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NOVELTY FRAMEWORK FOR IMPLEMENTATION OF LOGISTICS FIELD AUDIT – CASE STUDY OF WAREHOUSE LABOR SAFETY

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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 subsystems; 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 logistics and non-logistics systems with special emphasis on logistics subsystems such as procurement, distribution, transport, warehouse, etc. The paper presents a case study of a warehouse system, with an emphasis on labor safety. Four types of warehouse workers were determined. The developed methodology provides the basis for future theoretical research and practical implementation.

Keywords: logistics processes, audit, warehouse, safety, 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 operation of logistics processes (Andrejić *et al.,* 2013; Andrejić *et al.,* 2016). 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 (Andrejić *et al.,* 2015; Andrejić and Kilibarda, 2017). 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 (Sekulova *et al.,* 2014). This paper fills the mentioned

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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 for 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. An example of implementation is given in section five. The last section deals with concluding remarks and future research directions.

2. LFA Definition and Implementation Process

LFA represents a tool for improving logistics processes. There are different goals of logistics audits. 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 problem elimination, and setting priorities for reaching the desired state. In order to successfully conduct an audit in a company, the auditor must observe the following principles (Sekulova *et al.,* 2014; Đurđević *et al.,* 2022):

- 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, a new methodological approach for the implementation of LFA is developed. The most important steps are shown 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.

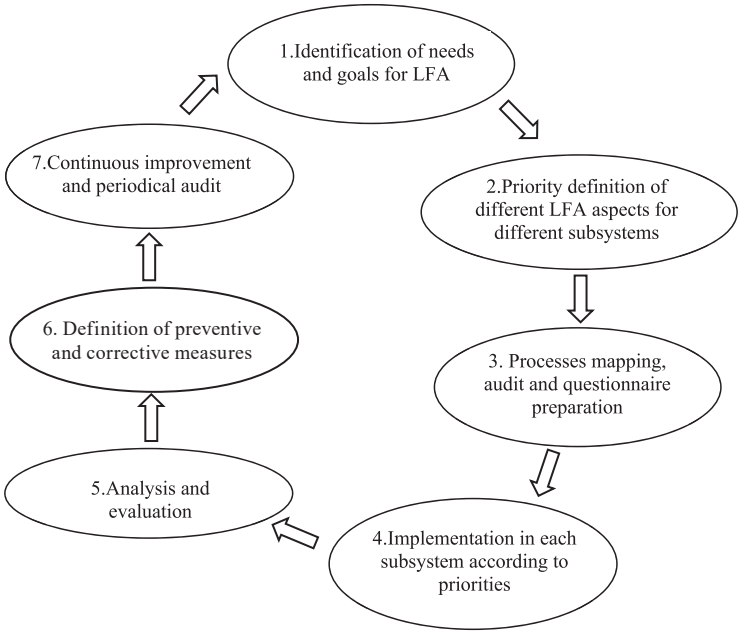

Fig. 1.
LFA Implementation Process – New Approach

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 a 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 audits are the last steps in LFA.

3. Different 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.

3.1. 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 (Andrejić *et al.,* 2013).

3.2. 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, and working with hazardous materials. Special procedures must be defined for visitors, as well as for securing entrances and exits to facilities (Đurđević *et al.,* 2022; De Koster *et al.,* 2010; De Koster *et al.,* 2011; Hofstra *et al.,* 2018).

3.3. 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, 2015)) 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 (Andrejić *et al.,* 2016).

3.4. 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. The 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 (Andrejić *et al.,* 2013).

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 detail 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 checking 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 (Agrebi *et al.,* 2014). 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 sectors); evaluation criteria (time, price, flexibility, reliability, etc.); professional staff (specialized/secondary job); a 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. The 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: the choice of transportation 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 (ISO 9001, 2015; ISO 45001, 2018; ISO 14001, 2015).

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 considered: fleet/vehicle; employees in transport; type of transport (LTL/FTL/other); the number of demands/turnovers; product (goods) type; weight/volume/number of pallets; additional requirements: temperature regime, dangerous goods, oversized transport; insurance; driver licenses, training, etc. (Andrejić *et al.,* 2016; Zmeškal *et al.*, 2020).

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. 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. The 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, etc.

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: the 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 (m^2, m^3, pallets); forklifts; employees in the warehouse; warehouse overtime; allocation strategy; inventory strategy; location od order picking zones. As mentioned, the 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 (Andrejić *et al.,* 2013).

Energy consumption and waste generation are very present in 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, etc.

4.4. Distribution

Today, distribution is present in many systems, not only in logistics ones. For customers, the distribution represents a picture of a complete logistics service (De Koster *et al*., 2011). 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 (Andrejić *et al.,* 2016). As in transport, the crucial aspect for the end user is quality service quality aspect. For distribution very important are: failures; theft; complaints; delays; driver (overtime hours, training, licenses), etc.

5. Implementation of Safety Aspects of LFA in the 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 injury risks of workers in the warehouse (Schwartz *et al.,* 2021). 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, 2015) 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.

5.1. Risk Assessment Matrix

Depending on the system being observed, it is necessary to carry out a risk assessment using certain approaches. Different approaches are used to assess risk components depending on: the type of system, company size, complexity, requirements, activity, etc. However, in business systems, special emphasis is placed on the severity of the consequences, considering injuries at work. In this sense, below is a matrix for assessing the severity of the consequences for employees in the warehouse. With certain modifications, it can also be used in other systems (Table 1). The matrix consists of four risks (main, high, medium, and low), as well as monetary damage expressed in €, damage to employees, the environment, and the reputation of the company itself, which may occur if the risk is realized.

Table 1
Matrix for Risk Severity Assessment

Qualitative Formulation	Monetary Damage (€)	Damage to Employees	Environmental Damage	Reputation
Main	> 1.500.000 €	Accidental death	Damage related to pollution, irreversible	International coverage (one-month media presence), accusations, brand name is very damaged
High	< 1.500.000 €	Serious injury with permanent consequences	Damage related to contamination, reversible	International coverage (two-week media presence), investigations by outside parties, the brand name was badly damaged
Medium	< 300.000 €	Injury with more than 3 days of sick leave	Damage that has an impact outside the location where it occurred	National coverage, investigations by outside parties/authorities, long-term damage to the brand name
Low	< 150.000 €	Minor injury with more than 1 day of sick leave	Damage that only affects plants, no contamination	Local reporting, external party/ authority investigations, local brand name damage

The main risk is the risk that leads to the death of employees in the company, as well as the environmental damage that is irreversible and related to environmental pollution (including employee pollution). This risk puts the company at a disadvantage in the market, where there is an investigation of the company by external parties as well as international reporting on the consequences caused by the main risk. The monetary damage caused by the occurrence of the main risk amounts to more than €1,500,000. The main risk usually appears once in 5 years, with a probability of occurrence of 20%, and occurs once in 1,000 cases.

When it comes to high risk, it results in severe injuries to employees that entail permanent consequences. Contrary to the main risk, here the damage is not irreversible, but reversible and is related to the contamination of both workspace and employees. High risk, as well as the main risk, puts the company in a difficult position on the market, then to an investigation by external parties as well as to international reporting. The monetary damage that occurs due to the occurrence of high-risk amounts to less than €1,500,000. High risk can occur once in 3 years, with a probability of occurrence of 33%, and occurs once in 500 cases.

Medium risk is the risk that leads to employee injuries, where they have to take more than three sick days. The damage caused by the occurrence of this risk is widespread both in the company and in its environment. This risk leads to long-term damage related to the company's reputation, national reporting, and like the previous two risks, an investigation by external parties/authorities. The monetary damage caused by the occurrence of a medium risk is less than €300,000. A low risk is a risk that can occur once a year, with a probability of occurrence of 100%, where it occurs in one in 100 cases.

If a low-risk event occurs, an employee of the company will suffer an injury that requires more than one day of sick leave, while the resulting damage is limited only to the plant life within the company, i.e., there is no contamination of people and work surfaces. With this risk, the reporting is also national, where the damage related to the reputation of the company is not international, but local. The monetary damage if a low risk occurs amounts to less than €150,000. Low risk can occur multiple times in one year, with a probability of occurrence of 100%, occurring in one in 10 cases.

5.2. Risk Assessment

In this part of the paper, the assessment of the risks of injuries at work is performed, where the focus is placed on warehouse workers. Four warehouse workers are present in the observed company:

- Warehouse clerk: entering data on receipt into the system, recording stocks, placing goods in storage locations, carrying out re-storage of goods, dispatching vehicles and loading goods, processing orders for issuing goods, printing and sticking labels, cleaning the warehouse and forklifts, takes care of the technical correctness of the means of loading, warehouse equipment, IT equipment, personal equipment, etc.
- Order picker: performs all warehouse tasks related to the manipulation of goods, realizes the physical receipt and dispatch of goods together with the warehouseman, performs storage, order-

picking, sorting, marking, loading, unloading, and preparation of goods for separation, performs warehouse cleaning, etc.

- Warehouse receiving checker: qualitative and quantitative control, receiving returns (scans each piece of merchandise in each box and confirms return orders), addressing returns (scanning each individual piece and placing it in its final location on small shelves), storing boxes in small shelves by location, separating products by type, origin or request, packs pieces into plastic bags, declares returns, delivers pieces (receiving orders for separation, picking relevant pieces from location, forming boxes with separated products and loading them), sorts products, cleans warehouse, etc.
- Forklift driver - realizes the reception of vehicles and unloading of goods, quantitative and qualitative reception of goods, data entry into the system, records stocks, puts goods in storage locations, realizes their re-storage, dispatches vehicles and loads goods, processes orders for issuing goods, packaging, forming shipments, prints and glues labels, cleans the warehouse and forklifts, takes care of the technical correctness of loading equipment, warehouse equipment, IT equipment, front, electric and manual forklifts.

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 2 and Table 3). 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.

Table 2

Safety Aspect of LFA for Warehouse Clerk, Order Picker and Warehouse Receiving Checker

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	/

Table 3

Safety Aspect of LFA for Warehouse Forklift Driver

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)
	Loads falling from forks, unloading and transferring pallets - possible injuries to body parts (minor consequences)		-Instructions for handling, maintenance and safe work with the forklift; -Limited load lifting height and number of pallets;		The employee is trained for safely operate a forklift
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))	6h-7h Low probability	The employee is trained for safe work	Acceptable	Mark the paths (pedestrians/ internal transport)
	Collision with a forklift, hitting a rack or a static object (serious consequences)		- Technical correctness of the forklift; - Marked transport routes;		- Carry out periodic inspection of forklifts for 3 years; -Limit the speed of the forklift;
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
Impossibility or limitation of timely removal from the workplace	Overturning of the forklift due to improper speed - possible crushing and injury of the whole body (very serious consequences)	Occasional exposure Low probability	- Adjusted speed of the forklift (5km/h); -Regular inspection and removal of defects on forklifts;	Insignificant	Mark the paths (pedestrians/ internal transport)

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	/
Working at height	Using the forklift basket for vertical lifting (inventory of goods, control of shelf life and condition of goods, control of the correctness of declarations) - risk of falling (very serious consequences)	Occasional exposure Low probability	-Training for safe and healthy work; -Inspection of work equipment by a licensed institution;	Insignificant	- Use protective equipment for work at height; -Perform regular inspections/checks of work equipment by a licensed institution;
Working in a confined or hazardous area	Working in the basket of a forklift - danger of hitting the basket fence (very minor consequences)	Occasional exposure Low probability	/	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 Low probability	Regular cleaning of floors in case of spillage of goods	Insignificant	In the case of wet floors, place a warning sign
	Climbing into the forklift driver's seat and getting off - the possibility of falling or hitting the forklift in the event of a slip, possible injuries (minor consequences)		-Handrail; -Keeping the forklift clean;	Insignificant	/
	When driving a forklift, possible injuries due to falling from the driving seat in case of inappropriate speed and turning (very serious consequences)		- Speed of the forklift (5km/h); -Regular control and removal of defects on forklifts;	Acceptable	Mark the paths (pedestrians/ internal transport)
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	/

5.3. Injury Reporting

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 cause that led to the injury (the manner of injury that is also represented by an international code). The following Table 4 shows an example of injury reporting.

Table 4
Example of Injuries Reporting

Number	Name and surname	Time of the injury	Workplace where the injury occurred	Type of injury	Assessment of severity of injury	Cause of injury at work
1.	Person 1	01.02.2016. Monday, 12h	Warehouse	Individual	Easy	Forklift speed
2.	….	….	….	….	….	….

5.4. Preventive and Corrective Measures

In order to protect its employees from possible injuries at work, it is necessary to implement preventive and corrective protection measures. When it comes to the environment in which employees work, it is necessary to protect the atmosphere from various types of pollutants, and if this is not possible, it is necessary to strive to remove sources of endangerment of employees and apply means that protect them from the aforementioned influences. Eye protection agents, respiratory protection agents, and the like can be used as means. The problem of noise protection arises as a result of the presence of various handling and transport vehicles as well as the processes that emit them and can represent one segment of the protection of employees in the warehouse. In order to provide protection against noise, it is possible to apply different approaches. One of them is to influence the noise generators through their elimination or reduction. Also, in order to protect employees, it is possible to apply certain protective means such as earplugs or antiphons (similar to headphones).

In addition to the mentioned measures, one of the more important is marking the floors in the areas where employees work. Guidelines used for floor marking for the purpose of achieving occupational safety help the company to determine how and where floor marking should be applied to improve safety. These instructions are described in detail by the OSHA (Occupational Safety and Health Administration) standard. If the mentioned standard is used, there will be no endangerment of employees and violations of regulations, and therefore fines will be avoided. Floor markings can be used in different parts of the company. When developing a floor marking plan, a company should ensure that there is a good balance

between using effective floor markings and avoiding using them if the marking leads to confusion and ambiguity. The most significant is in the separation of vehicles and employees' paths. If there are forklifts or other means of internal transport in the warehouse, using floor markings is a good way to prevent accidents that may occur. In this case, floor markings direct employees where they should move, while they tell drivers of transport manipulative vehicles where they should drive, which will minimize the overall risk. Accidents that can happen if equipment and employees come into contact can be fatal, and using floor markings is an effective way to protect everyone.

One of the most dangerous areas in any part of the company is near electrical equipment (an example is electrical panels). To ensure the safety of employees, it is important to warn employees of the potential hazard and to ensure that they do not approach the area without proper safety equipment. Placing floor markings around all electrical equipment can increase employee awareness that they are exposed to hazards in that area. Also, it is recommended to place signs for floor marking so that employees can notice the danger that exists. Areas around high-voltage equipment must be clearly marked so that people have immediate access when necessary. Also, the installation of floor markings is very important in places where it is prohibited to store various items of work.

Given that workers are exposed to various dangers and hazards (physical, chemical, and biological) when performing tasks in the warehouse, it is necessary to use certain means and/or equipment for personal protection at work. The following Table 5 will show the dangers and harms for which the mentioned equipment is required in order to protect personnel. In the observed case, the chemical and biological properties do not require the use of means and/or equipment for personal protection at work.

Table 5

Hazards that require the use of Personal Protective Equipment (PPE)

			Physical dangers and hazards						
	Mechanical					Thermal			
	Fall	Hit, Collision	Cut	Vibration	Slip	Heat	Cold		
Body	Head	Skull							*
		Ears							*
		Eyes			*				
		Breathing airways							
		The face							
		The whole head							
	Hand	Palm			*				
		Other parts							
	Leg	Foot		*	*		*		
		Other parts							
	Other	Skin							
		Abdomen							*
		Internal organs							
		Whole body							

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 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. Conclusions 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. A 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 logistics process mapping, and therefore the implementation of LFA.

The 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.

The 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.). Due to limitations in the paper, it was not possible to describe all aspects of the logistics audit that was carried out in the observed case. Other aspects of this case study will be presented in future papers.

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