method to crypto-attacks may decrease. Therefore, it

is recommended that the whole text taken from a web page should not be used as a cryptographic key. To do this, it is suggested to use separate inconsistent paragraphs, sentences or words of text taken from a web page. For the same purpose algorithms can be used to mix paragraphs, sentences, or words. In accordance with one of these rules, it is necessary to agree on what part of the text extracted from the web page will be used as a cryptographic key.

Therefore, the web site, web page (or social network page, post), where cryptographic key will be taken to be used in the process of encryption, and the agreement prosedure of the text fragments taken from there is determined.

The method proposed in the article ensures that each cryptographic key is used only once. The proposed approach can be considered as corresponding to the ideology of single-use cryptographic keys. Thus, given the number of new web pages created daily in the world, it is possible to generate practically "infinite" keys from them and use them as single-use cryptographic keys. Moreover, such use of Internet pages, including web pages, as a cryptographic key combines several parameters of single-use keys. Although websites do not meet all the requirements for single-use keys, the availability of a wide range of keys allows them to be used for this purpose.

When web pages are implemented as cryptographic keys, the key becomes easier to be changed frequently and delivered to parties according to an agreed rule. Using the proposed method, it is possible to change the cryptographic key without any contact other than determining the agreement process between the parties involved in the information exchange. Given the power of the Internet, the new cryptographic key can be used as a real example of single-use keys.

When using web pages as a cryptographic key, the cryptographic key is equal to the length of the text, and has such properties as non-periodicity of repetition and impossibility to be decrypted.

Although each key can be used once when using web pages as a cryptographic key, it is not possible to destroy the key after each use or promptly after the retention period. The reason is that the web page used as a key is on servers located in different countries of the world.

The main advantages of encrypting web pages with cryptographic keys are as follows:

– the method is simple, since it does not require the construction of a complex mathematical model, as well as additional calculations;

– the cryptographic key to be used in encryption is determined only at the time of encryption;

– the cryptographic key used in the encryption process is used only once;

– no additional resources are required to store, manage and change the cryptographic key.

The proposed approach, together with other cryptographic methods, can be used to ensure the security of the confidential information.

5. CONCLUSIONS

The article deals with the use of web pages and social media posts available worldwide as cryptographic keys that can be easily used in symmetric encryption algorithms. It is shown that the possibility of using web pages as cryptographic keys, as well as social network posts, eliminates the problem of sending a cryptographic key to the parties with symmetric encryption and allows to change it frequently. The proposed approach can be easily applied in symmetric encryption methods to ensure information security.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

REFERENCES

[1] Akhila, V.A., Arunvinodh, C., Reshmi, K.C., [et. al.], A New Cryptographic Key Generation Scheme Using Psychological Signals // *Procedia Technology*, 2016, 25, pp. 286 – 292.

[2] Aliguliyev, R.M., Imamverdiyev, Y.N., *Fundamentals of Cryptograpy,* Publishing House "Information technologies", Bakı, 2006, p. 688.

[3] Alqad, Z., Oraiqat, M., Almujafet, H. [et. al], A New Approach for Data Cryptography // *International Journal of Computer Science and Mobile Computing*, September 2019, Vol.8, Issue.9, pp. 30-48.

[4] Boneh, D., Shoup, V., *A Graduate Course in Applied Cryptography*, URL: https://crypto.stanford.edu/~dabo/cryptobook/draft_0_2.pdf

[5] Elizabeth, D., Denning, R., *Cryptography and data security*, USA and Canada: Addison-Wesley Publishing Company, Inc., 1982, 404 p.

[6] Gasimov, V.A., *Fundamentals of information security. Textbook*, MNS MTS Main Department Publishing Center, Baku, 2009, p. 340.

[7] Ghrare, S.E., Barghi, H.A., Madi, N.R., New Text Encryption Method Based on Hidden Encrypted Symmetric Key // *ACIT* 2018, Ceske Budejovice, Czech Republic, June 1-3, 2018, pp. 240-244.

[8] Gupta, R., Anchal, J., A New Image Encryption Algorithm based on DNA Approach // *International Journal of Computer Applications*, 2014, Volume 85, No 18, pp. 27-31.

[9] Huss, N. How Many Websites Are There in the World? (2023), URL: https://siteefy.com/how-many-websites-are-there/

[10] Hussain, S.M., Ajlouni, N.M., Key Based Random Permutation (KBRP) // *Journal of Computer Science*, 2006, 2 (5), pp. 419-421.

[11] Hussain, S.M., Al-Bahadili, H., A Password-Based Key Derivation Algorithm Using the KBRP Method

// *American Journal of Applied Sciences*, 2008, 5 (7), pp. 777-782.

[12] Lele, R., Jainani, R., Mikhelkar, V. [et. al.], The Book Cipher Optimised Method To Implement Encryption And Decryption // *International Journal Of Scientific & Technology Research,* 2014, Volume 3, Issue 1, pp. 11-14.

[13] Menezes, A.J., Oorschot, P.C., Vanstone, S.A., *Handbook of Applied Cryptography, Fifth Printing*, Boca Raton, USA: CRC Press, 2001, 816 p.

[14] Monrose, F., Reiter, M.K., Li, Q. [et al.], Cryptographic key generation from voice // *Proceedings 2001 IEEE Symposium on Security and Privacy*, Oakland, CA, USA, 2001, pp. 202-213.

[15] Paar, C., Pelzl, J., *Understanding Cryptography*, Berlin: Springer, 2010, 372 p.

[16] Pal, S., Paul, P. Cryptographic Technique Using Biometric Authentication // *International Journal of Innovative Research in Computer and Communication Engineering*, 2014, Vol. 2, Issue 9, September, pp. 5681-5685.

[17] Ristanovic, D., Protic, J., The Book Cipher Algorithm // *Dr. Dobb's Journal*, October, 2008, pp. 48-51. URL: drdobbs.com/security/the-book-cipher-algorithm/210603676

[18] Shumay, M., Srivastava, G., PixSel: Images as Book Cipher Keys // *Intl Journal of Electronics and Telecommunications*, 2018, Vol. 64, No. 2, pp. 151–158.

[19] Smart, N. *Cryptography: An Introduction (3rd Edition)*, New York, USA: McGraw Hill College, 2004, 433 p.

[20] Wang, C., Ju, S., A novel method to implement book cipher // *Journal Of Computers*, 2010, Vol. 5, No. 11, pp. 1621–1628.

[21] Wang, C., Ju, S., Book Cipher with Infinite Key Space // *2008 International Symposium on Information Science and Engineering*, Shangai, China: IEEE, 20-22 Dec., 2008, pp. 456-459. URL: https://ieeexplore.ieee.org/document/4732257.

ASPECTS CONCERNING RESEARCH & DEVELOPMENT ACTIVITIES IN ROMANIA AND EU COUNTRIES

Cristina ANTONOAIE

Regional Department of Defense Resources Management Studies, Brasov, Romania

In today's world the research and development are essential for society. In this paper we have analyzed three indicators reflecting this aspect: research and development expenditure by sectors of performance, total researchers by sectors of performance, and share of women researchers.

Key words: *R&D, sectors of performance, researchers, digital society*

1. INTRODUCTION

With the help of the data provided by the Eurostat Database we have graphically analyzed the research and development indicators in Romania and the rest of the European Union countries.

The database tree comprises under the label of Research and development (R&D) the following items [1]: Research and development expenditure, by sectors of performance, Intramural R&D expenditure (GERD) by source of funds, Total researches by sectors of performance – head count, Total researches by sectors of performance – full time equivalent, Research and development personnel, by sectors of performance, Share of women researchers, all sectors, Share of women researchers by sectors of performance, Intramural R&D expenditure (GERD) by NUTS 2 regions, Researchers, all sectors by NUTS 2 regions.

2. RESEARCH AND DEVELOPMENT

Research and experimental development [2] (R&D) "comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. R&D expenditures include all expenditures for R&D performed within the business

enterprise sector (BERD) on the national territory during a given period, regardless of the source of funds. R&D expenditure in BERD are shown as a percentage of GDP (R&D intensity)."

The first indicator that we have taken into consideration is the Research and development (R&D) expenditure as percentage of the GDP (Gross Domestic Product).

In Figure 1 we can observe the evolution of this indicator in all sectors between 2010 and 2021 in Romania and EU-27 composite average. Romania has the lowest value among all the EU countries in 2013, 2014, and 2017-2021. The highest values are in Finland between 2010 and 2014 (3.71%, 3.62%, 3.4%, 3.27%, and 3.15%) and in Sweden between 2015 and 2021 (3.22%, 3.25%, 3.36%, 3.32%, 3.39%, 3.49%, and 3.36%).

In Figure 2 we can observe the evolution of the second indicator – the R&D expenditure by business enterprise sector in Romania and EU-27. Also, from our data, we see that the minimum values were registered in Cyprus from 2010 to 2015 (0.08%, 0.07%, 0.07%, 0.09%, 0.11%, 0.11%) and in Latvia from 2016 to 2021 (0.11%, 0.14%, 0.16%, 0.17%, 0.21%, 0.23%). The maximum values were in Finland from 2010 to 2013 (2.58%, 2.55%, 2.34%, 2.25%), in Austria in 2014 (2.22%), in Sweden from 2015 to 2020 (2.24%, 2.26%, 2.4%, 2.36%, 2.43%, 2.52%), and in Belgium in 2021 (2.42%).

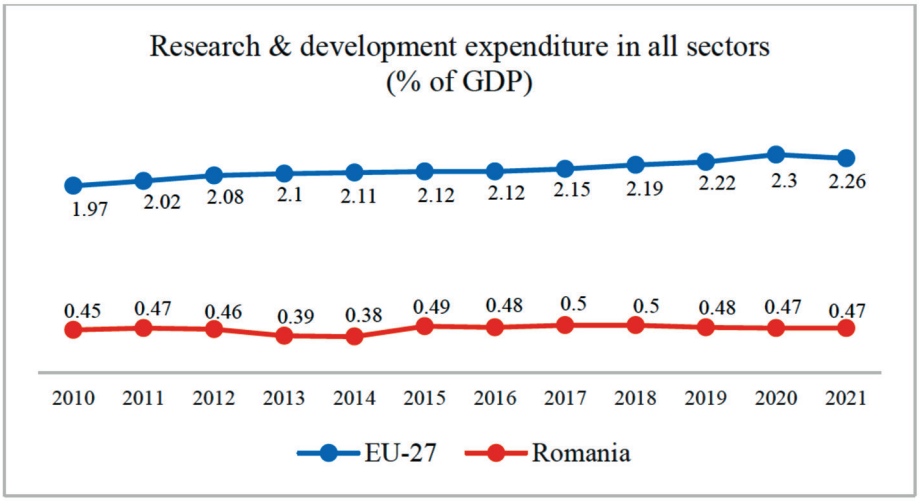

Fig.1 Research & development expenditure in all sectors

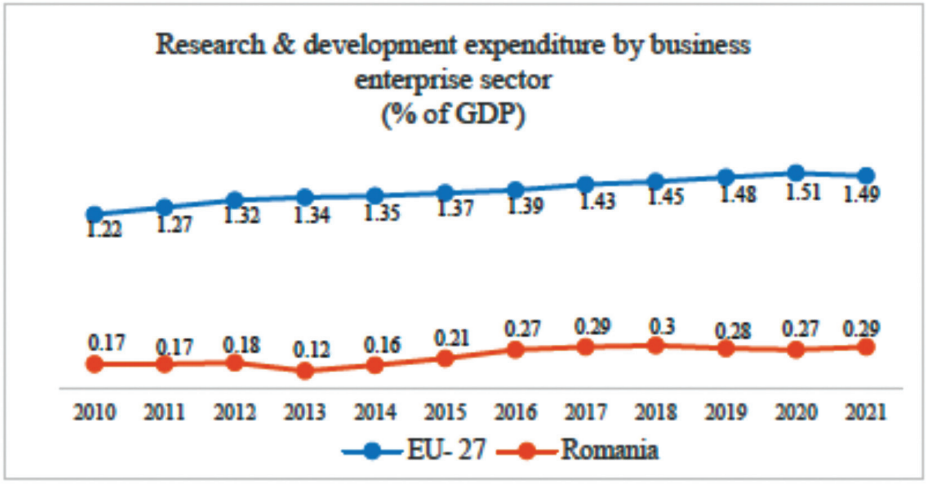

Fig. 2 Research & development expenditure by business enterprise sector

In Figure 3 we have the evolution of the third indicator – the R&D expenditure by government sector in Romania and EU-27. From the rest of the data we see that the minimum values were in Malta between 2010 and 2014 (0.02%, 0.03%, 0.06%, 0.07%, 0.07%) and from 2016 to 2021 (a constant 0.01%). In 2015 the lowest value was in Ireland (0.05%). The highest values of this indicator were in Germany for all the analyzed period (from 0.4% to 0.47%).

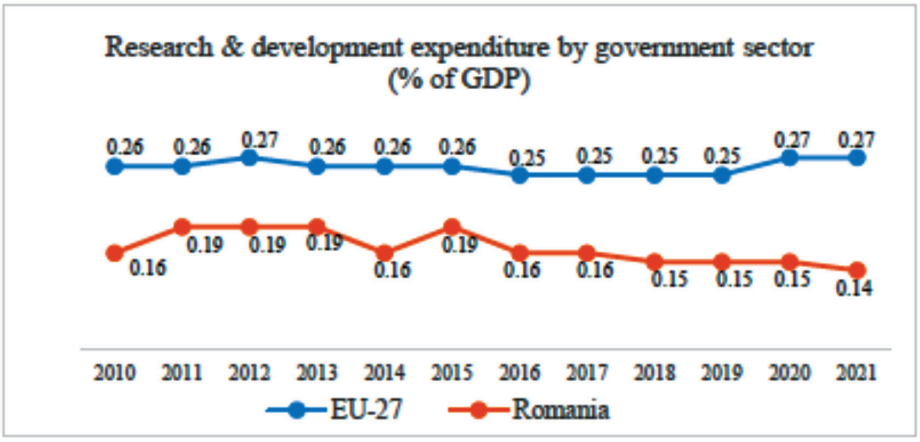

Fig. 3 Research & development expenditure by government sector

The fourth indicator analyzed (Figure 4) is the R&D expenditure by higher education sector in Romania and EU-27, as we can observe in Figure 4. Romania has the minimum values in 2014 (0.06%), and from 2019 to 2021 (0.05%, 0.04%, 0.04%). For the rest of the years analyzed Bulgaria has the lowest values (0.04% - 0.07%). The highest values were in Denmark (0.88% - 1.04%).

In this category of R&D expenditure we have also the one from the private non-profit sector. Several countries, including Romania have the value of this indicator 0% (Poland, Luxembourg, Slovakia, Netherlands). The highest values were in Portugal from 2010 to 2012 (0.16%, 0.13%, 0.12%) and in Cyprus from 2013 to 2021 (0.06% - 0.12%).

3. TOTAL RESEARCHERS

Researchers [3] are "professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the management of the projects concerned. Head count (HC) data measure the total number of researchers who are mainly or partly employed on R&D."

The next category of indicators refers to the total researchers by sector of performance in Romania. We begin with the values from all sectors (Figure 5). For the period analyzed the highest value was in 2009 (30,645 persons) and the lowest value was in 2011 (25,489 persons). The average was 27,914 persons.

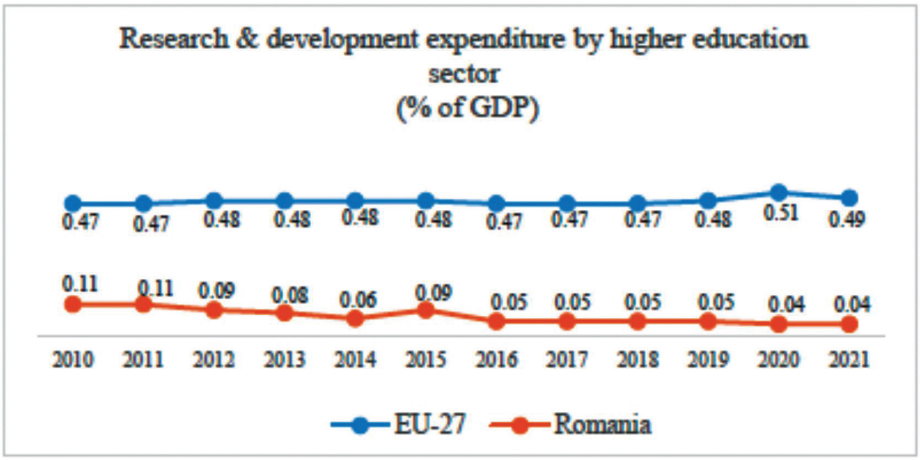

Fig. 4 Research & development expenditure by higher education sector

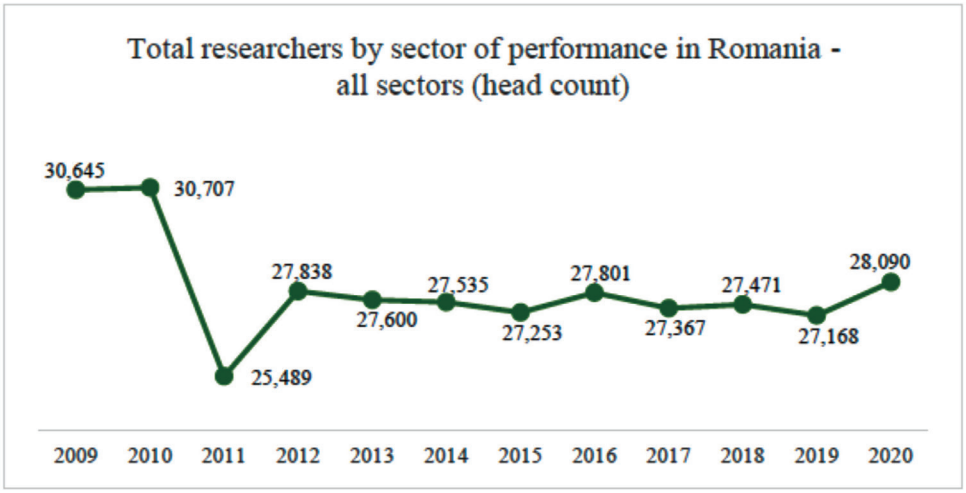

Fig. 5 Total researchers
by sector of performance – all sectors

Concerning the number of total researchers in business enterprise sector in Romania (Figure 6) the maximum value for the period analyzed was 6,389 persons in 2009 and minimum value was 4,122 persons in 2011. The average was 5,363 persons.

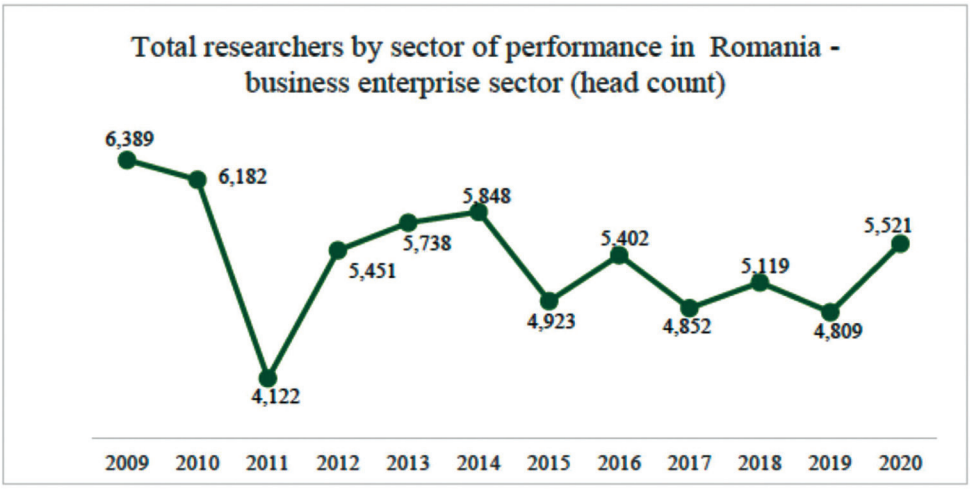

Fig. 6 Total researchers by sector of performance –
business enterprise sector

The next indicator is total researchers in the government sector (Figure 7). Here the evolution is different, having a constant growth from 2010 to 2020, from 5,831 persons to 7,249 persons. The average was 6,733 persons.

persons and then small decreases and increases with 15,069 persons in 2020. The average was 15,639 persons.

Even if we don't have any R&D expenditure in the private non-profit sector from the part of the state, we do have a number of researchers

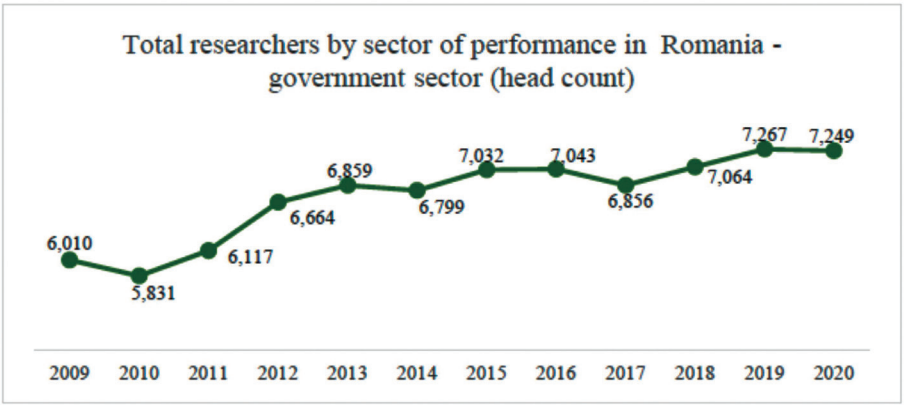

Fig. 7 Total researchers by sector of performance – government sector

The situation is different for the total researchers in the higher education sector (Figure 8). We have an abrupt decrease from 2010 to 2011, from 18,540 persons to 15,086

with values from 109 persons in 2009 to 251 persons in 2020, with a maximum value of 273 persons in 2016 (Figure 9). The average was 179 persons.

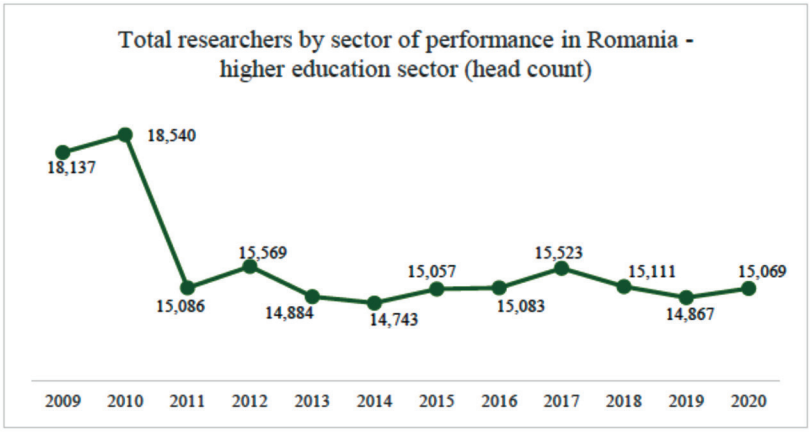

Fig. 8 Total researchers by sector of performance – higher education sector

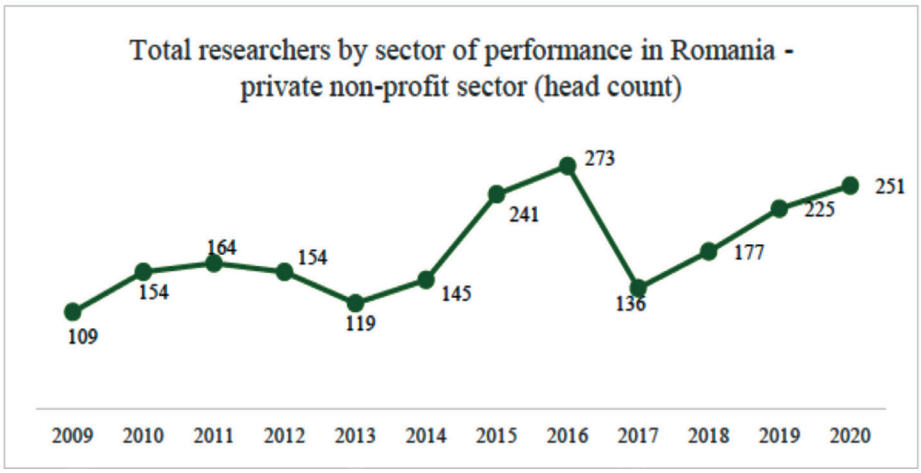

Fig. 9 Total researchers by sector of performance – private non-profit sector

4. SHARE OF WOMEN RESEARCHERS

Researchers are [3] "professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the management of the projects concerned. The share of women researchers among total researchers in head count in all institutional sectors is shown."

Based on previous head count of the total researchers by sector of performance from 2009 to 2020 we also made an analysis of the share of women researchers in Romania. The general evolution in all sectors (Figure 10) was one of increase from 44% in 2010 to 47.3% in 2020.

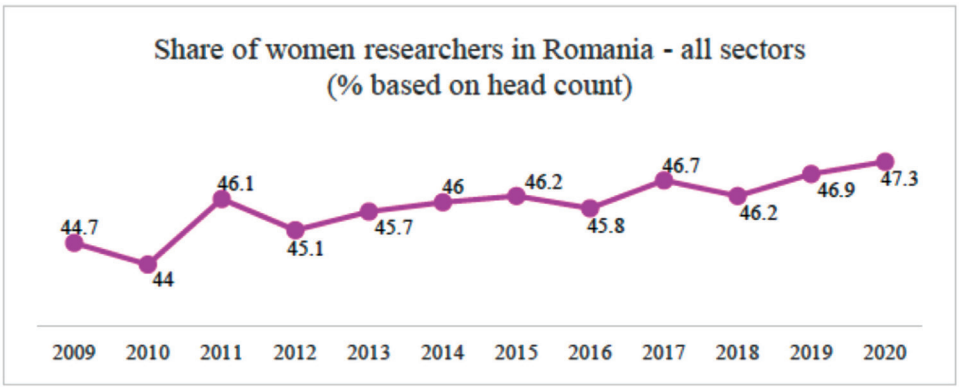

Fig. 10 Share of woman researchers – all sectors

In the business enterprise sector we have the maximum value of 40.1% in 2014 and the minimum value in 2018 – 32.5%. The evolution is a combination of increases and decreases (Figure 11) with more than 0.5% from a year to another.

In the government sector (Figure 12) we have a maximum value for the share of woman researchers in 2010 (49.9%) and a minimum value in 2011 (46.3%).

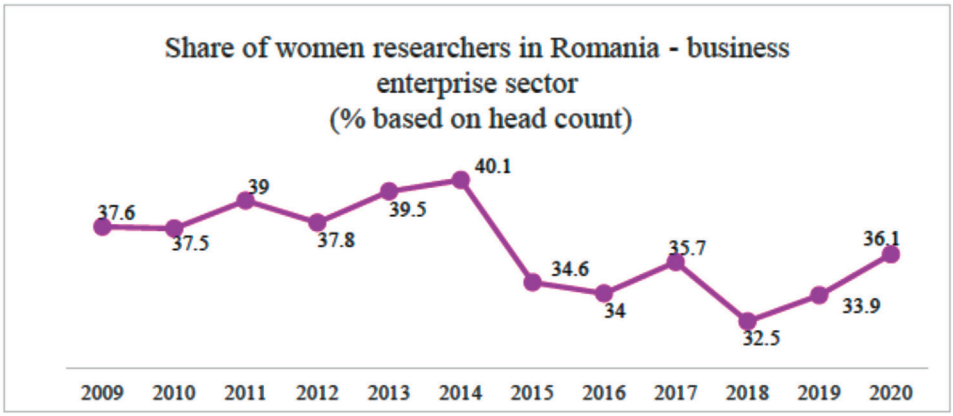

Fig. 11 Share of woman researchers – business enterprise sector

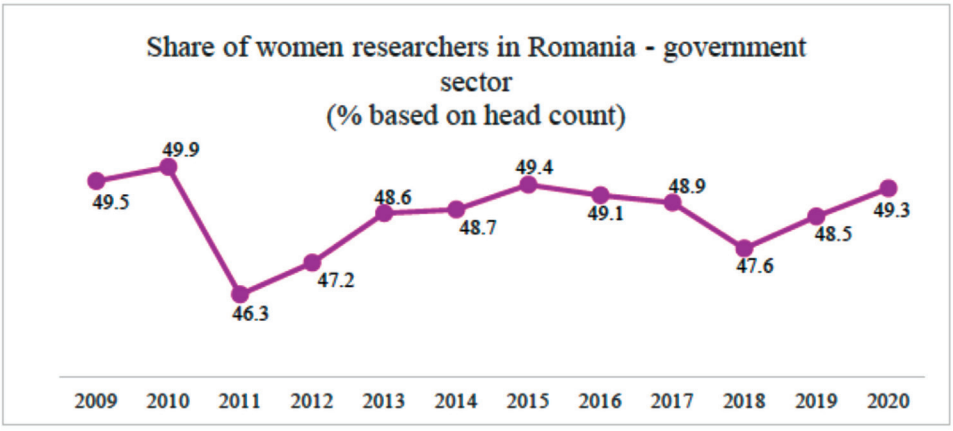

Fig. 12 Share of woman researchers – government sector

In the higher education sector (Figure 13) we have almost a constant increase of the share of women researchers in Romania, from a minimum value of 44.3% in 2010 to a value of 50.4% in 2020.

The highest values of share of women researchers in Romania is in the private non-profit sector (Figure 14), with values from 30.9% to 55.2%.

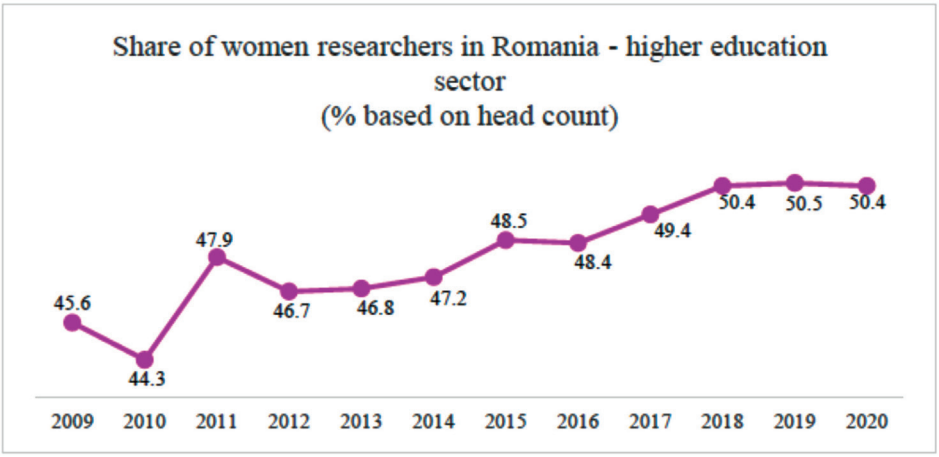

Fig. 13 Share of woman researchers – higher education sector

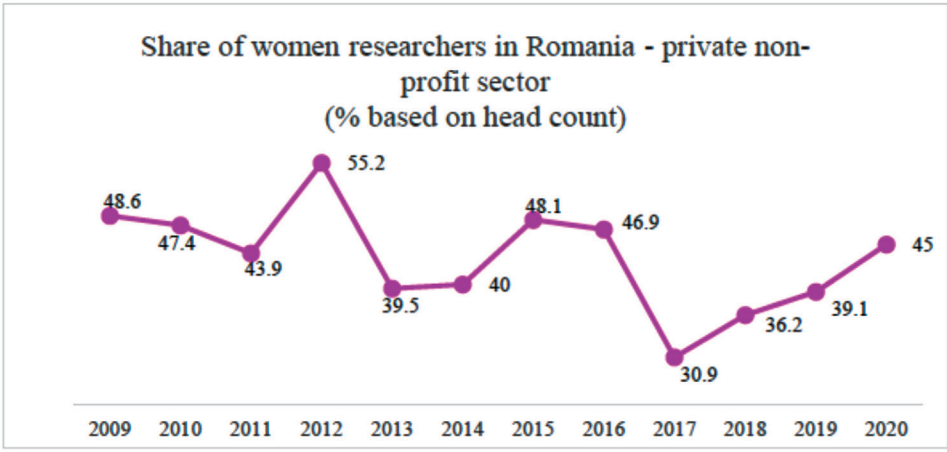

Fig. 14 Share of woman researchers – private non-profit sector

CONCLUSIONS

Research and development activities are essential to our society in its way to become a digital society. Business enterprise sector, government sector, higher education sector, and private non-profit sector are contributing by their employees to the creation of that society. Besides expenditure we need performant personnel in order to advance in the future and women researchers are very important in this process.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

ENDNOTES

[1]https://ec.europa.eu/eurostat/web/main/data/database, last retrieved 27 February 2023.
[2]https://ec.europa.eu/eurostat/cache/metadata/en/rd_esms.htm, last retrieved 27 February 2023.
[3]https://ec.europa.eu/eurostat/cache/metadata/en/hrst_esms.htm), last retrieved 27 February 2023.

REFERENCES

[1]https://ec.europa.eu/eurostat/web/main/data/database, last retrieved 27 February 2023.
[2]https://ec.europa.eu/eurostat/cache/metadata/en/rd_esms.htm, last retrieved 27 February 2023.
[3]https://ec.europa.eu/eurostat/cache/metadata/en/hrst_esms.htm), last retrieved 27 February 2023.
[4]https://ec.europa.eu/eurostat/databrowser/view/tsc00001/default/table?lang=en, last retrieved 27 February 2023.
[5]https://ec.europa.eu/eurostat/databrowser/view/tsc00003/default/table?lang=en, last retrieved 27 February 2023.
[6]https://ec.europa.eu/eurostat/databrowser/view/tsc00005/default/table?lang=en, last retrieved 27 February 2023.

IMPROVEMENT OF KNOWLEDGE MANAGEMENT IN HIGHER EDUCATION INSTITUTIONS

George BUCATA , Diana Elena RANF, Alexandru-Marius RIZESCU

"Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania

Knowledge management is a relatively recent phenomenon in its scope, but it has emerged on the wave of growing interest in changing the conventional/ traditional format of knowledge management. At the beginning of the last decade, many organizations found that they could no longer keep up with the increasing complexity of their tasks. Managers could not simply do what they were used to doing in the rigid production hierarchy. To do what they were supposed to do, they needed access to knowledge, but they also needed new skills to acquire it. The transmission of knowledge through successive "transfers" is an essential part of the concept of the "technological society" in which we live today, including educational institutions. The aim of this article is to demonstrate, through a documentary analysis, the usefulness of integrating knowledge management concepts and practices into the activities of higher education institutions in order to improve performance and simplify work processes.

Key words: *knowledge management, educational institutions, educational management, institutional management.*

1. INTRODUCTION

The information brings to the fore two important components that are intertwined in the definition of knowledge management, namely the evaluation of knowledge and the appropriate management of human capital. Knowledge management is a branch of management that deals with knowledge actions such as organizing, blocking, filtering, collecting, storing, sharing, disseminating, and using knowledge objects identified as information, data, experiences, assessments, analyzes, and initiatives. Knowledge management is about capturing knowledge where it is created, sharing it with people, and applying it in a productive process. Because knowledge management focuses on identifying knowledge and formally sharing and reusing it, it enables problem solving, dynamic learning, strategic planning, and decision making in an efficient

and effective manner. The research method used is the analysis of documents from external secondary sources.

Although universities are a kind of knowledge repository, according to recent studies, the knowledge developed in academic institutions is not adequately preserved or collected, and most of the content developed in academic institutions is unknown to the general public (Galgotia & Lakshmi, 2022). The article aims to raise awareness about the importance of appropriate knowledge management in higher education. [3]

2. THEORETICAL FRAMEWORK

2.1. Knowledge management theoretical framework

According to David and Dominique (2013), there are 4 changes that have influenced the knowledge society:

- the increasing dominance of intangible capital - the micro- and macroeconomic levels;
- innovation should be seen as a multifaceted activity in the life of the knowledge society;
- the use of knowledge tools and their impact on society;
- increase in the production of knowledge.

The two authors describe these four changes by noting other princes and the fact that they are produced with different force and speed in the different economies and regions of the world. This creates economic stratification based on the ability and speed of absorption of the four changes in national or regional economies. The trigger for the four changes lies in the social developments that have led to the demystification of production and services by changing the rules of the game of economic competition.

Fig. 1 Knowledge management processes and applicability (Source:*https://www.teamcarney.com/capabilities/knowledge-management-solutions/*)

The most competitive companies are not those that offer a unique product in thousands of copies, but those that are able to offer products that can be adapted to the needs of different customers, up to unique products for each customer. The theoretical models of knowledge

management present work patterns and thought patterns that, when understood and applied, lead to a better valorization of knowledge in organizations. Among the numerous approaches in the field, we have selected two models that are considered fundamental in the field of knowledge management: the dynamic process of knowledge creation (SECI) proposed by Ikujiro Nonaka and the intellectual capital model, with variants proposed by different authors. Among the most appreciated authors in this field are the Japanese Ikujiro Nonaka and Hirotaka Takeuchi, who developed the SECI model. This model is a description of the dynamic creation of knowledge in organizations and its practical use. The model, originally developed by Nonaka and Takeuchi, was supplemented by Toyama and Konno to make it more applicable to organizations. The name of the model is an abbreviation for the four stages to be developed for the creation and valorization of knowledge through applications: S — Socialization, E — Outsourcing, C — Combination, I — Internalization. To better understand the model, it is necessary to define the two types of knowledge that Nonaka used in the development of the model: explicit knowledge and tacit knowledge. [5]

Explicit knowledge can be analyzed from a dual perspective: Words and numbers. Both perspectives may involve assumptions, intuitive responses, and mental connections that are difficult

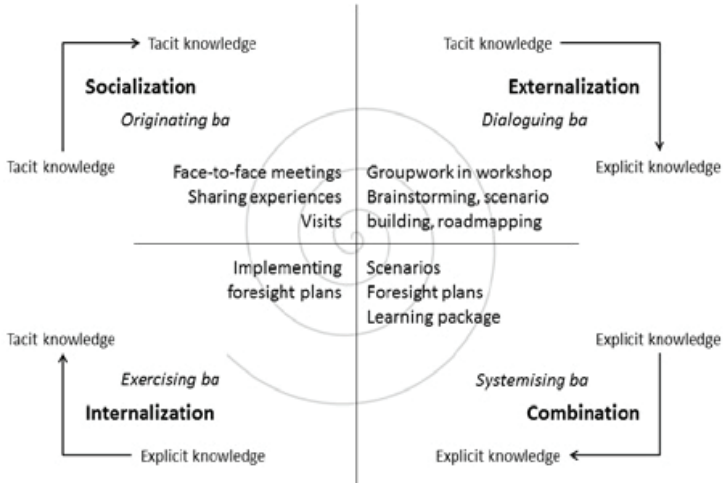

Fig. 2 SECI model created by Ikujiro *and Hirotaka, theoretical perspective*
(Source: *Nonaka, Toyama, & Konno, 2000*)

to formalize and express, leading to difficult exchanges. They are often the result of practical experience and learning through trial and error. One of the philosophical ideas behind the model is that ”we can know more than we can say”. Based on the differences between tacit and explicit knowledge, the basic scheme of the model includes four stages, as shown in Figure no. 2:

Socialization may be the process by which tacit knowledge is passed on by employees through their experiences. Since tacit knowledge is contextual, the key to acquiring it is to share the same experiences and collaborate with those who have it. The best example is the traditional master-disciple relationship. The teacher learns the profession by directly imitating the actions of the master and improving his knowledge through practice, not through words or writings. The quality of the relationship between those who share common experiences, whether it is the student and the master, the employee and the customer, or the boss and the subordinate, is a fundamental factor in promoting knowledge creation in the organization.

Outsourcing is the process of expressing tacit knowledge in the form of explicit knowledge. Of the four steps, it is the most important in knowledge creation because it leads to the emergence of new knowledge and concepts. When tacit knowledge becomes explicit, it crystallizes into forms that can be communicated to others and form the basis for the emergence of other knowledge. An example of outsourcing is improvement meetings, where employees primarily try to identify and name the problems they face. This leads to new knowledge about the situation they are facing. The success of transformation depends on the use of methods to verbalize experiences shared by members of a community or small group. Metaphors, analogies, or schemas are often used to crystallize new ideas and concepts.

In the combination phase, the explicit knowledge gained is linked and filtered to yield only those categories that can be translated into lessons learned to ensure organisational sustainability. Reconfiguration of existing knowledge through sorting, collecting, combining, and classifying leads to the creation of new knowledge. An illustrative example is that of an analyst who collects financial data and reports on the company’s finances. The synthesis of the report represents new knowledge for the decision maker to use in decision making. [1]

Internalization is the process of transforming explicit knowledge into tacit knowledge. It is achieved by embedding explicit knowledge in actions, practices, or simulations of concrete situations. Therefore, the

process is also referred to as learning by-doing. Through internalization, explicit knowledge is disseminated throughout the organization and the creation of a new set of tacit knowledge leading to the resumption of the entire knowledge production cycle is initiated. For this reason, the core of the model proposes a spiral, which proposes the continuous resumption of the SECI cycle, resulting in the continuous growth of the organization's knowledge.

2.2. Educational management theoretical framework

Higher education is organized in universities, academies of studies, institutes, colleges of higher education, hereinafter referred to as institutions of higher education, or universities that have received provisional accreditation or accreditation. Higher education institutions are educational institutions that carry out educational activities based on study programs provisionally approved or accredited in accordance with the law, as well as education and training programs at the college level, based on the principle of quality and correlation of the educational offer with the labor market.

Management is the science, art and technique of planning, administering, organising and controlling the elements of a system, a particular field of activity. The term was first used in business and then extended to all areas of activity, and it has been used to develop specific characteristics (e.g., personnel management, priorities, stress, etc.). However, it has also found its own expression in every other field (military, medicine, education, etc.). Education is directly responsible for the success of future generations. A predictable correlation of the educational offer with the demands and dynamics of the labour market affects the professional integration of human resources and the sustainability of fundamental areas for the Romanian economy and society.

The management theory applied in the field of education contributes to this by providing the scientific basis for a global approach to achieve the goals of the educational system. Educational management has clear and hierarchical goals, principles of efficiency and quality, specific functions, strategic elements, affirmation of creativity in solving situations, interdisciplinary and systematic approach, basic research. It differs from general management by specific reporting of educational content, content, trained human resources, information, communication and participation of stakeholders through specific educational strategies (based on motivation, responsibility, cooperation, logic, affectivity).

Educational management involves the mastery of theory, methodology, principles, a specific mentality, a right way, a leadership art and learning resources.

3. KNOWLEDGE MANAGEMENT AND ITS IMPACT ON ROMANIAN UNIVERSITIES

Knowledge management focuses not only on the acquisition and transfer of knowledge, but also on how this knowledge is used to achieve a competitive advantage. It highlights the difference between the learning process and the simple acquisition of knowledge. Learning is about changing behavior in the sense of creating the ability to do something new, to perceive the world and relationships with it differently, to expand the spirit of innovation. Knowledge utilization refers to the transformation of knowledge into new products and services. Innovation is both a social process and the result of personal transformation. Transforming individual imagination through an iterative process into values that can be shared contributes to the development of employees' sense of belonging to the company and fosters innovation. To realize an innovative project, the individual vision must match intelligence, competence and collective will. Innovation can be understood as a process of eliminating routine and outdated strategies to enable the development of organizational creativity. [6]

In universities, knowledge development refers to the accumulation of new knowledge to innovate, adapt, and achieve organizational goals. The forms of knowledge accumulation differ according to the entity that accumulates the knowledge. The human resource accumulates knowledge through socialization (human interaction), explicit internalization (formal or informal learning), implicit internalization, implementation of work processes or through practice), generation (analysis and mental synthesis). Artificial intelligence systems acquire knowledge by processing new facts in the context of an original knowledge base and mindset. The organization, considered as a learning organization, changes its range of possible actions in a given context. The speed at which an organization learns to anticipate and adapt to developments in the environment is a source of competitive advantage. The organization gathers from the outside by hiring (hiring a consultant and using his expertise to gain new knowledge) or buying (buying a company for the knowledge it contains). From the inside, the organization gathers knowledge by disseminating knowledge from a particular component source and

expanding existing knowledge sources.

In the academic environment, an important aspect of knowledge development is the process of transforming tacit knowledge (from the practical environment) into tacit knowledge (related to human resources) through the exercise of work processes. The efficiency of this process is determined by the individual's mental model or mindset, the individual's prior knowledge, and the practical context. The role of each of these factors can be derived from the following analogies: The practical context corresponds to the raw material supplier; the mental model corresponds to the technology of raw material transformation; and the prior knowledge has the role of a catalyst that enables the transformation of the raw material.

The mental model can be regarded as a sum of knowledge and the most important factor in the knowledge development process. In knowledge management theory, two types of mental models are distinguished: linear thinking and systemic thinking. Studies on the two mental models show that systemic thinking enables high efficiency and effectiveness of human decisions in professional or social life. In the systemic approach, a system of decisions is built to change the system, which can compensate for the negative effects of decisions made only for a part of the system in the case of linear thinking. The previous knowledge can be characterized by scope, structure and quality. The larger the scope, the larger the platform on which new knowledge can be built. The structure or variety of knowledge contributes to the building of deeper knowledge. The quality of knowledge reflects its ability to respond more effectively to practical needs. The better the knowledge is matched to practical needs, the more intensive the accumulation process. The practical context is intended to provide information or knowledge that is the substance needed to acquire new knowledge. Through its dynamics, the practical context leads to new connections or new knowledge. [4]

Universities must adapt to the times and create new professions, such as knowledge transfer experts: people who extract knowledge from various sources, organize it so that everyone can use it, and update it regularly; knowledge management strategies: people who develop strategies for the knowledge base - audit the sources of knowledge, determine the requirements arising from the assumed mission, goal and objectives, strategically plan the necessary knowledge, determine the implementation modalities, etc.; knowledge designers: people with similar concerns to specialists who have been developing rules and facts

for expert systems for two decades. In the new profession, knowledge designers aim to design the rules and the knowledge base at the level of the whole organization; knowledge management officers: responsible for creating the knowledge infrastructure, its structures and processes, and an organizational culture focused on learning and knowledge acquisition (Figure no. 3).

(Andrei, Zait, Zbuchea & Vătămănescu, 2019), both those in leadership positions and regular employees, in educational institutions it is a challenge to identify the key employees who possess important knowledge. These individuals, in fact, constitute a true knowledge architecture of an organization and are formally or less formally capable of providing the essential functions

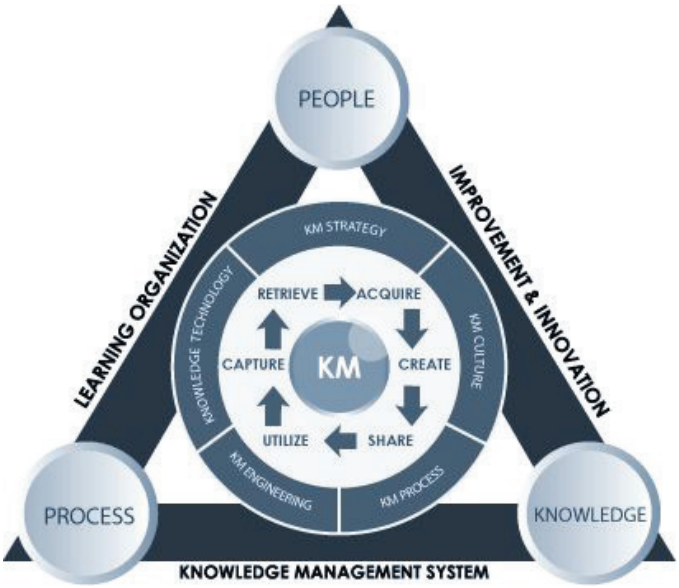

Fig. 3 Knowledge management pyramid, people-process-knowledge
*(*Source:*https://ilpilotaprivato.it/mod/page/view.php?id=42)*

Every college has a wealth of knowledge (individual staff experience, practices, methods, documentation, etc.) that, if used effectively, can make a significant contribution to the success of the organization. Just as in the private sector knowledge management largely depends on employees for managing information and knowledge throughout the creative cycle-from creation to destruction/ consumption-and thus helping organizations to use their assets wisely and to their fullest potential and to capitalize on their investments (which are not necessarily calculated in monetary terms).

Creating the capabilities required to meet an organisation's development needs requires a minimum set of prerequisites: committed employees, the decision to initiate the knowledge process, and the appropriate tool (technology) to be used in accordance with the company's strategies for the goals set. The easiest way to fail in this initiative is to try to implement these new technologies in an old format, which will inevitably lead to unsatisfactory results. Other challenges in integrating knowledge into the organisational loop have been highlighted in studies that focus on the ability to predict whether the desired integration process will be easy or difficult to implement. For example, the optimal integration of knowledge from individuals into units depends on the extent to which knowledge can be learned, while the ease of implementation depends on the extent to which knowledge is tacit. Implementation challenges arise when these two dimensions do not align (McIver, Fitzsimmons & Lengnick-Hall, 2019). [2]

4. CONCLUSIONS

It is important to remember that knowledge management does not mean managing for knowledge's sake, but that the overall goal is to create value and leverage to improve and refine the organization's competencies to achieve its goals. The values of the learning organization and its competitive advantage derive from continuous learning, both individually and collectively. In a learning organization, every experience is seen as a learning opportunity and great emphasis is placed on training members. The learning organization concept focuses on group-level learning, that is, the way the team thinks and the way people work together. This type of approach promotes collaboration, engagement, access to knowledge and talent, and consistent organizational behavior. Such a description of an organization's social capital suggests investing appropriately, giving people space and time to connect, allowing them to share their goals and beliefs, providing opportunities and fair rewards, and inviting people to participate authentically, not just to be present. Also, the establishment of knowledge about the work of organizations and the actors within them means that the demarcation between the theoretical and the applied side in the areas related to this development (knowledge management, organizational learning, intelligent systems) remains purely conventional. New concepts and the development of solutions, initially linked to an operational vocation, are integrated into projects, transparently exposed to community validation, including at the international level, and transformed into organizational

models, tools and practices; their innovative dynamism testifies that knowledge means, above all, originality in diversity.

The need to integrate the concept of knowledge management in organizations is emphasized in the literature. Among the basic arguments are: the rapid pace of change and disruption caused by the global context characterized by constant dynamics, economic, security and health crises (Usman, Zaveri & Hamza, 2021).

The education sector, as a compass for society, is directly responsible for providing society with the best prepared human resources, characterized by adaptability and flexibility, able to face the future challenges of the labor market. A measure of this performance of educational institutions is the demonstration of their ability to ensure their own sustainability, to integrate the knowledge and experience gained into documents and practices, and to disseminate it more widely.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

REFERENCES

[1] Andrei, A.G., Zait, A., Zbuchea, A., & Vătămănescu, E.M., (2019). *Use of Knowledge Management Strategies in SMEs: a Radiography of the Romanian Context. Conference: IFKAD*, Matera, Italy;

[2] Galgotia, D., & Lakshmi, N. (2022), *Implementation of Knowledge Management in Higher Education: A Comparative Study of Private and Government Universities in India and Abroad. National Library of Medicine*, doi: 10.3389/fpsyg.2022.944153;

[3] McIver, D., Fitzsimmons, S.R & Lengnick-Hall, C.A. (2019). *Integrating knowledge in organizations: examining performance and integration difficulties. Knowledge Management Research & Practice, Vol. 17, Issue 1*, 14-23, DOI: 10.1080/14778238.2018.1538667;

[4] Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, *Ba and Leadership: a Unified Model of Dynamic Knowledge Creation. Long Range Planning, Vol. 33, Issue 1*, 5-34;

[5] Paul A. David, Dominique Foray, (January 2013). *Economic Fundamentals of the Knowledge Society, în Policy Futures In Education. An e-Journal*, 1(1): Special Issue: Education and the Knowledge Economy;

[6] Usman, S.H., Zaveri, J., & Hamza, A. (2021). *An Integrated View of Knowledge Management Enablers, Components, and Benefits: Comprehensive Literature Review. Journal of International Technology and Information Management, Vol. 30, Issue 4.*

https://assignmentpoint.com/wp-content/uploads/2015.

TYPES AND STYLE OF MILITARY TEXTS USED IN FOREIGN LANGUAGE TEACHING

Nasibova Lutviya AKIF

Postgraduate student, Military Scientific Research Institute of the National Defense University, Baku, Azerbaijan

The article talks about the importance of teaching the culture of speech in military educational schools. One of the actual issues of teaching the culture of speech is the choice of style, the perfection of speech and the essence of the choice of style. In the development of speech culture of cadets, the analysis of military texts, especially military discourses during the teaching of a foreign language, is brought to the fore. The use of military texts in military educational institutions will help to improve the language skills of cadets and enrich vocabulary in the military field in the future. Also, I think my scientific article is relevant in terms of functional style. The article is also a helpful supply in the students' choice of style.

Key words: *discourse, style, the culture of speech, business and academic communication.*

1. INTRODUCTION

Oral speech and the choice of style play an important role in the teaching of foreign languages. The choice of style of military texts requires special attention in the development of culture of speech of cadets. Because military words and especially international words occupy a special place in the lexicology of modern world languages and cause the mutual enrichment of languages and bringing closer to the languages of different systems. International words or terms come across in the lexical fund of world languages. When investigating the compatibility problem of military-related documents and agreements of international organizations in different languages, the attitude to military words should be determined, attention should be paid to how they differ from each other in explaining their essence and functions in different languages. Military texts require special attention among the types of the text. Military documents, texts, military education

all cause the emergence of a certain military discourse. Military texts serve a defined, predetermined communication. Such texts are usually used in the context of military discourse. The use of military texts also shapes military genres. Military texts are a special type of text and tend to have relatively rigid genre conventions. Such texts are considered appropriate only for a specific audience or professional discourse community. [1, p. 89]. The language of military texts, or the terminology used in them, is renewed and developed concerned with the events taking place in the military environment. Many of these words have characteristics such as hybridization, formation from other words, loan - words. Most of them are of Latin, Greek, French origin.

2. MILITARY DISCOURSE

Military discourse is a strictly standardized speech process. The development and formation of military discourse is its perception within corresponding to the social institution [3, p. 164]. The difference of military discourse from other discourses is determined by extra linguistic factors occurring in the context of communication and includes the following items. First of all, the communicants of the military discourse are "the commander and his subordinates", or rather than, the means of expression of hierarchical relations belong to this type of discourse. Secondly, the purpose of the discourse is to organize activities that ensure the security of the state and its vital interests from internal and external threats. Thirdly, ideals and values can only be seen in loyalty to the position, military oath, high-level field training, combat preparation, combat skills and activity, and achieving the goal. The fourth, chronotopically, military discourse is determined by the unity of any time and place where practical or real combat operations aimed at the defense of the state and its interests are carried out. Institutional military discourse includes its specific genre, discursive formulas, strategies, and precedent texts. Military discourse is represented in a broad sense by military materials, military-political, military-artistic, military-technical, military-scientific, military-publicistic texts, as well as various military business documents. As it is known, military discourse includes scientific and technical materials and directly military documents. Scientific and technical materials also include numerous texts related to the operation or structure of combat equipment. Military documents are texts and graphic images intended for

the management of military apparatus in peace and war dispositions, which carry information on a wide range of issues:

-military documents: field order, battle order, etc.:

- service documents: orders, instructions, reports, etc.:

-training regulations documents: recommendations, instructions. [3, p. 163].

2.1. Formal and informal types of military discourse

Military discourse can be used in newspapers, magazines, radio, television and on the Internet in order to create emotionality and expressiveness in terms of expression. Also, military discourse is based on social political influence among communicative acts. This includes social values, as well as political situations in the country, the concept of "war", etc. It affects the spiritual world of the person, who receives the text and, as a result, causes a strong reaction of the receiver of the text. Military discourse can be structurally divided into macro and micro contexts [2, p. 64]. Each of them has its own place in the information system, and mutual-hierarchical relationship in the communication process. Military discourse organizes itself based on internal and external information. The development of the thought given in the discourse depends not only on the author, but also on the process of self-organization [4, p. 26].

Genres of speech differ from a formal syntagmatic and functional point of view. Genres of speech range from ordinary everyday dialogue to official business styles, military speeches and voluminous training regulations. It is difficult to learn the genres of speech at these fields, since the statements are multidirectional in purpose.

As is known, the speech act is communication, and the speech genre is the form of speech used by the communicator. Any discourse has a communicative system and reaches a real potential dimension. The real dimension is the field of communicative practice as a set of discursive events, a speech activity in a certain social space, which has a processuality related to real life and time, which ends with a text. Discourse includes a set of speech activities and genres, which have a semiotic space in terms of potential dimension, personifying verbal and non-verbal signs.

The concept of genre in military discourse is closely related to genres of different styles. The stylistic features of military texts are determined by the location of military literature between two functional

styles of the language - official business and scientific and technical styles. The official business style has a number of stylistic features characteristic of military documents. The main ones include the following: modifier - the necessity of speech, accuracy, logic, objectivity, clarity, formality, stereotype, concreteness, generalization, seriousness of narration, standardization of business speech. The use of special terminology, which refers directly to military affairs, brings the texts of military subjects closer to the scientific and technical style [8, p. 89]. This greatly contributes to the mutual understanding of specialists in the military sphere of activity. Colloquial speech and, for example, professionalism, or "military slang", are not used in official documents. A significant place in military texts is given to abbreviations and abridgement. Thus, the functional styles of the language, at the junction of which military texts are located, determine the specifics of their translation. In addition to the structural division inherent in all discourses, the military discourse is divided into two main parts, formal and informal. The formal part of the military discourse includes military-artistic materials, military-publicistic and military-political materials, military-technical and military-scientific materials, and management acts related to the life and activities of the army and military institutions of the armed forces. Examples of informal discourse include communication in a military environment, military slang, and military anecdotes. [8, p. 126].

3. GRAMMATICAL AND LEXICAL FEATURES OF MILITARY TERMINOLOGY IN TRANSLATION

Military terminology requires special attention. New military terms are created according to the rules typical of English terminology as a whole. For example, an abbreviation, a phrase, an affix, a transfer of meaning (in a figurative meaning), a change in meaning, etc. I would like to note the most common terms in military texts: the English term ***Army*** is translated into Russian as ***Армия, сухопутные войска***. There are also a number of terms that have direct equivalents in Russian and English. These include ***Rifle, Field gun, Filed hospital, Mine detector.***

1. This mine detector *is designed for use on all grounds - Это* ***миноискатель*** *спроектирован для обнаружения мин, заложенных на любом типе грунта.*

2. Field Hospital *Staffers Provide Around-the-Clock Care in New York's Central Park - Сотрудники* ***полевого госпиталя*** *оказывают круглосуточную медицинскую помощь в…*

3. *I had a 9-millimeter pistol concealed in my waistband and* ***a rifle*** *with two 30-round magazines… - У меня за поясом висел 9ти – миллиметровый пистолет, а также* ***винтовка*** *с двумя магазинами по 30 патронов.* [6, p. 77]

In English military terminology there are terms denoting such realities that are absent in Russian terminology, but are expressed by generally accepted equivalents: ***Pentagon, Air National Guard, Territorial Army.***

1. *A secret* ***Pentagon*** *directive orders planning to try to destroy a militia group…-Секретная директива* ***Пентагона*** *приказывает попытаться уничтожить группу ополченцев .*

2. *To join the* ***Air National Guard****, you must be between 18 and 39 years old. - Для того, чтобы вступить в* ***национальную гвардию ВВС*** *США, Вам должно быть от 18 до 39 лет.*

3. The Territorial Army *would be renamed the Army Reserve under plans unveiled by Defense Secretary - В соответствии с планами, представленными министром обороны,* ***Территориальная армия*** *будет переименована в армейский резерв.* [6, p. 79]

In English military terminology there are terms denoting such realities that are not in Russian terminology, and at the same time there are no generally accepted equivalents. For this reason, translators have to face a number of difficulties in translating. The traditional translation of these terms is a description of the meaning of these terms: Fluid battlefield, Conventional forces, Green Berets; terms given in literal translation - General Stuff; transliteration - Master sergeant, as well as the translation using both versions (literal and transliteration) - Texas tower.

1. General staff, *in the military, a group of officers that assists the commander of a division or larger unit -* ***Общий штаб*** *– это группа офицеров, которая помогает командиру дивизии или командиру более крупного воинского формирования*

2. A master sergeant *is the military rank for a senior non-commissioned officer in the armed forces of some countries -* ***Мастер сержант*** *- это воинское звание старшего унтерофицера в вооруженных силах некоторых стран.*

3. The Texas Towers *were a set of three radar facilities off the eastern seaboard of the United States which were used for surveillance…* ***Техасскиебашни*** *представляли собой группу из трех радиолокационных*

сооружений у восточного побережья Соединенных Штатов, которые использовались для наблюдения ..

4. *In 2016, for the first time in America, more special operations than* ***conventional forces*** *died at war, a remarkable fact given that special operations make up less than 5% of the US military - В 2016 году в Америке впервые в военных конфликтах погибло больше военнослужащих из* ***войск специального назначения****, чем из войск,* ***оснащённых неядерными средствами ведения войны****, примечательно то, что войска специального назначения составляют менее 5% от всей американской армии.* [6, p. 80]

3.1. Pseudo-internationalism in the military lexicon

There are also a number of terms in the English military lexicon which spelling and pronunciation in Russian are identical. These terms are called pseudo-internationalisms: Position, Commission, Principal, Secretary, Department.

1. On Jan. 20, 2001 Colin Powell became the first African-American to be appointed to the ***position*** *of secretary of state- 20 января 2001 года Колин Пауэлл стал первым афро-американцем, назначенным на* ***должность*** *госсекретаря.*

2. Powell began his military career in the Reserve Officers Training Corps program at the City College of New York and received his ***commission*** *upon graduation in June 1958 - Пауэлл начал свою военную карьеру в колледже Нью-Йорка по программе корпуса вневойсковой подготовки офицерского резерва и получил* ***офицерское звание*** *после его окончания в 1958 г.*

3. Some Terai groups are illegal armed groups that use violence as a ***principal*** *strategy - Некоторые из этих групп представляют собой незаконные вооруженные формирования, которые избрали насилие в качестве своей* ***основной*** *стратегии.*

4. Powell was the highest ranking military officer in the United States Armed Forces, and the principal military adviser to the president of the United States, the National Security Council, and the ***secretary*** *of defense. - ...Пауэл был самым высокопоставленным офицером вооружённых сил США и главным военным советником президента Соединённых Штатов, руководителя Национального Совета безопасности и* ***министра*** *обороны США.*

5. The secretary has also led the State ***Department*** *in major efforts to solve region a land civil conflicts throughout the world... - В* ***Министерстве*** *иностранных дел США госсекретарь (министр) также отвечал за решение региональных и гражданских конфликтов во всём мире.* [6, p. 83]

3.2. Methods of semantic communication in military texts

It is necessary to pay attention to the methods of semantic communication during the compatibility of the texts used or constructed during the preparation of documents with a military content. Military terms used in military documents are inculcated by mass media to both the public and individuals. The main thing here is to pay attention to the correct explanation of these terms in different languages. Also, unlike other texts, military texts should not be exaggerated. Even a word or phrase in a military document can be vital. For this reason, military texts should generally be prepared in accordance with the principle of stability, ambiguity and polysemy leading to different interpretations should not be expected.

Certainly, learning the vocabulary of any language is very important. In order to use the language accurately and correctly, we need to address all areas of it. Unlike simple vocabulary exercises, encountering words in abundant texts with the help of authentic means accelerates the process of forming lexical habits. One of the main issues that arise is the correct selection of reading materials. Reading materials should be rich with military terms but also touch on topics that we need in our daily life. Topics in this format include *"Daily routine", "National security structure", "Service Functions and Responsibilities", "Organization - Headquarters, Department Of The Army", "Army Organization by components", "Army Organization by Branch", etc.* Such texts given in the military style show good results in enriching the language skills of the cadets. For example:

"The day a man enters any br of the Armed Forces he begins to take mil tng. The daily routine starts with "reveille" and ends with "laps." The mil tng, based on mil regulations, field manuals, technical manuals, and orders, includes instructions and classes, drill and ceremonies, physical fitness program, range practice, field exercises, map reading, tactics, etc.

Interior guard duty routine is also a part of soldier's life. Sols are detailed for duty according to a duty roster. The detail for guard consists of an officer of the day with necessary offs, noncoms and pvts. The senior noncom of the gd, whatever his gr, is known as the sergeant of the guard.

If there is no off of the gd he will perform the duties of the comdr of the gd. There it, always one CPL of the gd for each relief." [8 p. 74].

3.3. Examples of informal type of military discourse

The informal military discourse is a type of institutional discourse. It includes army jokes, slangs and everyday expressions. Along with jargon and slang, the use of common colloquial and slang expressions also indicates the cultural and educational level of the military group shown. Army slang is unlikely to be used in civilian life. All these factors show that most of the speech acts are related to the everyday life of the soldiers. However, these slangs have become popular among cadets. This is primarily reflected in the vocabulary. As we know, there are many borrowed military terms in the Azerbaijani language. Especially slangs were transferred from other foreign languages. For example, from the Russian terms: *дембель, дедовщина, горбатый дембель, кузнечики, партизина, самоход, самоволка, уставщина, начмед, начфин, начфиз, начвещь, начпро, замкомвзвод, каптёрка, капрал, кпп, etc*. are used informally from Russian to Azerbaijani**.** In English, these slangs are distinguished by their relevance. For example, *canteen - dog vomit, slop shop, chaw - hall, bread - punk, soup - hot weather, beans - bullets, sharpnel; food - baby food, meatballs - mystery balls, cheese - mouse trap, coffee - ink, shavetail general - brigadier general, golf leaf - major, half lieu - junior lieutenant, light colonel - lieutenant colonel, Big Bug - commander, brass ass - officer, iron ass – staff officer, etc. [1. p. 10]* are terms used informally in English terminology.

Military jargons from the NATO alphabet are used by various military personnel. Here are some examples of slang from the NATO alphabet: *Alpha Charlie - A vulgar term for verbal reprimand (ass chewing), Blue Falcon - Someone who betrays you (buddy f'er), Bravo Zulu - A compliment meaning 'well done', Charlie Foxtrot - Mixed is a vulgar term for the situation (a "clusterf--"), Charlie Mike - Continue the mission, Mike - One minute, NEGAT Bravo Zulu - a job that goes unsaid, Oscar Mike - always on the move, Tango Mike - Thank you very much, Tango Uniform – Failed operation ("t--s Up") [1. p. 12] and so on.*

4. CONCLUSIONS

The process of teaching a foreign language is also based on the concept of developmental education and is aimed at the development of the student's personality, who is able and willing to participate in intercultural communication. Currently, educational reform is eliminating conservatism in educational systems,

eliminating the gap between the level of personnel training and the needs of society. So, for this purpose, according to the modern trends in society and education, the goals and tasks of teaching foreign languages have been specified, the predominant competencies have been determined, and the content of education has been revised.

When teaching military-institutional discourse and speech in a foreign language to cadets, one should not forget about the actual linguistic and cognitive aspects reflected in the linguo-cognitive approach. The effectiveness of this approach is determined not only by the choice of language tools, but also by cognitive components. This includes, of course, the coincidence of linguistic units and the commonality of knowledge about the environment [2, p. 6].

Thus, in the formation of professional foreign language communicative competence of cadets, special teaching methods are required that develop linguistic and cognitive components that allow the implementation of military speech. In the formation of cadets' stylistic skills, the main attention should be focused on the implementation of professional activities, the formation of foreign language communicative competences and the correct selection of military discourses.

In the teaching of foreign languages, it is necessary to pay attention to a number of issues in the study of military discourse, military terminology, as well as military lexicon. Here, it is necessary to improve the ability to present various topics, discuss topics, debate, and especially work with text. It is possible to construct sentences that reflect reality using the presented word, use template words, build the association network of the studied word, etc. Sometimes it is to build a speech by taking examples from the speeches of prominent people, well-known generals, and to master their translation in an alternative language.

In the curriculum of military schools, such texts and discourses have a special place in the study of foreign languages. In order to form not only the language skills of the cadets, but also the stylistic skills, they should be familiar with the texts of general household, socio-political content, as well as the typical texts of the military-political style that are closely related to their specializations, the terms suitable for their specializations, the words and expressions characteristic of the term. This ensures the enrichment of their vocabulary with specialized military terms, and we also achieve a number of results in the direction of developing the national self-awareness of young cadets and increasing the feelings of military patriotism.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

REFERENCES

[1] Mehdiyeva G. About the correspondence problem of military documents and agreements of international organizations.// Baku Girls' University. Scientific works. Volume 10 No. 3 2019 (39) p. 7-13

[2] Mammadov Azad, Mammadov Misgar Cognitive perspectives of discourse analysis. Baku, Chashioqlu, 2010. – 96 p.

[3] Mammadzade Ainur Lexical features of the English-language military discourse // News of the Pedagogical University. Humanities Section, 2012, No. 3, pp. 163-165

[4] Mammadbayli Aysel The role of cultural frames in the cognitive structure of artistic discourse (on the material of the English language). Monograph. - Baku: Mutergim, 2020. -140 p.

[5] Arnold, I. V. Stylistics. Modern English: textbook / IV Arnold. - 13th ed., erased. - Moscow: FLINTA, 2016. - 384 p.

[6] Dyukov R.V., Kurgalina M.V. Military vocabulary in the aspect of translation // Language, communication and social environment. 2020. T.18. C. 75–83.

[7] Kalashnikova Olga Anatolyevna, Samoilova Antonina Vadimirovna (Krasnodar) A military scientific text as an object of linguistic analysis // News of the Volgograd State Pedagogical University. Philological sciences, 2021. No. 4, 124-130

[8] Nelyubin L. L. Textbook of military translation: textbook for universities / L. L. Nelyubin, A. A. Dormidontov, a. A. Vasilchenko - Moscow: Military Publishing house 1981. P. 379.

[9] Safonova O. Y. Stylistic features of military texts // E-scio. 2018. No. 4 (19) 140-142

THE INFLUENCE OF HYBRID ATTACKS ON A STATE IN AN ALLIED CONTEXT

Claudiu-Florin NISTOR

Land Forces Staff, Bucharest, Romania

The interdependence of states on each other is now increasingly visible, mainly from an economic perspective, due to the opening up of markets along with the phenomenon of globalisation. This relationship becomes more pronounced and visible in an allied or union context, where more relaxed trade policies between states also facilitate the negative effects of hybrid attacks on a member state or neighbour. The influence of such attacks, even if their main purpose is closely related to weakening the combat capacity of the adversary state and facilitating its own military advance, is felt over a wide regional area, undergoing a transformation from an attack with a military objective to an attack with an economic effect. A specific example of this is the hybrid attacks that have been enhanced by the Russian Federation's maritime supremacy in the Black Sea area bordering Ukraine, as a result of which maritime grain exports have been halted, with global effects that have required a joint effort by the main world players to avoid a possible crisis. This article analyses the immediate and medium-term effects of such hybrid attacks, especially those on the European continent, contrasting the two international entities, the European Union and the North Atlantic Treaty Organisation.

Key words: *hybrid attack, Euro-Atlantic area, national interdependence, alliance.*

1. INTRODUCTION

In an international community formed of states that are part of unions, alliances or states between which there is no formal form of connection, problems in one of them (caused by hybrid attacks) can have effects on another, often affecting economic relations. This gives substance to the hypothesis that in the 21st century, given the phenomenon of globalization and the dependence of economic markets on the world, the proper functioning of a state is closely related to the situation of the countries with which it has economic relations. Such a relationship generates, on the one hand, substantial and mutually beneficial economic advantages

evidenced in economic growth, but it also has negative effects since if a state suffers from internal problems or hybrid actions, not only it will be affected, but also the countries with which it has economic relations[1].

Hybrid attacks on a state often also have an indirect economic effect, inevitably affecting countries with relations with the target state. In a union context (e.g. the European Union), economic activities between states take place much faster than between two states with conventional borders, as the Schengen area allows goods and citizens to transit across borders much more easily, reducing bureaucracy and the usual controls [2].

In such an easy area for commercial traffic, the effects of hybrid attacks are ultimately felt by most states of the union, possibly also by those with which it borders. One consequence, caused by Russia's supremacy in the Black Sea region, is the embargo on Ukrainian shipping, thus compounding the economic problems created by the ongoing war [3].

2. THE DIMENSION OF A HYBRID WAR IN THE EURO-ATLANTIC AREA

In order to determine the size of a hybrid war in an allied context, it can be analyzed militarily from the perspective of the North Atlantic Alliance and socio-economically from the perspective of the European Union. In terms of the hybrid component, such a war (in the Alliance concept) involves both state and non-state actors, and its objectives are aimed at both political institutions, the collective mindset of the civilian population and the destabilisation of global security. To achieve these objectives, the main avenues of attack are propaganda, cyber attacks, disinformation and other unconventional tactics. Today's technology facilitates the propagation of the effects of these hostile actions, in terms of speed and intensity, due to the increased interconnectedness of the member states of an alliance or union, mainly caused by the phenomenon of globalisation. [4]

In order to build a basis for combating such hybrid actions, a state needs a sufficiently developed resilience capacity. From a national perspective, Romania has recognised this by including resilience capacity in the first chapter of the "National Defence Strategy for 2020-2024". [5]

Until 2015, from the point of view of the allied military context, the North Atlantic Alliance's official positions included a series of strategic objectives aimed at the security of the entire organisation in terms of protection against the effects of hybrid attacks. However, action on updating policies to prevent and combat hybrid threats has been delayed for the following reasons: [6]

1. Internally, the Alliance has developed a decision-making

process that cannot always be translated into concrete military action or any other instruments of action until hybrid action had an effect on the organisation or its member states;

2. Externally, the potential hybrid threats identified over time have tended to come from the same sphere of influence (predominantly from the Russian Federation, China, Pakistan, etc.), especially since the end of the Cold War;

3. Theoretically, the concepts of hybrid threat or attack require a more determined and concrete approach in line with Alliance policies. At the same time, this presents a number of implementation difficulties, given the decision-making process and security culture of member states [6].

This policy on hybrid threats and actions has evolved over time, so that since 2015, the organization has developed new strategies aimed at combating them by:

1. preparing the North Atlantic Alliance and its member states;
2. deterring hybrid threats;
3. countering them from the perspective of supporting any member or ally. [4]

A first direction, as an integrated part of the new strategies, is the preparation of member states by identifying the vulnerabilities of each state, analysing and disseminating each hybrid threat in by specialists of a special section, part of the Joint Security and Intelligence Division, which has been set up within the North Atlantic Alliance in response to future hybrid threats. [4]

This structure responds to issues related to hybrid threats by combining both military and civilian instruments, thereby improving the organisation's ability to deal with such threats.

The Alliance supports Member States in identifying their vulnerabilities, increasing their resilience and provides, upon request, critical situation support in various areas such as: C.B.R.N. incidents; critical infrastructure protection; strategic communications; civil protection; cyber defence; energy security; counter-terrorism. [4]

Another area of preparedness for member states is the exercises conducted by each state to educate themselves and raise awareness of the dangers posed by hybrid threats, involving both military and civilian elements in the process.

Anticipation of hybrid threats is a basic prerequisite for dealing with the hybrid problem. It contributes to increasing the ability of own forces to avoid hybrid action and improves decision-making. [4]

The last line of action, relates to countering hybrid threats in

support of any member state or ally, with reference to the need to ensure continuity of anticipation and preparedness activities to counter their effects. In this respect, if these activities are successfully carried out, in the event of a real situation, specific Alliance forces will be able to intervene at very short notice, anywhere and at any time.

An analysis of an individual state as compared to a member of a military alliance (or union) shows that the potential for responding to hybrid threats or actions must be commensurate, and its effectiveness increases as more experienced actors are involved in the decision-making process, whereas a state isolated in this respect may be unable to react adequately to such an event.

Membership of an international community (union or alliance) offers the possibility for a state to reduce the potential negative influence of the dominant state actor in the area, otherwise its possibilities for action are reduced. Such a situation is represented by the Republic of Moldova, which does not belong to the European Union or the North Atlantic Treaty Organisation.

The negative influence of the Russian Federation on the Republic of Moldova has manifested itself especially in the economic sphere. Due to the almost exclusive dependence on the Russian market, the export of mainly raw materials and unprocessed products and the price of energy, the gross domestic product of the Republic of Moldova was among the lowest of all countries on the entire European continent [7].

3. THE EFFECTS OF HYBRID ACTIONS ON A TARGETED STATE

According to the second point of the Alliance's Strategy for responding to hybrid threats [4], anticipating future hybrid attacks is an important part of addressing this issue, providing an opportunity to take measures that will ultimately lead to deterrence. This deterrence can be achieved both by building an appropriate defence that meets current needs, but also by threatening potential retaliation by responsible actors, whether state or non-state. In this regard, the crippling of a critical infrastructure (physical or virtual) by hybrid means (cyber attacks, sabotage, etc.) should be followed by immediate countermeasures by both the European Union and the North Atlantic Alliance, and doctrines need to be updated or developed in this regard. [8]

In 2022, the effects of hybrid instruments were felt across the Euro-Atlantic area, with sabotage actions on critical infrastructure key elements of certain states, with consequences for large parts of the European continent.

Some sabotage actions even

include the use of drones to achieve their objectives. In this case, on 6 October 2022 in Denmark, authorities reported several unauthorized drone flights in the area of the North Sea gas pipelines. These types of incidents have been repeated within a short period of time in the same area, and given that the possible target for action was a major gas pipeline, part of critical infrastructure, several European countries have proceeded to increase their defence capabilities.

One such example is Norway, which sent military structures to protect offshore oil and gas installations, and France, which increased its capacity to protect sea cables below sea level, prompted by fears of a possible imminent hybrid attack from Russia [9].

At the same time, two days after this event, another incident was reported in Germany, where rail transport in the north of the country was disrupted due to sabotage. According to the authorities the probability of an accidental event is zero, as the cables essential for rail transport were deliberately cut in two separate locations. This attack has caused serious delays to rail transport and the perpetrator of this attack on critical infrastructure has not yet been identified. [10]

Another example of a concrete hybrid action took place on 18 October 2022 in the United Kingdom area of the Shetland Islands archipelago, specifically, their connection to the outside world was disrupted as telephone cables and internet connections were severed in two separate locations. Although government authorities have stated that there is a possibility of an accident, the likelihood of two such events occurring in the same area is minimal, leaving room for hybrid actions. [9]

The sabotage actions in October 2022 were felt in North-Western Europe, so that in France two days later, on 20 October in Marseille, a similar event as the previous one occurred, with fibre optic cables serving the telephone network and Internet connection being cut, with global effects affecting Asia and Europe. [11]

However, hybrid actions directed against a state are not just about sabotage. In Norway, for example, a Brazilian researcher was arrested on 25 October on suspicion of spying for the Russian Federation by the Norwegian security agency. The latter charges that the false identity of the alleged Brazilian researcher at the University of Tromsø endangers the national security interests of the Nordic state. [12]

Despite the fact that the perpetrators of the hybrid activities described above have not been officially identified, these events cannot remain at the level of random accidents, since the evidence found

proves otherwise, the geographical area is the same, the time of occurrence is very short and the means used in their occurrence are unconventional.

According to the established criteria, these events can be classified as hybrid actions, since they affect the critical infrastructure of a state, their effects are felt on the rest of the continent, affect the civilian population and jeopardise national security interests.

The figure no. 1 shows the evolution of weekly cyber attacks in different industries worldwide. These attacks are an integral part of hybrid attacks and represent only a fraction of the total, so that the total of such attacks is much larger.

In order to produce an overview of hybrid actions, including statistical data and possible forecasting, it is necessary to keep a record of them, by different areas of activity, to meet the main prevention needs of

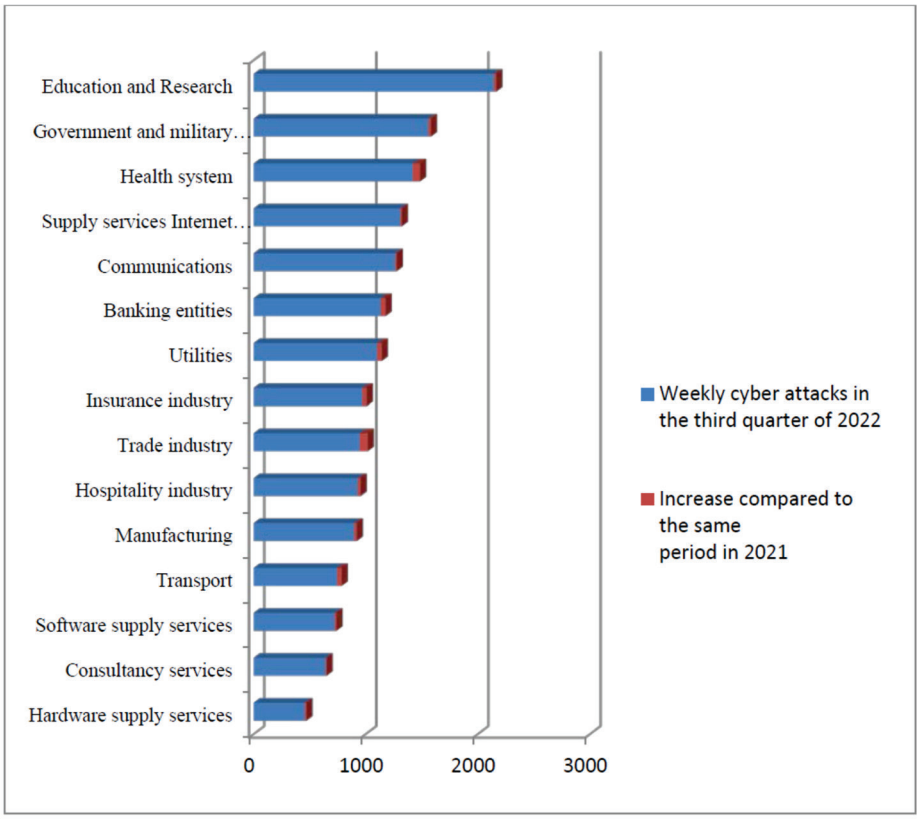

Fig. 1 The evolution of cyber actions, during one week, in the 3rd quarter of 2022, compared to the same period in 2021 [13]

the target countries, thus increasing the chances of anticipating future actions.

4. THE INFLUENCE OF HYBRID ATTACKS IN AN ALLIANCE ENVIRONMENT

In order to base an analysis on the main influences of hybrid actions at the level of an alliance or union, it must be specified that this type of actions targets national vulnerabilities, represented by political actors, military authorities, national economy, social classes, information systems and last but not least, critical infrastructure. In carrying out this type of action, a range of political, economic, civilian and informational instruments is used to achieve the proposed objectives, which go beyond the military border, so that combating this type of attack requires not only a classic military response but also the use of unconventional instruments, while using the measures available in the other sectors of activity affected. [14]

Among the most important effects of a hybrid attack is the economic one (affecting both state and private actors), for which significant funding is needed to remedy and possibly prevent in the future.

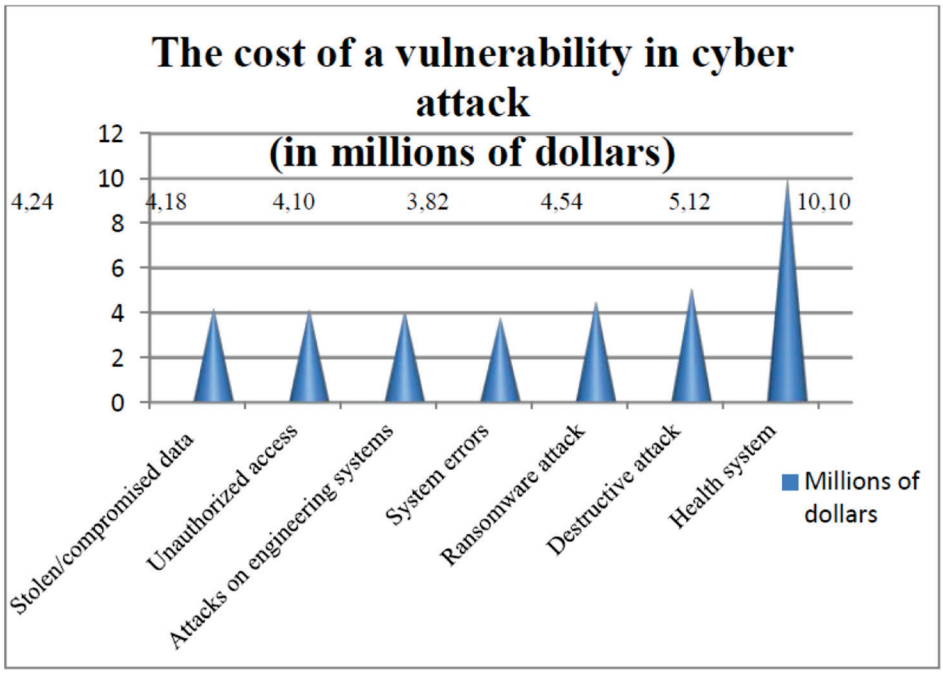

Fig. 2 The average cost of a vulnerability subject to a cyber attack [15]

Figure no. 2 shows the average cost of such a hybrid cyber action affecting either private or state-owned entities that are part of the critical infrastructure. In these cases, the target state may be economically affected, requiring measures to be taken to remedy the damage currently caused and future investments to prevent it.

Such examples, where actions targeted at one member state of an alliance have had effects on other members, are presented in the third chapter of this paper. At the same time, the complexity of actions makes it difficult for states to find a pattern of action and to develop precise methods for their prevention.

As a result of the effects of such attacks, a state's resilience capacity changes in the sense that it has to be able to adapt to possible similar scenarios in the future. In this respect, an example of measures to prevent certain cyber attacks is the increase in the protection capacity of public authorities' IT systems, which must be kept constantly updated in terms of security policies, i.e. anti-virus software must be purchased and staff must be trained to prevent such attacks.

Hybrid threats do not take into account the territorial borders of states and manifest themselves at international level, even if the initial intended target was a victim state, the final effect may be limited to other neighbouring states or even within the international community. This final effect is more visible in the context of the European Union or the North Atlantic Alliance, where due to interdependencies of an economic, social or military nature, the national vulnerability of one state can become a problem for another state actor, member of that alliance. In this respect, given that threats come in an international context, the united effort of action should be synchronised, systemic and combine national and international counter elements. [14]

5. CONCLUSIONS

In the light of the above, it can be concluded that hybrid actions against one member state of the European Union or the North Atlantic Treaty Organisation can have direct effects on other members. In the examples listed above, there is an interdependence of these states in terms of their economic relations and critical infrastructure.

In terms of visibility and reach, the result of damaging a state's critical infrastructure, which is linked to its neighbours, is an obvious topical issue, which has reached a critical stage mainly due to technological

advancement. This type of action is characterised by high efficiency, low cost, affects a large geographical area, generates high costs for restoring the infrastructure involved to operational status and usually affects several sectors of activity, both civilian and military.

At the same time, the use of cyber-attacks causes mainly material damage and the inability of certain systems to function for a certain period of time, while exfiltrating confidential data. In order to give a broader picture of the average costs of such hostile actions, Figure 2 provides some concrete data in this respect, but it should be noted that these types of actions in the information environment can be directed not only against a state, but also against private operators or even ordinary citizens, with financial benefits being the main objective.

In order to respond to these means of destabilising states, the members of the alliance or union must first of all make national efforts to resolve their own vulnerabilities, and then the main line of effort must be unity of action at international level.

At the same time, because of the complexity of the instruments used in hybrid actions and the distinct planes on which they manifest themselves, there is a need for a clear conceptual definition and measures to prevent and counter such actions, both nationally and in the allied context. The latter must not be carried out at military level alone, as it is not the only one targeted in such an attack, but requires the cohesion of several sectors of activity, from both civilian and military points of view.

ACKNOWLEDGEMENT

This article is original research and has not been published elsewhere.

REFERENCES

[1] Business Terms, *Economic Interdependence*, https://businessterms.org/economic-interdependence/;

[2] Ministry of Internal Affairs, Romania, *Spațiul Schengen,* http://www.schengen.mai.gov.ro/index04.htm;

[3] Council of European Union, *Infographic - Ukrainian grain exports explained*, https://www.consilium.europa.eu/en/infographics/ukrainian-grain-exports-explained/;

[4] North Atlantic Treaty Organization, *NATO's response to hybrid threats,* 2022, https://www.nato.int/cps/en/natohq/topics_156338.htm#:~:text=Hybrid%20threats%20combine%20military%20and,and%20use%20of%20regular%20forces.;

[5] National Defence Strategy for 2020-2024 ;

[6] Galkins, Kaspars, *NATO and Hybrid Conflict Unresolved Issues from the*

Past or Unresolvable Threats of the Present, Monterey, California. Naval Postgraduate School, 2012, https://calhoun.nps.edu/handle/10945/17369;

[7] International Monetary Fund, World Economic and Financial Surveys, *World Economic Outlook database: October 2022,* https://www.imf.org/en/Publications/WEO/weo-database/2022/October/weo-report?.

[8] Prof. Dr. Sven Biscop, *Military Offensives, Hybrid Attacks – And No Peace in Sight,* Egmont Royal Institute for International Relations, 30 september 2022, https://www.egmontinstitute.be/military-offensives-hybrid-attacks-and-no-peace-in-sight/;

[9] James Billot, *Hybrid attacks on the rise across Europe,* The Post, 26 October 2022, https://unherd.com/thepost/hybrid-attacks-on-the-rise-across-europe/;

[10] Sarah Marsh and Andreas Rinke, *"Malicious and targeted" sabotage halts rail traffic in northern Germany,* Reuters, 8 october 2022, https://www.reuters.com/world/europe/rail-northern-germany-standstill-due-technical-issue-2022-10-08/;

[11] John Leicester, *French police probe multiple cuts of major internet cables,* AP News, 21 october 2022, https://apnews.com/article/technology-europe-france-marseille-business-8b33a5634232031f#:~:text=LE%20PECQ%2C%20France%20(AP),phone%20services%20were%20severely%20disrupted.;

[12] Jon Henley and Pjotr Sauer, *Norway arrests 'Brazilian researcher' accused of spying for Russia,* The Guardian, https://www.theguardian.com/world/2022/oct/25/norway-arrests-brazilian-researcher-accused-of-spying-for-russia#:~:text=Norway%20arrests%20'Brazilian%20researcher'%20accused%20of%20spying%20for%20Russia,-This%20article%20is&text=Jos%C3%A9%20Assis%20Giammaria%2C%20the%20suspected,Giammaria%2C%20the%20suspected%20Russian%20agent.&text=Norway's%20domestic%20security%20agency%20has,of%20being%20a%20Russian%20spy.;

[13] Check Point Research: *Third quarter of 2022 reveals increase in cyberattacks and unexpected developments in global trends*, Check Point Software Technologies Ltd, https://blog.checkpoint.com/2022/10/26/third-quarter-of-2022-reveals-increase-in-cyberattacks/;

[14] Patrick J. Cullen, Erik Reichborn-Kjennerud, *MCDC Countering Hybrid Warfare Project: Understanding Hybrid Warfare A Multinational Capability Development Campaign project*, Norwegian Institute of International Affairs, 2017, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/647776/dar_mcdc_hybrid_warfare.pdf;

[15] International Business Machines Corporation, *Cost of a data breach 2022 - A million-dollar race to detect and respond,* https://www.ibm.com/reports/data-breach;