

INFORMATIONAL ASPECTS OF COMBAT LOGISTICS

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Abstract:

The article aims at presenting the way the perception of the essence of a contemporary operation has changed along with the changes in the international security environment and how the significance of information in combat logistics has evolved. The first part of the study comprises the synthesis of the content characterising the international security environment and the terms defining a contemporary military operation. The subsequent, subdivided, parts contain the synthesis of materials identifying the term "information" and aim at presenting its essence and role in the contemporary combat logistics. The content focusing on the significance of information in logistics has been substantiated with numerous examples from history. The article was prepared on the basis of multifaceted analyses of professional literature as well as periodicals concentrating on both logistics support and information, which made it possible to carry out the synthesis and formulate conclusions.

Keywords:

information, logistics, operation, combat, logistics service support

INTRODUCTION

Recent military events observed both in our part of Europe and in the Middle East as well as the analysis of studies of theoreticians and practitioners preoccupied with the art of warfare indicate that the traditional understanding of combat as the subject of cognition for this field of study underwent a fundamental change at the outset of the 21st century. The suitability of Clausewitz's theory for the new conditions in the field of security has not withstood the test of time to some extent. Taking into account the recently observed conflicts even Clausewitz's philosophy of war is being questioned, as

it refers to wars fought between nations organised into states. At present, wars with non-state participants are increasingly often observed¹. Samuel Huntington's perception of the core of contemporary threats, in a general sense, has been described as follows: "All these developments have led many to see the gradual end of the hard, "billiard ball" state, which purportedly has been the norm since the Treaty of Westphalia in 1648, and the emergence of a varied, complex, multi-layered international order more closely resembling that of medieval times²." General Sir Rupert Smith, in his book *The Utility of Force*, defines contemporary threats and measures of countering them as the fourth generation warfare, providing the following definition of their nature: "The war of the industrial era no longer exists. At present, it can be observed that our opponents are formless, and their leaders and operatives are outside the structures in which we order the world and society ... It is a war amongst the people³". The experience gained from the observation of military operations conducted in the Republic of Iraq, Afghanistan, in the Middle East, in Central Africa and in Ukraine evidences that a contemporary enemy, perceived as a non-state entity, is capable of asymmetric response consisting in the combination of guerrilla war or riots, which are characterised by unpredictability and uniqueness, and furthermore, can be supported by other economically strong organisations or even states interested in these developments. The recent actions taken by separatists in Ukraine induced military specialists to attempt to define a new type of operation, which was called a hybrid operation. Asymmetric and hybrid warfare is characterised by the fact that it does not involve significant forces or measures to achieve the intended objectives. The events referred to hereinabove seem to corroborate Samuel P. Huntington's predictions formulated in the 1990s regarding the civilisation of cold war between the Islam and the West, "Cold peace, cold war, trade war, quasi war, uneasy peace, troubled relations, intense rivalry, competitive coexistence, arms races: these phrases are the most probable descriptions of relations between entities from different civilisations⁴." New conditions, evolving in the international security environment, for conducting military operations against forces engaged in asymmetric or hybrid warfare, entail the necessity of withdrawing from the theory of direct military operations conducted by concentrated armed forces in favour of more conceptually sophisticated and flexibly conducted indirect and manoeuvring operations, aimed at eliminating the possibility of spreading of a given conflict and restoring the situation from before the crisis within a specified time frame.

The complexity of the contemporary security environment thus depicted undoubtedly results from the permeation of the states of peace, crisis, conflict or combat, because of which the armed forces have to retain the ability to perform extremely different

¹ S. Koziej: *Strategia i potencjał obronny Polski w ramach członkostwa w NATO*, Warszawa 2001, p. 5.

² Samuel P. Huntington, *Zderzenie cywilizacji*, WWL Muza, Warszawa 2008, p. 35.

³ K. Kowalski, S. Hajt, G. Stankiewicz, *Wybrane aspekty operacyjno-logistyczne determinujące przestrzeń optymalizacyjną systemu logistycznego sił zbrojnych*. [in:] "Logistyka i transport", No. 2/2009.

⁴ Samuel P. Huntington, *Zderzenie...*, p. 354.

operations – starting with those below the threshold of war and ending with conventional warfare, conducted under dynamically changing circumstances⁵.

1. SSENCE OF A CONTEMPORARY MILITARY OPERATION

In professional literature the term “operation” has various definitions, as it is influenced by both the changing conditions of combat and the views of theoreticians on the rules of conducting it and achieving the predefined objectives. S. Koziej⁶ defines it as a clash with the enemy on an operational scale, where it forms a set of battles and operational and tactical actions of a lower level – reciprocally related with regard to the objective, place and time. According to W. Kaczmarek⁷ an operation is an action taken by operational groups (operational concentration) of armed forces, or sometimes by tactical groups formed by one or several branches of armed forces, which should lead to the achievement of strategic goals. *Encyklopedia...*⁸ defines an operation as the entirety of actions of armed forces (combat, battles, redeployments and manoeuvres) as well as organisational and security initiatives, carried out at different times and over a sizeable territory, connected by a common objective and plan. With respect to their objective and nature military operations of the main forces in a given group (concentration) of armed forces can be divided into offensive, defensive and withdrawal operations. A different approach can be found in the allied administrative publications⁹, where an operation is viewed as a military action or the implementation of military strategic, tactical, training, protective or administrative missions, or it is also a process of conducting combat operations, including deployment, delivery of supplies, attack, defence and transport necessary to achieve the goals of a battle or campaign. *Słownik...*¹⁰ [glossary] prepared by the employees of AON (the National Defence University of Warsaw) defines an operation as the entirety of military and non-military initiatives directed by the strategic management and carried out by the uniform operational command in order to achieve a strategic objective (to obtain a resolution).

The analysis of both the available literature and the course of conflicts that took place after the Second World War provides the basis for formulating a thesis that under the contemporary conditions none of the above operations, in their pure form, will occur. Under the present circumstances the best effects are produced by combining the efforts of respective branches of armed forces within one common operation – a joint operation. This operation consists in the synchronisation of efforts of forces and means of combat of different branches of armed forces during the fulfilment of operational tasks and in the use of their diversified capabilities to obtain synergies, so that the effects of such operations could exceed the ordinary sum of results produced by

⁵ Based on a fragment of the doctoral thesis of G. Stankiewicz.

⁶ S. Koziej, *Teoria sztuki wojennej*, Bellona, Warszawa 1993, p. 18.

⁷ W. Kaczmarek, *Działania operacyjne wojsk lądowych*, AON, Warszawa 2004, p. 21.

⁸ *Mała encyklopedia wojskowa*, Tom 2, MON, Warszawa 1970, p. 523-524.

⁹ *NATO glossary of terms and definitions (AAP-6)*. North Atlantic Treaty Organization NATO Standardization Agency (NSA), 2009, p. 2-O-2.

¹⁰ *Słownik terminów z zakresu bezpieczeństwa*, AON, Warszawa 2002, p. 92.

individual operations of respective branches of armed forces.¹¹ The results of considerations presented hereinabove provide the sufficient basis for an unambiguous statement that fire, movement and information still remain the elementary factors of combat¹².

The considerable organisational complexity, the high dynamics of conducted operations as well as the increasingly sophisticated and precise military equipment generate, on a continuous basis, additional needs of commanders with regard to information, the consequence of which is the creation of a network centric battlefield.

On the basis of the general analysis of both the current geopolitical situation and the new, in terms of quality, conditions for conducting a wide range of operations by armed forces the conclusion can be drawn that the armies' demand for various types of information has been rapidly growing, to enable them to obtain a coherent picture of a battlefield and to form quickly the knowledge of the current operations and emerging tendencies. The essence of the knowledge formed on the basis of information from the battlefield¹³ (Fig. 1. presents the superiority and inclusion relations of such terms as sign, data, information, knowledge, wisdom and truth) is to have the possibility, taking account of the dynamics of the operations in progress, of developing new creative scenarios (forecasts and variants) for further actions.

Information should, as quickly as possible, create the picture of the location of all stationary and mobile logistics resources (material, technical, transport and service resources) of one's own and enemy's forces and provide on this basis the knowledge of the possibilities of their use appropriately for the needs at a specific place and with a minimum response time. Furthermore, it should provide the knowledge of potential possibilities of exerting a destructive impact on the logistics system by the enemy. It is important to form, on the basis of information provided in real time, the dialectical awareness of key entities (military staff and armed forces) taking part in combat.

2. IDENTIFICATION OF THE ESSENCE OF THE TERM "INFORMATION"

What is the information in combat and how to understand it? "Information" is a complex notion, occurring in various disciplines: statistics, psychology, information technology, political science, economics and also in logistics. Therefore, it is difficult to es-

¹¹ M. Wiatr, *Operacje połączone*, Adam Marszałek, Toruń 2006, p. 29.

¹² Cf.: *Taktyka ogólna wojsk lądowych. Podręcznik*. Praca zbiorowa (ed.) M. Huzarskiego. AON, Warszawa 2000, p. 32.

¹³ Considering the information as a set of data it can be concluded that the primary element of each information is represented by data that need to be appropriately structured, because otherwise such data are meaningless, despite the fact that they can be, for example, stored (e.g. recorded on a disk). According to the infological interpretation data form elements of a message and they can be defined as "a section of reality adapted to represent another section of reality". Such definition incorporates different types of data: notations, analogue representation, speech, images, sounds, diagrams, films, etc. Therefore, the information is formed exclusively by a structured data set. cf.: B. Stefanowicz: *Informacja. Wiedza. Mądrość*. Biblioteka Wiadomości Statystycznych – tom 66, GUS, Warszawa 2013, p. 17. [online]. [available: 23.07.2014]. Available on the Internet: http://stat.gov.pl/cps/rde/xbcr/gus/OZ_Informacja_Wiedza_Madros_180413.pdf.

establish one common interpretation for this term. The popular meaning of the term “information” is most often deemed to signify the act of notifying of something or communicating something, a message, an indication or an instruction. The term is thus described in *Uniwersalny słownik...*¹⁴. However, in *Nowa encyklopedia...*¹⁵ the notion of information is defined as an abstract object, which can be, in a coded form (data), stored, sent (e.g. vocally, as an electromagnetic wave) and used for control purposes (e.g. a computer controlled by a program). L. Ciborowski defined the notion of information in the following way: *information is a stimulus acting on the human sensory system, that causes the production, in a man’s imagination, of an object of thought, reflecting the image of a material or abstract thing (object, process, phenomenon, notion, etc.), which according to his belief (consciousness) is somehow associated with such stimulus*¹⁶.

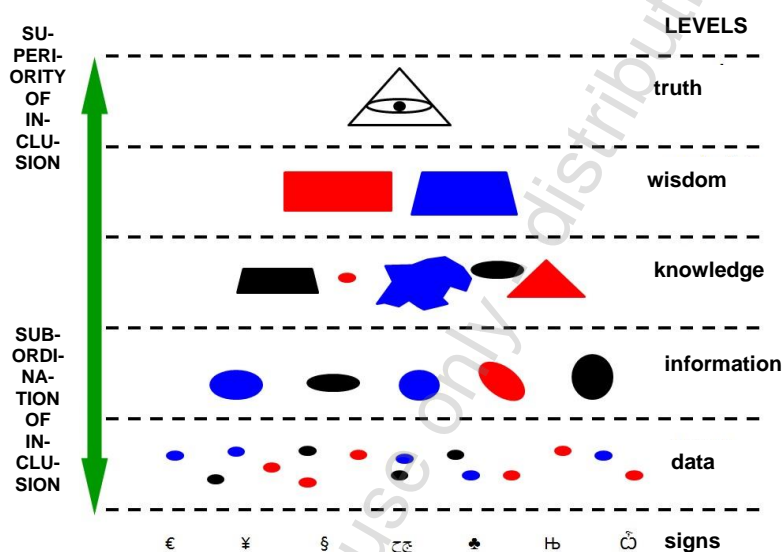


Fig. 1. Superiority and inclusion relations of such terms as sign, data, information, knowledge, wisdom and truth

Source: Own work by G. Stankiewicz on the basis of: Z. Antczak: *Zagadnienie wiedzy w kontekście organizacji (w ujęciu epistemologiczno-semantycznym)*. [in:] *Nauki społeczne. Social sciences. 1 (7) 2013. UE, Wrocław 2013, p. 19.*

The occurrence of information in various areas of social life (thus, also in combat) makes it possible to distinguish a number of its characteristics, which are presented in the figure below. Owing to the identification of properties characterising information, it is possible to distinguish the groups of qualitative criteria (Tab. 1.), which should be satisfied by it.

¹⁴ *Uniwersalny słownik języka polskiego, Tom I (A-J)*, (ed.) S. Dubisz. PWN, Warszawa 2006, p. 1212.

¹⁵ *Nowa encyklopedia powszechna PWN*, PWN, Warszawa 1995, s. 54.

¹⁶ L. Ciborowski, *Walka informacyjna*, Adam Marszałek, Toruń 1999, p. 50.

A little known fact which occurred on the Omaha beach in Normandy, during the first day (6 June 1944) of the landing operation under the code name Overlord, can serve as an example of the information in combat at the operational and tactical level, which satisfies the qualitative criteria. On the first day of this gigantic landing operation the most precise shot during the whole invasion was fired in the direction of the beach, from the distance of eleven kilometres from the seashore. A 152 [mm] projectile was fired from the light cruiser HMS Ajax and it went straight into the embrasure in the tower of the perfectly camouflaged bunker, exactly at the moment when the breech block of the cannon was open and the crew was loading it. The whole mechanism of the 155 [mm] cannon breech block was completely destroyed and the steel barrel, 7.62 [cm] thick, was shattered to pieces¹⁷. This cannon, like many others by the time they have been eliminated from combat, inflicted huge losses among the landing soldiers and equipment.

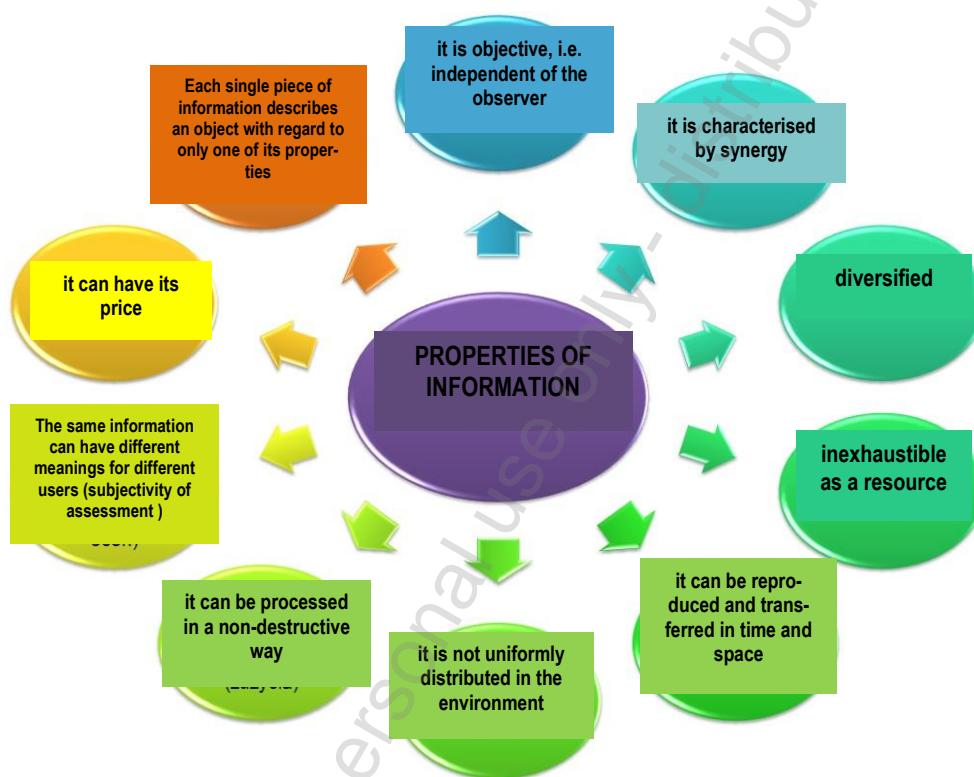


Fig. 2. The set of properties of information

Source: own work by G. Stankiewicz on the basis of: W. Gryncewicz: *Doskonalenie jakości informacji w jednostkach administracji skarbowej. Podejście infologiczne. Praca doktorska.* AE, Wrocław 2007, s. 47.

Such an incredibly accurate shot was fired owing to the information obtained in an original way¹⁸ one year earlier. The information, having been deemed credible, was

¹⁷ S. E. Ambrose, *D-Day 6 czerwca 1944*, Magnum, Warszawa 2012, p. 508.

¹⁸ The blind son of the farmer on whose land the Germans were building a large bunker, being a part of the huge and complex system of fortifications of the Atlantic Wall, posed no threat, in the opinion of the German soldiers, and was allowed to move freely near the construction site of the bunker. The

subject to complex processing into the useful information, that is an ordinary order to fire.

Table 1. Specification of groups of qualitative criteria

No.	TYPE OF QUALITATIVE CRITERION	DESCRIPTION
1.	FUNCTIONALITY	joint, resultant extent to which the requirements concerning the intended purpose of the product, for example information, are fulfilled
2.	CORRECTNESS	extent to which the requirements for the conditions and process of making the product (information) are fulfilled
3.	USEFULNESS (productiveness, efficacy)	extent to which the utility requirements are fulfilled
4.	SENTIENCE (contentment, satisfaction)	extent to which the sentience requirements are fulfilled
5.	PROFITABILITY (economy, effectiveness, efficiency)	extent to which the economic requirements are fulfilled

Source: own elaboration by G. Stankiewicz on the basis of:
B. Stefanowicz: *Informacja...*, p. 24.

When a systemic approach is adopted to consider combat, a definite set of subsystems can be distinguished, the most important of which include the response subsystems (fire, logistics, combat service support). However, for the response to be feasible, first the informational and controlling subsystem has to act in a pre-emptive manner, and therein the first one to act is the perception of elements and space of the battlefield (military operation area). Only after the data have been thus obtained a signal to initiate a specific response is given. If the response is not supposed to be an instantaneous and non-recurrent event, the information feed subsystem will also have to act, as it ensures the further operation of the perception and response subsystem¹⁹. The data fed into the informational and controlling subsystem have to be free from any undesirable characteristics of information – an illustrative set of undesirable properties of information is presented in Fig. 3.

Undesirable properties of the information fed into the informational and controlling subsystem, combined with the time of its provision deviating significantly from real time, have, apart from the obvious effect of impeding the execution of a task, a specific undesirable economic dimension. A fourfold increase in a linear error of the target reconnaissance in the two-dimensional space (on a plane) in relation to its critical value, i.e. its increase from 25 [m] to 125 [m], causes a 25-fold increase in the costs of

farmer, who was a member of the French Resistance, asked his son to measure by steps the coordinates he considered significant and then passed these data on to Bayeux. Cf.: S. E. Ambrose: *D-Day...*, p. 508.

¹⁹ L. Ciborowski: *Walka...*, p. 123.

completing the fire mission with the same fire effectiveness, in a scale of one target, for example a dug-in artillery battery²⁰.

L. Ciborowski, summarising his extensive, mathematically substantiated, considerations regarding the time of imparting information, concludes that “...*the time of imparting the information has the same price as the accuracy of reconnaissance*”²¹. Therefore, the provision of accurate information within the required response time, over a specified distance, about the target or logistics needs, is directly related to advanced technology making it possible to pass such information, in the appropriate form, safely and in the way preventing the enemy from intercepting the information or interrupting the process of its provisions or distorting such information.

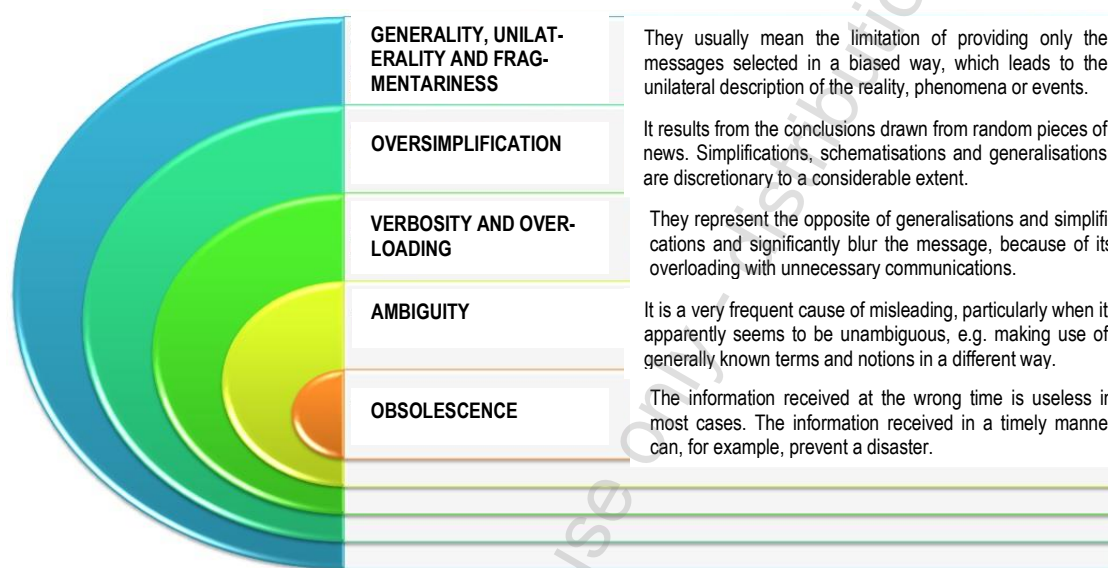


Fig. 3. The set of undesirable properties of information according to S. Garczyński

Source: own elaboration by G. Stankiewicz on the basis of: S. Garczyński: *Z informacją na bakier*. Instytut Wydawniczy Związków Zawodowych, Warszawa 1984, p. 20-41.

An example of the information adopted for the planning of operations which was characterised by such negative properties as generality and oversimplification, on the basis of which the sufficient knowledge or wisdom or even truth could not have been built, is provided by the warfare between the American and Japanese armed forces on the Pacific island of Peleliu, during the Second World War. This small island having the area of only 13 [km²], located to the south of the Mariana Islands, became the field of two-month heavy fighting under Operation Stalemate II, lasting from 15 September to the end of October 1944. In accordance with the plan, in the landing and ground operations the First Marine Division and the 81st Infantry Division were employed, in total

²⁰ Ibidem, p. 156.

²¹ Ibidem, p. 143.

about eight thousand marines and 17 thousand soldiers ensuring combat and logistics support, indispensable to proceed with the offensive²².

The First Marine Division commanded by General W. Rupertus did not have any accurate information about the fortifications on the island or its topographic profile, except for a few aerial photographs. The Japanese created on the island a complex system of fortified caves, which did not sustain any major damage after the initial bombing²³. Furthermore, despite the earlier experience, insufficiently accurate conclusions were drawn for the assessment of combat environment with regard to the prevailing temperature and air humidity and the influence exerted by them on a man acting with extreme physical effort and under extreme stress. During the fighting temperatures prevailing on Peleliu constantly remained at 40 [°C]. Under these conditions the first landing troops had the standard provision of drinking water, which was quickly exhausted, and the logistics system, as a result of various interruptions characteristic of the first phase of operations, was not able to respond to the demand of scattered soldiers. As a result of this situation, out of the total number of losses in manpower exceeding 40 [%] (8,800 soldiers²⁴, including 2,500 sick and wearied ones) from the First Marine Division and the 81st Infantry Division, one third was caused by water shortage, because of which soldiers were quickly dehydrated and wearied and had to be evacuated from the battlefield²⁵. Desperate soldiers were trying to drink water gathered in the craters made by bombs, however the quality of this water was so poor that many of them suffered from poisoning, which eliminated them from further fighting. Logisticians at the lower levels of command demonstrated even some degree of irresponsibility, as in the situation where demand exceeded their capabilities they resorted to improvised solutions, and as a result of oversights they delivered water to one of the batteries in the drums for storing diesel oil, thus worsening the already complex situation, because the drinking of water contaminated with oil causes gastrospasms, also eliminating from fight²⁶. In 1944 the American logistics system was heavily overloaded, because the monthly maintenance of one marine required the delivery of 4.5 [t] each month (150 [kg] per day)²⁷. Numerous mistakes in the planning and commanding of the operations on Peleliu resulted in recalling General W. Rupertus from his position, which was preceded by his nervous breakdown.

3. ROLE OF INFORMATION IN COMBAT LOGISTICS

What is the role of information in the logistics support for the fighting forces? The complexity of actions at the operational and tactical level, resulting from the character of contemporary operations, in terms of their high dynamics and the accuracy and in-

²² H. Ambrose, *Pacyfik*, Magnum, Warszawa 2010, p. 356.

²³ D. Ford: *Pacyfik*. Znak, Kraków 2013, p. 120.

²⁴ *Bitwa o Peleliu*. [online]. [available 06.10.2014.]. Available on the Internet: http://pl.wikipedia.org/wiki/Bitwa_o_Peleliu.

²⁵ H. Ambrose: *Pacyfik*, p. 360.

²⁶ *Ibidem*, p. 358 - 359.

²⁷ D. Ford, *Pacyfik*, p. 117.

tensity of fire attacks, which, in turn, depend on the capabilities of modern means of reconnaissance and "information control" of the armed forces, causes that the daily demand for materiel per fighting soldier may total even 200 [kg] and more²⁸.

To illustrate the daily changes in the consumption of materiel (ammunition, fuel and food rations) the authors made an attempt, on the basis of available materials, at estimating the volume of consumed materiel from the time of the Great War to the contemporary forecasts, per fighting soldier, as presented in Fig. 4.

In the second year of the Great War the daily demand of a British division included 20 rail wagons with food and feed for horses and 30 rail wagons with ammunition and other warfare materials²⁹. These needs were at a similar level in the case of other armed forces taking part in the war. The average load capacity of the then used rail wagons was about 15 [t]³⁰. On the assumption that the average filling ratio when loading a wagon was 0.9, it means that the daily needs of a division of infantry (rounded to 18 thousand men³¹) totalled about 38 [kg] per soldier in combat.

During the Second World War, among the supplies of various materiel items ammunition, expressed as a daily demand per fighting soldier, represented 20 [kg]³². The demand for fuel, performing the key role in armoured and motorised formations, totalled 42 [l] per man per day^{33,34}. Taking account of the weight of food rations and drinking water³⁵, it is justified to assume that the daily average needs per soldier fighting with varying intensity and in different battlefield environments during the Second World War totalled about 66 [kg]. However, in the case of the American naval, airborne and

²⁸ [online]. [available: 13.06.2011]. Available on the Internet: <http://www.logistykafirm.com/sa.php?aid=263&p=&cat=25&catname=Default>.

²⁹ M. van Creveld, *Żywić ...*, p.186.

³⁰ Materials of the Polish Association of Railway Enthusiasts. [online]. [available: 21.10.2014]. Available on the Internet: <http://www.psmk.org.pl/nasze-zbiory/wagon-blatt-8/>.

³¹ Structure of a British division at the time of the Great War. [online]. [available: 21.10.2014]. Available on the Internet: <http://www.westernfrontassociation.com/great-war-on-land/general-interest/891-structure-army-british.html>.

³² E. Nowak, M. Kaźmierczak: *Zapotrzebowanie wojsk w amunicję*. [in:] PWL, No. 5/98, p. 76.

³³ During the preparations and operations between 25 August and 1 September 1944, at the Gothic Line in Italy, three corps belonging to General Leese's Eight Army (59 thousand soldiers in combat sub-units preparing to start offensive actions and pursuit from 25 August 1944) needed 1,817,000 litres of fuel per day for 60 thousand vehicles, i.e. 31 litres of fuel per fighting soldier. Cf.: J. Holland: *Piekło Italii*. Amber, Warszawa 2008, p. 280.

³⁴ During its operations in France in a period from May to June 1940 a German tank division needed 45,000 litres of petrol per hour, i.e. 540,000 litres per day of operations under average conditions. Taking account of the average manpower of a German division in that period (about ten thousand officers, non-commissioned officers and privates cf.: [online]. [available: 21.10.2014]. Available on the Internet: http://www.abteilung7.org/grhwh_4pd.htm the daily demand for fuel totalled 54 litres per man. Cf.: J. Macdonald: *Wielkie bitwy II Wojny Światowej*, Morex, Warszawa 1994, p. 9.

³⁵ The average weight of a single food ration was adopted, based on the American K-ration (three boxes kit) including dry food weighing 1 kg, and 3 litres of drinking water per man per day. Cf.: V. Milano, B. Conner, *Front w Normandii*. Dom Wydawniczy Rebis, Poznań 2013, p. 425 and cf.: [online]. [available: 21.06.2014]. Available on the Internet: <http://en.wikipedia.org/wiki/K-ration>.

landing operations in the Pacific, as mentioned earlier, the daily demand for materiel amounted to as much as 150 [kg] per soldier. The values presented above are approximate as no unambiguous literature data are available. In the contemporary operations the significance of the constantly growing demand for materiel for the fighting armed forces is similar to that observed in earlier warfare, however now it is necessary to deliver such supplies at a minimum “delivery response time” and in the situation of permanent threat posed by the enemy’s impact on the back (communication) zone of operations.

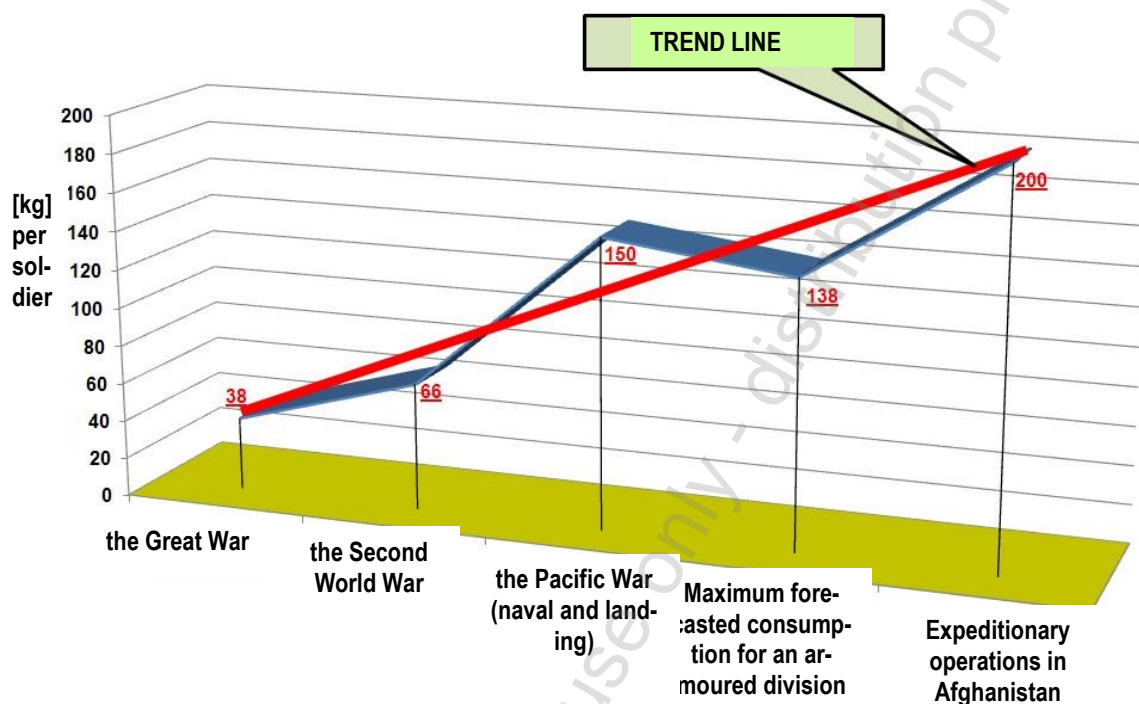


Fig. 4. Daily changes in the consumption of materiel in selected armed conflicts

Source: own work by S. Hajt and G. Stankiewicz based on the synthesis of literature data³⁶.

As already mentioned, the contemporary military operations are characterised, in terms of logistics, by the fact that apart from the logistics activities as such the response time and accuracy of actions are of crucial importance, i.e. the continuous “fighting for time” and “fighting for accuracy”. In professional literature it is assumed that the “logistics response” time regarding the demand for materiel for the fighting forces should not exceed two hours at the lowest organisational levels. Therefore, in the logistics systems of the modern world armies permanent efforts are being made to achieve the optimum capabilities making it possible to “bridge”, in an informational and technical and organisational sense, the space and time gap separating the supply, i.e. logistics resources, and the demand, i.e. the fighting forces’ requirements for materiel and services. The fast pace of technical and organisational changes in the civilian

³⁶ The consumption forecast for an armoured division was made on the basis of the methodology presented in *Poradnik logistyczny do ćwiczeń i treningów sztabowych*, Praca, (ed.) W. Nyszk, AON, Warszawa 2008.

and military logistics has a direct impact on the modified perception of its essence in terms of time and space. Periodicals, and not only the specialist ones, mention some newly created terms characterising flow streams (physical and informational) in contemporary global logistics. Such terms include the “*death of distance*”, or even the “*death of time*”³⁷, as well as a controversial term “*time compression*”. However, the possibility of achieving optimal logistics activities, in terms of their adequacy and response time, is determined by the fulfilment of a precondition consisting in the provision of the information about the needs, resources, space, delivery lead time and the possibilities of satisfying such needs, perceived as a flow from the source of origin to the final recipient. Having taken into consideration the astonishing fact that the broadly understood logistics represents 90 [%] of warfare, while mathematical calculations related to the movements and supply of armed forces are, as once stated by Napoleon, unbecoming of Leibnitz or Newton³⁸, the demand for information and tools for processing it and for the information triggering flow streams is huge. The complexity of logistics operations based on information was very aptly defined by Field Marshal Sir Archibald Percival Wavell, Commander of the British Army in the Middle East and in Asia during the Second World War “*The more I learn about the war, the more I realise that it depends on administration and transport (...). It does not require a lot of skill or imagination to determine where and when the army should be: to determine where the army can be moved and whether it can be supplied at that place requires enormous knowledge and hard work. Each commander should base his planning on becoming meticulously familiar with supply and manoeuvre factors. Only in such case he will know when and how to risk, and battles can be won only by taking a risk*”³⁹.

In individual actions it is enough to have the information on the basis of which the basic knowledge is formed and then a task is generated for those who will carry it out. However, at operational levels, where the system of operations and the subsystem of logistics are more complex as they concern a larger territory and are also subject to greater internal and external turbulences ensuing from combat, it is required to have not only simple information, but the picture formed on its basis, perceived as knowledge and wisdom, and, in a longer perspective of the system operation, as truth (principle).

An interesting example illustrating the essence of information about the enemy’s production and logistics potential in combat can be provided by the advantage gained over the Wehrmacht forces after the initial defeat at the Eastern Front during the Second World War.

American ideas regarding the organisation of mass production and vertical integration (clusters) influenced the Soviet arms industry in the period of a big industrial revolution of the 1920s and 1930s. Attempts were made to concentrate the production of, for example, a tank in one place – from steelmaking, through the manufacturing of

³⁷ K. Rybiński, *Co z tą wizją?*, Newsweek, No. 51-52/2007, p. 97.

³⁸ M. van Creveld: *Żywiąc wojnę*, Tetragon, 2014, p. 306.

³⁹ *Ibidem*, p. 306.

engines and armament, to the final assembly. Thus, it was possible to reduce the railway transport, which was already overburdened. The intention was to organise large series production, while the final product had to be functional, and not necessarily characterised by a high quality.⁴⁰ The location of numerous industrial plants at one place, ensuring the availability of raw materials for production, fossil fuels, railway network well-developed and connected with other centres and urban centres with highly qualified engineering staff and workers, which represented the fundamental conditions for establishing the industry, enabled the Russians to undertake gigantic efforts related to the evacuation of manufacturing plants, critical for the war industry, together with human resources, to the safe regions of the Soviet Union. In the second half of 1941, according to the most recent Russian sources, at least 2,593 plants were evacuated to the east. Between June and 20 November one million of goods wagons were necessary to evacuate by railway machinery and other industrial equipment from Ukraine, Byelorussia and Baltic states⁴¹. Twenty-five million workers were resettled together with families. At the end of 1942 only 55 out of 1,523 large industrial plants relocated to the east did not work⁴². Apart from industrial plants, the evacuation included also kolkhozes and sovkhozes. Two million three hundred and ninety-three thousand cattle were transported to the eastern parts of the Soviet Union in the second half of 1941⁴³. Such a huge evacuation operation was coordinated by the Evacuation Council, established two days after the German attack⁴⁴. It may prove that the Russians were perfectly aware of the evacuation potential inherent in the assumptions for the cluster-based industrial developments located within their territory. The above actions ensured the excellent production result for the following years of war, as presented in Tab. 2.

Taking account of the scale of technical and organisational difficulties and time, the whole evacuation operation should be considered a huge logistics success. The Germans undoubtedly had the information about the production capabilities of the Russian arms industry, however it seems that other key information was not taken account of while developing strategic and operational plans, namely the information about the potential enabling the Russians to relocate and restart quickly the production decisive for warfare efforts to the other, safe regions of the Soviet Union. This potential, as mentioned hereinabove, resided in the cluster-based concept for the location of industrial developments within the area of this vast country and in the possibilities of using the railway transport on a mass scale, and also in the workers' determination. The inaccurate assessment or even the failure to notice "the evacuation potential of the arms industry" by the German war planners prevented them from creat-

⁴⁰ T. Zawadzki, *Boje na obrzeżach. Operacja Barbarossa 1941*, Polityka - pomocnik historyczny, Wydanie specjalne No. 6/2011, p. 65.

⁴¹ R. Braithwaite, *Moskwa 1941*, Znak, Kraków 2011, p. 295.

⁴² R. Overy, *Krew na śniegu*, Wydawnictwo Dolnośląskie, Wrocław 2009, p. 166.

⁴³ S. Dębski, *Wielka ewakuacja. Operacja Barbarossa 1941*, Polityka - pomocnik historyczny. Wydanie specjalne No. 6/2011, p. 93.

⁴⁴ R. Overy: *Krew...*, p. 164.

ing the specific level of knowledge, or even wisdom, and thus, during the strategic and operational planning of the first phase of Operation Barbarossa, they were not inclined to take account of a concept of indirect actions against the opponent's logistics potential, developed by Liddell Hart⁴⁵. It can be stated that from the perspective of this theatre of war operations the Clausewitzian idea of *schwerpunkt* (focal point, point of maximum effort) – being the axiom at the operational and tactical level – was not applied in the strategic and operational practice. It seems that despite the vastness of the European part of Russia and the lack of sufficient range of the main strength of the German air force, there was a possibility of planning joint (airborne and ground) operations to reach the targets, as part of the indirect approach against the enemy's production and transport network potential. Therefore, the thesis stating that the Wehrmacht's final defeat on the Eastern Front was "forged in factories"⁴⁶, and not only in the Russian ones, taking into account the American material and technical aid delivered initially by the Persian route, can be considered justified. Concurrently, it has to be noted that the reason for the outlined situation was the lack of appropriate assessment of the information from the non-military area, due to which the "operational wisdom", objective in nature, could not have been built and the information could not have been properly used for military purposes. Perhaps the distribution of the information about the evacuation potential of the Russian industry was not uniform among the numerous planners of Operation Barbarossa, and therefore, the information could not produce any synergies leading to wisdom or even truth – we do not know this. An interesting example of the drawing, at a later stage, of the right conclusions from the existing situation, within the indirect approach, and the occurrence of wisdom, on the basis of combat losses and not on the basis of the information available earlier, was the proposal of Albert Speer (German Minister of Armaments) concerning the establishment of a special staff to identify the critical targets in the Soviet Union, whose destruction by air forces would result in the reduction in armaments production. Since it was impossible to destroy production plants, the staff decided that the targets that would produce the classical effects of the indirect approach should include the power plant located on the upper Volga, providing energy supply to industrial plants in Moscow, and power plants in the Urals, supplying the major part of the plants evacuated in 1941 and continuing production for war purposes. In December 1943 the performance of the task was entrusted to the air corps supported by long-range bombers. However, the plans were not realised, because the designated air forces were allocated to fulfil

⁴⁵ Liddell Hart defines the indirect approach as a philosophical truth and calls it a law of life in all spheres, and in reference to warfare he identifies it with the manoeuvre directed at the enemy's back. In his considerations he added that the attack made as part of the indirect approach should be directed against appropriately selected objects (sources and types of supply), playing the most crucial role in the process of supplying the opponent's forces. Only when such objects are destroyed a severe crisis occurs in the delivery to the armed forces of important, i.e. indispensable for the effective execution of military operations, types of supplies. Cf.: E. Nowak: *Działania pośrednie przeciwko potencjałowi logistycznemu przeciwnika*. [in:] WPTiL, No. 6/97.

⁴⁶ Ł. Przybyło, *Gospodarka „na baczność”. Operacja Barbarossa 1941*. Polityka - pomocnik historyczny. Wydanie specjalne, No. 6/2011, p. 65.

other tasks. Thus, an attempt at taking by the Germans the indirect approach against the production and logistics potential of the Soviet Union was put to an end⁴⁷.

Table 2. Russian production results in 1940-1945

WAR INDUSTRY PRODUCTION IN THE SOVIET UNION			
Year	Tanks	Airplanes	Heavy guns
1940	2794	10565	15300
1941	6590	15735	42300
1942	24446	25436	127000
1943	24089	34845	130000
1944	28963	40246	122400
1945	15419	20052	62000

Source: own work S. Hajt on the basis of: N. Davies: *Europa walczy. 1939-1945 nie takie proste zwycięstwo*. Znak, Kraków 2008, s. 53.

It can be observed that the complex process of evacuation of the significant part of the Russian production potential for the purposes of war, combined with severe losses in manpower and equipment at the first stage of the defensive operation 1941/42, was carried out in an exemplary manner, preventing the production potential from reaching the critical level that would render impossible or significantly prolong the process of restoring the former performance, in line with the general model of system reliability (Fig. 5.).

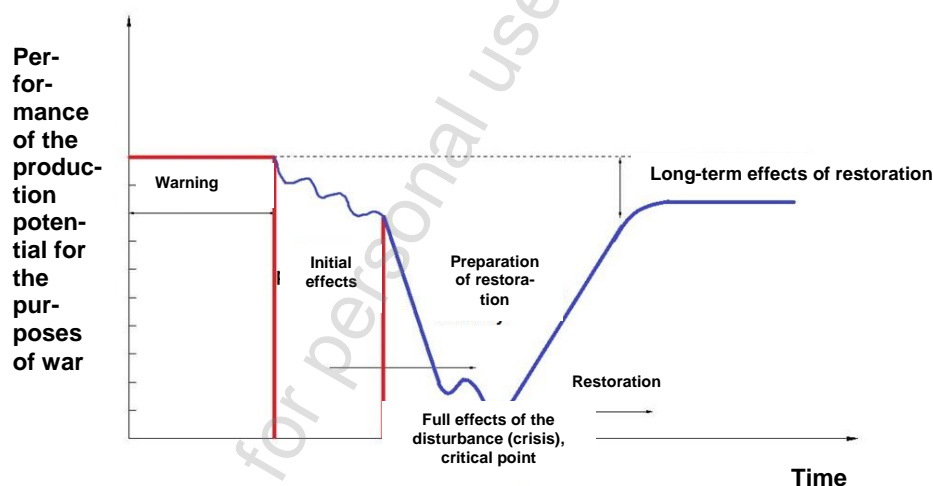


Fig. 5. General model of system reliability

Source: own elaboration by S. Hajt on the basis of: T. Nowakowski: *Podatność na zagrożenia systemów logistycznych*. [in:] Wykład, WSOWL, maj 2014.

⁴⁷ E. Nowak, *Działania pośrednie a trwałość zaplecza walczących wojsk*. [in:] WPTiL, No. 5/97.

The information about the method of operation of the enemy waging a total war, decision makers' knowledge of the possibilities of evacuating the industry, the wisdom in managing the process of evacuation as well as experience gained during the war with Napoleon⁴⁸ in 1812, perceived as the truth, enabled the Russians, at a specific time perspective, to achieve a huge military success, which was based on resources produced for the purposes of war.

In the logistics of military operations conducted in space and time, even the seemingly insignificant information about an elementary event, or its lack, concerning a small formation, can bring about results that are operationally or even strategically meaningful. The action of one of the armoured spearheads belonging to the First Front of Ukrainian Marshal Ivan Konev, that took place on 21 April 1944, can serve as an example. The tanks of this formation, located only a dozen or so kilometres from Zoosen, where the Army's Supreme Headquarters (OKH⁴⁹ – Oberkommando des Heeres) stationed, were short of fuel, as a result of which the crucial knowledge of the location of General Hans Krebs's staff was not gained⁵⁰, thus enabling him to evacuate and retain the continuity of command.

Data regarding the requirements for materiel and services of the forces engaged in combat are acquired on the basis of prognostic data, which represent mere information. However, this informational basis combined with other data such as the type of operations, the location of forces at a given time, the turbulence of the environment in which a task is carried out, and further linked with the data concerning own resources and the possibilities of their use (movement) creates the logistic knowledge. The logistic knowledge, that has to be dialectical in nature, can be used only at this stage to control the mobile executive potential. In the example presented hereinabove one of the listed data probably was not understood properly by decision makers – we are not able to verify it – and thus, the action that was well planned from the operational perspective did not achieve the intended objective.

4. NEW DIMENSION OF INFORMATION IN COMBAT LOGISTICS

At the beginning of this century the information in combat, owing to the possibilities offered by both the development of the means of combat and the gigantic advancement in the ways of procuring, sending, gathering and processing information, has gained a new significance, in each of its aspects, for the military operations planning and execution. The availability of the relevant information resources about the opponent's military, logistics and economic potential opens up enormous possibilities when

⁴⁸ Cf.: During this war the Russians made use of the vast area of their country to protect their forces and to hinder Napoleon's operations by evacuating resources, mainly the logistics ones. On the deserted areas, the Russian forces retreating before the Napoleon's army, implemented the burnt ground tactics. The region was cleared of all stocks of feed for horses and food, which were evacuated or destroyed. The abandoned towns and villages were treated in a similar way and wells and streams were contaminated with carrion. D. Smith: *Napoleon przeciwko Rosji 1812*. Replika, Zakrzewo 2012, p. 64.

⁴⁹ German Army's Supreme Headquarters from 1936 to 1945.

⁵⁰ Cf.: A. Beevor: *Druga wojna światowa*. Znak, Kraków 2013, p. 938.

combined with the contemporary means of the fourth generation warfare, making it possible to conduct precise attacks. The selection of the appropriate so-called soft targets may contribute significantly to the reduction in own logistics needs and shorten the time of conducted operations.

If, for example, during the Second World War such actions had been undertaken by the Germans with regard to the resources of the Soviet union (described hereinabove), the warfare operations could have had an undesirable outcome. In the history of armed conflicts a lot of examples can be found that corroborate the presented theses. Numerous analyses conducted by military theoreticians and practitioners, aimed at identifying the most effective way to acquire and optimally manage the information and to create on its basis the knowledge and truth (principles) concerning the optimum methods of conducting warfare, provide the premises for the new qualitative perception of operational environment, characterised by the properly sequenced integration of direct and indirect operations against the opponent's logistics and economic potential, as exemplified by Warden's five rings theory – Fig. 6. The systemic approach adopted by J. A. Warden, taking account of the knowledge, experience and means available for the army, enabled him to identify the sensitive points of the state structure that have to be attacked, precisely and in a proper sequence, to achieve the strategic objective at one's own and the opponent's minimum losses.

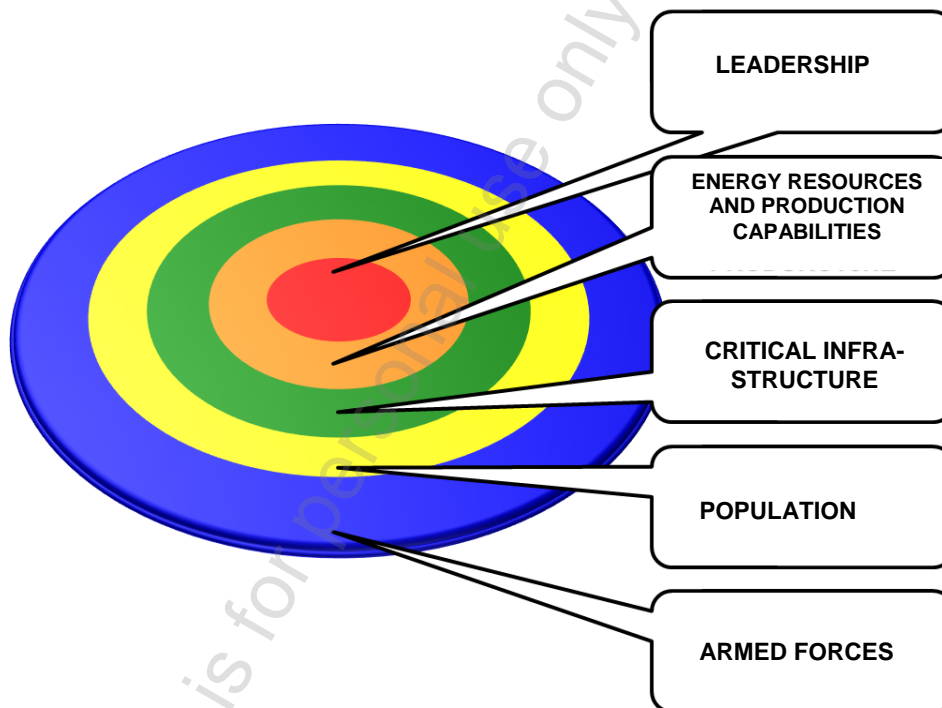


Fig. 6. Warden's rings

Source: own work of G. Stankiewicz on the basis of: Gary M. Jackson: *Warden's five-ring system theory: legitimate wartime military targeting or an increased potential to violate the law and norms of expected behavior?* Maxwell Air Force Base, Alabama, April 2000. [online]. [access: 06.10.2014]. Available on the Internet: handle.dtic.mil/100.2/ADA425331.

Leadership is the most sensitive element of the state structure, followed by the sources of the state vital forces, understood as its energy resources and production capabilities (fuel, electric energy, etc.), critical infrastructure, population and finally armed forces, which are resistant, vital and capable of delivering blows⁵¹.

From the perspective of the objective that the opponent intends to achieve by undertaking activities aimed at causing a disruption in the defender's logistics system, the following have to be taken into account⁵²:

- disorganisation of the state defence system or, directly, of the operational command system;
- destruction of the communication infrastructure in important regions;
- destruction of selected facilities of the state energy system;
- destruction of selected military stocks of materiel;
- disorganisation of access for reserve units.

The legitimacy of the above theses can be substantiated, among others, by the analysis of the course of the Gulf conflict (1991). It shows that during the initial phase of warfare Operation Instant Thunder was conducted, the objective of which was to establish control of the air space, deprive the Iraqis of the surface-to-air missile system, cause a disturbance in the state's functioning and inflict maximum losses to land forces.

It can be observed that such model of conducting operations was convergent with the key assumptions of Warden's five-ring system theory. The availability of the above elements (places where strategic, operational or tactical centres of gravity are located) is the direct opposite of their importance. When a foreign state is attacked, first the external ring of armed forces is encountered, then, the second ring, closer to the centre, formed by the population, etc., whereas the most sensitive element – the leadership – is situated in the very centre.

As soon as the digital battlefield enabled not only airborne formations, but also infantry formations to act by deploying independent, fast combat teams, easily penetrating deep into the opponent's order of battle and evading attacks, the operational or even strategic centre for managing the opponent's forces came within their reach. At present, armies do not have to fight the main groups of enemy forces. Having appropriate information resources, the army can simply manoeuvre and bypass such forces, like it did during Operation Iraqi Freedom⁵³, and then leave them far behind. Even the maintenance of supply routes has become easier, because the supply convoys could select different safe routes on an ongoing basis and the relatively small formations did not 'consume' that much of supplies, as compared to unwieldy armies, arduously breaking through the enemy's defence.

⁵¹ Cf.: Gary M. Jackson, *Warden's...*, p. 51.

⁵² *Organizacja i prowadzenie działań w tylowej strefie operacji*. A. Tomaszewski, AON, Warszawa 2006, p. 41.

⁵³ *Iraqi Freedom* – operation started on 20 March 2003, whose objective was to overthrow the Iraqi leader, Saddam Hussein. In September 2010 the President of the United States declared the end of the operation.

It could seem that the obvious giving up of direct kinetic actions in favour of conceptually sophisticated operations, based on the information and modern means of warfare, should limit the logistics requirements (materiel, technical, transport and service needs). However, as demonstrated in practice, this is not the case. Prof. M. Creveld claims that if Operation Desert Storm⁵⁴ lasted longer than 100 hours and the units penetrated deeper into the enemy's positions, the supply system of the world's best army would have to collapse⁵⁵. It was even admitted by General W. G. Pagonis himself⁵⁶. It should be remembered that the system was prepared to handle as much as one million tonnes of supplies, gathered in Saudi Arabia for half a year, to satisfy the needs of half a million soldiers, and at the peak delivery time a given checkpoint was passed by a truck every three seconds⁵⁷. It evidences that the system was perfectly prepared, and yet, some problems arose, even with the duration of the system operation. Despite the fact that warehouses were bursting at the seams, some units had to cope without food all days long and sometimes were forced to buy mineral water in Iraqi shops on their way⁵⁸. Similar situations occurred during Operation Iraqi Freedom, and, like in 1991, there was a shortage of trucks, as in any other campaign since 1939⁵⁹.

The described cases prove that logistics problems are of a permanent nature, the information about logistics needs is improperly acquired in direct command relationships, and the methods of forecasting requirements, i.e. creating the logistics knowledge, are imperfect.

In essence, combat represents a negative cooperation between the participating entities, and, undoubtedly, the turbulence of this environment is and will be the main reason for the occurrence of logistics problems, despite the even most perfect methods for the acquisition and processing of information about the needs and the possibilities of satisfying them. However, logistics problems can be minimised by continuously improving the created methods for forecasting the needs and for balancing them with the possibilities of meeting them, within the shortest possible response time, in line with the criterion of $4xW$ ⁶⁰. Today, the electronic system, LOGFAS⁶¹, can serve as an

⁵⁴ *Desert Storm* (17.01-28.02.1991) – joint operations, conducted on the basis of resolution no. 678 of the United Nations Security Council of 29 November 1990. Its main objective was to liberate Kuwait annexed by Iraq.

⁵⁵ M. van Creveld, *Żywiq* ..., p. 336.

⁵⁶ General *William Gus Pagonis* was the Director of Logistics during the Gulf War (1991).

⁵⁷ M. van Creveld: *Żywiq* ..., p. 334.

⁵⁸ *Ibidem*, p. 338.

⁵⁹ *Ibidem*, p. 339.

⁶⁰ $4xW$ – at the right time, quantity, quality and place.

⁶¹ LOGFAS (Logistic Functional Area Services) – a system developed as a set of IT tools, containing a uniform standard for the operation of IT systems supporting the management of logistics support services in allied multinational structures. At present, the LOGFAS standard represents a sort of integration platform for the modules corresponding to respective functional areas of logistics support services, aimed at the management of distributed information resources, on the basis of the shared data banks and modern ICT tools, based on the data interchange network. G. Stankiewicz: *Informa-*

example of continuous efforts to achieve perfection in logistics operations in the area of forecasting and balancing the needs and visualising the location of warehouses and the transport network, which supports the decision-making process, combined, in the area of implementing the above in practice, with integrated self-loading systems such as PLS (the United States), DROPS (Great Britain), MULTI (Germany) and VTL (France). The authors provided the complete characteristics of these systems in their articles published in *Zeszyty Naukowe WSOWL* no. 2/2010 (pp. 44-74) and 2/2011 (pp. 58-76).

CONCLUSION

Globalisation processes and revolutionary changes in information technologies remodelled our perception of numerous phenomena in the surrounding reality. They have reevaluated not only the way we live, work, learn or communicate, but also the way we fight. In the era of the information society, the reliable and up-to-date information has become a special value or even luxurious goods, whereas for the contemporary military operation it represents the necessary condition for its efficient and effective management.

From the perspective of several decades it can be definitely stated that the contemporary possibilities of acquiring and processing information, despite the logistics problems accompanying the operations described by Prof. Creveld, bring about pronounced progress in the effectiveness of all logistics operations.

The following conclusion can be drawn: the contemporary informational possibilities significantly facilitate the multifaceted perception of the complex operational environment in almost real time, owing to which logistics streams of materiel and service flows can be monitored and adjusted on an ongoing basis, to achieve their full compatibility with the continually changing needs and to situate them in the area of combat operations. Furthermore, the present informational possibilities of the armies make it possible to reduce to a minimum the Clausewitzian truth about friction in war⁶², despite the growing number of entities filling, together with equipment, the operational space, where it could seem that friction should increase in proportion to the number of entities forming a given system.

The reliable operational and logistics information passed on to command posts almost in real time, which is then processed, in an equally short time, by means of tools sup-

tyczne narzędzia wsparcia logistycznego systemu meldunkowego NATO w SZ RP. [in:] *Komplementarność logistyki cywilnej z logistyką wojskową: teoria i praktyka*, V Międzynarodowa Konferencja, Rynia 06-07.06.2013 r., [electronic document].

⁶² Friction is the resistance of diverse factors to predefined strategic and tactical plans, restricting the army's operations in practice and compelling the army to use significantly larger forces than it results from theoretical assumptions. Friction is influenced, among others, by such factors as the paralysing impact of danger, the deterioration of soldiers' physical strength or the vagueness of the situation and the lack of sufficient information about one's own and the opponent's positions. Quite often friction originates by accident, e.g. because of an expected turn of weather conditions. According to Clausewitz, friction is a factor that can be overcome by the commander's energy and iron will and by the preparation of the army for the war, of the body for an effort and of the spirit for a danger. Cf.: C. von Clausewitz: *Księga pierwsza o naturze wojny*. [in:] C. von Clausewitz: *O wojnie*. MON, Warszawa 1958.

porting decision-making processes, to the information that triggers flow streams handled by the integrated executory system, makes it possible to reach the maximum threshold of logistics effectiveness termed “just-in-time”.

Owing to the currently existing potential possibilities of achieving the maximum threshold of logistics effectiveness, based on the information, combat formations can be partially released, during their operations, from logistics units and subunits which have so far hampered, to a varying extent, their leeway, manoeuvring in particular. Prof. Crevelde, having analysed the logistics needs during the Great War, particularly the highly materiel consuming British Somme Offensive in 1916, states that the art of operations has become an addition to logistics to a far greater extent than it was the case in the 18th century⁶³. At present, the information and the possibilities of processing it, combined with the modern technologies for picking loads and transporting them over large distances, with the concurrent minimisation of the quantity of the means of transport necessary to handle them (including loading), causes that it is the art of operations that sets out requirements, whereas logistics, performing a service role, is capable of meeting them.

The limited space of the article has made it impossible to adopt a broader approach to the discussed issues, so the authors are aware it may contain certain imperfections. Therefore, the authors would be grateful for any critical remarks concerning the publication, which can be send via e-mail to the addresses indicated hereinabove.

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⁶³ M. van Crevelde: *Żywiąc...*, wyd. cyt., p. 308.

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