



GS1 GLOBAL STANDARDS AND EPC GLOBAL AS A SOLUTION ENABLING TRACEABILITY OF GOODS IN SUPPLY NETWORK

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ABSTRACT. The process of ensuring the safety of goods delivered to the market is connected with monitoring and administrating of needed dates at every stage of supply chain and at the level of every supplier included in this chain. The problem started to be discussed more closely when the new legal food traceability requirements were introduced. Food sector companies were forced by these requirements to introduce the system of monitoring of origin and every movement of every item offered to clients (so called traceability system). This system is composed of special procedures and rules to monitor and gather all needed information about goods. The idea of traceability system is to be able to track every item of goods offered at every stage of supply chain, included every raw material used for production of this item as well as to transfer these information to next step of supply chain. Global standards used by GS1 system of monitoring, registration and flow of information are sufficient to meet above-mentioned requirements. The paper presents the GS1 and EPC global standards and possibilities to introduced them into FMCG companies. The case of implementing GS1 standards to trace food goods in whole supply chain is presented.

Key words: traceability, GS1 system, EPC global, supply chain.

"TRACEABILITY" - FULFILLMENT OF LEGAL REQUIREMENTS

Every supplier of food products (producer and retailer) is obliged to register every movement of goods, that means - where, when and from whom he bought these goods, etc. The best way to automate this process is to implement the global standards, readable for all participants of supply chain.

The obligation of monitoring of movement and origin of foods and fodders results directly from Regulations 178/2002 from 28 January 2002 of European Parliament and Council of Europe. The regulations came into force in countries of European Community since 1 January 2005. The English word "traceability" is used very often instead of polish one, because the English version is used and recognized more widely.

All participants of supply chain are responsible for monitoring of goods distributed in this chain, not only producers and wholesalers of goods but retail shops as well, which are the last stage of supply chain. In fact, retail shops are the first ones where the "searching" of problems reasons is being held, if any alarm occurs on the market. In case the client reclaims the product not suitable for use, the retail shop is obliged to identify the product (name, producer, who delivered the product, batch number of product, etc.) and to transfer these information to supplier of this good.

According to present legal regulations the one who offers the product on the market is responsible for its quality and safety. To offer on the market means to store and present goods to be sold to clients, to deliver them as well as any other way to introduce these goods to the market, with only exception of direct sale. These rules are covered in details by Regulations from 29 January 2004 (of Veterinary Inspection), from 11 May 2001 (of foods and conditions in which they are kept) and from 28 July 2005 (its amendment). Following this interpretation the producer or brand owner will be the one who introduces products into the market. But in fact the differently constructed commercial agreements are signed and according to them usually the delivers of products are responsible for withdrawing of goods from the market.

There are a few basic rules of monitoring goods origin and movements, which should be considered by every handler of food products [ECR Europe 2004]:

- systems and procedures of traceability processes should fulfill the main aim, to cover legal requirements of access to information about traced products and to ensure the possibility of quick withdrawing of these goods from the market,
- monitoring system should be based on standards approved and accepted by all participants of supply chain to ensure the quick and precise flow of information and optimisation of data processing,
- every participant of the chain has a free will to choose his own traceability system, the only condition is, his system must enable to exchange all information needed with other participants of the chain.

According to above-mentioned rules every participant of supply chain of food products has to gather information about goods bought and delivered by him. From the point of view of safety of goods introduced on the market, the most important case is to possess the information and to have quick access to it. The way the information is gathered is also very important. These data should be collected in a way acceptable for all participant of supply chain. Of course, records may be performed manually. However, from the point of view of logistic process management, it is more efficient for a company to develop a database in a computer system.

The suppliers of raw materials are also responsible for health quality of food products. They are the part of supply chain as well. This results directly from Regulation (EC) No 1935/2004 (together with Regulations 80/590/EWG and 89/109/EWG overruling the first one). This legal document, article 17, specifies requirements regarding traceability:

1. The traceability of materials and articles shall be ensured at all stages in order to facilitate control, the recall of defective products, consumer information and the attribution of responsibility.
2. With due regard to technological feasibility, business operators shall have in place systems and procedures to allow identification of the businesses from which and to which materials or articles and, where appropriate, substances or products covered by this Regulation and its implementing measures used in their manufacture are supplied. That information shall be made available to the competent authorities on demand.
3. The materials and articles, which are placed on the market in the Community, shall be identifiable by an appropriate system, which allows their traceability by means of labeling or relevant documentation or information.

This Regulation will come into force in October 2006, thus upstream sector connected with a food industry will be obliged to observe traceability rules.

The GS1 System, which uses global standards to identify individual units and flow of information, offers tools and solutions to fulfill the traceability requirements.

SYSTEM GS1 – SOLUTION FOR "TRACEABILITY"

The GS1 System is administered by GS1 (previously EAN International) being a global organization that currently consists of over 1.000.000 user companies, 104 member organizations from 105 countries. The GS1 standards are used in over 20 industries such as FMCG, healthcare, automotive and transportation.

It is generally assumed by representatives of food sector companies that they meet food traceability requirements by means of the following norm and standards: ISO 9001:2000, HACCP, IFC or BRC. Indeed, those standards ensure safety of food products produced, stored or distributed, thanks to internal systems of product and trade partner monitoring. However, this does not guarantee the continuity of traceability processes in the whole supply chain. Companies obliged to track and trace their products may encounter the following problems:

- lack of relation registration between:
 - batch/lot numbers (e.g. records of connections between particular batch numbers of products or semi-manufactured articles),
 - batch or lot numbers or number of logistic units (e.g. the records of information about number of logistics units in relation to lot number of units contained),
 - numbers of logistics units and numbers of trade partners (e.g. records of information from whom a particular logistic unit was received and to whom it was sent),
- lack of a uniform identification method and data record about tracked and traced products and the trade partners, and thus lack of possibility of effective information exchange.

The GS1 System allows for elimination of the above-mentioned problems. In order to broaden possibilities of the system and in order to support its users, the implementation grid [EAN International 2004] presented in Table 1 was defined. It combines basic traceability rules with accessible technologies and the GS1 System tools.

Table 1. Implementation grid of the GS1 standards
Tabela 1. Siatka wdrażania standardów GS1

Traceability principles	Enabling technologies	GS1 system tools
unique identification	automated identification	GTIN, SSCC, GLN, application identifiers
data capture and recording	automated data capture	EAN/UPC GS1-128
links management	electronic data processing	software applications
data communication	electronic data interchange	EANCOM / XML

The unique identification of products, lot production, logistics units in range of traceability can be assured using GS1 global identifiers:

- GTIN (Global Trade Item Number) - which can identify the individual number of a consumer packaging (retail unit) or trade packaging (non retail),
- SSCC (the Serial Shipping Container Code) - which usually identifies the individual number of a pallet or trade unit,
- GLN (Global Location Number) - it enables unique and unambiguous identification of physical, functional or legal units, such: the warehouse, individual loading docks, the branches of firm etc.,
- AI (Application Identifier) - are identifiers which identify data that appears after them; each attribute of logistics units or trade unit included in a logistic label are definite by means of AI's.

Batch/Lot number presented by means of AI (10) is essential information, which needs to be linked with collective packaging number.

Data capture and recording is realized based on an assumption that every participant of supply chain uses uniform GS1 standards which are reflected in appropriate bar code symbols. To realize requirements of traceability all units should be equipped with labels with bar code. Several basic symbologies are used in the GS1 system depending on the type of packaging and function in the supply chain:

- bar-coding trade units (retail): EAN-13, EAN-8,
- bar-coding trade units (non retail): EAN-13, ITF-14 or GS1-128,
- bar-coding logistic units: GS1-128.

The management of data related to tracked and traced units requires correct data connection in databases. It means that information about numbers of units on each packaging level are associated with information about trading partners, and/or the places of delivery and receipt of these units.

Data communication is the key element ensuring the realization of traceability rules, because when any hazardous product appears on the market, the suitable flow of information among trade partners makes quick and effective actions possible, e.g. product recall. In order to exchange information more efficiently, EDI is the best solution.

EDI - (Electronic Data Interchange) is defined data structure transfer, by means of standard messages, from one computer application to another, without or with minimum human intervention. In order to exchange information more effectively and to meet traceability requirements it is enough for trading partners to exchange the following EDI message - DESADV (Dispatch Advice).

This message contains a lot of information characterizing in detail a given dispatch. However, from the traceability point of view the most important information is as follows:

- information about trade partners – GLN,
- information about delivered product - GTIN + AI (10),
- information about logistic unit - SSCC.

Generally, the above mentioned principles are related to correct identification of packaging within a logistic process taking into account batch/lot number and/or other data which must be recorded to meet traceability rules.

Taking into account the above mentioned rules for traceability system which would function in a company, guarantees the fulfillment of traceability requirements and simultaneously generates some additional benefits:

- reduction of labour work,
- elimination of errors,
- reduction of costs,
- effective management,
- and improve the competitiveness of company.

There is one basic conclusion arising from the above mentioned rules defining the usage of the GS1 standards for traceability reasons: every partner engaged in a food supply chain should gather information related to delivered and shipped goods. This information concerns both the goods themselves but also recipients and suppliers of these goods. From the point of view of product safety, information and a quick access are the most important issues. Data capture method is another important issue. It is important to present the data in a way comprehensible for all participants of a supply chain: standard, universal and common. Records may be performed manually. However, from the point of view of logistic process management, it is more efficient for a company to develop a database in a computer system.

Technology based on RFID and EPC global standards offers larger visibility of supply chain and more effective methods of monitoring goods through this supply chain.

TECHNOLOGY RFID/EPC

The technology of recording and reading bar codes was developed and popularized worldwide and that is why it is cheap and globally used. However, the main reason why this technology is globally used, are the global GSI numbers, which unambiguously identify product, pallet or location. Bar codes, which are data carriers, will slowly be pushed out by RFID tags, which consist of a microchip with and antenna activated via radio waves. Information in a tag is recorded in a binary manner and processed by means of special transferred into numerical data. The superiority of RFID technology (Radio Frequency Identification) over a traditional one (e.g. bar codes) lies in considerably broadened quantitative possibilities of data record about a specific object.

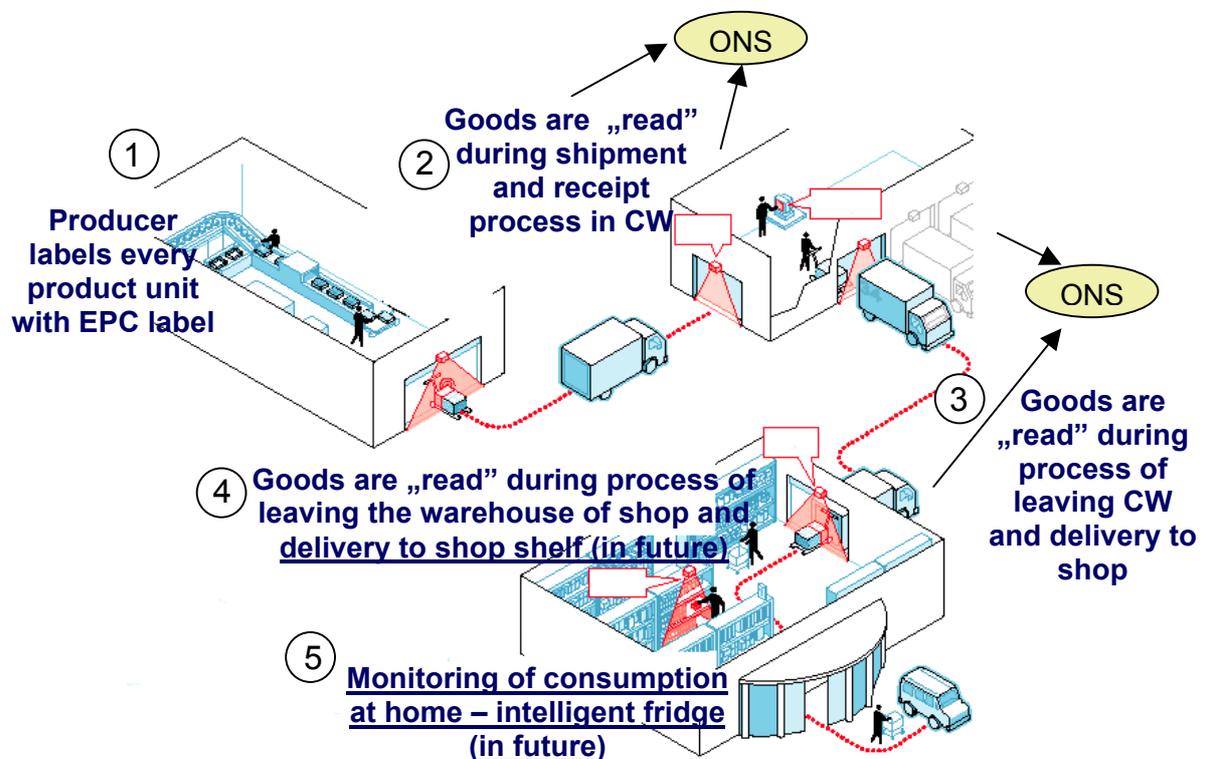


Fig. 1. The whole supply chain by use of EPC global system [GCI/IBM 2003]

Rys. 1. Schemat pełnego łańcucha dostaw w aspekcie wykorzystania sieci EPC global [GCI/IBM 2003]

Open EPC standards are not only standard ways of recording definite information in an EPC tag, but first of all the EPC global network, permitting to identify automatically an individual unit in a supply chain in every company, in every branch of industry, worldwide. EPC global network consists of the following basic elements:

- EPC - product code written on an electronic carrier; individual, global object identifier,
- tags and readers - the device to collect data, connecting flow of goods with flow of information,
- middleware - the software for filtering output data from readers and for reducing overloading of network; this is also the interface to internal computer systems and to the EPC global network,

- ONS (Object Naming Service) - resource, which "knows" where information about EPC is kept (ONS is similar to DNS),
- EPC IS (the EPC Information Service) - the server, enabling the users to exchange data between trading partners based on EPC codes. This server uses the PML language (Physical Markup Language) - designed by Auto - ID laboratory as a method of product description. PML is a standardized XML dictionary for description of physical object, systems, processes and environments connected with the object.

The possibility of tracking the flow of goods in real time is one of basic advantages of the above-described technology and at the same visibility of the whole supply chain. Each product identified with an individual number EPC is tracked and traced in a supply chain. Whenever a product leaves a warehouse, this action is recorded and visible for participants of the whole EPC global network. A retailer orders a particular product for example from a manufacturer. Thanks to the EPC global network such a company can observe when the ordered goods leave factory, when they appear in a distribution centre and when they are delivered to the shop. But what is the benefit of monitoring flow of an individual product in a supply chain?

Looking for answer to the above-mentioned question about reasons for such a detailed identification, we come to the following conclusions:

- by means of an individual EPC number in case of a product recall, we can reduce size of the assortment to be withdrawn - not always will it be necessary to withdraw the whole lot after having defined the source of the problem,
- it is possible to react more quickly to critical situations caused by the introduction of dangerous products into the market - the possibility of tracing product history, without necessity of insight to internal databases; such functionality is in place thanks to the EPC global interfaces and internet tools.

SOLUTION "TRACEABILITY" USING GS1 STANDARDS IN PRACTICE

Many companies use GS1 standards as a solution for monitoring and tracing products in supply chain now. The example of implementation of EDI communication in connection with GS1 standards in food product supply chain is presented below.

This case present three companies - participants of supply chain on Dutch market:

- REMIA - producer of margarines, oils and dressings,
- Van Uden Food Express - logistics operator for Remia, who is responsible for warehousing and transport of REMA goods,
- Makro - network of shops of Metro group - retail shop.

The flow of goods and information among these three companies can be described shortly as follows. REMIA prepares the order based on EDI ORDER send by MAKRO. REMIA sends the INSDDES message (dispatch instructions) to Food Express, which describes the details about client's order. After picking process is finished, Food Express sends a DESADV message (shipment note) to MAKRO and REMIA (including the details about goods prepared). REMIA prepares the invoice for MAKRO, sending special INVOIC message (Invoice).

Describing the flow of goods, four steps of process can be marked out:

1. REMIA marks the pallet with a logistics label, including such data as: number of logistics units, quantity, shelf-time, production batch number, etc. Warehouse stock in REMIA is automatically actualized and a DESADV message is sent to Food Express. Before shipment, the data read from logistics label are confronted with data from computer system by using ADC system.

2. Food Express sends periodically the warehouse stocks report via INVRPT message to producer. Thanks to this process the producer knows exactly when and in what quantities the stocks have to be replenished. When Food Express receives the goods, the logistics label is read and data from it are introduced and automatically confronted with the system (the information about delivery was sent earlier via EDI message DESADV).

3. REMIA sent the INSDES message connected to MAKRO order. Food Express labels the pallets with logistics label having the SSCC code. Then the message DESADV (shipment note) is sent to METRO and REMIA, including details about shipment. Warehouse stocks are actualized automatically in Food Express system.

4. MAKRO prepares receipt note based on DESADV message. The goods are accepted in receipt zone, SSCC codes are read and confronted with a receipt note in the system.

In the present example, the basic traceability rules are processed through the system based on GS1 standards, where the whole supply chain uses global standards for gathering and administrating of data. If a crisis situation occurs in above-presented example, the withdraw of any batch will be possible quickly and efficiently thanks to implemented system.

SUMMARY

Solutions based on the GS1 standards in the context of traceability requirements fulfillment come down to correct packaging identification taking into account batch/lot number and/or other data, which must be recorded to meet traceability rules. Therefore correct usage of the GS1 standards, also in critical situations, makes it possible to withdraw products from the market, using global GS1 identifiers, recorded and stored in databases: GTIN, SSCC, GLN and suitable AIs. EPC numbers are based on the same numbers as GS1 identifiers, e.g. GTIN, SSCC, and GLN. They are however enriched with a serial element, which makes it possible to identify individual units, objects by means of EPC tags.

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STANDARDY GLOBALNE GS1 I EPC GLOBAL JAKO ROZWIĄZANIE WSPOMAGAJĄCE ŚLEDZENIE TOWARÓW W ŁAŃCUCHU DOSTAW

STRESZCZENIE. Zapewnienie bezpieczeństwa dostarczanych na rynek produktów wiąże się z rejestrowaniem i gromadzeniem danych na ich temat na każdym etapie łańcucha dostaw żywności, a więc na poziomie każdego z przedsiębiorstw biorących udział w tym łańcuchu. Na problem zwrócono szczególną uwagę podczas ustanawiania nowych przepisów prawa żywnościowego. Wymogi te w naturalny sposób wymusiły na przedsiębiorstwach branży żywnościowej i żywieniowej konieczność śledzenia ruchu i pochodzenia produktów - z ang. "traceability", czyli stosowania określonych zasad i procedur pozwalających zapisywać konieczne informacje o produktach. Istotą "traceability" jest możliwość monitorowania ruchu i pochodzenia danego produktu (partii produkcyjnej) na każdym etapie łańcuch dostaw, czyli możliwość uzyskania danych z poprzedniego etapu łańcucha (od kogo i co otrzymano?) i jednocześnie przechowywania informacji dotyczących następnego etapu (do kogo i co wysłano?). System GS1 posługujący się globalnymi standardami

Sokołowski G., 2006, GS1 global standards and EPC global as a solution enabling traceability of goods in supply network. LogForum 2, 2, 1.

URL: <http://www.logforum.net/vol2/issue2/no1>

w zakresie oznaczania jednostek i przepływu informacji, posiada niezbędne narzędzia pozwalające spełnić to założenie. W artykule zaprezentowane zostaną standardy GS1 i EPC global i możliwości ich zastosowania w branży FMCG. Poza tym przedstawiono case, opisujący zastosowanie standardów GS1 w celu śledzenia żywności w pełnym łańcuchu dostaw produktów spożywczych, czyli na linii: producent - centrum dystrybucji - detalista.

Słowa kluczowe: śledzenie towarów, system GS1, EPC global, łańcuch dostaw.

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