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Research dilemma of military logistics

Dylematy badawcze logistyki wojskowej

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Abstract. For many years, continuous work has been carried out at the level of theory and practice aimed at sorting out the terminological chaos and defining a transparent, universally acceptable scope of military logistics research. Despite many attempts made by numerous circles conducting scientific research on the problems of modern military logistics, so far it has not been possible to develop the necessary consensus. This state of affairs is most influenced by the interdisciplinary nature of logistics issues in the military sector and the high dynamics of changes taking place in military logistics systems, as well as their environment. Currently, however, many arguments indicate that for the further development of military logistics, it is necessary to undertake extensive research aimed at identifying the scope of its research fields and indicating further research perspectives of military logistics. The aim of the article is to identify and evaluate the scientific evolution of military logistics and to indicate its further research perspectives in an interdisciplinary formula. The research problem undertaken to be solved has been specified in the following form: what priority research directions should be adopted in the development of military logistics and what affects the improvement of its dimension to the expectations of entities creating the military logistics system? A number of methods were used in the material, among which the leading ones were: analysis and synthesis, querying the literature on the subject, abstraction and inference. As an empirical method, the diagnostic survey method using the expert interview technique was used. The adopted approach made it possible to obtain a cross-cutting nature of the considerations, at the same time providing grounds for further, extended research on this extremely important and current problem.
Keywords: military logistics, interdisciplinarity, research, dilema, science

Abstrakt. Od wielu lata trwają nieustanne prace na płaszczyźnie teorii i praktyki zmierzające do uporządkowania chaosu terminologicznego oraz określenia przejrzystego, powszechnie akceptowalnego zakresu

badań logistyki wojskowej. Pomimo wielu prób podejmowanych przez liczne środowiska, prowadzące badania naukowe nad problemami współczesnej logistyki wojskowej, dotychczas nie udało się wypracować niezbędnego konsensusu. Na taki stan rzeczy największy wpływ ma interdyscyplinarny charakter problematyki logistycznej w sektorze militarnym oraz duża dynamika zmian zachodzących w wojskowych systemach logistycznych, a także ich otoczeniu. Obecnie wiele argumentów wskazuje jednak na to, że dla dalszego rozwoju logistyki wojskowej niezbędne jest podjęcie szeroko zakrojonych badań ukierunkowanych na identyfikację zakresu jej pól oraz perspektyw badawczych. Celem artykułu jest identyfikacja i ocena naukowej ewolucji logistyki wojskowej oraz wskazanie jej dalszych perspektyw badawczych w formule interdyscyplinarnej. Podjęty do rozwiązania problem badawczy został sprecyzowany w następująco: jakie priorytetowe kierunki badań należy przyjąć w rozwoju logistyki wojskowej oraz co i w jakim zakresie wpływa w największym stopniu na doskonalenie jej wymiaru wobec oczekiwań podmiotów tworzących wojskowy system logistyczny? W materiale wykorzystano wiele metod, wśród których wiodące były: analiza i synteza, kwerenda literatury przedmiotu, abstrahowanie oraz wnioskowanie. Jako metodę empiryczną wykorzystano metodę sondażu diagnostycznego z użyciem techniki wywiadu eksperckiego. Przyjęte podejście umożliwiło uzyskanie przekrojowego charakteru rozważań, dając jednocześnie podstawy do dalszych, poszerzonych badań tego niezwykle istotnego oraz aktualnego problemu.
Słowa kluczowe: logistyka wojskowa, interdyscyplinarność, badania naukowe, dylematy, nauka

Introduction

Scientific research in the field of security and logistic support for the armed forces has been directed towards finding solutions enabling optimisation of processes satisfying current functioning and logistic needs of military subunits and units undergoing training or fighting for many years. They are conducted in many dimensions within different disciplines and scientific fields. With the development of military logistics in its practical dimension at the level of theory, scientists began to consider it in several aspects, primarily such as [1]:

- pragmatic - oriented towards the analysis of experience and the formulation of practical recommendations;
- management - equating logistics with management;
- IT - covering research on changes in logistics under the influence of IT development and concerning the process of designing, implementing and developing IT systems in logistics;
- mathematical - the subject of research is the application of mathematical models to solve logistic problems;
- technical - focusing on technical and organisational issues, transport problems and logistics infrastructure;
- economic - focused on the study of the cost-effectiveness of logistics activities in a changing environment; primarily includes the problems of rationalisation of total logistics costs and their components;
- systemic - which includes the study of logistics as a system of action; logistics is treated here as a general method of problem solving.

Such extensive research perspectives on military logistics result from its interdisciplinary character and result in the assumptions, contents and methods of

individual research concepts permeating each other, creating a difficult to unravel weave, characterised by specific interdependencies.

In view of the above, the aim of the study was to identify and evaluate the scientific evolution of military logistics and to indicate its further research perspectives in an interdisciplinary formula. The research problem was formulated as follows: which priority research directions should be adopted in the development of military logistics and what, and to what extent, influences the improvement of its dimension in relation to the expectations of entities forming the military logistics system? The aim of the study was subordinated to the structure of the article consisting of two main parts. The first one refers to the identification of contemporary research fields of military logistics and the second one indicates on the basis of empirical research results the research perspectives in the area of military logistics support. It should be stressed that due to the vastness and multidimensionality of the problem, the presented considerations are of a fragmentary nature, indicating, however, the essence of the researched problem.

Literature review

The issue of the development of military logistics, due to its interdisciplinarity, is the subject of research aimed at identifying development trends and indicating the possibility of optimizing the processes taking place in military logistics systems. In the past few years, there has been an increased interest in the planning and execution of military logistics operations. Military logistics as a branch of science is also responsible for providing comprehensive solutions in procurement, demand forecasting, inventory control, warehousing, and transportation operations in the most effective and efficient manner possible [13].

The published research results indicate that one of the development trends in military logistics is the implementation of solutions implemented in "civil logistics" [10]. Many others indicate that the development of logistics, including military and military, will be determined by the dynamic development of new technologies, in particular IT, such as the Internet of Things, robotization, Big Data [6], [12].

Another area of development of military logistics, noticed in the literature on the subject, is the provisions of the law and procedures for managing the logistic support of troops, correlated with the changes that have occurred in recent years in the security environment and systems of the armed forces of states, especially in central and east Europe. There are also trends for the adaptation of business solutions to the needs of military logistics systems [3].

Research fields of military logistics

The area of focus of research conducted by those involved in military logistics is very extensive. It refers to the sphere of interest of several scientific disciplines, which have a structured linguistic and terminological apparatus and a set of formed and separated parts of the knowledge of reality. As a result of research in the field of military logistics, a specific scientific knowledge is created, which is (should be) the basis for the improvement and development of tasks carried out in the framework of security and logistical support of units and military institutions. Nowadays, in the literature on science studies, it is indicated that the basic criteria for dividing the whole of scientific knowledge into components should be subject, methodological and linguistic differences, fulfilled together. In a somewhat simpler version, it is simply considered that fragments of science are separated by object and method. According to scientists, the most commonly used division of science into its components is the division distinguishing three degrees: field of science, discipline of science and scientific speciality. They are defined as follows [9]:

- a field of science is a coherent system of knowledge containing the common laws, theories and methods of its disciplines used to produce the scientific knowledge of the field;
- a scientific discipline is a system of knowledge containing detailed laws, theories and methods used to solve specific scientific problems and increasing the knowledge of the field to which it belongs;
- a scientific speciality is generated by the objects studied within it and makes it possible to study or design by the scientific methods of the disciplines, a chosen type of mental or material object, and may be part of a single basic discipline but may also belong to several disciplines.

Many studies have been devoted to the issues of science, its identity and classification. It is noticeable that one of the basic duties of scientists identifying themselves with a particular discipline, field or area of knowledge is to constantly discuss the identity of the science they practice. While in everyday life an intuitive perception of the boundaries and peculiarities of individual scientific fields is sufficient, in some situations a more structured and thoughtful approach is required [7].

In view of the above, it is worth pointing out that the results of research to date unambiguously indicate that the development of modern military logistics requires the simultaneous use of the latest achievements of science and technology, especially in the field of applied research and development work and the widespread use of the achievements of management science and quality in improving the applied solutions, and as a consequence to develop optimal solutions. At present, it also seems reasonable to state that the area of special exploration of military logistics is the theory and practice aimed at optimising the management of organic and acquired logistic resources with a particular focus on maximising the effectiveness of applied

solutions. The overriding aim of scientific research undertaken in the area of military logistics appears, therefore, to be the precise definition of challenges and expectations in relation to all elements of the logistics system, as a prerequisite for the proper management of logistical potential used in all conditions of state functioning for the benefit of military units and institutions. In this regard, research and development work should be carried out in two main aspects: operational and technical. The operational aspect is related to the necessity of carrying out research aimed at obtaining an answer as to what capabilities the logistics system should be characterised by and determining the capabilities that should remain the responsibility of combat support subunits. This allows for optimal use of the technical and material resources at one's disposal and determines the capabilities necessary for acquisition. The technical aspect is related to the conduct of research aimed at acquiring tools to ensure the realisation in the technical and technological dimension of an effective logistic protection giving the possibility of full use of the operational capabilities of the armed forces. It includes in particular technologies in the field of: exploitation of military equipment, procurement and storage of means of supply, reconnaissance and technical evacuation, servicing and maintenance and repair of military equipment, new technologies in the field of: integrated information technologies enabling to obtain a picture of a uniform logistic situation - LCOP (Logistic Common Operation Picture). The pursuit of a holistic approach to solving logistic problems has resulted in the past and is related nowadays to the necessity of continuous search for optimal solutions in logistic activities. Optimisation, which in its essence is the selection of the best solution from among those available under given conditions from the perspective of a specific criterion, is the primary task of logistics in its theoretical as well as practical dimension [8]. It translates into its detailed tasks, which include, above all [11]: streamlining the management of material goods flow processes and, as a consequence, fully satisfying the material needs of logistic process participants; subordinating logistic activities to the requirements of recipient (client) service; increasing the flow efficiency, which in the military sector is expressed primarily in the aim to reduce the expenditure ensuring the implementation of operational tasks at the expected level.

Concluding this part of the article, it should be indicated that in the area of military logistics it is possible to point to well-established and emerging problem fields. The former certainly includes areas of scientific knowledge correlated with subsystems and functional areas of the military logistics system. They are relatively clear although their boundaries are in many cases blurred and historically changeable. The challenge for the further scientific development of military logistics will certainly be the identification of new, so far insufficiently researched problem areas influencing the proper functioning of military logistics systems. To this end, it has proved necessary to conduct empirical research, the description of which is presented in the second part of the article.

Research perspectives in the field of military logistics support - empirical studies

On the basis of the source literature, in order to solve the defined research problem it turned out to be necessary to conduct empirical research. Due to the nature of the area researched, the method of diagnostic survey conducted with the expert interview technique was selected as the most appropriate. Prepared interview sheets, containing two open-ended questions, were addressed to 8 experts representing scientific circles (7 experts) and institutions of the Polish Armed Forces (1 expert). The experts had in-depth knowledge and long-term experience in conducting scientific research on the development of military logistics systems. In the first part of the interview the experts referred to the question: *Please indicate the priority directions of research in particular subsystems and functional areas of the military logistic system of the Polish Armed Forces and specify probable difficulties in the implementation of the research process. The second question was in the form: Please propose determinants of improvement of individual subsystems and functional areas of the military logistic system of the Armed Forces of the Republic of Poland.*

Due to the limited scope of this material, the results of empirical research have been aggregated and presented in Table 1. *Priority directions of research of the military logistics system of the Polish Armed Forces and* Table 2. *Key determinants of the military logistics system improvement*. Due to the secrecy of the information, the area of mobilisation of the economy and strategic reserves was deliberately omitted.

Table 1. Priority research directions of the military logistic system of the Polish Armed Forces

AREAS OF RESEARCH	PRIORITY RESEARCH DIRECTIONS	
	CLOSER PERSPECTIVE (up to 5 years)	FURTHER PERSPECTIVE (beyond 5 years)
Management subsystem	structural and procedural changes in the effectiveness of managing logistic protection as a consequence of an increase in the potential of the Polish Armed Forces; a system of education and training for managers at all levels of the military logistics system; strategic management processes;	innovative information technologies dedicated to logistics resource management (hyper-converged infrastructure - HCI; managerial competences of logistics executives in the armed forces;
Technical subsystem	technical evacuation systems; the efficiency of the processes carried out;	„future technologies" used in the civilian sector; artificial intelligence, IT - „cloud"
Materials subsystem	the level of commoditisation of material stocks at all levels of logistics provision; integrated visualisation of the material situation at all levels of the military logistics system;	fuels of the future, renewable energy sources, Smart Energy automation of military stores;

Tab. 1. cd.

AREAS OF RESEARCH	PRIORITY RESEARCH DIRECTIONS	
	CLOSER PERSPECTIVE (up to 5 years)	FURTHER PERSPECTIVE (beyond 5 years)
Transport and traffic subsystem	autonomous transport platforms; intelligent transport management systems;	innovative solutions for means of transport (drones, robots, autonomous vehicles); space technologies;
Military infrastructure subsystem	new technologies in construction; renewable energy sources;	smart military infrastructure; „barracks of the future";
Medical subsystem	structural and procedural changes in battlefield medical support; digital medical diagnostics;	artificial intelligence in battlefield medicine vaccines based on nanostructure carriers;
Host state support area	legal and procedural developments in support of allied troops infrastructure investments	intelligent army traffic management systems

Source: Own elaboration based on expert survey

The opinions of experts presented in Table 1 have been collated in terms of common positions of most of them. It is worth noting that the experts, despite representing different research areas, in most cases agreed on the need to intensify research on the real capabilities of the military logistics system for the needs of the planned increase in the potential of the armed forces in the coming years. Both the increase in the number of soldiers and the increase in the number of military equipment will generate increased logistic needs. Along with newly formed military units and tactical compounds, logistics structures must be created to ensure effective support for troops at levels I, II and III of logistics protection. This requires changes in each of the subsystems of the military logistics system. Secondly, the need for a wider and faster implementation of new technologies for the needs of military logistics systems has been stressed. Despite the ongoing process of implementation of IT systems in the Polish Armed Forces to support the identification of means of supply and inventory management, the dynamic development of such technologies as artificial intelligence, Big Data, robotisation and the Internet of things, shed new light on the possibilities of their use in the armed forces. The above-mentioned areas are in line with the defined priority directions of research in the Ministry of National Defence [4]. The need for research into the possibilities of broad application of new technologies in military logistics systems, according to experts, stems from two reasons. The first is the need to adapt to the standards of contemporary and future supply chains, whose customers are the armed forces, and where modern technologies are increasingly widely used. This is to facilitate future cooperation, through the ability to better share information,

track cargo and speed up service delivery. The second reason stems from the plans to introduce a large number of modern military equipment to the Polish Armed Forces and, as a consequence, to increase the inventory of means of supply and goods, which will require an efficient system of inventory management and logistics services, for which IT systems will be necessary to support the management and implementation of logistics processes, integrated with other national and allied systems operating in the Polish Armed Forces.

The collected opinions gave rise to the identification of key determinants conditioning the improvement of the military logistics system. Out of the collected experts' suggestions, 2 to 4 determinants, the most important from the perspective of the development of the studied logistics subsystems, were selected. The results are presented in Table 2.

Table 2. Key determinants for improving the military logistics system

AREAS	KEY DETERMINANTS OF IMPROVEMENT
Management subsystem	comprehensive, regular education and training of logistics managers; adaptation of the procedures for managing the logistical protection of troops to dynamic changes in the armed forces and their environment; guaranteeing real-time access to logistical information at the various levels of military logistic support;
Technical subsystem	maximum unification of technical equipment; upgrading of military stationary and field technical infrastructure; adjusting the duration and scope of technical maintenance to the technological level of military equipment;
Materials subsystem	ensuring the required level of stocks of means of supply at particular levels of logistic protection of troops; upgrading of the technical infrastructure of supply depots; simplifying procedures for obtaining supplies for troops;
Transport and traffic subsystem	increasing capacity at tactical level; enhancing the redeployment capacity of troops, equipment and supplies at tactical, operational and strategic levels; improving delivery effectiveness on the modern battlefield;
Military infrastructure subsystem	adaptation of the barracks infrastructure to NATO standards; upgrading of accommodation, storage and training facilities; increasing the temporary accommodation of soldiers; streamlining the process of launching new investments;
Medical subsystem	preparing military medicine and medical logistics personnel for the needs of present and future Polish Armed Forces; improving the level of medical diagnosis on the battlefield;
Host state support area	shortening the decision-making process for approvals and permits in areas of cooperation between military and non-military links; adaptation of the state's military and transport infrastructure to the increased presence of allied forces.

Source: Own elaboration based on expert survey

The key determinants of improvement of the military logistics system, identified on the basis of expert opinion, in the face of challenges facing the Polish Armed Forces reflect in fact the needs for necessary changes in the potential and capabilities of the logistics system of the Polish Armed Forces. This will be related to the modernisation of logistics infrastructure, logistics equipment, education and training of personnel, as well as verification of legal provisions and management procedures.

In Table 3. the *greatest research difficulties*, the experts' opinions on the limitations of the research process in the development of the logistics system of the Polish Armed Forces are presented.

Table 3. The greatest research difficulties in developing a military logistics system

MAJOR RESEARCH DIFFICULTIES
frequent changes in the strategic vision of the armed forces resulting from the current situation - changes in the concept of development of the Polish Armed Forces;
secrecy of information and limited availability of data for scientific research teams;
the need to obtain formal approvals for conducting social research - difficult collection of empirical material;
limited possibilities to publish actual research results - research dilemmas in a hierarchical organisation;
the marginal nature of research in the evaluation of scientific entities;
limited scientific resources for military logistics research;
insufficient sources of funding for interdisciplinary research into the problems of military logistics security and support.

Source: Own elaboration based on expert survey

Among the mentioned difficulties, the most frequently mentioned were formal limitations, connected with the secrecy of some information, which limits both the access to knowledge and the universality of scientific publications, as well as the procedures required to conduct research in the Ministry of National Defence, which should be taken into account by researchers when drawing up a research plan [5].

Summing up the empirical part of the article, it should be noted that the main factors influencing the directions and dynamics of development of the military logistics system are the changes taking place in the whole armed forces and their environment, resulting from the challenges of national and international security environment and the need to meet the allied standards, while adapting to modern trends in the civilian market. Opinions presented in this part of the material constitute only a part of this extremely complex and multifaceted phenomenon, and the presented views may be only a contribution to further, extended research.

Final conclusions

The results obtained in the research process allow the following general conclusions to be drawn:

In the area of military logistics it is possible to point to well-established and emerging problem fields, correlated with subsystems and functional areas of the military logistics system.

Priority research directions of the military logistic system of the Polish Armed Forces in a closer perspective will be concentrated around building capabilities for logistic support and protection of troops in conditions of increased numbers.

In the longer term, research will concern the implementation of innovative technologies for military logistics systems.

The development of the military logistics system of the Polish Armed Forces will be determined by a number of improvement activities, in terms of technical and material potential and infrastructure, education and training of personnel, management procedures and legal solutions.

The implementation of the research process on the improvement of the military logistics system is associated with a number of constraints that researchers should take into account, when developing research tasks.

In conclusion, it should be stressed that conducting research in the field of military logistics, is extremely important due to the dynamic changes occurring in both the security environment and civil logistics, while pointing to further problem areas, the knowledge and ordering of which is necessary for its further development.

BIBLIOGRAPHY

[1] Brzeziński, M., 2007. Systemy w logistyce, WAT, Warszawa 2007, 25.

[2] Brzeziński, M., 2010. Podejście systemowe w logistyce, „Systemy Logistyczne Wojsk" 38/2010, 17-18.

[3] Bury, P., 2021. Conceptualising the quiet revolution: the post-Fordist revolution in western military logistics, "European Security", 30 (1), 112-136.

[4] Decision No. 235/DNiSW MON of 26 June 2019 on the introduction for official use of the document entitled "Priority directions of research in the Ministry of National Defence for 2017-2026".

[5] Decision No. 40/MON of 22 March 2022 on the coordination, planning and implementation of scientific research in the Ministry of National Defence.

[6] Fernández-Villacañas Marín, M.A., 2020. The Transformation of the Defense and Security Sector to the New Logistics 4.0: Public–Private Cooperation as a Necessary Catalyst Strategy. In: Rocha, Á., Pereira, R. (eds) "Developments and Advances in Defense and Security. Smart Innovation, Systems and Technologies", 152. Springer, Singapore, 293–303.

[7] Gorynia, M., 2018. Współczesne nauki ekonomiczne: tożsamość, ewolucja, klasyfikacje, „Ekonomista" 5, 497.

[8] Jałowiec, T., 2020. Paradygmaty logistyki wojskowej, Difin, Warszawa, 67.

[9] Pabis, S., Jaros M., 2009. O klasyfikacji nauk, „Forum Akademickie", 2, 22.

[10] Rutner, S.M., Aviles, M. and Cox, S., 2012. „Logistics evolution: a comparison of military and commercial logistics thought", The International Journal of Logistics Management, 23, 1, 96-118.

[11] Skowronek, Cz., Sarjusz-Wolski Z., 2008. Logistyka w przedsiębiorstwie, PWE, Warszawa, 20-21.

[12] Wang, J., Ling, D., Liu, W., Hu, S., Jiang, F., 2020. Research on Metadata System and Model of Military Logistics Information Resources. In: Deng, Z. (eds), 2019. "Proceedings of 2019 Chinese Intelligent Automation Conference". CIAC 2019. Lecture Notes in Electrical Engineering, 586. Springer, Singapore, 699–708.

[13] Zeimpekis, V., Kaimakamis, G., Nicholas, J., Daras, N. J., 2015. Military Logistics Research Advances and Future Trends, Springer International Publishing Switzerland, 105-169.