

LOGISTICS FIELD AUDIT – A NEW APPROACH FOR IMPROVING LOGISTICS PROCESSES

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Abstract: *The importance of efficient logistics processes in literature and practice has been recognized. In this paper, a new methodological approach for logistics process improvement, Logistics Field Audit (LFA) is proposed. The approach comprises seven interconnected steps: identification of needs and goals for LFA; priority definition of different LFA aspects for different subsystem; processes mapping, audit and questionnaire preparation; implementation in each subsystem according to priorities; analysis and evaluation; the definition of preventive and corrective measures, continuous improvement and periodical audit. Basic aspects of LFA such as the operational, safety, environmental, and service quality aspect are identified. The approach is applicable in both logistic and non-logistic systems with special emphasis on logistics subsystems such as procurement, distribution, transport, warehouse, etc. The developed methodology provides the basis for future theoretical research and practical implementation.*

Key words: *logistics processes, audit, improving, quality, safety, LFA*

1. Introduction

The importance of logistics for all industrial sectors has long been recognized. The events in the last few years further highlight the importance of logistics. There are many challenges and problems in logistics. In order to operate successfully, companies must ensure the efficient operating of logistics processes ([1] i [2]). In that manner, companies must monitor and improve all aspects of logistics processes in both the logistics and non-logistics sectors. In practice, numerous standards, approaches, methods and tools are used to solve the mentioned problem.

However, a partial solution is not enough. In this way, conflicting goals that exist in different parts of the company cannot be resolved. In order to simultaneously improve all logistics processes, it is necessary to carry out a complete check in all aspects ([2], [3] and [4]). In this paper, a new methodological approach called Logistics Field Audit (LFA) was developed. The aim is to define all aspects of LFA in different logistics systems and subsystems. The paper makes a great basis for theory and practice.

LFA should be defined as a control and diagnostic tool for solving different problems in certain fields of logistics. There is no precisely defined way in which LFA is

applied in companies, but it is a process that is different for each company [5]. This paper fills the mentioned gap in theory and practice. A logistics audit is important because it positions and determines the exact place of logistics in the company's structure, as well as the position of the company in relation to the global and domestic markets.

Through the implementation of LFA, first of all, a complete picture of the observed processes in companies is obtained, as well as a plan for the further development of the company, together with a plan for how to improve the services, as well as all the costs associated with that service. Familiarity with the process within the company for which the audit is being done plays an important role when implementing a logistics audit. LFA allows measuring the efficiency of certain systems within the company. LFA also gives the opportunity to improve systems where a problem is noticed, as well as evaluate those systems and finally monitor system improvements.

The paper is organized as follows. The next section defines the goals and principles of LFA, as well as, steps in the implementation process. The third section defines different aspects of LFA, while section four describes LFA in logistics subsystems. Example of implementation is given in section five. The last section deals with concluding remarks and future research directions.

2. Definition and implementation process

LFA represents a tool for improving logistics processes. There are different goals of logistics audit. The main goal of the logistics audit is to describe the current state of the system and define possible ways and directions in order to solve the problem or reduce it and improve the quality of the system's work. The results of the logistics audit are a description of the current state of the system, identification of problems, the proposal of measures for problems elimination, and setting priorities for reaching the desired state [4]. In order to successfully conduct an audit in a company, the auditor must observe the following principles ([5] and [6]):

- the objectivity of processing logistics audit - objectivity reflects objectively facts that are actually at the time of implementation audit,
- confidentiality of commercial information,
- commercial independence of the auditor - auditor isn't bound by a third person who may have the benefit of any audit results,
- professional independence of the auditor - auditor can't be an employee of the evaluated company,
- repeatability - when the audit has been repeated the comparability of results must be secured,
- control of results - the final report of the audit must be checked in terms of content and formal side at least with one other external auditor.

In this paper new methodological approach for the implementation of LFA is developed. The most important steps are below (Figure 1):

1. **Step 1:** Identification of needs and goals for LFA;
2. **Step 2:** Priority definition of different LFA aspects for different subsystems;
3. **Step 3:** Processes mapping, audit and questionnaire preparation;
4. **Step 4:** Implementation in each subsystem according to priorities;

5. **Step 5:** Analysis and evaluation;
6. **Step 6:** Definition of preventive and corrective measures;
7. **Step 7:** Continuous improvement and periodical audit.

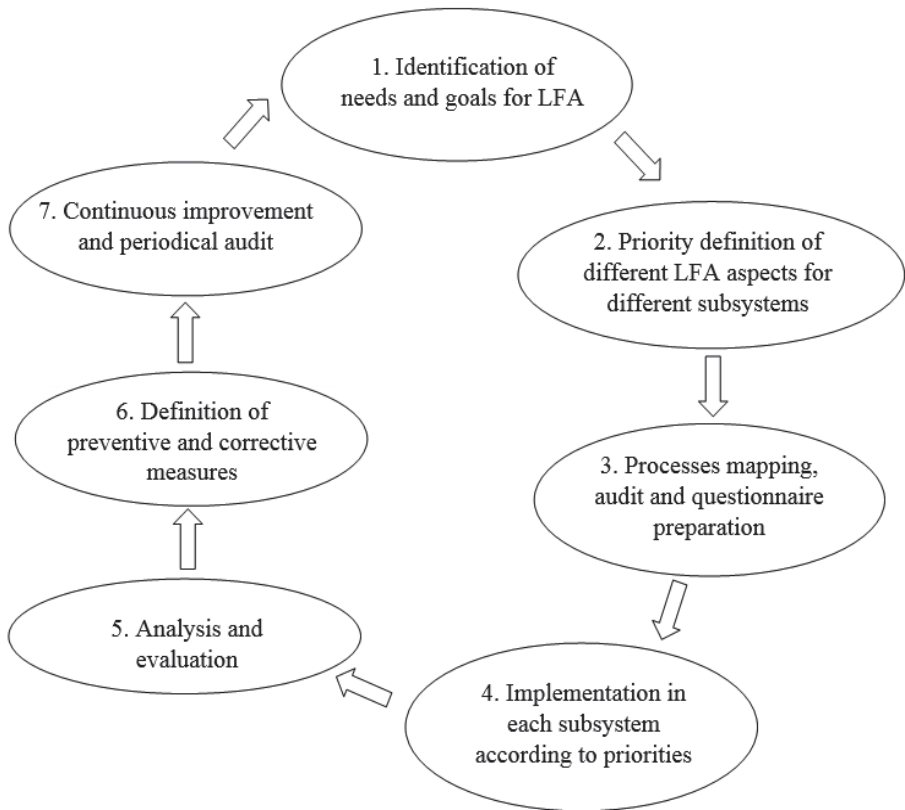


Figure 1. LFA implementation process – new approach

The first step is the identification of the needs and goals of LFA in which the company must recognize the positive effects of process improvement. In the second step, the company needs to identify the priority of different LFA aspects in all logistics subsystems. This step can vary greatly from company to company. The next step is process mapping, as well as audit and questionnaire preparation. This largely depends on the type and size of the company. For process mapping, a large number of approaches can be used. The fourth, most important step is the audit process. Before starting, it is necessary for the auditor to understand all processes within the company, and also to review the current state of all processes. Comparing current and desired (future) states is very important. Analysis and evaluation of all information from the previous step is also very important phase. Critical and problem points must be defined in this phase. After that, the auditor can define preventive and corrective measures. Continuous improvement and periodical audit are the last steps in LFA.

3. Aspects of LFA

As mentioned before implementation process of LFA largely depends on the logistics company. However, regardless of the size and type of company, four basic aspects were identified:

- operational,
- safety,
- environmental and
- service quality aspect.

Operational aspect

One of the basic aspects is the company's operation which includes essential processes within a company, operating procedures, technologies, etc. For example, outsourcing transport processes is crucial for some companies. First of all, it means the selection of transport provider, as well as, the choice of type and form of procurement, etc. In the warehouse sector special attention is paid to the place and role of the warehouse in the system, the choice of storage technology, ordering technology, the type of internal transport, order picking technologies, value added activities, and all other important activities. Every company needs the best possible cooperation between procurement, transport, production, warehouse, distribution and other sectors [1].

Safety aspect

First of all, the safety aspect of the logistics audit concern is the safety of all employees and then all visitors to the company. Safety is also reflected in vehicle speed control within the company and warehouse, protection of the working atmosphere, protection from noise, fire and explosions protection and security of racks and storage equipment, working with hazardous materials. Special procedures must be defined for visitors, as well as for securing entrances and exits to facilities [6].

Environmental aspect

The importance of this aspect has been growing in recent years. Reverse logistics, green logistics, circular economy, and different international standards (for example ISO 14001) confirm the significance of the environmental aspect. The ecological aspects of LFA concern the protection of the environment: pollution, waste, energy consumption, water consumption, and other related problems [2].

Service quality aspect

Logistics service quality is crucial for market success. In this sense, it is most important to pay attention to service quality level, customer satisfaction, and customer loyalty. Following issues are related to service quality: percentage of damaged goods at the exit, percentage of lost shipments, percentage of goods returned to the warehouse, speed of loading and unloading operations, number of additional activities carried out by

the warehouse, accuracy, and reliability of delivery, percentage of complaints and claims, number of wrongly delivered shipments in a certain period of time, number of wrongly routed shipments, number of wrongly delivered shipments, number of late deliveries, percentage of damaged shipments [1].

4. LFA in logistics subsystems

This section connects LFA aspects and basic logistics subsystems, namely: procurement, transport, warehouse, and distribution. Each of the basic logistics subsystems will be described in more details and connected to previously described logistics audits, together with the main items for the checklist. The checklist represents a range of different questions that the auditor would use when meeting the system. Of course, there is no universal checklist, but it is directly adapted to the observed system in the company.

4.1 Procurement

The basic task of procurement is to secure the right amount of material, at the right time, in the right condition, from the best supplier [7]. The task of procurement is to monitor the flow of materials from the procurement market to the end customer or user. From the *operational aspect* the most important items are: type of procurement (direct/indirect/JIT); procurement operating (independently/within other sector); evaluation criteria (time, price, flexibility, reliability, etc); professional staff (specialized/secondary job); form of procurement (centralized/decentralized/combined); cooperation with other sectors (sectors/level of cooperation). The safety aspect of the procurement subsystem includes workplace safety, security, and protection of employees, information and data safety. Work atmosphere is also important, together with a clean and tidy office where the employees work.

The *environmental aspect* is critical for the observed logistics subsystem. The most important parts are: choice of transport mode (road/rail/air/ship) and vehicle choice (capacity/energy consumption/speed). At first glance *service quality aspect* is not crucial for procurement. However, the quality of procurement is very important for other subsystems and customers. Among others, the most important are: delay in ordering; frequency and size of delivery; the quality of the purchased products; customer satisfaction with realized service; order processing failure ([8], [9] and [10]).

4.2 Transport

Transport is one of the basic processes for companies from various industries. Transport is present in many systems as its own process, although many companies decide to outsource it. There are several items from the *operational aspect* that must be taken into account: fleet/vehicle; employees in transport; type of transport (LTL/FTL/other); number of demands/turnover; product (goods) type; weight/volume/number of pallets; additional requirements: temperature regime, dangerous goods, oversized transport; insurance; driver licenses, training, etc ([1] and [2]).

There are two significant groups of parameters from the *safety aspect* of transport systems. The first one relates to the goods, while the second relates to the vehicle and driver. There are many reasons that can cause problems. It is very important to consider: goods lost; security certificates (TAPA, ISO, etc); technical inspection of the vehicle; medical certificates for drivers; the number of accidents on a monthly basis ([8], [9] and [10]). The impact of transport on the environment has long been clearly recognized. The *environmental aspect* of LFA for transport, among others, should include the number of km (traveled) in the observed period; engine type; fuel consumption; emission of greenhouse gases; the age of the fleet; empty drive; time and space utilization; tire, motor oil, and other waste disposals; driver's overtime. *Service quality aspect* in transport is critical for customers. Numerous parameters should be analyzed: complaints; delivery delays; changes in the properties of the goods during transport; theft.

4.3 Warehouse

The role of warehouses in supply chains is crucial, regardless of the type. LFA is the most complex for warehouses. The number of items for each aspect confirms that. From the *operational aspect*, the most important are: a number of demands/turnover; warehouse type (distribution, production, etc); goods (final product, raw material, semi-final); the processing of goods in the warehouse (order picking/sorting/labeling packaging); capacity (m2, m3, pallets); forklifts; employees in the warehouse; warehouse overtime; allocation strategy; inventory strategy; location of order picking zones. As mentioned *safety aspect* is very complex. Some of the most important items are separate traffic lanes for pedestrians and forklifts; vehicle speed control; floor condition; cleanliness and tidiness; lighting inside the warehouse; control of security systems; the existence of fire roads; the existence of first aid kits; dangerous goods; temperature sensitive zone ([1] and [6]).

Energy consumption and waste generation are very present in the warehouses. In that manner *environmental aspects* of LFA should include: waste disposal; zone for return of goods; use of LED bulbs; air quality monitoring; noise level monitoring; vibration level monitoring; temperature monitoring; electricity consumption; other energy costs (water, gas); packaging resources consumption. The warehouse *service quality aspect* is recognized in the literature and practice. It is necessary to pay attention to the number of complaints; loading/unloading time; failures in order picking (typing failures; failures in amount (shortage, excess, etc.), omission failures, and condition failures (damage, lack of packaging, labeling)); write off expired goods.

4.4 Distribution

Today, distribution is present in many systems, not only logistics. For customers, the distribution represents a picture of a complete logistics service [3]. Problems in distribution affect customer complaints. The *operational aspect* of LFA includes fleet/vehicle; the number of deliveries (total/per vehicle/ per driver); routing strategies; the appearance of the goods; gross weight/number of parcels; capacity of the vehicle. There are some similarities with the transport subsystem. The *safety aspect* in the

distribution has several items: GPS control; speed control; incentive and discipline measures; accidents.

The impact of distribution on the *environment* is very strong. In recent years, more and more attention has been paid to the environmental aspect: vehicle characteristics (engine, technical maintenance, etc); community restrictions; legal restrictions; fuel consumption; vehicle utilization ([8], [9] and [10]). As in transport, the crucial aspect for the end user is quality *service quality aspect*. For distribution very important are: failures; theft; complaints; delay; driver (overtime hours, training, licenses), etc.

5. Implementation of safety aspects of LFA in warehouse

As mentioned before the implementation of a complete logistics audit is a complex process. In this part of the paper, the LFA of one segment is presented. Namely, the safety aspect of the warehouse system is analyzed, with a special emphasis on the risks of injuries of workers in the warehouse. In the observed logistics system, the need for the application of LFA was identified. The reason for the application is the more frequent injuries of workers in the warehouse in the last six months. It was found that the number of injuries increased and that an increasing number of workers were on leave. With the aim of successful implementation, a logistics audit was prepared. All processes are mapped. Since the company has implemented the ISO 9001 standard, some of the procedures already existed. A questionnaire with appropriate checklists was prepared. After that, the LFA implementation was carried out in the warehouse. Through analysis and evaluation, critical points and risks that caused problems were identified. Corresponding corrective and preventive measures are defined. In order to maintain the system, periodic audit (internal and external) is advised. The most important results are presented below.

The following table shows the most important risks, work activities and severity of consequences, exposure, and probability, applied security measures, risk assessment, and reducing/elimination measures (Table 1). Since the labor is exposed to various hazards (physical, chemical, and biological) when performing tasks in the warehouse, it is necessary to use certain Personal Protective Equipment (PPE). The greatest dangers are related to the legs, namely impact, slipping, scratches, etc. It was concluded that chemical and biological risks do not require the use of PPE for personal protection at work.

If an employee is injured in the company, a report on work injury and occupational disease that occurred at the workplace must be issued. Record of injuries is also one of the very important stages. The records should contain the name and surname of the injured person, the time of the injury (date, day of the week, and hour), the workplace where it occurred, the type of injury (individual or collective), the severity of the injury (light, serious, fatal injury at work, i.e. an injury due to which an employee is unable to work for more than three consecutive working days), the source of the injury at work (the material cause that is represented by an international code) as well as what is the cause that led to the injury (the manner of injury that is also represented by an international code).

Table 1: Safety aspect of LFA for warehouse labor

Risks	Work activities and severity of consequences	Exposure and probability	Applied security measures	Risk assessment	Reducing/elimination measures
Mechanical hazards arising from the use of work equipment					
Free movement of parts or materials	Falling of goods from pallets during packing/unpacking and storage of goods - possible injuries to parts of the body (minor consequences)	Daily exposure Low probability	The employee is trained for safe work	Acceptable	Mandatory use of Personal Protective Equipment (PPE)
Internal transport and movement of work machines or vehicles, moving work equipment	Movement in warehouses, goods control, packaging, unpacking of goods - possible risk of being hit by a forklift (serious consequences)	Occasional exposure Low probability	The employee is trained for safe work	Acceptable	Mark the paths (pedestrians/internal transport)
Hazardous work equipment that can produce explosions or fire	Fires and injuries can occur due to carelessness or failure to observe preventive measures (serious consequences)	Present exposure Low probability	Sufficient number of extinguishers; Automatic fire alarm and extinguishing systems; Fire protection rules; Marked evacuation routes;	Acceptable	Act in accordance with prescribed technical instructions and regularly check whether laws and regulations are being followed
Other factors that may appear as mechanical sources	Injury in the form of cuts is possible by using a scalpel	Occasional exposure Low probability	/	Insignificant	Apply the correct tool
Hazards that appear in connection with the characteristics of the workplace					
Hazardous surfaces that have sharp edges	When moving in warehouses, there is a possible risk of injury caused by hitting sharp edges, protruding parts of stored goods (very minor consequences)	Occasional exposure Low probability	Secured movement	Insignificant	/
Wet or slippery surfaces	When moving on wet and slippery surfaces, it is possible to slip, fall and cause injuries (serious consequences)	Daily exposure Negligible probability	Regular cleaning of floors in case of spillage of goods	Insignificant	In the case of wet floors, place a warning sign
Hazards arising from the use of electricity					

From direct contact with installations and equipment	During operation, if the insulation is mechanically damaged, electric shocks and injuries are possible (very serious consequences).	Occasional exposure Negligible probability	Correctly and properly performed voltage and contact protection on electrical installations	Insignificant	Perform a daily visual inspection for mechanical damage
From indirect touch	Malfunction of the protective systems on the drive electric motors of the installed work equipment, which can lead to electric shock (very serious consequences)	Occasional exposure Negligible probability	Control periodical inspections of electrical equipment	Insignificant	/

During the audit, it was established that the causes of the increased number of injuries are actually the result of changes at the operational level (operational aspects of LFA). Namely, due to the lack of workers and the increased number of demands, activities in the warehouse were also increased. There was a lot of overtime in the warehouse. Due to fatigue, and poor concentration, more frequent injuries occurred. The injuries were mostly minor, but there were also a few serious injuries. This further resulted in increased leave, and therefore an additional lack of labor. An additional problem identified in the given system is the replacement of jobs, for example, a recipient controller replaces the order picker and vice versa. All this led to the slowing down of the process and additional injuries. Measures to solve this problem are proposed.

6. Conclusion and future research directions

Based on the above, it can be concluded that the importance of a logistics audit is great. Regardless of the large number of standards that contribute to the improvement of processes, there are no systems that focus on the improvement of logistics processes in such an efficient and integrated way. Logistics audit is not a completely standardized procedure and it is different for each company. The LFA is directly influenced by the auditor and the management of the company. The degree of complexity of the company directly affects, first of all, the process of process mapping, and therefore the implementation of LFA. Previous example showed that it is necessary to monitor all aspects of LFA in all logistics subsystems. This is the only way to get a complete picture and identify all critical points. In order to achieve the best and most accurate result of the audit, it is necessary to approach it as objectively and rigorously as possible. It is very important to compare current and future states. LFA is a continuous process that must be repeated periodically. The first LFA cycle is actually the most demanding, while each subsequent cycle is simpler and faster.

LFA approach proposed in this paper does not exist in literature and practice. This also represents the greatest contribution of the paper. There are partial segments that are not systematized in this way and they are not implemented according to the methodology developed in this paper. In future research, it is necessary to conduct as many tests as possible on real systems in order to confirm the possibility of application. It

is also necessary to direct future research towards the implementation of specific methods in individual phases of LFA application (multi criteria decision making methods, managerial methods, statistical, simulation, etc).

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Abstract: *Značaj efikasnih logističkih procesa prepoznat je u literaturi i praksi. U ovom radu je razvijen novi metodološki pristup za unapređenje logističkih procesa nazvan Logistics Field Audit (LFA). Pristup se sastoji od sedam povezanih koraka: identifikacija potreba i ciljeva LFA; definisanje prioriteta različitih aspekata za različite podsisteme; mapiranje procesa, priprema audita i kreiranje ček listi; implementacija u svakom podsistemu prema definisanim prioritetima; analiza i evaluacija; definisanje preventivnih i korektivnih mera; kontinualno unapređenje i periodično ponavljanje audita. Kao glavni aspekti LFA identifikovani su: operativni, bezbednosni, ekološki i aspekt kvaliteta. Pristup je primenljiv kako u logističkim tako i u drugim kompanijama čija osnovna delatnost nije logistika. Poseban akcenat je stavljen na podsisteme nabavke, distribucije, transporta i skladištenja. Razvijeni pristup pruža osnovu budućim teorijskim istraživanjima i praktičnoj primeni.*

Keywords: *logistika, audit, unapređenje, kvalitet, bezbednost, LFA*

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