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Standards and Norms in Material Requirements Planning on the Example of Military Logistics

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Abstract:

Purpose: *The aim of the article is to demonstrate the importance of norms and standards in the planning of material needs in logistics based on the example of the military, as well as to characterise their types and methods of development, implementation and improvement.*
Design/Methodology/Approach: *To address the research problem, the authors conducted an analysis and synthesis of the literature and normative documents including the existing assumptions, concepts and analytical and statistical comparisons.*
Findings: *The research carried out highlights the need to improve norms and standards in logistics services as they ensure optimal operating conditions for enterprises (including military units). Properly selected and implemented, they affect the size of stocks of material resources allocated to secure the tasks performed by organisations and lead to achieving best economic results.*
Practical implications: *The article discusses what factors and conditions should be considered when setting standards and norms, highlights the benefits of using them and points out gaps in this topic.*
Originality: *This paper presents the benefits of using standards and norms in the business activities of organisations, including military units. Particular attention is paid to their importance in planning material needs and methods of their development. The use of standards and norms in the logistic economy helps to use available materials and financial resources in an efficient way.*

Keywords: *Standards, norms, material needs, logistics management.*

JEL classification: *D24, D51, F52, M2, P41.*

Paper Type: *Research article.*

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1. Introduction

The supply processes that occur in the military forces determine the combat readiness and effectiveness of the functioning of military units in times of war and crisis, as well as in times of peace. Material procurement is a component of the supply system, which includes a set of activities related to meeting the logistic needs of the armed forces.

Among this set of activities and operations carried out within the field of army economy are the following: anticipation (forecasting) of needs, material planning, requirements planning, receiving, storage, maintenance, refreshing, picking and issuing of materials, as well as accounting and reporting activities.

The army's logistical material supply system can be described more generally as a system to guide this supply. The processes that constitute its parts remain in specific relationships with each other and form a whole unit. Each element of the supply system contains a subjective content (supply bodies), an objective content (material resources) and an informational content (a set of current, synthetic and monographic information flowing among the supply chain).

Such an integrated set of elements of the supply system, which interact with each other and the environment, should help improve the efficiency of procurement and lead to a more rational management of equipment and materials (Straka, 2013).

Material supply, in conjunction with technical support, is considered one of the most important factors in determining the readiness and operational efficiency of the armed forces. Modernisation of military equipment and the systematic improvement of working and service conditions lead to an increased demand for various types of material resources.

This requires the creation of an appropriate supply system that would enable full execution of tasks while also taking into account a wide range of economic aspects, including improving efficiency in resource management. Poland's membership in NATO serves as a strong impetus for the qualitative enhancement of the economic activities of logistical services, particularly in the areas of supply and material management.

When considering the improvement of military economy, special attention should be paid to the issue of standardisation. The refinement of existing standards, as well as their functions, must be one of the primary tasks of military logistics in the coming years.

Current trends toward streamlining supply processes, improving resource management efficiency, and improving the standardisation system fully justify the need to address the topic of this study.

2. Research Methodology

To address the research problem, the authors employed the following research methods:

- Empirical methods: scientific observation and surveys and assessments (opinions).
- Theoretical methods: analysis and synthesis of literature and normative documents, available materials including the relevant literature, existing assumptions and conceptual designs, as well as generalisation, comparison, and analytical-statistical methods.

The subjects of the observations were units of the Polish Armed Forces. The primary source data consisted of the inventory and reporting documentation of these units, as well as sector-specific regulations applicable in military logistics.

In preparing the article, a review of the literature and normative acts relevant to the Ministry of National Defence was carried out, together with an examination of documents made available to the authors during the writing process, including declassified documents from various levels of the Polish Armed Forces and available NATO publications.

A valuable source of information for considerations on the functioning of standards and norms in logistics was scientific articles published in both military and civilian journals. Additionally, numerous legal and normative acts that regulate the functioning of the logistics system were used in the preparation of this article.

3. Empirical Results and Discussion

In meeting the military's needs for combat and material resources, logistics undertakes specific economic activities referred to as military economy. This encompasses a set of tasks related to planning, allocation, and rational management.

These activities are primarily carried out by the organisational units of logistics and occur wherever military and civilian services are provided for the needs of the armed forces. (Ficoń, 2004; Dorobek, 2014).

For the military economy to function properly, an appropriate process must be ensured (Ficoń, 2000). The determination of these needs is based on the following foundations:

- the adopted defence concept,
- organisational and mobilisation assumptions,
- assumptions of the military equipment system,
- military training and maintenance,

- military plans for the replacement of material resources.

In the adopted defence concept, the level of expenditure related to the material supply of the military should ensure the full execution of its functions without compromising the economic growth of the country. In addition, when developing the defence concept, many other issues are considered, such as the division of the Armed Forces into different branches.

The defence concept serves as the starting point for formulating further premises, including those related to determining the material needs of the military (Dworecki, 1997).

The organisational and mobilisation assumptions are derived from the national defence strategy and form the foundational basis for determining material requirements. These assumptions are developed for various planning periods, tailored to the prevailing global political situation and the economic condition of the country (Mazarr *et al.*, 2019).

They encompass key personnel groups within the military, the organisational structure across different branches of the armed forces, including the heads of various military branches and services, as well as the number and types of military units (Dziedzic, 2022).

The assumptions of the military equipment system constitute another fundamental basis for determining material requirements. The value of the equipment system includes the costs associated with its development, implementation, and operation.

Alongside the introduction of new types of material equipment, it has become necessary to organise appropriate coordination between the existing equipment and the newly introduced models within the overall equipment inventory. Well-organised coordination in this regard extends the service life of older models, which is significant from the perspective of reducing overall societal expenditure on national defence (Lis and Jałowiec, 2015).

Military plans for training and maintenance are primarily driven by operational and training requirements, which lead to the consumption of various materials such as ammunition, fuel, food and uniforms. When determining the amount of material resources needed to support the training process, it is essential to consider the amount and quality of materials currently available to the military, as well as those scheduled for delivery during the training year.

Training plans are closely related to maintenance plans, including repairs, maintenance and other activities. Addressing these needs provides a basis for determining the requirements for spare parts, fuel, and other necessary supplies. Military plans for the replacement of material resources primarily concern

equipment and materials that need to be periodically rotated, renewed, or updated (Penc, 1996). The replacement process involves materials that are partially worn out, as well as obsolete items that should be retired due to standardisation efforts.

This also applies to perishable goods, such as food, medical supplies, and clothing, which should be replaced because of their limited shelf life. Conducting the replacement of material resources in a planned and rational manner helps reduce the costs associated with maintaining military stockpiles (Stańczyk, 2015).

The planning of material needs is based on standards and norms developed according to the authorised establishment tables, which are documents that define the characteristics and specifications of an organisational unit, including its internal organisational structure, the number, types, and ranks of all positions within the unit, as well as the quantity and types of weapons, military equipment, transportation means, and other equipment allocated to the unit (Dz. Urz. MON, 2005).

Furthermore, it relies on tables of allowances, which are documents specifying the total amount of standard and tabulated (allocated) equipment and supplies to which a unit is entitled, as determined by the norms of entitlement according to its purpose (MON, 2005). This planning also takes into account the personnel strength of the respective economic units, as well as the military units and institutions under their logistical support.

Standardisation is a concept generally understood as the creation and application of uniform standards and guidelines aimed at achieving the best possible performance of tasks without violating existing regulations (Krawczyk, 2001). The content of the standardisation function comprises the determination of objectives, resources, standards, and evaluation criteria.

In the context of the military economy, standardisation is an ongoing process that involves establishing, implementing, and approving the quantities of equipment and materials. Effective standardisation offers opportunities to enhance the efficiency of resource management through the application of a well-designed and consistently implemented standardisation system. Such a system can serve as an accurate benchmark for actions and as a basis for assessing both the planned and actual expenditures of labour, as well as the use of military fixed assets and current assets (Oleksyn, 2013).

Norms and standards, treated as obligatory directives that define the precise boundaries of economic activities, are utilised across all economic units in the processes of planning material needs.

At the level of an economic unit, they are used to develop logistical requirements, supply plans, and procurement plans for military logistics. The norm system serves as a tool for shaping the scale and structure of supply.

For example, the allocation of items, such as uniforms, to users is based on established norms regarding both quantity and variety, with reissuance occurring after the appropriate period, time frames specified by these norms. Norms currently hold particular importance in the process of control (Romanowska, 2004). They enable the verification of the accuracy of needs planning, the proper use and consumption of material resources by individual users, and the evaluation of asset management within logistical services.

Well-designed and realistic norms that align with the current needs of managing units and the capacity to meet those needs are an effective tool for reinforcing economic discipline. They serve as an instrument for the proper organisation of work and play a significant role in improving the military economy, especially in enhancing resource management efficiency (Kruk, 2017).

A norm is a multifaceted concept that is primarily used in philosophy and technical sciences. In every context, a norm prescribes a specific way for the recipient to behave in a given situation and under certain conditions. In economic terms, a norm represents a particular quantity (amount or value) that serves as the basis for a broadly understood economic activity, often setting the upper permitted limit.

In discussions on improving the functioning of the military economy, considerable attention should be paid to the issue of refining existing norms, as well as their role in the management system (Garlikowska, 2014).

To determine the amount of resources required to meet the needs of units and subunits, various norms are adopted as standard reference bases. These norms define the quantities of material equipment or the use of material resources, expressed both in physical units of measurement (e.g., kilogrammes, metres, pieces, etc.)-referred to as material norms—as well as in monetary units (value-based)-known as budgetary norms (Twaróg, 2003).

In addition to norms, regulatory standards play an important role in the military economy. These are rules that establish procedures and specify the amount of materials required for a particular unit. They have found an especially broad application in the management of technical equipment, the planning of the employment of civilian military personnel, and the determination of the overall levels of stockpiles.

The primary regulatory standards used in military logistics activities are as follows:

- Standards for the employment of civilian personnel.
- Standards for the entitlement of equipment and materials.
- Standards for the consumption and needs of spare parts for field equipment.
- Standards for the planning and use of equipment.
- Standards for current usage stock levels.

- Time standards for the repair of equipment and items.

The norms and regulatory standards in place within the military economy aim to establish appropriate conditions for the management of material resources by the various logistic services. In any management system, a norm serves as a fundamental building block upon which the system is built.

However, it only fulfils its role in practical management when it is realistic and accurately reflects the needs of the managing entity. In other words, the better and more precise the norm, the greater the assurance of rational resource utilisation (Romanowska, 2004).

The accuracy of determining material consumption norms depends largely on the standardisation method adopted. In the military economy, two primary methods are used to establish consumption norms: the technical method and the statistical method. The technical method involves determining the consumption norm by performing technical calculations based on detailed design and technological documentation. Three approaches are used in the technical development of consumption norms:

- The analytical-calculative method involves calculating the necessary quantity of materials required to produce a product based on design drawings or a formula, taking into account specific technological conditions.
- The experimental laboratory method involves determining the quantity of materials needed to produce a product through experimental laboratory research. These experiments should be conducted under conditions that closely resemble the actual technological process.
- The experimental production method is applied when, due to the technological conditions specific to a particular enterprise or the characteristics of the material, only experimentation on a production scale allows for the accurate determination of the necessary quantities of materials consumed in the manufacturing process.

The norms developed using the technical method play an important role in enhancing the quality of defence-related products. In the military economy, they are primarily applied in the supply process within the equipment utilisation system at the economic unit level.

Statistical methods are used to determine consumption norms when more precise methods are not feasible. In the statistical method, consumption norms are established by utilising statistical data that reflect the material consumption patterns during previous periods, under consistent conditions of use.

The accuracy of the consumption norm determined by this method depends on the length of the period used as the basis for establishing the norm. The longer this

period (assuming comparable conditions), the more accurate the norm. The minimum period that should be used to establish statistical consumption norms is typically one year.

When calculating the norm using the statistical method, the analysis includes the degree of repetition in material consumption for the same purposes over a specific time and the savings assumptions for the planned period. The basic and essential elements for determining a statistical consumption norm are as follows:

- Actual consumption of the material or a group of materials with similar or comparable properties in previous periods.
- Planned consumption of a specific material in the given period.
- Evaluation of the conditions of consumption in the planned period.
- The projected savings rate in material consumption.
- A list of materials with similar or comparable properties for which statistical consumption norms will be calculated for the planned period.
- A list of reference points against which the statistical consumption norms will be established.

The elements for calculating consumption norms must be systematically prepared, as this is crucial for ensuring the accuracy of their calculation. In both theory and practice, the following statistical methods are used to determine average consumption norms (Luszniewicz, 1987; Wywiał, 2011).

- Representation method: this method involves equating the consumption norm for a specific group of materials with the unit consumption norm of a selected material, called the representative. The main drawback of this method is the appearance of large fluctuations in the actual consumption of materials.
- Index method: this method requires the availability of already established consumption norms from previous years and current reporting periods. Using this method, the average consumption norms for the planned period are determined based on norms from previous years, following appropriate adjustments (Zimny, 2010).
- Extrapolation method: similar in principle to the index method, this approach requires data on average consumption norms over a longer period and relative stability in material consumption conditions. The main stages of developing average norms using the extrapolation method include gathering informational materials and establishing dynamic series of data on average material consumption norms, conducting mathematical and economic analysis of these series, smoothing the dynamic series using the least squares method, and determining average consumption norms for the future period through extrapolation.

In practice, long dynamic series for relative material consumption can only be constructed for a limited number of materials. Therefore, economic analysis is the primary component of the extrapolation method. This analysis allows us to determine whether the observed phenomena indicate a consistent trend and whether this trend reflects actual development rather than being influenced by external or random factors.

The analysis also enables one to identify the mathematical relationship that best corresponds to the development of the individual dynamic series. When applying statistical methods of standardisation, it is important to eliminate disturbances and irregularities from previous periods that significantly impacted deviations from the standardised consumption. Additionally, the planned changes that will occur in the future period for which the consumption norm is established should be taken into account.

In addition to the aforementioned methods for standardising material consumption, the estimation of norms is also applied. These so-called estimated norms are calculated based on the recorded consumption of materials over a certain period and the gathered statistical data, particularly when the statistical sample size is small.

The choice of methods for developing consumption norms depends on the type of materials, reference units, the nature of the economic unit's activities, and the purpose of the standardisation. The usefulness of these norms in the supply process is evident when they serve as a basis for establishing budget norms, which are economic and financial instruments that should be widely considered in the planning and supply activities of the armed forces. Budget norms are developed for recurring budget tasks, where the costs of execution can be determined based on the documentation available within the military.

The development of budget norms involves analysing and determining the expenditure (costs) required to accomplish specific budgetary tasks by military units and linking these expenditures to appropriate reference factors (both quantitative and qualitative). Quantitative (measurable) factors include, for example, the number of soldiers in a unit or the number of equipment units.

Qualitative (nonmeasurable) factors encompass all those factors that cannot be directly quantified but still influence the level of expenditure (costs), such as the specific needs of a specialised unit compared to other units. Budget norms in the military, according to the developed methodological assumptions, could be established using the statistical-calculative method and the analytical-research method.

The statistical-calculative method involves determining the budget norm without a detailed analysis of the expenditure structure covered by the norm or an in-depth examination of the impact of various factors on the individual components of the

standardised expenditures. The norm is represented by the average value calculated from the actual expenditures incurred in the previous period by the military units.

This value is established in relation to a specific reference unit, such as the expenditure per soldier. The use of the statistical-calculative method is mainly justified for indicative norms. The analytical-research method is based on breaking down the entire group of standardised expenditures (costs) into components, analysing the necessity of each component, and examining the influence of various factors on these individual components.

When determining norms using this method, the value of the expenditure (cost) is mathematically linked to a set of the most significant reference factors. The analytical-research method is characterised by its detailed analysis of the expenditure structure, which allows for the identification of necessary expenditures from the actual costs. This method is more precise than the statistical-calculative method, making it suitable for developing mandatory norms for military units. The process of establishing budget norms involves the following stages:

- Development of assumptions for budget norms,
- Collection and analysis of data for the development of budget norms,
- Preparation of a proposal for budget norms,
- Approval and implementation of budget norms.

The development of assumptions for budget norms initiates the work aimed at establishing detailed guidelines for their creation. Within this stage, the following activities should be undertaken:

- Determination of the composition of the expenses covering each standard,
- Identification of the types of unnecessary expenses, if any,
- Identification of quantitative factors that influence the amount of expenses and qualitative factors as a basis for dividing units into comparable groups,
- Designation of the military unit from which output data will be collected for the establishment of norms,
- Development of a questionnaire (if the outputs will be collected by survey) for data collection.

Data collection and analysis include sending out surveys to selected military units, receiving the collected materials and analysing them. As a result of the analysis, the determination of normative functions indicating the dependence of the expense (cost) in relation to different factors.

The development project of standards includes carrying out calculations related to the final elaboration of budget standards and giving them a form of practical use. The ready-made standards projects in the form of catalogues, supplemented by a descriptive part, are subject to agreement with the concerned central institutions.

The final stage of work in setting budget standards involves approving, issuing and implementing the developed standards, checking the effects of their implementation and the continuous improvement of them. The sets of standards (e.g., tables of dues) developed and approved by the relevant regulation are reproduced and distributed to the responsible management units for use, with a timeframe for practical application. Practical use of the current standards is the final stage of their implementation. The period prior to the standards' introduction is often used to train the concerned military units in the principles of using the newly created standards.

An important, but at the same time often undervalued issue is the keeping of standards up to date. In many cases, standards remain in force for many years, although during this time, due to technical progress (use of other raw materials, production technology), changes in the rules of use, significant organisational changes, changes in unit prices or other important reasons, the standards established years ago do not fulfil their purpose.

Therefore, they do not provide a correct measure of needs in planning or a basis in the procurement process and they do not reflect consumption and efficiency of management in the form of both material and value standard. For this reason, both material standards and value standards should be reviewed and, where necessary, modified.

The starting point for verification should be the results of an analysis that compares the development of actual consumption to that determined by standards and identifies the reasons for deviations. This should be a continuous activity, supported by research conducted by the relevant organisational units specialised in the field of standardisation, supported by scientific experience and knowledge.

Changes to material consumption standards are usually made in accordance with an established and applicable procedure. In general, a circular or radial system of making changes can be used. The circular system of introducing changes is based on the distribution of correspondence or a special form containing the change proposal from the initiator of the change to the units concerned in order to collect opinions on the relevance of the change.

After the feedback on the change, the form is returned to the initiator and then, once finalised, the change comes into force. In the case of the radial system, the change intention is delegated to selected cells for comment. These, after reviewing and commenting, return the proposals for change to the initiative leader, who notifies all concerned of the change as being in force.

4. Conclusions

This paper has demonstrated the critical importance of standards and norms in the domain of military logistics, particularly in the planning and management of

material resources. Through an examination of various methodologies, technical, statistical, and analytical research, it is evident that each approach plays a distinct role in the development of effective standardisation processes.

These methods, when appropriately applied, enable the military to optimise resource use, thereby enhancing both operational readiness and economic efficiency. The research highlights that the success of these norms hinges on their continuous review and adaptation to reflect technological advancements, organisational changes, and evolving operational needs. The ongoing refinement of these standards is essential to ensure that military logistics remains responsive to the demands of modern defence strategies while maintaining rigorous economic discipline.

In conclusion, the effective implementation and regular enhancement of norms and standards are indispensable for the efficient management of military logistics. By ensuring that logistic operations are closely aligned with both strategic objectives and resource availability, these practices support the military's ability to achieve optimal outcomes in both planning and procurement processes.

The findings of this study underscore the necessity of a dynamic approach to standardisation, one that is continually informed by empirical data and aligned with the overarching goals of national defence.

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