Dr hab. Olimpia Kunert
Aviation Military Academy
ORCID: 0000-0001-9036-8746
e-mail: kontakt@fpk-kompetencje.pl

Informative value of material indexes in the logistics information system

Wartość informacyjna indeksów materiałowych w logistycznym systemie informacji

Abstract

Currently, the processing and transmission of the vast amount of information accompanying material flows are performed using modern computer and telecommunications technologies. However, the achieved results differ depending on the company's preparation to receive a specific information technology (IT).

One of the main problems, that need to be solved before starting the implementation of an integrated management system, is to set up all the rules for indexing and labeling information contained in databases. This issue is of key importance because it unifies records in databases making them unique based on their features and/or parameters, furthermore it enables qualification and selection of information according to specific criteria. Moreover, it facilitates data accumulation process.

The research conducted on the content of databases showed items inactive for over 5 years, in an amount of 28% to 45%, in the majority of the surveyed enterprises. This situation requires database cleaning and only active index files can be used for generating a new database.

The database cleaning process should aim to organize information in current materials management databases for present data processing needs, furthermore it should also prepare existing resources for transfer to the new IT system.

Key words:
information system, integrated management system, information technology (IT)

Streszczenie

Aktualnie przetwarzanie i przesyłanie ogromu informacji towarzyszących przepływom materialnym realizowane jest za pomocą nowoczesnych technologii komputerowych i telekomunikacyjnych. Jednak uzyskiwane efekty są bardzo różne w zależności od przygotowania przedsiębiorstwa do przyjęcia określonej techniki informatycznej.

Jednym z zasadniczych problemów, z jakimi należy uporać się przed rozpoczęciem wdrożenia zintegrowanego systemu zarządzania, jest ustalenie wszelkich zasad indeksowania i znakowania informacji zawartych w bazach danych. Zagadnienie to ma kluczowe znaczenie, bowiem z jednej strony ujednolica zapisy informacyjne w bazach i czyni je unikalnymi ze względu na cechy czy parametry, z drugiej zaś, umożliwia selekcjonowanie i wybieranie informacji według określonych kryteriów oraz agregowanie danych.

Wykonane badania zawartości baz danych wykazały, że w większości badanych przedsiębiorstw występowały pozycje nieaktywne od ponad 5 lat, w ilości od 28 do 45%. Sytuacja taka wymaga oczyszczenia bazy danych i dopiero pliki aktywnych indeksów mogą być podstawą utworzenia nowej bazy materiałowej.

Istotnym efektem tej operacji ma być z jednej strony uporządkowanie informacji w aktualnych bazach związanych z gospodarką materiałową dla bieżących potrzeb przetwarzania danych, z drugiej przygotowanie istniejących zasobów do migracji do nowego systemu informatycznego.

Słowa kluczowe:
wartość informacyjna indeksów materiałowych, system informacji, zintegrowany system zarządzania, technika informatyczna

JEL: M11

Introduction

The essence of the Logistic Information System is the data collection, processing and sharing information obtained after its processing, which is further used to make logistic decisions. IT systems, as a management technique, are perceived as a condition for the implementation of the operation of logistics systems assumptions. As reported by Mirosław Chaberek and Andrzej Jezierski (Chaberek, Jezierski, 2010) "The success of modern logistics depends on the application of modern information and communication technologies".

IT resources are used to implement all logistics functions; planning of logistics processes in various cross-sections and time frames, coordination of events, operations and logistics processes as well as operational control of logistics processes.

Logistic systems are organized and integrated material and product flows, created in a way that optimizes supply chain management through automatic identification of goods, controlling, electronic data exchange and comprehensive costs accounting. All material flows are accompanied by stream of corresponding information (Ferenc, 2012), which also enables computer simulations.

The control of material flows, consisting of seemingly low-complex activities, in practice is extremely complex procedure and requires mastering all phases of the production process or services. In addition, the effectiveness of employing IT systems requires a methodical approach at every stage of the implementation process. It is also necessary to distinguish mastery of flow methods from active tools (IT programs). Often, the production or service process needs to be divided into individual phases and methods and tools should be selected individually for each of them, which means that flow management can be decentralized.

The literature proposes a number of methods for determining material needs depending on the tasks. Alain Chauvet (Chauvet, 1997, p. 139) characterizes these methods as:

- "initial" which includes "calculations of needs according to the multi-indicator specification of each product",
- current methods, i.e. "inventory management, pull flow method, synchronization method, clock method, bottleneck management method, Kanban method and so-called "Process Design Guide",
- complementary (related) methods; "Delayed differentiation method", PERT method and "standardization method".

The basis of each method should be the calculation of production/service requirements and tasks definition. This is a complex issue resulting from many iterative activities between forecasts and reality.

Examination of material indexes usage in the logistics information system

The study of material indexes usage in material flow management was carried out over the past five years during the implementation of integrated management systems in seven industrial enterprises. It has shown that the components of logistics management are the same regardless of whether we cope with the production of products or services, and regardless of the type of products, services, the type or size of the company, Material flow management is carried out in the full cycle of organizational activities, i.e. planning, organizing, preparing resources and controlling.

At the planning stage we distinguish:

a) Pre-production manufacturing planning, including:
   - Defining the sequence of operations,
   - Determination of machine load,
   - Examination of tools and instrumentation preparation stage.

b) Material resources planning, including:
   - Inspection of material stocks level,
   - Develop projects, detailed instructions and prepare activities.

The organization stage includes:

- Checking purchases demands,
- Issuing instructions for parts and components delivery,
- Issuing work cards.

The resources preparation stage applies to:

- Monitoring the flow of materials and other production factors,
- Specification of the required intermediate deadlines,
- Materials flow monitoring.

Control stage

- Control of labor costs,
- Investigating areas of uncertainty,
- Initiating corrective actions,
- Registration of delays, waste, production shortages.

The information system includes information resources and these elements which enable supplying, maintaining and providing these resources to the user (Waściński, 2012, p. 46). These are the sender and recipient information together with technical and organizational means of collecting, communicating, processing and protecting the information. The conducted research has reviled, that in most of the surveyed enterprises, the databases content was not suitable for use in the IT system due to containing many of items inactive for over 5 years (from 28% to 45%).

Material index in the logistics information system

Identification by a unique key was forced when the use of the name became difficult and then practically impossible due to the restrictions posed by the applied data processing technologies (punched cards, "large computers"). Therefore, for marking materials, the Systematic Product List

(SPL) began to be used, which however had significant capacity restrictions related to the number of signs. Consequently, the new indexing rules have been created and called CMC (Commodity and Material Code). Its structure was significantly larger (13 characters) and was thought to secure the coding of materials for a long period. A new system for marking products with Polish Classification of Products and Services (PCPS) symbols was introduced as early as 1997 and was supposed to gradually replace the current SPL, which is practically discontinued since 2000.

Materials and products identification through a numerical code (also alphanumeric), with an appropriate structure, is widely used today. The structure of the code should allow for efficient creation of unambiguous and unique entries, and possibility to avoid duplication of items in files by assigning different codes to the same materials.

Identification by name is also applied today to search records in databases. It has an advantage over numeric or alphanumeric codes and does not require remembering the troublesome set of characters that define a given record. However, it also has a disadvantage — the lack of defined rules for creating products' names. This very often results in composing different names for the same product or for different (similar) materials — identical names, which in turn makes it difficult or even impossible to clearly identify the product. The application of this entries marking method is justified when their number allows for their easy use and guarantees unproblematic detection of a mistake (e.g. coding the units of measurement can be omit and replace by names — (pcs; set; m^2, etc.). Increasing database capacities, with the current technology, are not a fundamental problem, however numerical coding significantly reduces the size of tables and increases speed of service.

Modern systems enable the identification of a given record by a unique key (numeric, alphanumeric) or a unique name. Sometimes it is necessary to combine two identifiers that specify a given record, e.g. material index and unit of measure, when we buy the same material packaged and sold in different ways.

Coding and indexation rules

A properly built index structure is the basis for the good functioning of IT systems. If the number of entries in a given database exceeds hundreds or thousands of items, the problem becomes even more significant. Undoubtedly, for the Integrated Management System, proper labeling of materials, raw materials for production and all other material resources used by the company is of particular importance. Material resources decide about the continuity of the production process and about the cost-effectiveness of this process.

Material stocks secure production and sales maintenance and determine company's operating costs, therefore they must be controlled in such way that the optimal balance between the demands and the size of stocks is maintained according to ordering and delivery fluctuations cycles. Inventory regulations must be coupled with the process of taking orders, planning and controlling workloads, changes implemented during production resulting from customer or other needs (e.g. technology), technological process modifications and the current situation on the supply market.

Any process carried out from manufacture to finished product can cause changes in the materials demand. This approach forces the coupling of materials management with customer service (from the initial offer to the sale of the finished product). This requires, among others, the use of proper, unambiguous and efficient system of materials marking (indexing) used in the production process.

The SPL system, currently used in enterprises to index materials, is a non-developmental system. The work on the SPL has been abandoned; it is widely believed that the SPL code, due to a small number of characters it uses, significantly reduces coding possibilities of presently existing wide range of material and products.

The advantages of using SPL include the widespread use of this system in the enterprises (the force of habit) and usage of SPL code in existing and functioning databases (material, technology). The SPL structure can be expanded with additional signs allowing distinguishing, within the same index, other material parameters that are not important for the construction or technology, but are valid for the client, such as the source of the material.

The disadvantages of SPL usage include: the lack of developmental work on this index, which practically means that enrichment of records must be done internally; the need for parallel use of PCPS codes, as currently required; and too small capacity in relation to the rapid development of the number of various modern materials.

The organizing and cleaning up existing index resources are necessary before starting the new system implementation procedure regardless of the new target indexing system choice.

Material indexing study in industrial enterprises

In all surveyed industrial enterprises, IT services had Excel sheets containing the current state of

indexes associated with the turnover in a given position for use in analytical work. On average, it was close to 40,000 items of material indexes. Observation and analysis of the contents of the database and selection of individual entries allowed to specify the following conclusions.

1. Occurring items inactive for over 5 years, which had to be rejected.
2. The review of the active items allowed accounting the loaded ranges (in which the number of source items was the largest). There was no capacitive threat to the code (up to 10 characters).
3. A new index describing de facto the same material may be an obstacle to the proper management of materials.

Preparation of the existing resources for the purposes of migration to the new IT system

The problem of index resources

Commonly, the IT unit creates tools that allow operating the material database, and prepares other files that can be useful during "index cleanup" operations. It will determine the current number of indexes in the database, the state of active indexes (including those related to production) and the state of inactive indexes.

It seems reasonable to consider inactive the item in the material database that does not show turnover (income, expense) within 5-6 years, even if it is a non-zero position. This limit can be lowered in justified cases.

The material databases in the surveyed enterprises are .DBF files that can be easily exported to modern IT tools (e.g. excel spreadsheet or Access database). This enables the preparation and implementation of material index cleaning up if other tools are difficult to access.

Filtering inactive indexes

Two files should be selected from existing databases:

- containing active indexes, i.e. those that show turnover within the last 6 years; filtered by the date of the last operation, even if the current state is zero;
- containing inactive indexes — no action over 6 years — filtered by the date of the last trading, also items with non-zero inventory status in stock.

The process should be carried out once and efficiently during the production pause period (the operation can be carried out within a short period of time) and should result in smaller, pre-cleaned, functioning material database in the current system. The active index file will be the basis for creating a new material database.

Support for inactive indexes

Inactive positions should be subject to the following steps:

- items with a zero status should be archived
- non-zero items indicate unpopular materials — purchasing services should recognize them and make a decision to: leave a given item due to future needs, sell out unnecessary material or liquidate it.

The leftover items are selected from this file and added to the active index database.

Creation of a material database containing only active indexes

The selected database of active indexes must be subjected to the process of verification, cleaning of duplicated indexes and organizational work related to naming. It is necessary to verify the records that repeatedly identify the same material (different indexes — the same material).

The second problem that must be considered in this process is the extension of material identification to include features that are not relevant to its identification but may be required in the production process. The same material used in the production process may have specific properties, distinguishing it from others, it may be manufactured by another manufacturer, etc. The customer, for various reasons, may wish to use a specific source of material. If, from a constructional or technological point of view, its use does not change the manufacturing process, it seems reasonable to use one index specifying the material in the construction and technological documentation and, to meet any customer requirements, specify an additional description of the index identifying e.g. the source of the material. As the company will go through a transition period, and the cleaning of indexes should precede the implementation of the new system, the abovementioned marking principle (practically index extension) will be difficult to implement. In this situation, it seems justified to continue the practice of giving a separate code for materials differing e.g. in source, but these entries should be marked with the correct code associated with the current data structure (entries in new fields, expanding the existing record structure). These fields should be used to clean up and organize the existing active indexes database. At the time of implementing

the new system, the index exchange process will be carried out from "old" to "new" one. The design of this process will be adapted to the new material database structure.

For the transition period it is necessary to:

1. Expand the structure of the material database record with fields that allow to add additional markings in the form of: the appropriate index + supplier code and the development or selection of software to fill these fields, or
2. Include the above-mentioned data in the current structure, in unused fields, or
3. Create an additional file with the structure: "old index", "new index", supplier code.

Cleaning up the construction and technology database

After organizing the database of active indexes, it is necessary to clean up the construction and technological databases. This means that queries need to be run which search in these databases for "unpaired indexes", i.e. those that are in the construction and technology databases, but they are not in the active material database.

If the IT team maintained full compatibility between the material database and the construction and technological database according to materials (i.e. each material index used in the construction or technology had its equivalent in the material database), then the lack captured by the query means that the constructors and technologists use the inactive index, which should be eliminated and replaced by the new one, currently used and available material. This process will update the construction and technological databases. although it will not be a full update (e.g. it will be necessary to update the operation times). However, obtaining material connections update is one of the most important tasks that enable proper planning and management of material resources.

Introducing cleaned files for current exploitation

This step has been marked as the next one, however the IT team must plan systematic connection of cleaned files to currently operated systems. This can be done at any time, immediately after the operation is completed — ensuring the continuity of the current data processing.

The IT unit will specify recommendations for other services that will prevent the repetition of negative phenomena in the databases. Files should be closely monitored until migrated to the new system.

Summary

Making logistic decisions is based on possessing an efficient Logistics Information System in which the material indexes database plays a key role. Its essence is to share information obtained after it has been processed.

Work on creating and updating material indexes should be carried out systematically and not only in acute situations. This is crucial since the important effect of these works is ordering information in the current databases related to materials management for present data processing needs. Furthermore, they are essential for preparing existing resources for migration to the new IT systems. The process of cleaning material index databases requires coordinated process activities for preparation of production/services, supply, trade and accounting services. Studies have shown that "burden of unpurified databases" not only slows down the management of material administration but also prevents rationalization of material supply costs.

Bibliografia/References

Chaberek M., Jezierski A. (2010). *IT tools in logistics processes,* Warszawa: Ce DeWu.pl.
Chauvet A. (1997) *Management methods Guide*, Warszawa: Poltext.
Ferenc R., Instruments to support decision competencies of an investment project manage, O. Kunert (ed.) *Creative Industry Manager*, Lodz: University of Technology.
Waściński T. (2012). *Integrated management systems in logistics processes*, University of Natural Sciences and Humanities in Siedlce, 95.

Dr hab. inż. Olimpia Kunert

Profesor nadzwyczajny Lotniczej Akademii Wojskowej w Dęblinie. Posiada bogaty dorobek w postaci rozpraw, publikacji i wystapień na konferencjach naukowych. Dorobek naukowy umiejscowiony jest w obszarach interdyscyplinarnych (nauk społecznych oraz nauk technicznych). Prowadzi aktywną współpracę z przemysłem jest polskim konsultantem w zakresie doradztwa gospodarczego. Jej dorobek praktyczny to znacząca liczba wdrożeń innowacyjnych rozwiązań dotyczących problemów funkcjonowania współczesnych przedsiębiorstw.

Dr hab. inż. Olimpia Kunert

Associate professor of the Aviation Military Academy in Dęblin. She has extensive achievements in the form of dissertations, publications and speeches at scientific conferences. Her scientific achievements are located in interdisciplinary areas (social sciences and technical sciences). She actively cooperates with the industry and is a Polish consultant in the field of economic consulting. Her practical achievements include a significant number of implementations of innovative solutions regarding the problems of modern enterprises.