

IMPROVING MANAGEMENT IN FAVOUR OF DEFENCE AND SECURITY ON THE BASIS OF E-ECONOMY TOOLS

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Abstract: Effective management, particularly the one favouring broadly-understood security and defence, requires the integration of economic processes, including the processes referring to logistics, and the occurrence of a positive synergy effect. Access to an increasing amount of data, as well as the possibility to process them and share them with partners, is becoming a crucial matter in terms of integrating and improving management at every company and organisation. Economic practice refers to two basic tools of e-economy for that purpose: automatic data capture (ADC) and electronic data interchange (EDI), which are compliant with the global system of standards, GS1.

Keywords: Management, GS1 system, ADC, EDI, security.

USPRAWNIANIE ZARZĄDZANIA NA RZECZ OBRONNOŚCI I BEZPIECZEŃSTWA W OPARCIU O NARZĘDZIA E-GOSPODARKI

Streszczenie: Efektywne zarządzanie, szczególnie na rzecz szeroko rozumianego bezpieczeństwa i obronności, wymaga integracji procesów gospodarczych, w tym logistycznych i uzyskania dodatkowego efektu synergii. Kluczową sprawą dla integracji i doskonalenia zarządzania każdą firmą i organizacją staje się dostęp do coraz większej liczby danych, możliwość ich przetwarzania oraz współdzielenia ich z partnerami. W praktyce gospodarczej w tym celu stosuje się dwa podstawowe narzędzia e-gospodarki: automatyczną identyfikację (ADC) oraz Elektroniczną Wymianę Danych (EDI), według globalnego systemu standardów GS1.

Słowa kluczowe: Zarządzanie, System GS1, ADC, EDI, bezpieczeństwo.

1. Introduction

The innovative nature of the public and private sector favouring the improvement of management, is demonstrated by the use of two fundamental tools of contemporary e-economy: ADC (Automatic Data Capture) and EDI (Electronic Data Interchange). Managers managing organizations, facing new challenges and threats, will have an easier task thanks to the use of these tools. Effective management requires intersectoral cooperation and establishment of successful relations with stakeholders. Thus, ADC and EDI systems often still implemented according to internal or industry solutions are less effective than global tools. Best practices applied in the public, private and non-profit sector should therefore cover the use of the system functioning in 150 countries, adapted to meet the requirements of different sectors and compliant with the specific nature of all industries, i.e. GS1, which covers global standards and solutions of ADC and EDI. GS1 is more and more commonly used in civilian and military economy, thus the new methods and techniques in management and commanding should apply it in the broadest scope possible. It is gaining particular significance in managing entities playing an economic and defensive role. NATO adopted GS1 standards to its own ones, the so-called STANAGs, back in 1998. The Polish Armed Forces have also been promoting the application of GS1 standards since 2010, and implementing it actively since 2014.

Educational and scientific activities related to management, defence and security which use the GS1 system have been carried out for over 40 years, and since 1990 in Poland, particularly by the Institute of Logistics and Warehousing, which acted as the national GS1 organisation to June 2016 and is the founder and contents-partner of GS1 Polska. Its mission is to develop, promote and implement innovative e-economic solutions.

The article describes the essence of ADC&EDI and GS1 standards used to streamline management in all sectors and industries, in compliance with EU directives and regulations, new recommendations presented in European and national legal acts and other regulations the purpose of which is to improve defence and security.

The material presented was based on 27 years of experience in developing best business practices in terms of implementing ADC and EDI systems which streamline management in different sectors and industries in Poland, Europe, as well as in the world. The results of studies carried out throughout that period, expert opinions and experiences from the last 4 years, which ignited the implementation of GS1 standards in the Polish Armed Forces, were also used.

2. IT technologies in the integration and improvement of management

The world, the European Union, governments and the business itself consider the growth of e-economy the basic condition for the economic and innovative development of every company and institution. It requires the use of modern tools for data collection and transfer, which support management in every company and institution representing the public and private sector both internally and externally, i.e. in their relations with customers: suppliers and recipients, including the army and citizens as consumers, patients or soldiers. In economic practice, these tools are: Automatic Data Identification (ADC) and Electronic Data Interchange (EDI). At this point, cooperation, including trade and supplies to the military, on national, European or global open markets is carried out by flows of products within logistic supply chains controlled by IT systems.

To ensure due security and defence, it is necessary not only to provide the army with all required resources, but also to ensure current access to data concerning the type of available goods, their place of storage and their amount, including appropriate additional information, to be able to move the resources in compliance with the assumptions of logistics: suitable resources in required amount and time to a specified location. To achieve this goal, obviously with high service level, low costs and optimum profits for all supply chain participants, suppliers and recipients appreciate new technologies which make the flow of goods, information and documents smoother.

3. Automatic identification – its essence and techniques

Automatic identification – ADC (also called: AI, Auto ID, AIDC) is an automatic method of entering data of required detail to IT systems or a different microprocessor-controlled devices, called readers or scanners, without using the keyboard. Contrary to the manual method, which is time-consuming and frequently leads to errors, the new method is fast and accurate. Due to these advantages, IT systems applying ADC significantly improve the effectiveness of all operations: data recording, transactions, controls and steering.

ADC systems refer to different techniques, but two of them, optical (based on bar codes) and electromagnetic (based on identification with radio waves – RFID), prevail in civilian and military practice. Bar codes, as the easiest available and cheapest method, are in common use. Seeking to present as many characters on the smallest area possible, several hundreds of types and variants of bar codes were developed. However, only few of them (linear, two-dimensional, complex and composite bar codes) have found their way to common use, and are now applied as universal international standards. Radio tags are applied, for example, when technical reasons prevent the use of bar codes, e.g. to trace oversized resources. The method is used by such bodies as Departments of Defence in the United States and Brazil.

4. Electronic Data Interchange (EDI) according to global standards

Most of today's companies use IT systems such as purchase or finance and accounting systems to manage their business operations. The data used by these systems is obtained from various, often computer-generated, documents. Documents such as an order or an invoice should be accurately entered and quickly processed. Electronic Data Interchange (EDI), which is a system for electronic interchange of standard documents, is used to streamline internal and external settlement and accounting processes. It allows giving up paper documents and ensures faster, more cost-effective and accurate interchange of files. Electronic Data Interchange facilitates contacts with suppliers and recipients of every supply chain participant and improves management (still, it should not be mistaken for electronic data interchange as it is commonly understood).

As part of the GS1 system, communication standards with a common name GS1 eCom (GS1 e-Communication), allowing the automation of economic partnership, including commercial transactions between partners, have been drawn up. GS1 eCom makes two complimentary standards available: GS1 EANCOM[®]/EDIFACT and GS1 XML. GS1 standard: EANCOM[®] is a collection of detailed instructions concerning the implementation of 47 standard UN/EDIFACT messages. Both standards make it possible to establish direct connections between the physical flow of products/goods or companies and information concerning them. By using GS1 identifiers specifying products (GTIN numbers), company locations (GLN numbers) and logistic units (SSCC numbers), the standards allow direct integration of data collected in the course of scanning raw materials or resources during warehouse receipts or releases. They are the basis for generating electronic commercial documents. The standards allow commercial partners to interchange documents in a simple, reliable and cost-effective way. They cover master data transmission, commercial transactions, reports and planning, transport, financial messages and other general data.

5. Why should the standards be applied?

The drive towards standardisation results both from the need to provide an economic method for collecting and using information on economic objects and phenomena, to guarantee their reliability, and to ensure the compatibility of internally implemented IT solutions with the solutions of other business and institutional partners. The obligation to ensure interoperability and compatibility in civilian and military economy requires the standards to be open, simple, neutral, independent of technology, commonly implemented, durable and flexible. The GS1 system meets all of these criteria. It is presently the most popular global, comprehensive and

coherent system comprising different standards used to improve management in every sector and industry. The fact that it is applied so commonly, automatically improves security.

Among existing and currently implemented ADC and EDI applications, there are:

- individual solutions, defined as internal or private (which are useless when applied only within one company or institution, and from the perspective of cooperation),
- industry-related solutions (which must be applied on the basis of bilateral agreements, and thus may not be used in the entire supply chain),
- global (universal) solutions – recommended.

ADC and EDI industry standards are presently in the process of migration to global standards, but it is a long-lasting and costly process.

6. The GS1 system and its functioning

The GS1 system is a collection of comprehensive identification and communication standards to be used in logistic processes carried out as part of a supply chain and administrative management. They are applied in commerce, services, transport, administration, healthcare, postal services, the military etc. The system was developed in 1973 and it currently has over 2 million active participants registered at 112 national organisations, operating in 150 countries. It should be borne in mind, however, that there are many more companies and institutions using GS1 standards and solutions in the world. It is estimated that over 6 trillion GS1 codes are identified daily, with reference to retail products only.

On a global scale, the GS1 system is managed by the GS1 organisation with its headquarters in Brussels and Princeton (United States). On the national level, national GS1 organisations are responsible for managing and implementing the system. In Poland, the Institute of Logistics and Warehousing (ILiM) in Poznań bore this function from 1990, i.e. the year in which the system was adopted in Poland, to June 2016. ILiM is a research institute which is directly subordinate to the Ministry of Development and which celebrates its 50th anniversary this year. Today, the GS1 Polska Foundation, managed by its participants, bears the function.

As part of the Global Standard Management Process, the GS1 organisation defines basic guidelines concerning global identification and communication, giving national organisations the possibility to adapt them to their own conditions, leaving the basic rules intact.

The GS1 system also covers national standards, for which it outlines basic guidelines, leaving the development of detailed solutions to national organisations, so that they can provide for the requirements and conditions of national economy and the needs of companies and institutions operating in a specific country. The system also includes internal (company) solutions, which it prepares basic rules for, allowing the users of the solutions to define details.

Both national and internal standards are, at the same time, compatible with the global ones, which represents their greatest advantage.

Today, GS 1 system standards are used by tens of thousands of Polish companies and institutions, and over 23 thousand business entities, from ministries to SME enterprises, including military units, are the system's participants. The number of entities entitled to use GS1 coding increases each year – Figure 1.

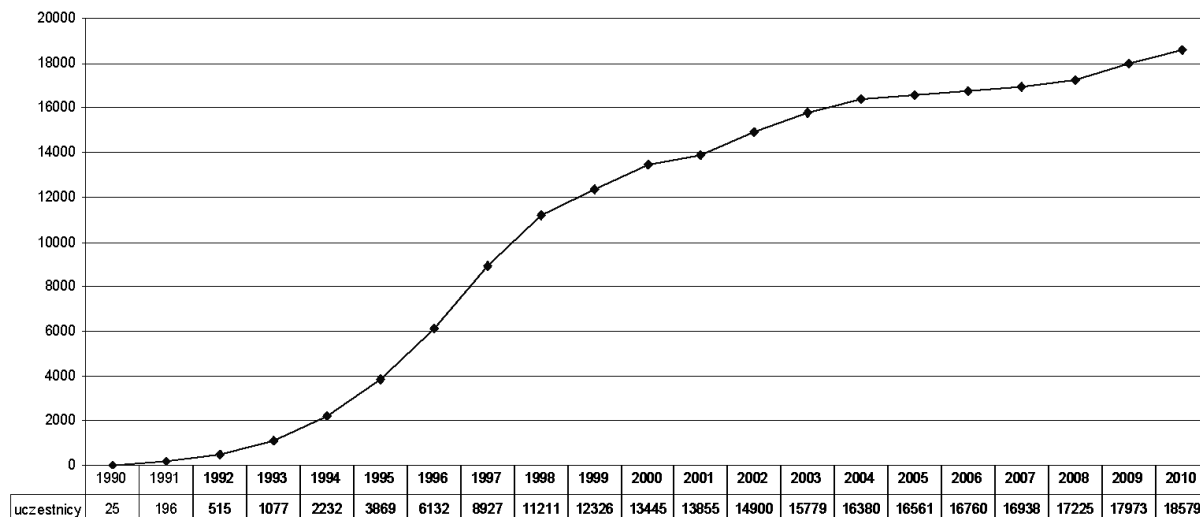


Figure 1. The number of GS1 system participants registered at GS1 Polska in the first 20 years. Source: ILiM – GS1 Polska.

The most important element which integrates all of the system's elements is a uniform method of identifying goods, services and other objects in the form of meaningless identifiers transferred between users by means of different technologies (bar codes, RFID tags or EDI documents). Identification and communication standards play a particular role in supply chains, because they provide a codified base serving the transfer of information. They help streamlining transactions, facilitate coordination and ensure effective use of resources within companies and institutions cooperating with each other. Basic elements of the GS1 system (Figure 2) create tools which enable such activities as:

- unambiguous identification of objects moved in supply chains,
- automatic collection of data concerning moved goods and logistic units, as well as provided services,
- sharing information on any events concerning them with other supply chain participants.

- recommended for common use by industry bodies,
- adapted to their automatic identification (by GS1 bar codes or EPC radio tags),
- adapted to unambiguous identification of basic business data, in IT systems (by global data identifiers, called Application Identifiers (AI GS1)).

The list of GS1 global identifiers with global and national names has been presented in Table 1.

Table 1.

The list of global GS1 identifiers

Identification:	Abbreviated name	Global name	Name according to GS1 Polska
products /goods and services	GTIN	Global Trade Item Number	Globalny Numer Jednostki Handlowej
companies, institutions, other formal and legal entities and physical locations	GLN	Global Location Number	Globalny Numer Lokalizacyjny
logistic units	SSCC	Serial Shipping Container Code	Seryjny Numer Jednostki Logistycznej
shipments	GSIN	Global Shipment Identification Number	Globalny Numer Identyfikacji Wysyłki
consignments	GINC	Global Identifier for Consignment Number	Globalny Identyfikator Przesyłki
returnable assets	GRAI	Global Returnable Asset Identifier	Globalny Identyfikator Zasobów Zwrotnych
individual assets	GIAI	Global Individual Asset Identifier	Globalny Identyfikator Zasobów Indywidualnych
service relations	GSRN	Global Service Relation Number	Globalny Numer Relacji Usługowych
documents	GDTI	Global Document Type Identifier	Globalny Identyfikator Typu Dokumentu
coupons	GCN	Global Coupon Number	Globalny Numer Kuponu
components	CPID	Component / Part Identifier	Identyfikator Komponentu
product components	GCTIN	Global Component Trade Item Number	Globalny Numer Części Jednostki Handlowej

Source: own study.

The majority of global identifiers are numerical, have fixed length and consist of 4 parts:

1. a prefix attributed by the GS1 global organisation to the national organisation (the prefix of GS1 Polska is 590);
2. company/institution number attributed by the national GS1 organisation to the business entity, with a set of identifiers compliant to their needs;
3. designation of an object attributed by the entity in accordance with its rights and market needs, providing for a required degree of detail;
4. a check digit calculated according to the GS1 algorithm, to verify if the identifier is correct.

The GS1 system also includes global data identifiers, the so-called AIs, which unambiguously, on a global scale, define the type of business data and its format.

8. Interoperability in favour of security and defence

GS1 global standards include ADC and EDI dual-use standards. NATO adopted them in 1998, and the Polish Armed Forces have been working on their implementation since 2010. The publication of Decision no. 3 of the Minister of National Defence of 3 January 2014 specifying the requirements of marking products supplied to the Ministry of National Defence with bar codes accelerated the implementation of ADC in the army, in compliance with GS1. Standards and solutions for interoperability concern the following elements used in civilian and military logistics:

- ADC techniques,
- types of objects coded in both economies,
- identification standards: identifiers of products, companies and logistic units,
- types of data according to "application identifiers" used in both economies,
- bar codes,
- product data interchange methods,

For the purposes of ADC implementation, the same standards as in civilian economy – GS1 – and, additionally, NATO industry standards, are used to mark objects in military economy:

- **ADC techniques:** there are six different ADC techniques, two of them, optical (based on bar codes) and electromagnetic (based on identification with radio waves – RFID), prevail in civilian and military logistics;
- **types of coded objects:** commercial units (all products including services), logistic units, locations, including formal and legal entities and physical locations;
- **identification standards:** GTIN numbers: GTIN-8, GTIN-12, GTIN-13, GTIN-14, whereas the Polish army mainly uses GTIN-13 and GTIN-14; SSCC and GLN numbers; NATO identifiers of commercial units: NSN as supplementary identifiers (JIM – national identifiers of commercial units used by the military – read only visually);
- **bar codes:** GS1, including EAN/UPC, ITF-14, GS1-128, GS1 DataBar, GS1 DataMatrix, Ad on 2 and Ad on 5; whereas the Polish army mainly uses EAN-13 and GS1-128, and at the next stage of implementation, presumably also GS1 DataMatrix code;
- **data identifiers:** Application Identifiers GS1 (AI) and industry identifiers ANSI/FACT (FACT Data Identifiers); the Polish army uses AIs, including the most popular ones in civilian economy;
- **product data interchange:** product sheet developed to follow the example of a product sheet consolidated in civilian economy. Additionally, there are recommendations to use newer data interchange solutions, using GDSN (Global Data Synchronization Network) or suitable EDI electronic documents presenting data concerning partners (PARTIN) and product catalogues (PRICAT) according to EANCOM®.

9. Summary

From the perspective of the management of companies and institutions, the essential element, irrespective of the sector or the industry, is information management, to ensure that all products and services moving along the supply chain are linked to their physical flow and are connected with their updated information. It requires assuming a holistic look on the supply chain, which may be achieved best by the continuous development of the global business language the GS1 system, commonly applied in civilian and military economy. In many industries, the civilian sector requires tracing products "from field to plate". In many countries, the military sector is also aware of the need to make improvements in supply chain management to ensure tracing the movement and origin of goods "from factory to foxhole".

The Polish Armed Forces are presently implementing ADC according to GS1, in compliance with the results of completed works and studies. The selected set of standards and solutions in the scope discussed includes all types of products – objects of commercial exchange handled by civilian and military economy, and scientific achievements favouring interoperability.

The usefulness of GS1 standards and solutions, so far applied mostly in the management of production and trade companies, has been proven, particularly in the scope of consumer goods, but also in other economic sectors, such as heavy industry, machine building or precision engineering. GS1 standards are also used to boost e-economy in administration, banking etc.

In the course of implementing the GS1 system in the army, discrepancies were identified, their significance with reference to interoperability was determined and solutions to increase the interoperability were developed. Best practices for specific material groups are presently being discussed with the Polish Armed Forces. At the same time, there is a need to perform further research, particularly aimed at developing best practices to facilitate the implementation of recommended GS1 standards and solutions in Poland and in the world.

Bibliography

1. Decision no. 3/MON of the Minister of National Defence of 3 January 2014 on guidelines specifying the requirements of marking products supplied to the Ministry of National Defence with bar codes. *Official Journal of the Minister of National Defence of 7 January 2014, item 11.*
2. Hałas, E., Kosmacz-Chodorowska, A. (2014). ADC i EDI jako efektywne technologie logistyczne podwójnego zastosowania. *Gospodarka Materialowa i Logistyka*, 5, 314-326, Warszawa: PWE.

3. Hałas, E., Kosmacz-Chodorowska, A. (2015). *Military supplies coding according to GSI – good business practices and their implementation in the polish armed forces*. Global supply chain standards and solutions in practice of national defence of Visegrad (V4) countries. Budapest: National University of Public Service (Nemzeti Közzolgálati Egyetem), 85-121.
4. Harps, L.H. (2005). *From Factory to Foxhole: The Battle for Logistics Efficiency*, <http://www.inboundlogistics.com/cms/article/from-factory-to-foxhole-the-battle-for-logistics-efficiency/>.
5. Kosmacz-Chodorowska, A. (2015). Wdrażanie kodów kreskowych w wojsku – współpraca z dostawcami. *Gospodarka Materialowa i Logistyka*, 5. Warszawa, PWE, 334-354.
6. Kosmacz-Chodorowska, A. (2016). Znaczenie ustandaryzowanego znakowania opakowań dla integracji i doskonalenia łańcucha logistycznego. In W. Wasiak (ed.), *Opakowania w łańcuchu dostaw. Wybrane problemy*. Warszawa, PIO, 133-157.
7. Kosmacz-Chodorowska, A. (2017). *Interoperacyjność standardów i rozwiązań w zakresie usprawniania logistyki łańcuchów dostaw gospodarki cywilnej i wojskowej z wykorzystaniem systemów automatycznej identyfikacji*. Lecture made at 6th International Scientific Conference in Logistics, FORUM 2017, Poznań.
8. Kosmacz-Chodorowska, A. (2017). Interoperacyjność systemów logistycznych automatycznej identyfikacji na świecie i w praktyce Sił Zbrojnych RP. *Problemy Jakości*, 8, Warszawa: PWE, 11-17.
9. *Kody kreskowe i inne globalne standardy w biznesie* (2012). Poznań: Biblioteka Logistyka.