Reverse Logistics Warehouse Process Optimization

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REVERSE LOGISTICS WAREHOUSE PROCESS OPTIMIZATION

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MASTER THESIS

REVERSE LOGISTICS WAREHOUSE PROCESS OPTIMIZATION
OPTIMIZACIJA SKLADIŠNIH PROCESA POVRATNE LOGISTIKE

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SUMMARY

Reverse logistics plays an important role in supply chain. The increased demand of customer these days has an intense influence on subjects in the logistics network. On the subject of logistics optimization, time is a crucial matter and considered to be an issue that could be optimized. Improving the whole operation in reverse logistics could be done by having a good time management of each activity. Giving the essence of a variety of tasks in backward process, every small step is considered important for achieving a better outcome.

Regarding reverse logistics warehouse process optimization at the distribution center, the logistics provider can improve the processes by observing the time in returned activities. For example, the process of checking documents, opening packages and products scanning could be different in terms of duration. It is difficult to notice how long one activity lasts in a process. Unless the data is measured in order to analyze the major problems. Information technology and paperless system could be applied to support the operations in reverse logistics as well as to increase customer satisfaction level.

KEYWORDS: reverse logistics; warehouse operations, optimization; disposition cycle time

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1. INTRODUCTION

Logistics is an essential element, which plays important roles in various types of business. It is involved in the management and movement of goods as well as services from manufacturers to consumers. At present, the world is growing faster and closer as a result of globalization; logistics service demand has been increasing because of the extension of customer and supply networks, which has been carrying the challenge to companies [1]. Regarding this reason, it is a good opportunity that companies can improve activities related to logistics, to build and increase competition in business. Lately, improving performance of logistics has turned into an important part of policy objective because of a significant impact that logistics affects economy [2] and globalization likewise affects business and environment as well.

Concerning logistics in the Republic of Croatia, logistics market in this country is claimed that it still remains underdeveloped and it cannot be considered competitive in a global scale [2]. According to The Logistics Performance Index (LPI), it is a supportive tool which indicates the challenges and opportunities that 160 countries encounter in their performance on trade logistics and performance improvement that they can do. Customs, infrastructure, international shipment, logistics competence, tracking and tracing, and timeliness are the considered factors for LPI measurement. The top five of LPI global rankings of 2016 are Germany, Luxembourg, Sweden, Netherlands, and Singapore respectively; whereas the Republic of Croatia is on rank number 51 which is one of the lowest competitive countries compared in Central Europe [3]. Accordingly, this applies to reverse logistics as it is as part of logistics as well. To improve reverse logistics, it could be possible by optimizing the return processes. However, companies are frequently unaware, that return management can impact their customer and companies would miss opportunities if they do not pay attention on reverse logistics [4].

Thesis discusses the basics of reverse logistics and warehouse operations in general and provides a case study of reverse logistics in logistics distribution center in the Republic of Croatia. The study was carried out in 2014 in order to improve reverse logistics processes. To obtain an improvement, the processes need to be examined in detail.

The research provides the information of reverse logistics activities, process flowcharts and the data regarding cycle time. The data includes time spent for checking documents, opening the boxes, receipt of goods through the terminal, closing boxes, putting products on pallets, and removing pallets to virtual locations. In addition, there is provided quantity of returned products separated in conditions — in form of inventory, directed to outlet, and write-offs. The study focuses on the receiving processes according to the observed data.

This master thesis consists of six chapters;

1. Introduction;
2. Reverse logistics;
3. Warehouse operations;
4. Case study of reverse logistics in logistics distribution center;
5. Proposal for reverse logistics process improvement; and
6. Conclusion.

2. REVERSE LOGISTICS

This chapter explains the fundamental knowledge of reverse logistics, definitions, processes, activities, and important elements related to reverse logistics.

2.1 Definition of reverse logistics

Reverse logistics is the management of movement of goods and services by planning, implementing, and controlling. The movements of processes in logistics include storing, inventory, and transporting of raw materials and finished products. Reverse logistics is often defined as an opposite process of forward logistics; nevertheless both are essential components in supply chain management.

The Council of Logistics Management defines logistics as follows: [5]

"The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements."

Rogers and Tibben-Lembke define reverse logistics according to the foregoing definition as follows:

"The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal."

According to certain authors, reverse logistics has the operations similar to forward logistics; on the contrary, the processes operate from the point of consumption back to the point of origin which has the purpose to capture value of goods and properly dispose wastes [5].

The following definition of reverse logistics is given by DHL [6]:

"Reverse logistics is the opposite of procurement, production and distribution logistics, all of which support product creation and distribution from the first supplier to the customer. In environmental and economic terms, its goal is to provide the most efficient flow of residual matter created by the customer on the sales market - that is, used and worn-out goods, exchange parts, returns, empty bottles and packaging."

2.2 The basics of reverse logistics

Looking back to the background of reverse logistics, it has been mentioned that reverse logistics is one of the most disregardful elements in the operations and it considerably get attention only when something goes wrong [4]. Companies did not have interests in reverse logistics. Along with they also were not aware of the benefit that reverse logistics could provide, or costs that it could be saved for their companies. As well lack of experts who are well-educated and experienced in reverse logistics is often mentioned as a deficiency [4].

Moreover, rules and regulations often are not strictly determined like in the present, so the companies did not have to set up policy to comply and support with obligations. When

surroundings and determinants which could impact reverse logistics chain are changed, companies need to concern and possibly take some actions respecting to that issue. According to Gobbi, the focus on reverse logistics supply chains has been upgraded by many companies due to the implementation of environmental policies and regulations by publishing recovery programs, for instance, repair, reuse, remanufacturing, remarking, and refurbishing [7].

In the past decades, reverse logistics has been receiving more interests [8]. An attention in reverse logistics has been increasing continuously regarding to costs which is one of the biggest problems that firms are trying to reduce [9]. Many companies started paying their attention in reverse logistics, because reverse logistics is recognized as an important subject by helping a firm to reduce costs and to increase customer satisfaction [9], which could help an organization adopting strength as one of competitive advantages.

Reverse logistics is a part of business, which managing business is to focus on benefits that can be obtained by increasing the profit margins or reduce costs [10]. Apart from concerning on goods and operations, reverse logistics is also connected with information flow, which is needed an attention as well. Reverse information flow provides feedbacks from customers in order to understand customers demand, so companies can use this advantage to win competitors if they manage it suitably [11].

To improve management of reverse logistics activities, it can be done by specialists. Therefore, there is possibility of using a third party logistics (3PL) or outsourcing which is skilled and expert in performing certain tasks. A third party logistics can perform tasks more speedily and precisely than a company does. With this efficiency and effectiveness returned products disposition, a company will obtain lower costs and high revenues [12]. Hiring a third party logistics does not only give a company an advantage to have a proficient returned product handling, but also giving a time that a company can focus on other issues.

In general, reverse logistics is more complicated than forward logistics, for example, the flow of reverse logistics has less visibility than forward logistics flow [9]. However, it can make the organization becomes further efficiency and effectively if a company obtains a well-organized reverse logistics — including an additional benefit to have loyal customers resulting from after sales services and repeat purchases [13]. On the contrary, there will be a certain loss on account of damaged customer relationship and an impact from external liabilities if companies ignore reverse logistics [4].

The differences of returned products in reverse logistics are not only categorized by different type of products that makes the processes hard to manage, but also generates diverse conditions of them [5], because the condition of returned products mostly do not come to a company as ready-to-resell. For example, damaged, out-of-date, and end-of-life products are most often received. Rogers and Tibben-Lembke classify types of returned product and product dispositional channel as follows:

- **Types of returned product**
  - Close-Outs: first quality products that the retailer has decided to no longer carry;

  - Buy-Outs: where one manufacturer buys out retailers' supply of competitor's product;
  - Job-Outs: first quality seasonal, holiday merchandise;
  - Surplus: first quality overstock, overrun, marketing returns, slow-moving merchandise;
  - Defective: products discovered to be defective;
  - Non-Defective Defectives: products thought incorrectly to be defective;
  - Salvage: damage item, and
  - Returns: products returned by customers [5].

- **Product dispositional channel**
  - Return to vendor;
  - Sell as new;
  - Sell via outlet or discount;
  - Sell to secondary market;
  - Donate to charity;
  - Remanufacture or refurbish, and
  - Material reclamation or recycling or landfill [5].

According to the definitions of forward and reverse logistics as mentioned by The Council of Logistics Management and Rogers and Tibben-Lembke, forward and reverse logistics consist of the similar activities, [5]. Nevertheless, there are further details in various aspects — which are indicated the differences between forward and reverse logistics as displayed in the table 2-1.

Table 2-1. The differences between forward and reverse supply chains

Forward	Reverse
Base on profit and cost optimization	Base on environmentally conscious principles and law as well as profit and cost optimization
Relatively easier and straight forward forcasting for product demand	More difficult forcasting for product returns
Less variation in product quality	Highly stochastic product quality
Traditional marketing techiniques can be applied	There are factors complicating marketing
Processing times and steps are well defined	Processing times and steps depend on the condition of returned product
Goods are transported from one location to many other locations	Returned products collected from many locations arrive in one processing facility
Speed is a competitive advantage	Speed is not a critical factor
Standard product packaging	Higly variable packaging/lack of packaging
Standard product structure	Modifies product structure
Cost estimation is easier due to accounting system	Determination and visualization of cost factors is complicated
Consistent inventory management	Inconsistent inventory management
Financial implications are clear	Financial implications are not clear
Highly distribution process due to real-time product tracking	Less visible processes due to lack of information system capabilities for product tracking
Relatively easier management of product life cycle changes	Adjusting to the product life cycle changes is more difficult
Relatively more deterministic	Relatively more stochastic
Primary importance to manufacturers	Primary importance to EOL processors (i.e., remanufacturers, recyclers)

Source: [14]

2.3 Reverse logistics process

Reverse logistics process basically consists of collection, inspection, sorting, disassembly, and disposal [9]. From figure 2-1, it demonstrates a flow of forward logistics which has the movements showed with green lines and flow of reverse logistics which has the movements showed with red lines. It can be clearly seen that there are more complicated processes for backward flow than forward flow.

Returned products cannot immediately get back to be distributed to markets. Retrieving or collecting returned products need to be done at the point of consumption where final users return. Screening and checking products will be processed by gatekeepers whether products truly belong to the companies. This is very important step to scan returned goods before letting them into reverse logistics flow. This verification steps can be done by checking product identification or scanning product barcode. After that, checking conditions will be processed in order to determine which solution suits for each returned product. Goods will be returned to distribute again if they are in good conditions. Nevertheless, products will

be pulled off by taking usable parts after repair or recondition cannot be made. Putting goods through disposal is the last option that companies will decide.

Concerning the determination of returned products, the following questions can be included in the consideration whether what or how to manage them:

- What are the possible solutions that companies provided for returned product?
- What are the next steps and how companies have to take actions?
- How long it will take for one item processing in a return process?
- Is it worth it to take retuned goods back into reverse logistics flow and repaint or remanufacture them or it is better to sell it off via secondary market?

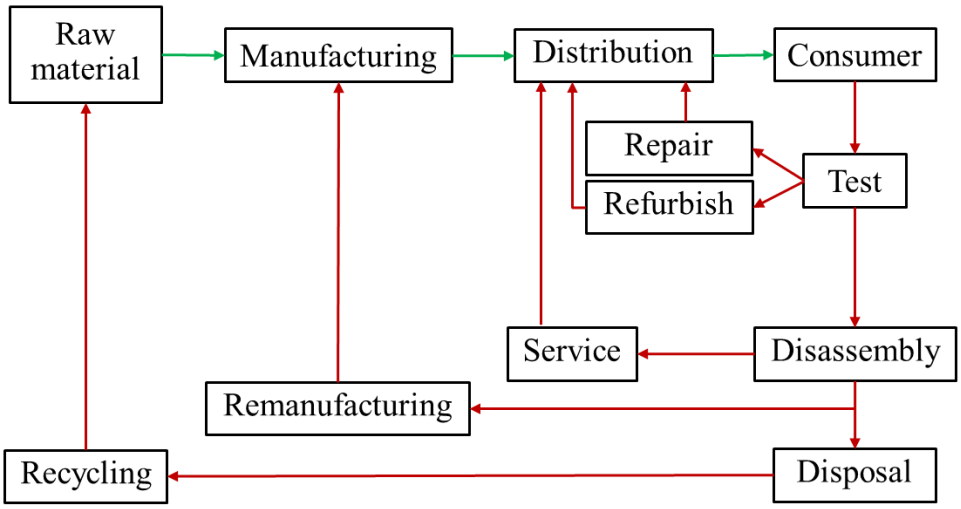


Figure 2-1. Flow of forward and reverse logistics activities

Source: modified from Srivastava [15]

The activities in reverse logistics can be divided by the sources from where the products are coming as follows: final consumer, retailer, distribution channel [5]. Reverse logistics processes can begin when a product is unwanted, broken, and out-of-date, etc. Nevertheless, the return can occur through production-waste by products or commercial returns in distribution process as well [9]. Due to these reasons, a product needs to be returned to a retail shop or a manufacturer. A manufacturer has to provide solutions and determine suitable disposal options for returned products. Based on the regulations on environmental protections of each country, an organization needs to concern on waste management as a serious issue as well.

In addition, manufacturers or sellers can countermand products such as damaged, non-standard, and expired products. Thus, these products need to be returned in order to storing, repacking, repairing, or finding a new channel to distribute them to markets again. In the same way, customers can return goods in case they do not satisfy products. In general, if the product can be reused, repaired or refurbished it can go straight back to the distribution process, if the product need to be remanufactured, it will be sent back to the manufacturer,

and if the product is decided to go to recycling, the product will be returned to the original supply chain [9]. When goods are taken from the shelf and paid by consumers, it does not mean that working processes of logistics companies come to an end. Skinner et al. state that there are more concerns about the product return flexibility when customers make purchases online [16].

According to the common reverse logistics activities, Rogers and Tibben-Lembke divide them into two groups of material as products and packaging as shown in Table 2-2. Managing returned products are not easy to organize as returned packaging since a difficulty depends on a condition of each item [5].

Table 2-2. Common reverse logistics activities

Material	Reverse logistics activities
Products	Return to supplier Resell Sell via outlet Salvage Recondition Refurbish Remanufacturer Reclaim materials Recycle Landfill
Packaging	Reuse Refurbish Reclaim materials Recycle Salvage

Source: [5]

- **Return to supplier**

Retailer or customer may return products to vendor when goods are in conditions as defective or damaged, which regularly happens during transportation. This would allow customers take full refunds if they return. In the same way with seasonal, end-of-life, wrong order and delivery place and redundant products can be retuned as well.

- **Resell**

Products that may be sold again without any recondition in the same or different channels. In general, resell products are returned products that customers bought them and do not want them anymore because they probably find another products which offer better price and quality or as a simple reason; they do not longer like them. It also happens with non-

defective products. Consequently, conditions of product are as good as new to distribute to markets which can be prior markets where they were on sell before or secondary markets.

- **Sell via outlet**

Product selling at outlet can be old-fashioned products such as clothes that are typically put on sell at outlet malls. It the same way with products that have flaws or imperfection; nevertheless, they still function well as they are set for their purposes of use. Nevertheless, there are factors that companies should concern with regard to cost of goods handling and transportation, and store operation [17].

- **Salvage/Reclaim materials**

Salvage is an activity to recover products by taking some parts of them that are useable and profitable for a company.

- **Refurbish**

A process of making products look new again by painting or cleaning.

- **Remanufacture/Recondition**

Rebuilding, repairing, and renovation products are usually applied for changing conditions of goods when they cannot be sold in markets anymore in order to make them have sufficient quality, satisfactory conditions and meet new customer demands. This activity is by some means a last chance if they can be fixed or reconditioned or replaced parts before sending products to recycle.

- **Recall**

Recall is also a one of the reverse logistics activities although it is not mentioned in the table above. As calling off products from markets generally regard to something negative, it commonly relates to likely hazard and government regulations concern aspects. Devices with high technology are regularly recalled as a result of defective electronics could lead to batteries or potential hazard problems. Recall might firstly give customers negative perception of manufacturing company and a brand despite that it can turn into a positive from how a company takes responsible action. Moreover, it helps to make customer trust in brand as well [18].

IKEA, a Swedish furniture brand is one of the most responsible companies to their customers. The company certainly recalls their products when there are problems, which can cause hazard or injury, as for example, Patrull Klämma and Patrull Smidig safety gate which can be used as a baby safety gate. The company continuously received reports that the gates are insufficient to be hold in its intended position and could make a tripping hazard. The reports say that there were children got injured falling downwards on stairs. Thus in this case, IKEA offered customers that they can return the gates to any store with a full refund and a proof of purchase is not required [19]. Similarly, chests and dressers are the products that IKEA is recalling in the United States and Canada. These products are unstable if not properly equipped to a wall — which could lead to the death or injury to children [20].



Figure 2-2. Patrull Klämma and Patrull Smidig safety gates.

Source: [19]

- **Recycle**

A process of converting used materials that will be thrown away as trashes into new and useful products. Recycle helps reducing amount of waste and pollution which would be made from burning and landfill to air, water, and land.

- **Landfill**

To dispose wastes to landfill properly.

- **Reuse**

Products or packaging can be reused without ant modification. For example, glass, plastic bottles, and paper box.

In general, when consumers return products regardless what the reasons are, if returned products are in good conditions and unused, they may get full refunds from a shop or manufacturer. Giving partly refund likewise happens as well. Moreover refund does not always come in the form of money. Shops may give customers gift cards or they only allow customers to change goods to other products instead [21].

There is also a time condition that stores allow consumers to return; usually return period is around 30-45 days for clothing and furniture [22] [23] [24]. However, this works with a company who has a high liberal of return policy, for instance, IKEA who has the return policy "It's ok to change your mind." And even offer the period of return, exchange, and store credit within 365 days [21]. The right of return for final consumer certainly depends on how a company set the policy and it also relates with economy, rules and regulations of that country as well.

2.4 Challenges in reverse logistics

Managing reverse logistics has the difficulties; challenges in the activities or reverse logistics are obstacles as well. This section states what are considered to be the challenges in the chain. The followings are the challenges in reverse logistics that are determined by

Rogers and Tibben-Lembke and apart from that, Dawe also identified six problem return symptoms [5]:

- **Disposition cycle time**

Lengthy processing cycle times, is one of the symptoms that was mentioned. In reverse logistics, time is very important subject. Disposition cycle time is the period of time finishing a cycle of one operation which could affect the quality of reverse logistics chain. Reducing disposition time would profit a company in highest return rate [25]. The more period that returned product is in the cycle, the more expensive cost of labor and storing that a company has to pay — including the value of goods that can be decreased by time such as electronics products. So, it should be reduced. Moreover, customer satisfaction is also an essential reason why a company has to shorten time spent, concerning to the returned product that is sent back in order to repair or rebuild and return to customer when it is finished;

- **Gatekeeping**

Gatekeeping in reverse logistics is the process when returned products are scanned or filtered before allowing them to enter the channel in order to prevent unauthorized and unwanted products from return [26]. Gatekeeping is the entering point of the chain which is not often concerned. It is very essential issue to minimize amount quantity of products in return [25]. If gatekeepers accepted wrong products to enter the channel, it will cause unnecessary work and waste of money and time to a company;

- **Conflict of manufacturer and retailer**

Rogers and Tibben-Lembke consider the conflict of disagreeing of product returning between manufacturer and retailer as a challenge in reverse logistics. Regarding to goods conditions, the manufacture may claim that the damage happens while goods are in return process so the manufacturer does not give full credit return to the retailer;

- **High inventory**

High inventory is as a result of large amount of returns that are held in the warehouse. How the company manipulates returns is certainly a reason that causes the problem;

- **Unidentified returns**

It is often that workers cannot recognize returned items due to lacking of product packaging or labels, and

- **Lack of information**

Information about reverse logistics process is the most significant challenge that companies have to deal with [5].

3. WAREHOUSE OPERATIONS

Warehouse operation or warehousing is one of the most significant components in supply chain. It is the core operation of logistics regarding to distribution activities as storage and transportation. Managing product to be successfully at the right time, right place and right quantity, without damages and differentiations is a mission of warehouse management. This chapter explains the typical warehouse processes and the integration of warehouse processes and reverse logistics optimization.

3.1 Typical warehouse processes for distribution chain

Basic processes of warehouse are receiving, put-away, internal replenishment, order picking, accumulating and sorting, packing, cross docking, dispatch and shipping. The processes in warehouse as mentioned by Bartholdi & Hackman are divided into two groups; receiving, put-away, and storage are considered inbound and order-picking, packing, and shipping are considered outbound processes. The details are explained as follows: [27].

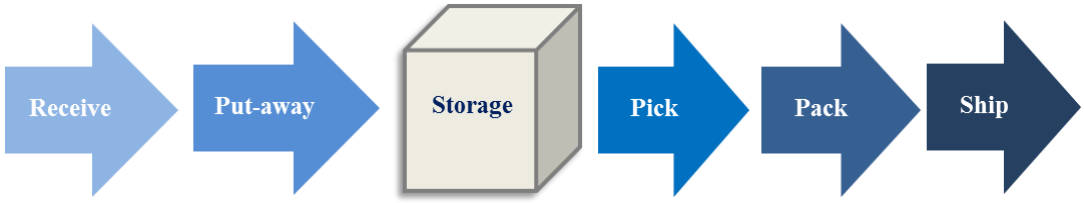


Figure 3-1. Simple flow of warehouse processes

source: [27]

1. **Inbound processes**

- Receiving; receiving of goods is the first line of warehouse processes. Process of receiving can begin with notice of the goods arrival. This allows the warehouse to prepare and schedule inbound operations in advance, so there are no uncoordinated events. With arrival, unloading process begins, which is removing goods from vehicles or containers. If there is necessity for labelling, this process occurs before goods are put away. Regarding this actions, a place for labelling must be predetermined.

Goods usually arrive in a warehouse in larger units such as pallets. Pallets have to be broken out into separate cartons if they are not arranged homogeneously [27]. In addition, it is necessary for receiving that the method of delivery is compatible with the unloading equipment in receiving warehouse. Otherwise there will be the need for additional equipment [28]. This receiving process should be done as fast as possible in order to improve cash flow [29].

- Put-away; put-away is a process of transferring products to store in storage locations in a warehouse. Stock Keeping Unit (SKU) has its own location, determined whether the positioning is predefined or random. There are several storage policies; a predefined storage policy determined a particular location for SKU to be stored, but a random

policy leaves the decision to the operator. In addition, a class based storage system allocates zones to specific product. It is based upon products turnover rate as ABC zoning. Another storage policy includes correlated storage of family groups, that is storing products at nearby positions if they are often required simultaneously [30].

Managing put-away process is important; it can reduce time defined for picking and in the end decrease total duration of outbound processes. For put-away the inventory management is necessary to be correct and up to date. It must be known, at all times what storage locations are available, how much weight they can bear, etc. After the product is placed on its location, the storage location should also be scanned to record where the unit has been placed. This kind of information will be of use when it is needed to pick orders [27]. There are several options for inbound SKU. First is inbound into high-density storage like drive-in racking, next is inbound into standard wide aisle reserve slots such as upper levels. The last is inbound into pick slots which are ground-level wide aisle racking. The latter is represented in a small amount of products with no current stock [28]. Put-away process may require a large amount of work because SKUs must be moved significant distance to its storage position. Put-away accounts for approximately 15% of warehouse operating costs [27].

2. Outbound processes

- Order-picking; order-picking is the major activity in many warehouses — to retrieve a right quantity as well as right products for customer orders [31]. Order-picking is considered by professionals in warehousing as the most significant subject that can be a productivity improvement object to warehouse cost reducing [32]. Process of order picking in a warehouse involves selecting and gathering specified amount of right SKUs in accordance with the order. The process is composed of lifting, moving, picking, putting, packing and other related activities [33].

Order-picking process starts when the warehouse gets order receipts from customers. During the order picking process, orders are generally assigned to several pickers. Picking lists should be provided in order to guide pickers the detail, location, and quantity of products as well as to plan the travel direction in warehouse which costs less picking time from the first to the last picking. However, total pick area is often divided into picking zones in order to prevent control problems. The zones are generally served by different pickers, through zoning policy. Orders are picked one by one or in batches in predetermined order [30]. Onwards, order picking can be manual or automated. In manual order picking, picker gathers units from their locations and then transports them to a packing area. In a case of automated picking, that is automated storage and retrieval system, system retrieves one or more unit loads and places them to a picking station. After, picker takes products on orders, the remaining items on unit loads are transferred to storage again [33].

The activities in order-picking process can be separated in more detail as follows: [27]

- travelling,

- paperwork and other activities,
- searching,
- extracting

The mentioned activities above are respectively arranged by the most of time spent in order-picking process. Travelling in warehouse to pick followed to the customer's orders uses up to 55%, which takes more than half of all the activities time spent in order-picking process. The rest of activities; paperwork and other activities, searching, and extracting spend not so much different time compared to each other's by 20%, 15%, and 10%. Hence, logistics providers should focus on time spent of order-picking process in order to operate the distribution faster and lower labor cost;

- Packing; packing process can be demanding because every picked unit is commonly handled separately. Common task of packing is preparing goods for further transportation by any carrier in a way that does not affect shipping costs in a negative manner. Packing can be done as a single piece, consolidate, pallet, or container followed by the quantity or customer request. It must be packed in appropriate packaging. This may include packing lists which clarify what are in the package.

Packing needs to be done precisely in accordance with an order, because is an important issue to customer service. Inaccurate orders will cause additional expenses such as returns which are expensive to handle. If there is a complication with picking orders, there will be complication with packing. Precisely, if all items from order are not positioned at the same time at packing area, shipment will likely be delayed or/and costs will increase. Shipment can be sent partially resulting with higher costs [27];

- Shipping; shipping is the final process of warehouse processes. After packing products in different types of packaging, they will be combined together to ship (consolidation) – which is commonly in a large unit [27]. First step is loading into transportation vehicles with assumption that the shipping methods are previously arranged. This process is not complex. It generally includes less labor than before mentioned, although there can be some additional activities if product is being staged before being loaded [27]. Outbound zone can include control which can be done manually or using a scanner depending on warehouse information system.

3.2. Integrated warehouse process and reverse logistics optimization

Optimization is a key element that companies adopt in business management. It does not only provide benefits for logistics industry, but also giving profits to other types of business. The speedily move of technology has resulted the opportunity to improve proficiency and success in warehouse operations. Advanced technologies such as software, robotics, and automation are subjected to essentially reduce labor [34]. For that reason, firms

adopt optimization in logistics beneficial to increase performance of the company by lowering stock, and reducing costs of transportation [35].

Bartholdi & Hackman state that, the activity that uses the most labor in warehouses is order-picking and the travel time to pick can be reduced by cautious put-away. [27]. There are plenty of technologies that are invented to support logistics activities and reduce costs in warehouse operations; it is an important issue which could lead to a successful warehousing, for example, information technologies (IT), barcode, radio-frequency identification (RFID), just-in-time and warehouse management systems (WMS) — which are discussed in detail as follows:

- **Information technology (IT)**

Information technology plays plenty of important roles in supply chain and logistics, it intervenes almost everywhere in the chain and as well as the operational processes in logistics. Information technology provides information to and from many different parts in organization. Many companies lack IT system support for return processes in reverse logistics. The resources of information systems are commonly unavailable for reverse logistics [5] so it makes the management even harder, for example, when returned products could not be tracked. Therefore, it is worth for a company to invest and regularly develop IT system and keep it up to date so it can be one of the competitive advantage in a company;

- **Barcode**

It is used worldwide on many products people consume in these days. The character of barcode has an area of parallel lines and spaces that tell important information related to the product. The cost to produce barcode is cheap; however, they have many limitations such as impossible for tracing and bulk reading [36];

- **Radio-frequency identification (RFID)**

Radio-frequency identification uses radio waves in order to identify and track information from equipped objects; it is in the form of electronics tag generally attached on device or embedded in animals. RFID provides several benefits, such as real time information, reduce operating costs, improve customer service, and reduce thievery. Using RFID directs to make buffers and inventory planning better [36].

- **Just-in-time (JIT)**

Just-in-time is a methodology that helps reducing inventory level and lead time which also support a company to have zero stock [32];

- **Warehouse management systems (WMS)**

Warehouse management systems is a software application which helps optimize activities in warehouse by supporting daily operations. For examples, it helps planning for the location and space using in advance, suggesting the suitable location in put away, and finding in picking activity.

Moreover, there are some strategies to optimize warehouse operation suggested by Ruehrdanz [37] following as:

- **Reduce time travelling**; To plan the optimized flow path in order to retrieve goods is often priority;
- **Batch orders**; to group and pick SKU for multiple orders in the same time. So, the pickers do not need to travel to the same location again, and
- **Obtaining real time systems**; operate activities in warehouse with paperless and real time system. This would help a company having a good, smooth and fast operation and supporting cooperation between workers as well.

In addition to mentioned, warehouse processes include those provided for items in return. Processing is often organized separately due to complexity of gatekeeping and product evaluation. Also, reverse logistics has often dedicated warehouse workers that are developing expertise in processing these specific products.

Mentioned processing will be analyzed in form of a case study in the next chapter.

4. CASE STUDY OF REVERSE LOGISTICS IN LOGISTICS DISTRIBUTION CENTER

The purpose of this research is to define the duration and complexity of reverse logistics processes. This will bring an understanding in return activities in order to obtain optimal solutions and improve the operations in the observed distribution center.

The observation was conducted at the logistics distribution center, which belongs to the logistics service provider who provides full logistics and value added services in the Republic of Croatia. The information of return activities and processes regarding time consuming were carried out in the second quarter of 2014. Regarding logistics service provider warehouse, it has total space 8,555 square meters which is divided into two zones; A and B. Currently, the area of 3,206.97 square meters of zone A is used to storage goods, while 966.14m of zone B is not used. However, in a certain period of time the logistics service provider plans to place goods of certain category in that space [38].

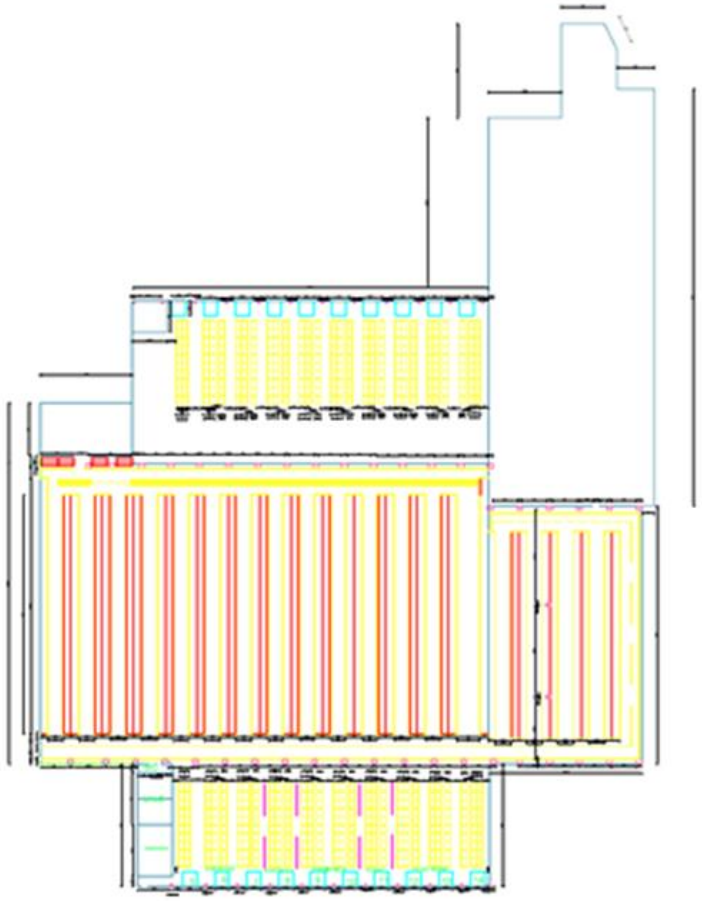


Figure 4-1. The layout of logistics distribution center

Source: Croatian logistics service provider [38]

With regard to the logistics distribution center, returned products come from two main channels:

- Final consumers
- Subjects of a supply chain:

    - clients own retail location and;
    - return from retail chains.

4.1 Return from final consumers processes

According to the returned products from final consumers at this distribution center, those are products with complaints and unwanted products. The reverse logistics activities of returned products from final consumers at this distribution center are described as following steps:

- Returned products from this final consumer are delivered to the distribution center with delivery list which contains lists of products and number of packages;
- The delivery list is forwarded to the operator at the return department;
- The courier positions returned products at the ramp for returns;
- The operator copies delivery list and keeps a copy of the document after receiving returned products;
- The workers check and scan packaging labels;
- Packaging labels are removed;
- The workers open the packages and check the amount and condition of products;
- The workers inspect items inside the packages and scan barcode. The important information such as sources and identification number of returned products can be tracked through barcode;
- The workers determine the status to each item whether it goes to inventory, outlet, or write-off.

Regarding returned products with inventory and outlet status, they are forwarded to a virtual location in return zone in order to be ready for picking by the warehouse workers. Returned products that are consolidated on pallets, they are assigned to the shelves in the distribution section. Returned products that are specified as inventory, they are products same quality as those in forwarding chain, ready to be placed on shelf without a modification and will be distributed afterward. Returned products which are stated as damaged products can be sold again in forward logistics chain, if only the damage occurred with packaging and the products are intact. Damaged products are directed to outlet channel and will be sold at the outlet stores. Process diagram can be seen in figure 4-2.

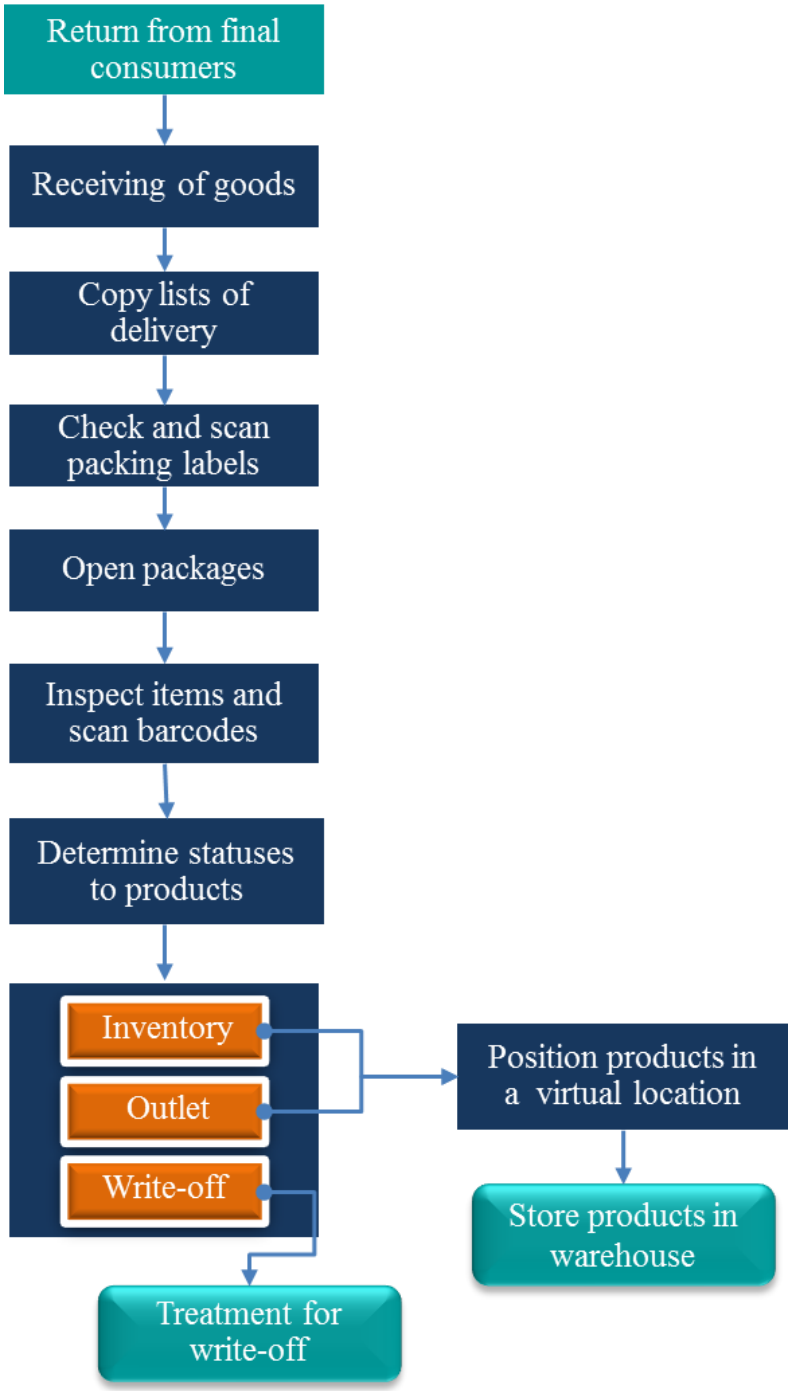


Figure 4-2. Return process of final consumer

Source: created by author

4.2 Return from subjects of a supply chain

At the distribution center, the sources of return from subjects of a supply chain are from clients own retail locations and return from retail chains. The states of returned products from this channel are not good as the returns from final consumer channel. The returned products from subjects of a supply chain are mainly a result of failed sale and damaged while processing in distribution part of the chain.

Before the return process starts, a logistics provider should be informed that products are being returned in the supply chain. Regarding this channel, returned products are attached with return receipt with a certain number. Handling processes of returned products from are pretty similar to return processes from final consumer according to the following steps:

- Verify documents according to sources of return (different clients) and sort boxes;
- The operator of return zone checks return receipt and compares the details with the data in the system;
- If all the details are correct, the data on receipt and data in the system should match each other. Return products will be approved into the return system;
- The workers open packages;
- The workers inspect goods and scan barcodes;
- Packages are closed;
- The workers assign the status to products respective of their conditions. If the conditions of products are good, they go to inventory. On the contrary, they are subjected to outlet and write-off if product conditions are not met;
- Assigned products are positioned to a virtual location;
- Store products at zero level of warehouse storage racks.

The returned products that are assigned as status outlet will be on sale for the workers of the logistics provider within the company and its customer as well. Respecting the common problem that happens in the return in this channel is the documents do not correspond so the information does not match. Moreover, there are products without label that causes more work to the worker to check product identification numbers.

In addition, this logistics distribution center also deals with certain retail locations as shown in figure 4-4. It receives returned products from certain places that the worker in return zone will not check the conditions of them considering to the status of products that are already assigned at the retail location. It is not necessary to do duplicate activities and it would be a waste of time. Return warehouse process diagram is provided in figure 4-3 and complete diagram presenting return from two channels can be seen in figure 4-4.

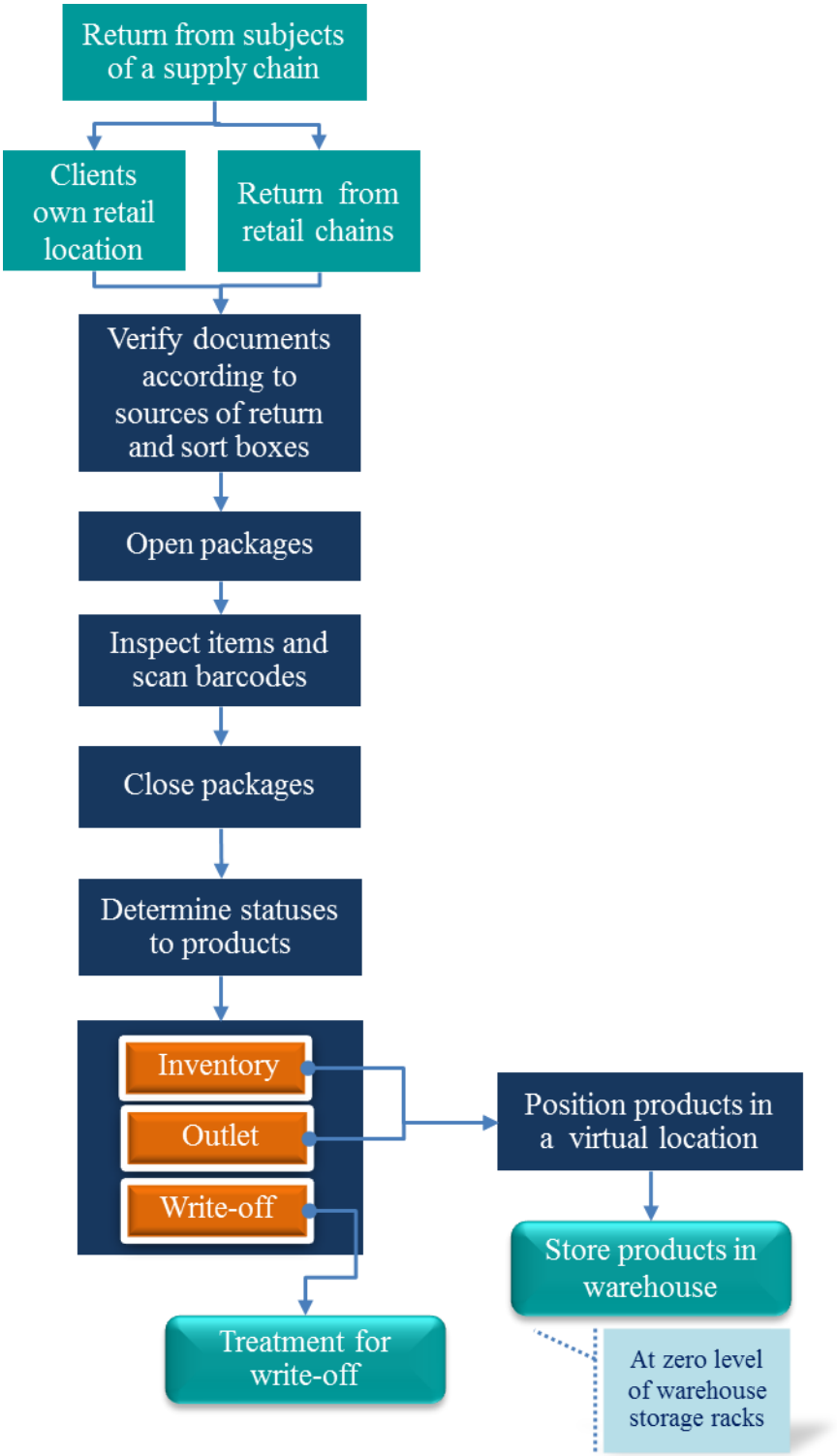


Figure 4-3. Return process of subjects of a supply chain

Source: created by author

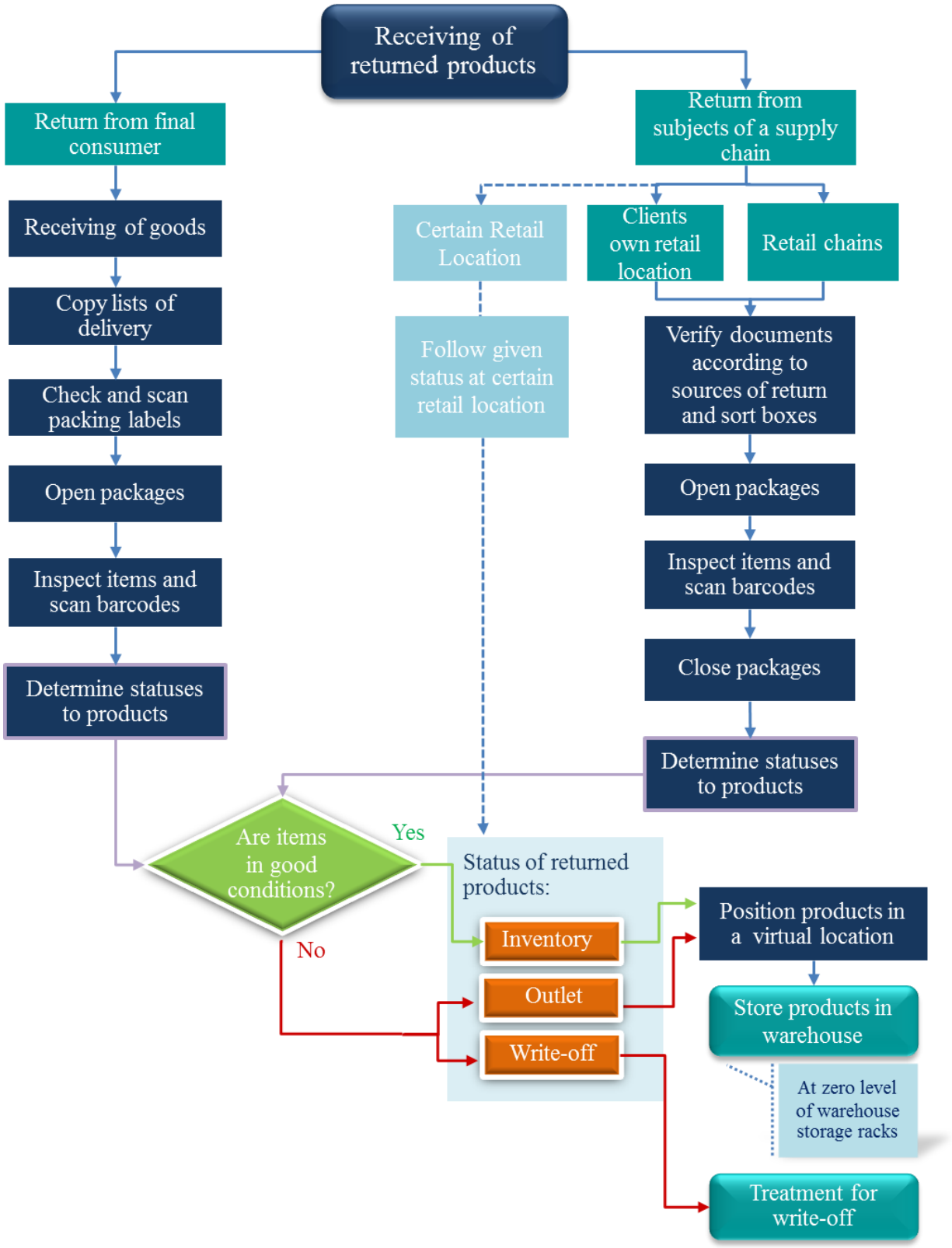


Figure 4-4. Return process of final consumer and subjects of a supply chain at logistics distribution center

Source: created by author

4.3 Analysis of return processes

Taking into consideration the return processes, the logistics distribution center received returned products from two main channels. Return from final consumers that logistics provider dealt with, most of the products were unwanted goods and products with complaints. Although return from final consumer included products with complaints, however, the status for all of the returned products were given to store in inventory as presented in Table 4-1. It means that the goods that were returned from final consumer did not have damage and would be ready to distribute to markets.

On the other hand, returned products from subjects of a supply chain channel are as a result of failed sale and damaged as mentioned before. For this reason, they could not be assigned the status as inventory on every returned product like the first channel. The alternative statuses for the rest of returned products in this channel are sending them to outlet and write-off. Assigning returned products to outlet is for damaged goods. As a consequence of transporting that may cause the damage or defect to products, some are still usable and they might be forwarded to alternative markets, some of them completely broken and are not able to be used anymore so in this case they were determined to write-off.

Considering the return from final consumer and subjects of a supply chain in percentage as displayed in figure 4-5, which is based on the amount of goods in table 4-1. The bar chart implicates where the returned products from both channels were assigned to. The first bar charts of inventory shows that the 679, which is the total number of the returns from final consumer went to inventory in 100% likewise return percentage from subjects of a supply chain that accounts for approximately 87% in inventory. As a result of good conditions of returned products from final consumer that can be stored in inventory and will be distributed to merchandise later, it caused a zero percentage in return on outlet and write-off. In the meanwhile, the percentages of sending items to outlet and write-off from return from subjects of a supply chain are quite small. They only charged around 3% and nearly 5% respectively.

Table 4-1. The quantity of returned products in separated categories

Statuses / Sources	Inventory (piece)	Outlet (piece)	Write-off (piece)
Return from final consumer	679	-	-
Return from subjects of a supply chain	1766	54	95

Source: created by author

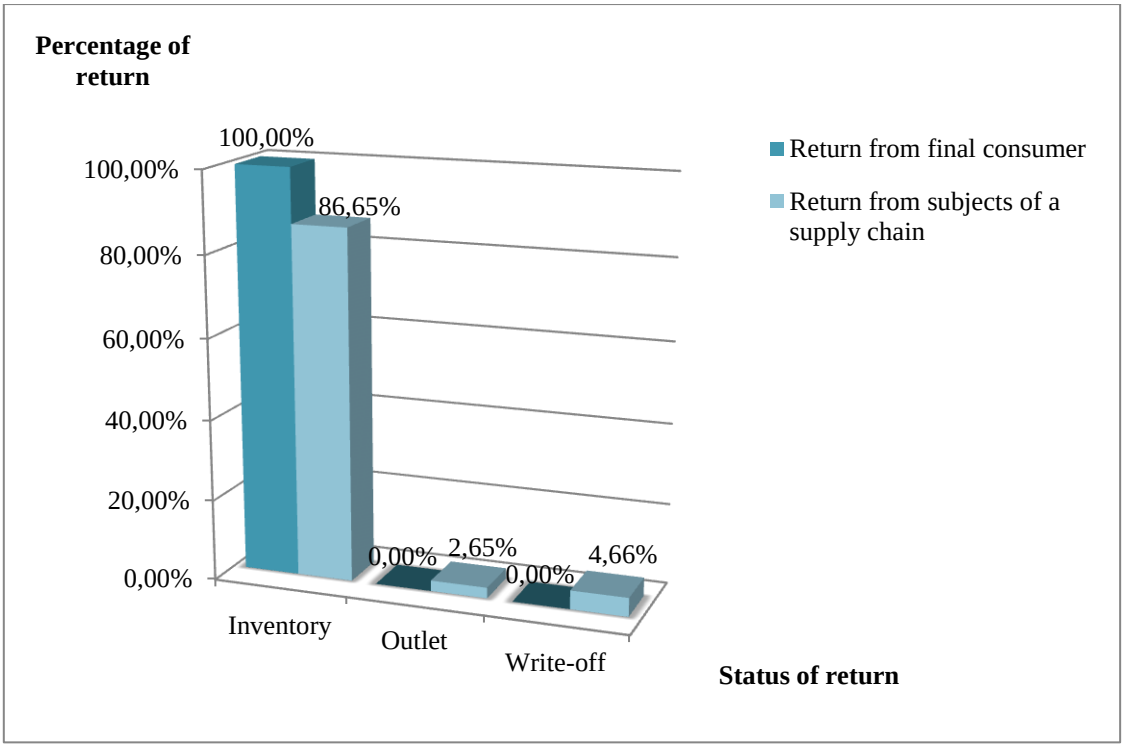


Figure 4-5. Percentage of return vs status of return at the logistics distribution center

Source: created by author

Regard to the aim of this research, the main purpose is to analyze the duration of time spent in activities of return processes with the expected result finding any practical improvement for the operations. The data were collected through both channels; from final consumer and subjects of a supply chain, which can be divided into clients own retail location and retail chains.

Looking at the big picture from the data of two channels as shown below in table 4-2 and table 4-3, it can be seen that the return from subjects of a supply chain spent more time in operating than the return from final consumer. The reasons are because of a large number of products in each return from subjects of a supply chain and included the complexity which leads to more steps to manage. The quantity of product in a box contained more than one item in a packaging comparing with return from final consumer, where each return had fewer amounts than return from subjects of a supply chain. Including wrong packaging, inaccurate color and size happened repeatedly with return from warehouse.

Exploring in more detail of time spent for return from consumer activities in the pie chart which shows the time spent on each activity in figure 4-6, the most time spent during the data assembled period takes 42 % of all activities in this channel which is about a half minute that was used for products scanning. It seems pretty short duration; still this time can turn to much time spent when there are many products to operate at the return channel. The

second most time spent are opening the boxes and positioning products on pallets. Both of them account 27% as displayed in the given pie chart in figure 4-4.

Table 4-2. The average time of return processes from final consumer separated in each activity

Average time of document review	Average time of opening the boxes	Average time of checking and scanning products	Average time of positioning products in virtual locations
00:00:03	00:00:22	00:00:34	00:00:22

Source: created by author

Table 4-3. The average time of return processes from subjects of a supply chain separated in each activity

Average time of sorting packages and checking documents	Average time of opening the packages	Average time of checking products	Average time of receiving goods through the hand held terminal (HHD)	Average time of closing and putting boxes on pallets	Average time of dropping off pallets on virtual locations
00:04:29	00:00:12	00:01:18	00:00:55	00:00:09	00:01:24

Source: created by author

Considering the return from subjects of a supply chain channel, the most time spent was on sorting boxes on pallets and checking documents which took almost 5 minute. It undoubtedly took half of the operation time which held 53% in returning as shown in figure 4-7. 17 % is the second most time spent that was taken on time of dropping pallets on virtual locations. The processes of opening and closing and putting boxes on pallet are the insignificant amount of time spent to manage the activities for return from subjects of a supply chain that accounts 2% to process.

With regard to the information during the data collecting period, some parts of the information have errors. The returned products from subjects of a supply chain channel were not assigned the conditions, resulting with only small amount of error. In a similar way, the time spent in warehouse processes were not completed in every activity; however, even it is not perfectly precise it still can be determined by its average to scrutinize the average time spent in general.

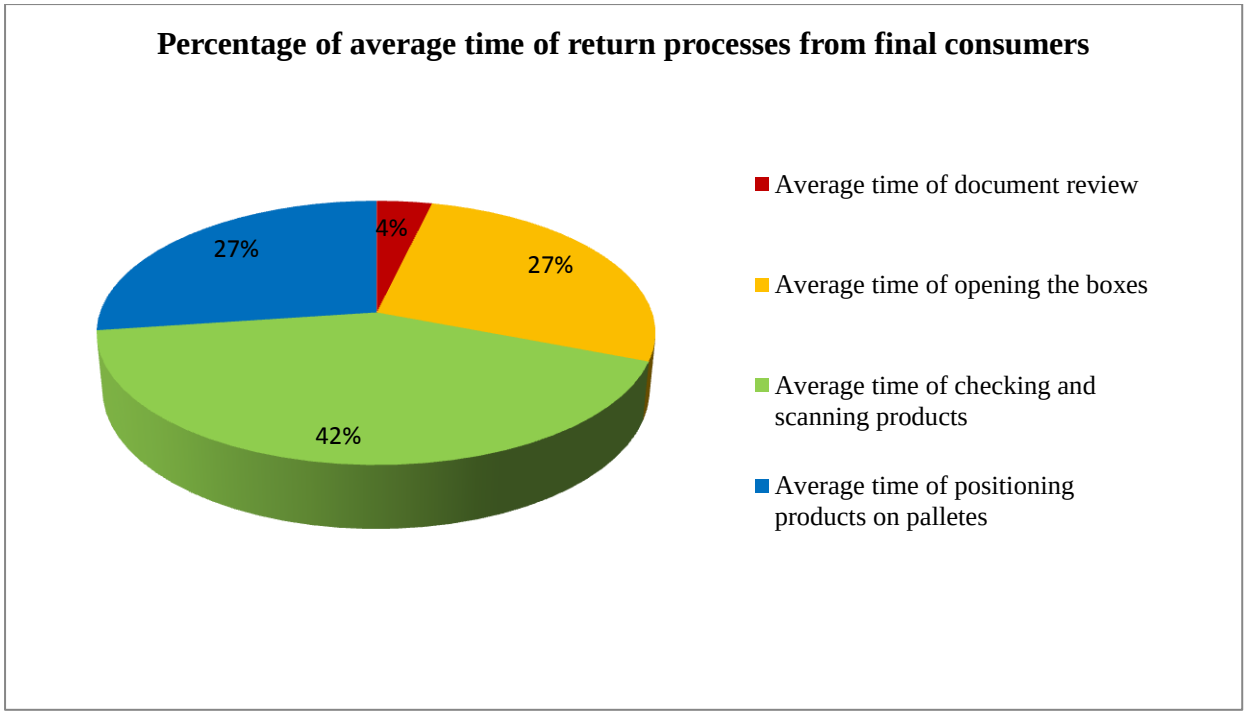


Figure 4-6. Percentage of average time of return processes from final consumers separated in each activity

Source: created by author

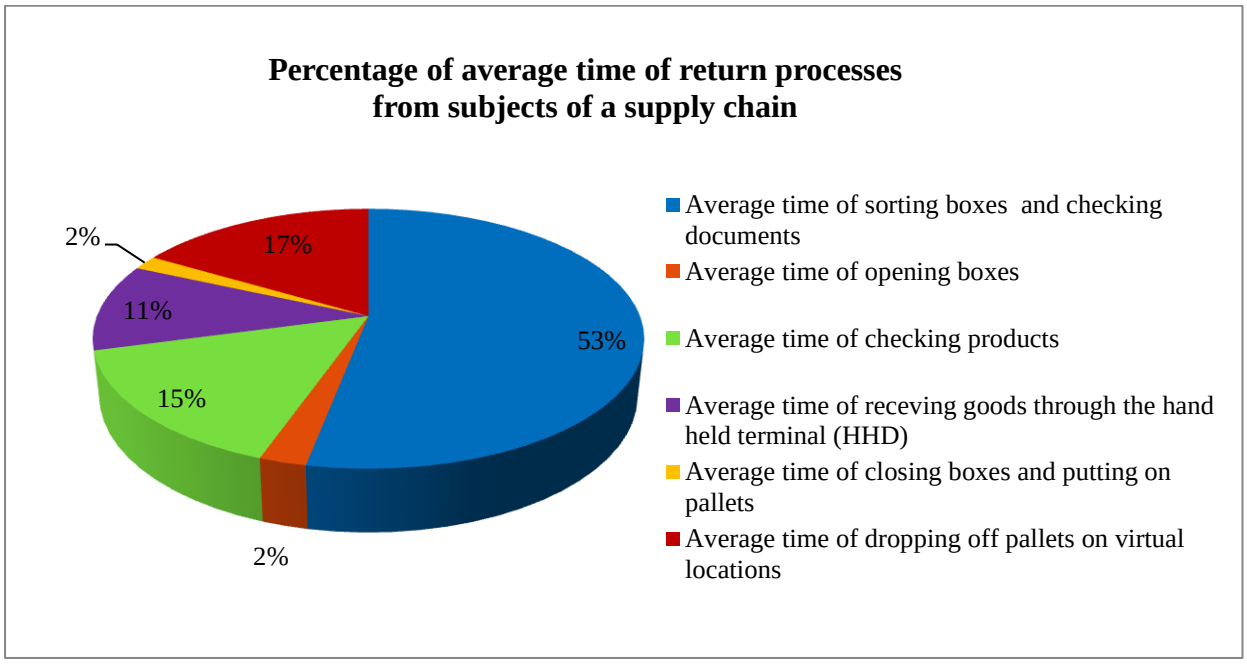


Figure 4-7. Percentage of average time of return processes from subjects of a supply chain separated in each activity

Source: created by author

5. PROPOSAL FOR REVERSE LOGISTICS PROCESS IMPROVEMENT

Finding proposals for activities improvement is the main objective of thesis to obtain the possible solutions which by some means gainfully lead to reverse logistics optimization attempted to manage the processes and related activities at the most effective.

Regarding the data analysis from the last chapter towards the problems of return from final consumer and subjects of a supply chain, the most time spent matters on scanning and sorting boxes and checking documents from return of final consumer and subjects of a supply chain respectively. There are some practical solutions that might help decreasing the time operating for these processes, including other activities at this retail location to accomplish return optimization as well as follows:

- **Classify the return from clients own retail location and retail chains**

Regarding the research, sorting boxes and checking documents spent most of the time in returning process of final consumers and subjects of a supply chain. These activities spent too much time and it caused the waiting queue in operations. Thus, the time can be decreased by determine how to stack goods on pallet in advance – which can be done at retail and wholesale locations. Goods can be arranged by separating between certain retail location, clients own retail location and retail chains. However, to obtain this improvement, it needs cooperation between the clients and the reverse logistics service provider.

- **Determine KPI to measure the operations**

KPI or key performance indicator is a performance measurement that evaluates certain activity of a company. It is a tool that encourages a company to achieve its objectives, which can bring successful to a company in the end. The logistics provider can establish KPI by setting targets which can be for short or long term and can observe them annually or quarterly. KPI does not only work with the operations within a company, but also with a satisfaction from customer. Key performance indicator has a plenty of type of measurement, some that related to reverse logistics would be suggested to this research are regarding operating costs and cycle time. In fact, this research is in some way similar to KPI measurement that evaluates the time spent in specifically activities in return.

- **Establish a policy for return**

Due to the large amounts of return from final consumer referring to the analysis of this research, all of the returns were undamaged. There were only unwanted products, which the packages of some of them possibly were not even opened by customers. Notwithstanding, these returns from final consumer need to pass through the regular processes as others returns as checking the documents, scanning the packaging, opening and inspecting the products. These processes spent a lot of time on each product event though all of the returned products from final consumer were moved to inventory after all.

Therefore, the clients of the logistics provider or supplier should establish the policy which has more strict rules to give refunds or rights of exchange to their customers. Even though the suppliers should concern customer satisfaction at the very first place when doing business; nevertheless it would help decreasing amount of return and protecting the company itself. This can be included to charging customers for transportation and shorten the length of return after buying products, for example.

- **Run a paperless system**

Considering to the return process of final consumer and subjects of a supply chain, both of the receiving procedures of return channels require list of delivery of the return from final consumer and return receipt of the return from subjects of a supply chain. These documents were used to verify the return products and one of them was copied before forwarding the original to the next department. In addition, the documents were often not corresponding and the information did not match. To help the reverse logistics provider company, these receiving procedures can be optimized by using electronic data in RL system.

- **Educate and train workers**

Regarding observation period at return location, it was recorded that there were many errors generated by warehouse workers included in RL processing. To solve the problems, it required experts who are skilled to make the situation through these difficulties by cause of some cases took up to few hours – which is too long and can cause bottleneck to a company. Accordingly, to have experts to be ready solving any future problems at a company, can be provided by educate and train workers who know the nature of activity in the company. It is possible to hire a person who is certainly an expert from outside; however, it would cost more. In addition it would waste the waiting time if an expert is not placed at the return location, but the company has to give a call for fixing each time when there is a problem at the company.

- **Place and store products in the suitable area**

According to the return process after determining product condition and assigning the status, returned products from subjects of a supply are positioned at the certain locations where the workers put them on the zero level. The products are mixed and unwell categorized.. Thus, preparing appropriate locations and separating products by category or rate of return as presented in the yellow highlight on the flow chart in figure 5-1, should be considered in the proposal for improvement.

- **Arrange the process in flow chart**

In order to improve the processes in this logistics distribution center, the returned products are possibly categorized by types, brands, colors, and markets of products to make the return processes orderly and easy for the pickers when the products are called. Thus, sorting products according to product categories is proposed as addition to return process after activity of opening packages for return from final consumers and subjects of a supply

chain as highlighted in the red boxes on figure 5-1. This newly added process would help the workers manage the following processes easier and tidier.

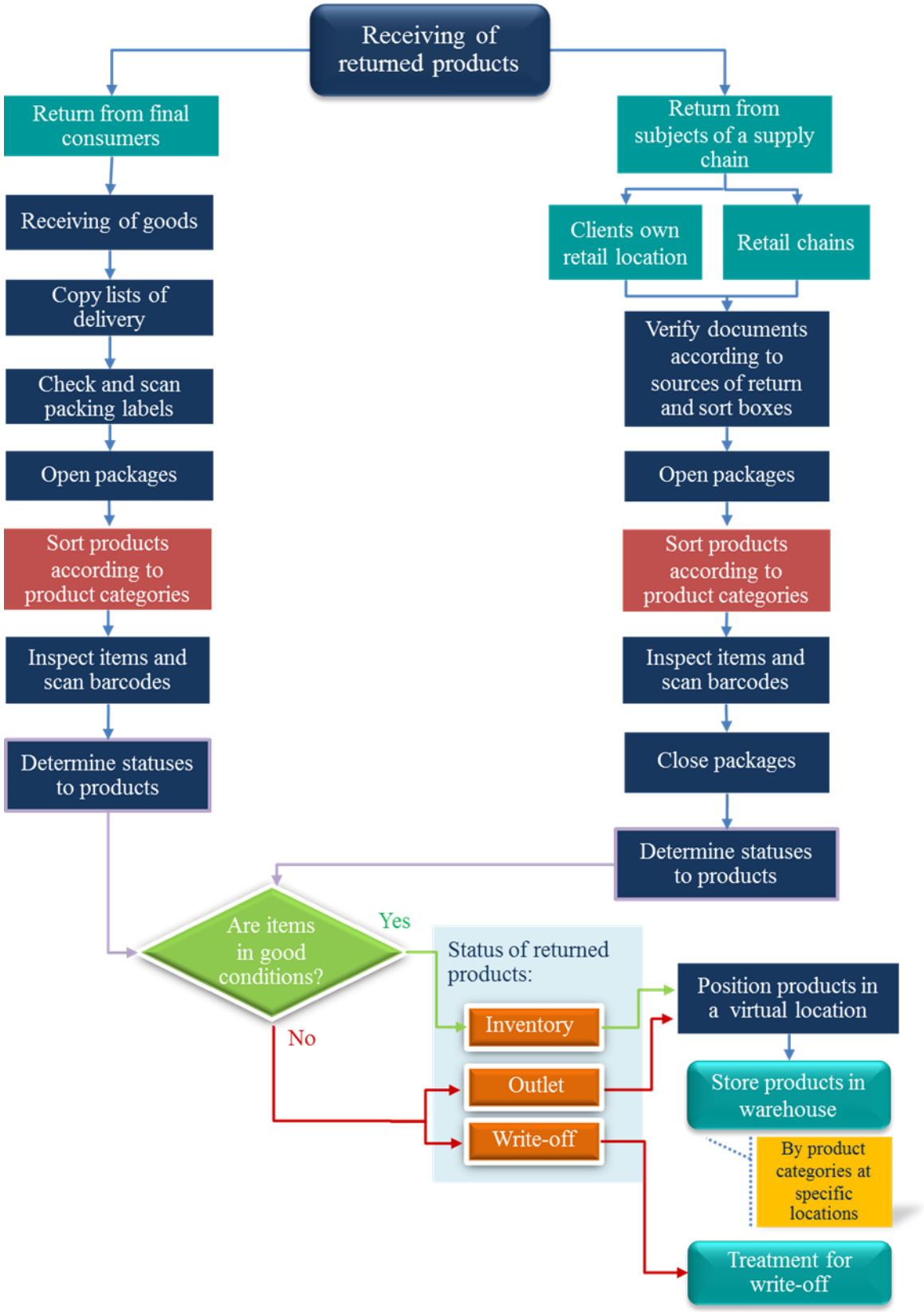


Figure 5-1. Proposed flowchart for return process at the logistics distribution center
Source: created by author

6. CONCLUSION

Eventually, the operations of return from final consumer and return from subjects of a supply chain at the distribution center during the observed period seem fine overall. The majority of returned products were assigned to inventory and there was less amount in outlet and write-offs for both channels — which means at this distribution center did not have much issue related unsatisfactory conditions of product that logistics provider needs to recover.

On the other hand, the main problem is a great deal of amount of the returns from final consumer. By this reason, it caused the significant time on product verification and scanning. Returned items were in good conditions without any damage. So, this can be improved by establishing or adjusting the policies of manufacturers, retail, and wholesale to tighten the return rules in order to decrease return quantity. It is also undoubtedly why the processes which related to documents took a lot of time in the activity of verification, scanning, and sorting products and packages. The logistics provider use paper-based data, which are list of delivery and return receipt during the receiving process. Nowadays there are plenty of technologies provided to support works related reverse logistics, adopting paperless system would help if the company concerns on this matter to decrease time in operating and increase more convenient to workers.

Operating return is the management that deals with disposition cycle time. In order to improve reverse logistics process and prevent bottle neck, time truly matters to be concerned. Each return activity has a consequence on another activity in the chain which affects the working time spent on each item. If the time in operations reduces, using of human resource will be reduced as well.

In conclusion, reverse logistics might be considered as hard and complicated subject and in a similar way, managing reverse logistics does not mainly make profit to organizations. However, it reduces costs if it is organized well. Reverse logistics is needed to be concerned gradually, to look into the process and find out what are the problems. Accordingly, there will be solutions to solve and improve the problems. Corresponding to this case study, the proposals for reverse logistics process are provided with the strongly believe that they would by some means optimize the operational processes in backward flow, reduce costs and bring the profitability to the organization.

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Appendix A. Data of time spent during the processes in return from final consumer

Ordinal box number	Account number	Number of items in a box	Time of document review	Time of opening the box	Time of receiving goods through the hand held terminal (HHD)	Time of Positioning on the palette	Time of disassembly the box	Conditions		
								Inventory	Outlet	Write-off
1	NLK15338689	4	00:00:03	00:00:05	00:01:50	00:00:04		4	-	-
2	NLK15333018	4	00:00:03	00:00:06	00:01:35	00:00:04		4	-	-
3	NLK15341317	8	00:00:03	00:00:07	00:01:47	00:00:04		8	-	-
4	NLK15320497	2	00:00:03	00:00:04	00:01:23	00:00:02		2	-	-
5	NLK15346455	3	00:00:03	00:00:10	00:00:48	00:00:01		3	-	-
6	NLK15337632	1	00:00:07	00:00:10	00:00:42	00:00:04		1	-	-
7	NLK15321433	8	00:00:09	00:00:08	00:01:53	00:00:05		8	-	-
8	NLK15320615	3	00:00:06	00:00:04	00:00:43	00:00:04		3	-	-
1	NLK15348488	3	00:00:06	00:00:05	00:00:50	00:00:10		3	-	-
2	NLK15331920	1	00:00:04	00:00:03	00:00:20	00:00:04		1	-	-
3	NLK15348430	3	00:00:10	00:00:08	00:01:12	00:00:04		3	-	-
4	NLK15341501	4	00:00:09	00:00:07	00:00:55	00:00:04		4	-	-
5	NLK15347606	6	00:00:10	00:00:08	00:01:49	00:00:04		6	-	-
6	NLK15348704	3	00:00:11	00:00:07	00:00:45	00:00:04		3	-	-
7	NLK15330298	3	00:00:04	00:00:04	00:00:33	00:00:04		3	-	-
8	NLK15322386	3	00:00:10	00:00:10	00:00:57	00:00:05		3	-	-
9	NLK15341453	3	00:00:06	00:00:07	00:00:51	00:00:04		3	-	-
10	NLK15336066	2	00:00:06	00:00:06	00:00:25	00:00:03		2	-	-
11	NLK15348280	1	00:00:12	00:00:11	00:00:39	00:00:05		1	-	-
12	NLK15322741	3	00:00:09	00:00:06	00:00:52	00:00:04		3	-	-
13	NLK15327384	5	00:00:11	00:00:09	00:00:59	00:00:09		5	-	-
14	NLK15339861	1	00:00:10	00:00:10	00:00:12	00:00:03		1	-	-
15	NLK15346424	3	00:00:15	00:00:12	00:00:50	00:00:03		3	-	-
16	NLK15329780	2	00:00:04	00:00:04	00:00:42	00:00:04		2	-	-
17	NLK15339498	6	00:00:09	00:00:03	00:01:32	00:00:05		6	-	-
18	NLK15312875	7	00:00:06	00:00:06	00:01:52	00:00:07		7	-	-
19	NLK15345342	3	00:00:03	00:00:04	00:00:25	00:00:03		3	-	-
1	NLK15344978	10	00:00:04	00:00:05	00:01:21	00:00:04		10	-	-
2	NLK15334882	3	00:00:05	00:00:04	00:00:40	00:00:04		3	-	-
3	NLK15333038	4	00:00:07	00:00:05	00:01:01	00:00:03		4	-	-
4	NLK15334331	2	00:00:04	00:00:03	00:00:27	00:00:03		2	-	-
5	NLK15343549	4	00:00:07	00:00:05	00:01:27	00:00:03		4	-	-
6	NLK15343549	2	00:00:11	00:00:08	00:00:22	00:00:03		2	-	-
7	NLK15330578	7	00:00:06	00:00:06	00:03:44	00:00		7	-	-
8	NLK15328881	6	00:00:07	00:00:04	00:01:27	00:00:03		6	-	-
9	NLK15320419	14	00:00:04	00:00:05	00:04:20	00:00:04		14	-	-
10	NLK15332342	1	00:00:04	00:00:04	00:00:25	00:00:03		1	-	-
11	NLK15322845	3	00:00:03	00:00:06	00:01:21	00:00:03		3	-	-
12	NLK15318353	3	00:00:03	00:00:03	00:02:42			3	-	-
13	NLK15329878	1	00:00:03	00:00:06	00:00:40	00:00:01		1	-	-
14	NLK15331597	4	00:00:03	00:00:05	00:00:51	00:00:01		4	-	-
15	NLK15324176	2	00:00:03	00:00:06	00:01:10	00:00:01		2	-	-

Ordinal box number	Account number	Number of items in a box	Time of document review	Time of opening the box	Time of receiving goods through the hand held terminal (HHD)	Time of Positioning on the palette	Time of disassembly the box	Conditions		
								Inventory	Outlet	Write-off
16	LP300443262	11	00:00:03	00:00:05	00:02:28			11	-	-
17	NLK15347704	2	00:00:02	00:00:02	00:00:22			2	-	-
18	NLK15325657	2	00:00:02	00:00:02	00:00:22			2	-	-
19	NLK15326321	2	00:00:02	00:00:02	00:00:22			2	-	-
20	NLK15340425	2	00:00:02	00:00:02	00:00:22			2	-	-
21	LP300454438	2	00:00:02	00:00:02	00:00:22			2	-	-
22	NLK15335379	2	00:00:02	00:00:02	00:00:22			2	-	-
23	NLK15333570	2	00:00:02	00:00:02	00:00:22			2	-	-
24	NLK15341438	2	00:00:02	00:00:02	00:00:22			2	-	-
25	NLK15317688	2	00:00:02	00:00:02	00:00:22			2	-	-
26	NLK15335521	2	00:00:02	00:00:02	00:00:22			2	-	-
27	NLK15339889	2	00:00:02	00:00:02	00:00:22			2	-	-
28	NLK15337555	2	00:00:02	00:00:02	00:00:22			2	-	-
29	NLK15339341	2	00:00:02	00:00:02	00:00:22			2	-	-
30	NLK15331643	2	00:00:02	00:00:02	00:00:22			2	-	-
31	NLK15335621	2	00:00:02	00:00:02	00:00:22			2	-	-
32	NLK15335621	2	00:00:02	00:00:02	00:00:22			2	-	-
33	NLK15337361	2	00:00:02	00:00:02	00:00:22			2	-	-
34	NLK15349036	2	00:00:02	00:00:02	00:00:22			2	-	-
35	NLK15332113	2	00:00:02	00:00:02	00:00:22			2	-	-
36	NLK15334534	2	00:00:02	00:00:02	00:00:22			2	-	-
37	NLK15335802	2	00:00:02	00:00:02	00:00:22			2	-	-
38	NLK15327297	2	00:00:02	00:00:02	00:00:22			2	-	-
39	NLK15334827	1	00:00:02	00:00:02	00:00:22			1	-	-
40	NLK15337699	2	00:00:02	00:00:02	00:00:22			2	-	-
41	NLK15341703	1	00:00:02	00:00:02	00:00:22			1	-	-
42	NLK15341068	2	00:00:02	00:00:02	00:00:22			2	-	-
43	NLK15332770	2	00:00:02	00:00:02	00:00:22			2	-	-
44	NLK15340105	2	00:00:02	00:00:02	00:00:22			2	-	-
45	NLK15332202	2	00:00:02	00:00:02	00:00:22			2	-	-
46	NLK15345796	2	00:00:02	00:00:02	00:00:22			2	-	-
47	NLK15339884	2	00:00:02	00:00:02	00:00:22			2	-	-
48	NLK15340026	2	00:00:02	00:00:02	00:00:22			2	-	-
49	NLK15331342	2	00:00:02	00:00:02	00:00:22			2	-	-
50	NLK15341700	2	00:00:02	00:00:02	00:00:22			2	-	-
51	NLK15338722	2	00:00:02	00:00:02	00:00:22			2	-	-
52	NLK15339180	2	00:00:02	00:00:02	00:00:22			2	-	-
53	NLK15340218	2	00:00:02	00:00:02	00:00:22			2	-	-
54	NLK15336033	2	00:00:02	00:00:02	00:00:22			2	-	-
55	NLK15340980	2	00:00:02	00:00:02	00:00:22			2	-	-
56	NLK15341604	2	00:00:02	00:00:02	00:00:22			2	-	-
57	NLK15341034	2	00:00:02	00:00:02	00:00:22			2	-	-

Ordinal box number	Account number	Number of items in a box	Time of document review	Time of opening the box	Time of receiving goods through the hand held terminal (HHD)	Time of Positioning on the palette	Time of disassembly the box	Conditions		
								Inventory	Outlet	Write-off
58	NLK15347607	2	00:00:02	00:00:02	00:00:22			2	-	-
59	NLK15345533	2	00:00:02	00:00:02	00:00:22			2	-	-
60	NLK15335491	2	00:00:02	00:00:02	00:00:22			2	-	-
61	NLK15348285	2	00:00:02	00:00:02	00:00:22			2	-	-
62	NLK15334503	2	00:00:02	00:00:02	00:00:22			2	-	-
63	NLK15331114	2	00:00:02	00:00:02	00:00:22			2	-	-
64	NLK15319308	2	00:00:02	00:00:02	00:00:22			2	-	-
65	NLK15326689	2	00:00:02	00:00:02	00:00:22			2	-	-
66	NLK15331555	2	00:00:02	00:00:02	00:00:22			2	-	-
67	NLK15333891	2	00:00:02	00:00:02	00:00:22			2	-	-
68	NLK15322019	2	00:00:02	00:00:02	00:00:22			2	-	-
69	NLK15338140	2	00:00:02	00:00:02	00:00:22			2	-	-
70	NLK15345562	2	00:00:02	00:00:02	00:00:22			2	-	-
71	NLK15336037	2	00:00:02	00:00:02	00:00:22			2	-	-
72	NLK15333571	2	00:00:02	00:00:02	00:00:22			2	-	-
73	NLK15328733	2	00:00:02	00:00:02	00:00:22			2	-	-
74	NLK15335574	2	00:00:02	00:00:02	00:00:22			2	-	-
75	NLK15322271	2	00:00:02	00:00:02	00:00:22			2	-	-
76	NLK15335649	2	00:00:02	00:00:02	00:00:22			2	-	-
77	NLK15322091	2	00:00:02	00:00:02	00:00:22			2	-	-
78	NLK15334883	2	00:00:02	00:00:02	00:00:22			2	-	-
79	NLK15330512	2	00:00:02	00:00:02	00:00:22			2	-	-
80	NLK15339658	2	00:00:02	00:00:02	00:00:22			2	-	-
81	NLK15340406	2	00:00:02	00:00:02	00:00:22			2	-	-
82	NLK15331955	2	00:00:02	00:00:02	00:00:22			2	-	-
83	NLK15335048	2	00:00:02	00:00:02	00:00:22			2	-	-
84	NLK15337027	2	00:00:02	00:00:02	00:00:22			2	-	-
85	NLK15325464	2	00:00:02	00:00:02	00:00:22			2	-	-
86	NLK15340123	2	00:00:02	00:00:02	00:00:22			2	-	-
87	NLK15345856	2	00:00:02	00:00:02	00:00:22			2	-	-
88	NLK15339255	2	00:00:02	00:00:02	00:00:22			2	-	-
89	NLK15337669	2	00:00:02	00:00:02	00:00:22			2	-	-
90	NLK15347552	2	00:00:02	00:00:02	00:00:22			2	-	-
91	NLK15335899	2	00:00:02	00:00:02	00:00:22			2	-	-
92	NLK15335736	2	00:00:02	00:00:02	00:00:22			2	-	-
93	NLK15322384	2	00:00:02	00:00:02	00:00:22			2	-	-
94	NLK15337429	2	00:00:02	00:00:02	00:00:22			2	-	-
95	NLK15339749	2	00:00:02	00:00:02	00:00:22			2	-	-
96	NLK15331710	2	00:00:02	00:00:02	00:00:22			2	-	-
97	NLK15317925	2	00:00:02	00:00:02	00:00:22			2	-	-
98	NLK15346238	2	00:00:02	00:00:02	00:00:22			2	-	-
99	NLK15340009	2	00:00:02	00:00:02	00:00:22			2	-	-
100	NLK15337334	2	00:00:02	00:00:02	00:00:22			2	-	-

Ordinal box number	Account number	Number of items in a box	Time of document review	Time of opening the box	Time of receiving goods through the hand held terminal (HHD)	Time of Positioning on the palette	Time of disassembly the box	Conditions		
								Inventory	Outlet	Write-off
1	NLK15347750	10	00:00:02	00:00:21	00:03:20		00:00:23	10	-	-
2	NLK15351008	6	00:00:02	00:00:28	00:01:02			6	-	-
3	NLK15333265	2	00:00:03	00:00:15	00:00:44			2	-	-
4	NLK15338832	2	00:00:03	00:00:13	00:00:40			2	-	-
5	NLK15350364	3		00:00:26	0:01.51			3	-	-
6	NLK15344906	6		00:00:14	00:01:15			6	-	-
1	NLK15349719	2		00:00:17	00:00:51			2	-	-
2	NLK15349019	6	00:00:02	00:00:14	00:01:25			6	-	-
3	NLK15339530	2	00:00:02	00:00:15	00:00:38			2	-	-
4	NLK15342389	6	00:00:02	00:00:10	00:00:50			6	-	-
5	NLK1531317	1		00:00:10	00:00:28			1	-	-
6	NLK15350043	1	00:00:02	00:00:38	00:00:26			1	-	-
7	NLK1532443	1		00:00:16	00:00:53			1	-	-
8	NLK15339795	2	00:00:02	00:00:21	00:00:12			2	-	-
9	NLK15317855	1		00:00:06	00:00:34			1	-	-
10	NLK15335417	3	00:00:02	00:00:14	00:00:57			3	-	-
11	NLK15336491	5		00:00:29	00:01:50		00:00:10	5	-	-
12	NLK15338021	1			00:00:33			1	-	-
1	NLK15346180	4	00:00:02	00:01:38	00:01:09			4	-	-
2	NLK15348223	2			00:01:02			2	-	-
1	NLK15348622	3	00:00:02	00:00:37	00:01:21			3	-	-
2	NLK15334186	2		00:00:16	00:00:42			2	-	-
1	NLK15349610	2		00:00:18	00:00:05	00:00:35		2	-	-
2	NLK15348198	2		00:00:07	00:00:05	00:00:50		2	-	-
3	NLK15333452	2		00:00:10	00:00:05	00:00:20		2	-	-
4	NLK15336183	2		00:00:17	00:00:05	00:00:42		2	-	-
5	NLK15341194	8		00:00:11	00:00:12	00:01:22		8	-	-
6	NLK1535029	3		00:00:17	00:00:33	00:00:36		3	-	-
7	NLK15319822	3		00:00:18	00:00:32	00:00:26		3	-	-
8	NLK15348448	3		00:00:18	00:00:24	00:00:30		3	-	-
9	NLK15339209	2		00:00:22	00:00:23	00:00:25		2	-	-
10	NLK15305302	2		00:00:06	00:00:17	00:00:21		2	-	-
11	NLK15340652	1		00:00:18	00:00:12	00:00:14		1	-	-
12	NLK15347826	1		00:00:18	00:00:08	00:00:18		1	-	-
13	NLK15335399	1		00:00:08	00:00:05	00:00:47		1	-	-
14	NLK15337672	1		00:00:08	00:00:11	00:00:19		1	-	-
15	NLK15342094	9		00:00:10	00:00:11	00:02:39		9	-	-
16	NLK15329735	7		00:00:15	00:00:14	00:01:31		7	-	-
17	NLK15342613	6		00:00:46	00:00:14	00:01:52		6	-	-
18	NLK15348385	8		00:00:18	00:00:05	00:02:13		8	-	-
19	NLK15340729	1		00:00:15	00:00:15	00:00:45		1	-	-
20	NLK15339637	1		00:00:05	00:00:17	00:00:18		1	-	-

Ordinal box number	Account number	Number of items in a box	Time of document review	Time of opening the box	Time of receiving goods through the hand held terminal (HHD)	Time of Positioning on the palette	Time of disassembly the box	Conditions		
								Inventory	Outlet	Write-off
21	NLK15342960	1		00:00:05	00:00:05	00:00:18		1	-	-
22	NLK15342552	1		00:00:04	00:00:27	00:00:31		1	-	-
23	NLK15343252	1		00:00:04	00:00:08	00:00:28		1	-	-
24	NLK15350363	1		00:00:11	00:00:05	00:00:27		1	-	-
25	NLK15337548	1		00:00:11	00:00:05	00:00:19		1	-	-
26	NLK15343283	1		00:00:17	00:00:05	00:01:40		1	-	-
27	NLK15319708	1		00:00:05	00:00:08	00:00:28		1	-	-
29	NLK15339888	1		00:00:05	00:00:07	00:00:30		1	-	-
30	NLK15339317	1		00:00:07	00:00:05	00:00:21		1	-	-
31	NLK15343075	1		00:00:07	00:00:03	00:00:50		1	-	-
32	NLK15330992	1		00:00:07	00:00:07	00:00:24		1	-	-
33	NLK15333524	1		00:00:09	00:00:05	00:00:21		1	-	-
34	NLK15349234	1		00:00:22	00:00:17	00:00:32		1	-	-
35	NLK15344746	1		00:00:09	00:00:09	00:00:27		1	-	-
36	NLK15334721	1		00:00:07	00:00:07	00:00:29		1	-	-
37	NLK15342430	1		00:00:09	00:00:08	00:00:23		1	-	-
38	NLK15338100	1		00:00:09	00:00:07	00:00:18		1	-	-
39	NLK15343187	1		00:00:09	00:00:04	00:00:20		1	-	-
40	NLK15340738	1		00:00:16	00:00:15	00:00:21		1	-	-
41	Nlk15341823	1		00:00:10	00:00:07	00:00:28		1	-	-
42	NLK15249033	1		00:00:15	00:00:05	00:00:19		1	-	-
43	NLK15337704	1		00:00:07	00:00:08	00:00:20		1	-	-
44	NLK15334742	1		00:00:09	00:00:06	00:00:20		1	-	-
45	NLK15337393	1		00:00:11	00:00:06	00:00:14		1	-	-
46	NLK15332792	1		00:00:08	00:00:19	00:00:55		1	-	-
47	NLK15342816	1		00:00:17	00:00:06	00:00:24		1	-	-
48	NLK15342106	1		00:00:12	00:00:10	00:00:14		1	-	-
49	NLK15339841	1		00:00:07	00:00:05	00:00:19		1	-	-
50	NLK15334159	1		00:00:07	00:00:18	00:00:38		1	-	-
51	NLK15322612	1		00:00:11	00:00:13	00:01:03		1	-	-
52	NLK15258648	1		00:00:14	00:00:25	00:00:26		1	-	-
53	NLK15320837	1		00:00:15	00:00:15	00:00:15		1	-	-
54	NLK15342162	1		00:00:08	00:00:15	00:00:21		1	-	-
55	NLK15314191	1		00:00:08	00:00:06	00:00:17		1	-	-
56	NLK15318209	1		00:00:12	00:00:05	00:00:17		1	-	-
57	NLK15333784	3		00:00:13	00:00:21	00:00:42		3	-	-
58	NLK15335606	1		00:00:14	00:00:05	00:00:30		1	-	-
59	NLK15342811	1		00:00:13	00:00:17	00:00:25		1	-	-
60	NLK15342598	1		00:00:10	00:00:11	00:00:33		1	-	-
61	NLK15344204	1		00:00:14	00:00:07	00:00:27		1	-	-
62	NLK15340727	1		00:00:10	00:00:04	00:00:20		1	-	-
63	NLK15340197	1		00:00:08	00:00:10	00:00:54		1	-	-
64	NLK15337666	1		00:00:10	00:00:22	00:00:50		1	-	-
65	NLK15349531	1		00:00:12	00:00:10	00:00:47		1	-	-

Ordinal box number	Account number	Number of items in a box	Time of document review	Time of opening the box	Time of receiving goods through the hand held terminal (HHD)	Time of Positioning on the palette	Time of disassembly the box	Conditions		
								Inventory	Outlet	Write-off
66	NLK15348037	1		00:00:05	00:00:10	00:00:31		1	-	-
67	NLK15320393	1		00:00:23	00:00:24	00:00:11		1	-	-
68	NLK15332585	1		00:00:05	00:00:20	00:00:21		1	-	-
69	NLK15337295	1		00:00:15	00:00:15	00:00:23		1	-	-
70	NLK15348691	2		00:00:16	00:00:12	00:00:47		2	-	-
71	NLK15325162	2		00:00:15	00:00:16	00:00:14		2	-	-
72	NLK15341079	3		00:00:11	00:00:12	00:00:57		3	-	-
73	NLK15339486	1		00:00:14	00:00:11	00:01:00		1	-	-
74	NLK15334996	1		00:00:07	00:00:17	00:00:14		1	-	-
75	NLK15341236	2		00:00:10	00:00:16	00:12:00		2	-	-
76	NLK15325603	10		00:00:10	00:00:38	00:01:18		10	-	-
77	NLK15339388	2		00:00:08	00:00:13	00:00:40		2	-	-
78	NLK15342136	6		00:00:10	00:00:12	00:02:00		6	-	-
1	NLK 15339481	6	00:00:10	01:00:10	00:01:40	0:00:10		6	-	-
2	NLK 15325608	2	00:00:10	00:00:13	00:00:33	0:00:10		2	-	-
3	NLK 15340193	4	00:00:05	00:00:10	00:01:27	0:00:10		4	-	-
4	NLK 15317306	1	00:00:13	00:00:07	00:00:15	0:00:05		1	-	-
5	NLK 15329946	4	00:00:06	00:00:22	00:00:50	0:00:03		4	-	-
6	NLK 15340455	2	00:00:09	00:00:27	00:00:32	0:00:03		2	-	-
7	NLK 15342872	1	00:00:05	00:00:20	00:00:40	0:00:03		1	-	-
8	NLK 15322450	5	00:00:10	00:00:20	00:00:55	0:00:04		5	-	-
9	NLK 15340551	1	00:00:05	00:00:24	00:00:42	0:00:05		1	-	-
10	NLK 15339426	5	00:00:05	00:00:34	00:01:07	0:00:06		5	-	-
11	NLK 15340987	2	00:00:15	00:00:10	00:00:56	0:00:05		2	-	-
12	NLK 15337423	2	00:00:02	00:00:21	00:01:11	0:00:06		2	-	-
13	NLK 15321288	3	00:00:02	00:00:10	00:00:51	0:00:10		3	-	-
14	NLK 15329562	3	00:00:11	00:00:05	00:01:04	0:00:04		3	-	-
15	NLK 15351071	4	00:00:05	00:00:15	00:00:46	0:00:02		4	-	-
1	NLK 15332845	3	00:00:05	00:00:14	00:00:47	0:00:10		3	-	-
2	NLK 15321387	3	00:00:05	00:00:18	00:00:45	0:00:05		3	-	-
3	NLK 15339475	3	00:00:05	00:00:09	00:01:19	0:00:05		3	-	-
4	NLK 15338064	3	00:00:02	00:00:17	00:00:58	0:00:10		3	-	-
5	NLK 15340736	7	00:00:07	00:00:17	00:02:46	0:00:15		7	-	-
6	NLK 15348296	2	00:00:02	00:00:22	00:00:45	0:00:10		2	-	-
7	NLK 15343444	2	00:00:02	00:00:20	00:00:39	00:00:11		2	-	-
8	NLK 15326244	1	00:00:10	00:00:20	00:00:35	00:00:02		1	-	-
9	NLK 15345372	3	00:00:05	00:00:20	00:01:24	00:00:10		3	-	-
10	NLK 15333400	4	00:00:05	00:00:15	00:00:58	00:00:12		4	-	-
11	NLK 15348814	1	00:00:05	00:00:13	00:00:24	00:00:05		1	-	-
12	NLK 15350468	4	00:00:02	00:00:19	00:00:45	00:00:19		4	-	-
13	NLK 15334380	4	00:00:02	00:00:20	00:00:50	0:00:05		4	-	-
14	NLK 15332685	1	00:00:02	00:00:20	00:00:27	0:00:10		1	-	-
15	NLK 15339857	1	00:00:02	00:00:15	00:00:26	0:00:02		1	-	-

Ordinal box number	Account number	Number of items in a box	Time of document review	Time of opening the box	Time of receiving goods through the hand held terminal (HHD)	Time of Positioning on the palette	Time of disassembly the box	Conditions		
								Inventory	Outlet	Write-off
16	NLK 15339892	2	00:00:02	00:00:12	00:00:34	0:00:10		2	-	-
17	NLK 15316471	1	00:00:02	00:00:14	00:00:56	0:00:02		1	-	-
18	NLK 15333740	2	00:00:02	00:00:16	00:00:46	0:00:05		2	-	-
19	NLK 15333912	1	00:00:02	00:00:15	00:00:24	00:00:02		1	-	-
20	NLK 15333909	1	00:00:02	00:00:18	00:00:29	00:00:02		1	-	-
21	NLK 15342608	1	00:00:02	00:00:15	00:00:24	00:00:02		1	-	-
22	NLK 15335614	2	00:00:02	00:00:17	00:00:30	0:00:05		2	-	-
23	NLK 15321614	2	00:00:03	00:00:10	00:00:39	0:00:07		2	-	-
24	NLK 15331447	1	00:00:02	00:00:10	00:00:26	0:00:02		1	-	-
25	NLK 15333304	2	00:00:05	00:00:36	00:02:23	0:00:03		2	-	-
26	NLK 15344401	1	00:00:02	00:00:10	00:00:34	00:00:02		1	-	-
27	NLK 15343998	1	00:00:02	00:00:02	00:00:20	00:00:02		1	-	-
28	NLK 15335961	1	00:00:02	00:00:05	00:00:27	00:00:02		1	-	-
29	NLK 15338773	1	00:00:02	00:00:06	00:00:20	00:00:02		1	-	-
30	NLK 15338786	1	00:00:02	00:00:05	00:00:25	00:00:02		1	-	-
31	NLK 15325258	1	00:00:02	00:00:05	00:00:24	00:00:02		1	-	-
32	NLK 15341504	1	00:00:02	00:00:08	00:00:26	00:00:02		1	-	-
33	NLK 15322487	1	00:00:02	00:00:07	00:00:24	00:00:02		1	-	-
34	NLK 15337703	1	00:00:02	00:00:07	00:00:30	00:00:02		1	-	-
35	NLK 15336631	1	00:00:02	00:00:07	00:00:22	00:00:02		1	-	-
36	NLK 15337825	1	00:00:02	00:00:07	00:00:24	00:00:02		1	-	-
37	NLK 15336369	1	00:00:02	00:00:08	00:00:20	00:00:02		1	-	-
38	NLK 15340917	1	00:00:02	00:00:04	00:00:27	00:00:02		1	-	-
39	NLK 15342316	1	00:00:02	00:00:03	00:00:21	00:00:02		1	-	-
40	NLK 15341333	1	00:00:02	00:00:08	00:00:25	00:00:02		1	-	-
41	NLK 15334082	1	00:00:02	00:00:06	00:00:21	00:00:02		1	-	-
42	NLK 15341128	1	00:00:02	00:00:05	00:00:22	00:00:02		1	-	-
43	NLK 15340660	1	00:00:02	00:00:07	00:00:31	00:00:02		1	-	-
44	NLK 15341484	1	00:00:02	00:00:06	00:00:31	00:00:02		1	-	-
45	NLK 15333725	1	00:00:02	00:00:04	00:00:37	00:00:02		1	-	-
46	NLK 15340049	1	00:00:02	00:00:05	00:00:32	00:00:02		1	-	-
47	NLK 15339910	1	00:00:02	00:00:07	00:00:31	00:00:02		1	-	-
48	NLK 15337521	1	00:00:02	00:00:08	00:00:40	00:00:02		1	-	-
Summary		**Total**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Total**
		679	00:00:03	0:00:22	00:00:34	00:00:22	00:00:17	679	0	0

Appendix B. Data of time spent during the processes in return from subjects of a supply chain

No.	Number of delivery report	Ordinal box number	Number of items in a box	Clients own retail location/ retail chains	Time of sorting a box and checking a document	Time of opening the box	Checking time	Time of receiving goods through the hand held terminal (HHD)	Time of closing boxes and putting on pallets	Time of dropping off pallets on virtual locations	Conditions		
											Inventory	Outlet	Write-off
1.	10037780 (OKAK150019656)			Retail chains	00:00:27					00:01:50			
		1	7				00:02:42	00:01:00	00:00:07		7	-	-
		2	6				00:02:00	00:00:31	00:00:07		6	-	-
		3	2				00:00:40	00:00:22	00:00:06		6	-	-
		4	2				00:01:39	00:00:50	00:00:06		1	1	-
		5	2				00:00:44	00:00:22	00:00:07		2	-	-
2.	9494 (OKAK15002083)			Retail chains	00:07:00					00:01:27			
		1	4			00:00:20	00:00:30	00:00:16	00:00:06		1	-	-
		2	4				00:02:06	00:00:28	00:00:07		3	1	-
		3	4			00:00:06	00:02:28	00:01:00	00:00:07		4	-	-
		4	6				00:01:00	00:00:30	00:00:06		6	-	-
		5	9				00:01:00	00:00:35	00:00:07		8	1	-
		6	1				00:00:20	00:00:10	00:00:05		1	-	-
		7	4				00:02:00	00:00:51	00:00:06		4	-	-
		8	2				00:04:53	00:00:22	00:00:12		2	-	-
3.	2015/84 (OPAK150019070)			Retail chains	00:11:33					00:01:42			
		1	11				00:02:45	00:01:43			9	2	-
		2	26				00:09:00	00:07:12			11	15	-
		3	4				00:01:49	00:00:40			4	-	-
		4	10				00:02:20	00:00:44	00:00:08		9	1	-
		5	1				00:01:00	00:00:38	00:00:07		1	-	-
		6	76					00:00:10	00:00:06		76	-	-
4.	84414, 84434 (OKAK 15002118)	1	7	Retail chains	00:05:26	00:00:10	00:01:01	00:00:35	00:00:15		Unknown		
		2	8			00:00:10	00:00:58	00:00:59	00:00:10		8	-	-
		3	8			00:00:10	00:00:58	00:00:52	00:00:05		Unknown	-	-
		4	8			00:00:10	00:01:25	00:00:50	00:00:04		Unknown	-	-
		5	9			00:00:12	00:01:11	00:00:44	00:00:10		Unknown	-	-
		6	16			00:00:27	00:02:48	00:02:25	00:00:18		15	1	-
		7	8			00:00:29	00:01:08	00:01:02	00:00:10		8	-	-
		8	7			00:00:10	00:01:00	00:00:35	00:00:10		7	-	-
		9	4			00:00:10	00:01:08				4	-	-
		10	6			00:00:09	00:02:10				6	-	-
		11	4				00:01:15				4	-	
		12	2				00:00:40			00:01:47	-	2	-
		13	12				00:00:45		00:01:03	00:01:16	12	-	-
5.	156007230	1	12	Clients	00:05:34	00:00:15	00:01:41	00:01:35	00:00:10		12		
		2	12			00:00:13	00:02:25	00:01:11	00:00:10		12	-	-
		3	5			00:00:13	00:00:58	00:00:30	00:00:13		5	-	-
		4	3			00:00:06	00:00:21	00:00:22	00:00:10		3	-	-
		5	4			00:00:06	00:00:30	00:00:17	00:00:09		4	-	-
		6	4			00:00:10	00:00:30	00:00:28	00:00:05		4	-	-
		7	4			00:00:10	00:00:44	00:00:25	00:00:07		4	-	-
		8	4			00:00:08	00:00:34	00:00:35	00:00:14		4	-	-
		9	3			00:00:05	00:00:32	00:00:32	00:00:05		3	-	-
		10	8			00:00:10	00:01:04	00:01:00	00:00:10		8	-	-
		11	7			00:00:18	00:01:00	00:01:10	00:00:20		7	-	-
		12	4			00:00:13	00:00:40	00:00:46	00:00:06		4	-	-
		13	7			00:00:10	00:03:38	00:01:02	00:00:40		7	-	-
		14	3			00:00:10	00:00:33	00:03:07		00:01:24	3	-	-

No.	Number of delivery report	Ordinal box number	Number of items in a box	Clients own retail location/ retail chains	Time of sorting a box and checking a document	Time of opening the box	Checking time	Time of receiving goods through the hand held terminal (HHD)	Time of closing boxes and putting on pallets	Time of dropping off pallets on virtual locations	Conditions		
											Inventory	Outlet	Write-off
6.	67 (OKAK50019435)	1	3	Retail chains	00:00:32	00:00:10	00:01:20	00:01:20	00:00:10		3	-	-
7.	OKAK15002085	1	24	Retail chains		00:00:13	00:02:10	00:02:03	00:00:06		24	-	-
8.	652-18 (OKAK150018804)	1	1	Retail chains		00:00:56	00:00:23	00:00:12			1	-	-
9.	662-18 (OKAK150018804)	1	1	Retail chains		00:00:39	00:00:25	00:00:10			-	-	1
10.	96 (OKAK150019427)	1	2	Retail chains		00:00:33	00:01:00	00:00:35	00:00:05		2	-	-
11.	112	1	8	Retail chains		00:00:10	00:01:02	00:01:02	00:00:05		7	1	-
		2	12			00:00:27	00:02:32	00:00:10	00:00:05		12	-	-
		3	12			00:00:10	00:01:00	00:00:26	00:00:10		9	3	-
		4	4			00:00:10	00:02:00	00:02:32	00:00:12	00:00:47	4	-	-
12.	10192331	1	6	Retail chains	00:06:08	00:00:10	00:00:18	00:01:08	00:00:10		Unknown	Unknown	Unknown
		2	10	Retail chains		00:00:10	00:01:10	00:01:07			Unknown	Unknown	Unknown
13.	10192332	1	6	Retail chains		00:00:10	00:01:07	00:00:50			Unknown	Unknown	Unknown
		2	8			00:00:10	00:01:27	00:01:25	00:00:10		Unknown	Unknown	Unknown
		3	4			00:00:12	00:00:20	00:00:24	00:00:08		Unknown	Unknown	Unknown
		4	4				00:00:30	00:00:30		00:01:16	Unknown	Unknown	Unknown
14.	323001056-15	1	13	Retail chains		00:00:10	00:04:15	00:04:16	00:00:10	00:01:36	12	1	-
15.	10137684, 10137685	1	5	Retail chains	00:04:16	00:00:10	00:01:00	00:00:44			5	-	-
		2	2			00:00:10	00:00:15	00:00:15			2	-	-
		3	1			00:00:10	00:00:20	00:00:19			1	-	-
		4	16			00:00:08	00:02:46	00:01:59			16	-	-
		5	18			00:00:09	00:03:42	00:02:17	00:00:32	00:00:57	18	-	-
16.		1		Retail chains	00:02:38	00:00:10	00:02:00	00:02:00	00:00:08		Unknown	-	-
		2	4				00:00:30	00:00:32	00:00:19		4	-	-
		3	1				00:00:20	00:00:03			1	-	-
		4	3				00:00:30	00:00:16		00:01:09	3	-	-
17.	10131366	1	3	Retail chains			00:01:40	00:00:15			3	-	-
18.	10131367	1	1	Retail chains			00:00:15				-	1	-
19.	10256902	1	2	Retail chains	00:01:08	00:00:10	00:00:15	00:00:15			2	-	-
		2	18			00:00:10	00:02:29	00:04:06			18	-	-
20.	10306098	1	2	Retail chains			00:01:00	00:00:55			-	-	2
21.	10306097	1	7	Retail chains			00:00:33	00:00:50			7	-	-
22.	10163386	1	2	Retail chains	00:03:50		00:01:26	00:00:10			2	-	-
		2	2				00:00:51	00:00:10			2	-	-
		3	1				00:00:10	00:00:10			1	-	-
23.	10392555	1	4	Retail chains	00:03:00	00:00:13	00:00:34	00:00:16	00:00:06		4	-	-
		2	5			00:00:05	00:00:27	00:00:34	00:00:10		5	-	-
24.	10391917	1	3	Retail chains		00:00:10	00:01:14	00:00:25	00:00:15	00:01:47	3	-	-
25.	592664001000891	1	24	Retail chains		00:00:10	00:01:29	00:00:36	00:00:10	00:02:15	24	-	-
26.	SO14-26397	1	4	Clients	00:04:47	00:00:06	00:00:20	00:02:32			-	-	4
		2	8			00:00:14	00:02:00	00:02:32			-	-	8
		3	8			00:00:10	00:01:00	00:02:33			-	-	8
		4	7			00:00:10	00:02:17	00:02:32			-	-	7
		5	8			00:00:10	00:00:12	00:02:33			-	-	8
		6	8			00:00:10	00:02:24	00:02:32			-	-	8
27.	SO14-26406	1	7	Clients		00:00:10	00:00:39	00:01:37			-	-	7
		2	7			00:00:05	00:00:35	00:01:37			-	-	7
		3	8			00:00:05	00:00:40	00:01:37			-	-	8
		4	8			00:00:05	00:00:35	00:01:37			-	-	8
		5	7			00:00:19	00:01:51	00:01:37			-	-	7
		6	9			00:00:06	00:00:47	00:01:37			-	-	9

No.	Number of delivery report	Ordinal box number	Number of items in a box	Clients own retail location/ retail chains	Time of sorting a box and checking a document	Time of opening the box	Checking time	Time of receiving goods through the hand held terminal (HHD)	Time of closing boxes and putting on pallets	Time of dropping off pallets on virtual locations	Conditions		
											Inventory	Outlet	Write-off
28.	OKAK156007372	1	2	Clients	00:01:40	00:00:10	00:01:50	00:00:10			2	-	-
		1	4		00:01:34	00:00:10	00:00:35	00:00:10			4	-	-
		2	5			00:00:05	00:00:20	00:00:38			5	-	-
		3	21			00:00:04	00:00:53	00:04:26	00:00:06		21	-	-
		4	16			00:00:04	00:00:55	00:02:34	00:00:10		16	-	-
29.	102, 101	1	4	Retail chains		00:00:10	00:00:47	00:00:15			4	-	-
		2	1				00:02:04				-	-	1
		3	4			00:00:10	00:00:34	00:00:05			4	-	-
30.	79, 77, 78, 80	1	4	Retail chains		00:00:10	00:03:59	00:00:15	00:00:48		3	-	1
31.	0017-780-2951	1	5	Retail chains	00:02:20	00:00:10	00:03:00	00:00:30	00:00:05		5	-	-
		2	4			00:00:39	00:02:03	00:00:32	00:00:10		3	1	-
		3	10				00:00:38	00:00:50	00:00:10		10	-	-
32.	1330-01754-15	1	3	Retail chains	00:07:16		00:01:13	00:00:08	00:00:05		3	-	-
		2	4			00:00:54	00:02:00	00:00:10	00:00:13		4	-	-
		3	2				00:00:37	00:00:20	00:00:09		2	-	-
		4	2			00:00:08	00:00:40	00:00:12			2	-	-
		5	2			00:00:10	00:01:32	00:00:40	00:00:06		2	-	-
		6	2				00:01:33	00:00:15	00:00:12		2	-	-
		7	1				00:00:37	00:00:17			1	-	-
		8	3			00:00:29	00:02:26	00:00:11	00:00:10		3	-	-
		9	2			00:00:07	00:01:26	00:00:15	00:00:09		2	-	-
		10	5				00:02:29	00:03:50		00:00:44	5	-	-
33.	4230-00450-15	1	3	Retail chains	00:11:09	00:00:54	00:01:08	00:00:10			-	3	-
		2	3			00:00:37	00:04:39	00:02:09			-	3	-
		3	2			00:00:31	00:00:52	00:00:30			-	2	-
		4	6				00:01:41	00:01:25		00:00:48	-	6	-
										00:02:48	-	-	-
										00:01:50	-	-	-
34.	NPO2015113147	1	10	Clients	00:00:50	00:00:05	00:02:10	00:01:20	00:00:10		10	-	-
		2	14			00:00:20	00:02:00	00:01:27	00:00:13		14	-	-
		3	17			00:00:30	00:02:26	00:02:41	00:01:30		17	-	-
		4	6			00:00:10	00:01:20	00:00:55	00:00:07		6	-	-
		5	8			00:01:05	00:03:43	00:01:40	00:00:10		8	-	-
35.	10008422	1	8	Retail chains	00:01:40	00:00:15	00:00:10	0:00:34	00:00:20				
		2	8			00:00:12	00:00:10	0:00:40			7	1	-
		3	3			00:00:10	00:00:10	0:00:26			2	1	-
		4	6			00:00:15	00:00:10	0:00:20					
		5	7			00:00:10	00:00:10	0:00:45			6	1	-
36.	150019926	1	4	Clients	00:00:54	00:00:10	00:00:05	0:02:38	00:00:05		4	-	-
		2	14			00:00:09	00:00:06	0:02:34	00:00:05		14	-	-
		3	1			00:00:10	00:00:03	0:00:26	00:00:10		1	-	-
		4	5			00:00:10	00:00:05	0:01:44	00:00:06		5	-	-
		5	17			00:00:20	00:00:05	0:04:18	00:00:05		17	-	-
		6	10			00:00:10	00:00:05	0:02:02	00:00:06		10	-	-
		7	6			00:00:10	00:00:05	0:01:16	00:00:03		6	-	-

No.	Number of delivery report	Ordinal box number	Number of items in a box	Clients own retail location/ retail chains	Time of sorting a box and checking a document	Time of opening the box	Checking time	Time of receiving goods through the hand held terminal (HHD)	Time of closing boxes and putting on pallets	Time of dropping off pallets on virtual locations	Conditions		
											Inventory	Outlet	Write-off
37.	150019925	1	7	Clients	00:00:50	00:00:05	00:00:05	0:01:55	00:00:06	00:02:12	Unknown	Unknown	Unknown
		2	7			00:00:10	00:00:12	0:01:10	00:00:04		Unknown	Unknown	Unknown
		3	11			00:00:15	00:00:10	0:03:51	00:00:05		Unknown	Unknown	Unknown
		4	9			00:00:10	00:00:05	0:03:56	00:00:05		Unknown	Unknown	Unknown
		5	6			00:00:07	00:00:20	0:01:09	00:00:10		Unknown	Unknown	Unknown
		6	12			00:00:10	00:00:15	0:02:05	00:00:03		Unknown	Unknown	Unknown
		7	12			00:00:10	00:00:15	0:03:03	00:00:05		Unknown	Unknown	Unknown
		8	8			00:00:07	00:00:05	0:03:26	00:00:02		Unknown	Unknown	Unknown
38.	SO14-26498 (OKAK156007447)	1	1	Clients	00:20:18	00:00:10	00:00:14	00:00:05			1	-	-
		2	3			00:00:10	00:00:20	00:00:13			3	-	-
		3	6			00:00:05	00:02:00	00:00:38			6	-	-
		4	9			00:00:05	00:01:04	00:00:40			9	-	-
		5	13			00:00:08	00:02:00	00:00:36			13	-	-
		6	6			00:00:08	00:01:10	00:00:50			6	-	-
		7	11			00:00:10	00:00:40	00:00:21	00:00:08		11	-	-
		8	9			00:00:10	00:03:00	00:00:39			9	-	-
		9	7			00:00:10	00:00:50	00:00:49			7	-	-
		10	15			00:00:10	00:03:00	00:00:34			15	-	-
		11	17			00:00:10	00:03:00	00:01:50			17	-	-
		12	12			00:00:06	00:01:00	00:00:35			12	-	-
		13	15			00:00:10	00:03:00	00:01:30			15	-	-
39.	SO14-26547 (OKAK156007470)	1	13	Clients	00:02:25	00:00:17	00:01:10	00:00:48			13	-	-
		2	15			00:00:25	00:01:50	00:00:53	00:00:06		15	-	-
		3	13			00:00:05	00:01:40	00:00:43			13	-	-
		4	21			00:00:10	00:03:24	00:01:00	00:00:09		21	-	-
		5	10			00:00:12	00:01:00	00:01:00			10	-	-
		6	15			00:00:21	00:03:00	00:00:38			15	-	-
		7	18			00:00:10	00:03:01	00:01:00			18	-	-
		8	9			00:00:05	00:01:00	00:00:28	00:00:12		9	-	-
		9	15			00:00:13	00:02:40	00:00:36			15	-	-
		10	19			00:00:05	00:02:36	00:01:00			19	-	-
40.	OKAK156007498	1	9	Clients		00:00:09	00:03:00	00:01:35			9	-	-
41.	OKAK156007554	1	8	Clients	00:04:07	00:00:13	00:02:01	00:00:50		00:01:21	8	-	-
										00:01:39			
42.	SO14-26511	1	7	Clients	00:03:01	00:00:08	00:01:17	00:01:00	00:00:06		7	-	-
		2	16			00:00:10	00:02:13	00:01:00			16	-	-
		3	6			00:00:03	00:00:30	00:00:32			6	-	-
		4	25			00:00:05	00:03:06	00:01:00			25	-	-
		5	8			00:00:07	00:01:01	00:00:37	00:00:16		8	-	-
		6	16			00:00:07	00:02:02	00:01:15	00:00:29		16	-	-
		7	12			00:00:16	00:01:18	00:00:42		00:01:17	12	-	-
43.	1130-01540-15	1	8	Retail chains	00:00:22	00:00:23	00:02:37	00:00:47	00:00:00		8	-	-
		2	11			00:00:20	00:00:42	00:00:18	00:00:10		11	-	-

No.	Number of delivery report	Ordinal box number	Number of items in a box	Clients own retail location/ retail chains	Time of sorting a box and checking a document	Time of opening the box	Checking time	Time of receiving goods through the hand held terminal (HHD)	Time of closing boxes and putting on pallets	Time of dropping off pallets on virtual locations	Conditions		
											Inventory	Outlet	Write-off
44.	OKAK15002133	1	6	Retail chains	00:05:44	00:00:10	00:00:15	00:00:10	00:00:05		6	-	-
		2	7			00:00:10	00:00:22	00:00:28	00:00:07		7	-	-
		3	5			00:00:06	00:00:07	00:00:15	00:00:05		5	-	-
		4	8			00:00:10	00:00:38	00:00:07	00:00:12		8	-	-
		5	6			00:00:14	00:00:34	00:00:12	00:00:10		6	-	-
		6	7			00:00:10	00:00:20	00:00:09	00:00:05	00:01:04	7	-	-
45.	10167728 (OKAK15002128)	1	10	Retail chains	00:13:42		00:02:40	00:01:08	00:00:09		10	-	-
		2	8			00:00:08	00:01:03	00:00:55	00:00:07		8	-	-
		3	7				00:00:50	00:00:32	00:00:06		7	-	-
		4	10			00:00:18	00:02:01	00:00:40	00:00:10		10	-	-
46.	10168896	1	4	Retail chains	00:04:57		00:00:38	00:00:16			4	-	-
		2	4				00:00:45	00:00:17			4	-	-
		3	3			00:00:10	00:00:30	00:00:16			3	-	-
		4	4			00:00:20	00:00:40	00:00:17			4	-	-
47.	10168897	1	4	Retail chains			00:00:21	00:00:28			4	-	-
		2	6				00:00:12	00:00:14			6	-	-
		3	2			00:00:06	00:00:19	00:00:10			2	-	-
		4	2			00:00:18	00:00:26	00:00:09		00:00:46	2	-	-
		5	3				00:01:00	00:00:44		00:00:45	3	-	-
48.	10167727	1	7	Retail chains			00:00:40	00:00:34	00:00:02		7	-	-
		2	7			00:00:25	00:01:30	00:00:30			7	-	-
		3	8			00:00:52	00:01:30	00:00:30			8	-	-
		4	6				00:01:54	00:00:30			6	-	-
49.	12935 (OKAK150019977)			Retail chains	0:06:03					00:02:28			
		1	4			00:00:06	00:01:43	00:00:08	00:00:07		4	-	-
		2	8				00:01:10	00:00:49	00:00:04		6	2	-
		3	4				00:00:53	00:00:06	00:00:13		4	-	-
		4	2				00:00:54	00:00:06	00:00:07		2	-	-
		5	2				00:01:05	00:00:35	00:00:03		2	-	-
		6	5			00:00:10	00:00:03	00:00:15	00:00:05		5	-	-
		7	12				00:01:25	00:00:05	00:00:21		11	1	-
		8	11			00:00:06	00:02:00	00:00:35	00:00:12		11	-	-
		9	9			00:00:05	00:00:50	00:00:37	00:00:03		9	-	-
		10	11				00:01:30	00:00:34	00:00:15		10	1	-
		11	2			00:00:04	00:00:30	00:00:15	00:00:07		2	-	-
50.	16255 (OKAK150019983)			Retail chains						00:01:58			
		1	4			00:00:12	00:00:30	00:00:13	00:00:04		4	-	-
		2	2			00:00:05	00:00:22	00:00:05	00:00:06		2	-	-
		3	4			00:00:12	00:01:02	00:00:30	00:00:05		4	-	-
		4	1			00:00:05	00:00:11	00:00:05	00:00:03		1	-	-
		5	5			00:00:04	00:02:00	00:00:16	00:00:03		5	-	-
		6	3			00:00:05	00:01:50	00:00:27			1	2	-
		7	8			00:00:06	00:01:40	00:00:36	00:00:05		8	-	-
		8	11			00:00:08	00:01:47	00:00:40	00:00:08		11	-	-
51.	2015/115 (OKAK150019971)			Retail chains	00:00:50								
		1	3			00:00:05	00:00:37	00:00:05	00:00:05		3	-	-
		2	6				00:00:57	00:00:05	00:00:06		6	-	-
		3	11				00:01:00	00:00:37	00:00:12		11	-	-

No.	Number of delivery report	Ordinal box number	Number of items in a box	Clients own retail location/ retail chains	Time of sorting a box and checking a document	Time of opening the box	Checking time	Time of receiving goods through the hand held terminal (HHD)	Time of closing boxes and putting on pallets	Time of dropping off pallets on virtual locations	Conditions		
											Inventory	Outlet	Write-off
52.	0592318001000644 (OKAK15002054)	1	24	Retail chains	00:00:39	00:00:06	00:02:31	00:00:28	00:00:07		24	-	-
53.	OKAK150020147			Retail chains	00:07:37					00:01:07			
		1	5				00:00:28	00:00:10	00:00:03		5	-	-
		2	3				00:00:20	00:00:12	00:00:05		3	-	-
		3	4				00:01:00	00:00:36	00:00:03		4	-	-
		4	2				00:00:20	00:00:20	00:00:04		2	-	-
		5	1				00:00:20	00:00:13	00:00:06		1	-	-
		6	2				00:00:25	00:00:05	00:00:08		2	-	-
		7	3				00:00:12	00:00:38	00:00:04		3	-	-
		8	3				00:00:33	00:00:24	00:00:04		3	-	-
		9	3				00:00:32	00:00:10	00:00:05		3	-	-
54.	10033062 (OKAK15002132)			Retail chains	00:24:50								
		1	15			00:00:04	00:00:58	00:00:25	00:00:07		14	-	1
55.	26543			Clients	00:00:22								
		1	2			00:00:04	00:00:35	00:00:05	00:00:06		2	-	-
56.	26543			Clients	00:00:45								
		1	1			00:00:05	00:00:25	00:00:10			1	-	-
57.	26460			Clients	00:00:40					00:01:47			
		1	3				00:00:53	00:00:12			3	-	-
		2	4				00:00:40	00:00:13			4	-	-
58.	26458			Clients									
		1	4				00:00:25	00:00:11			4	-	-
59.	26540			Clients	00:01:36								
		1	3			00:00:05	00:00:53	00:00:10			3	-	-
60.	10132748 (OKAK15002131)			Retail chains	00:02:56					00:00:25			
		1	2			00:00:03	00:00:23	00:00:15	00:00:04		2	-	-
61.	26565 (OKAK156007458)			Clients	00:00:52					00:01:09			
		1	3			00:00:04	00:00:40	00:00:12	00:00:06		3	-	-
		2	4			00:00:05	00:00:34	00:00:15	00:00:07		4	-	-
		3	4			00:00:05	00:00:42	00:00:18	00:00:06		4	-	-
		4	6			00:00:06	00:01:01	00:00:30	00:00:03		6	-	-
		5	5				00:00:30	00:00:16	00:00:04		5	-	-
		6	16			00:00:06	00:02:40	00:01:03	00:00:08		16	-	-
		7	24				00:03:50	00:01:02	00:00:13		24	-	-
		8	24				00:03:03	00:01:02	00:00:10		24	-	-
		9	21				00:02:50	00:00:51	00:00:03		21	-	-
		10	21				00:03:03	00:01:05	00:00:10		21	-	-
		11	21				00:02:00	00:01:39	00:00:11		21	-	-
62.	26483 (OKAK156007432)			Clients	00:03:40					00:01:32			
		1	21			00:00:07	00:03:52	00:03:00	00:00:05		21	-	-
		2	12			00:00:05	00:02:05	00:01:20	00:00:03		12	-	-
		3	12			00:00:05	00:02:00	00:00:53	00:00:03		12	-	-
		4	12			00:00:06	00:02:13	00:01:00	00:00:04		12	-	-
		5	21			00:00:05	00:03:08	00:02:00	00:00:03		21	-	-
		6	13			00:00:07	00:03:00	00:00:54	00:00:03		13	-	-

No.	Number of delivery report	Ordinal box number	Number of items in a box	Clients own retail location/ retail chains	Time of sorting a box and checking a document	Time of opening the box	Checking time	Time of receiving goods through the hand held terminal (HHD)	Time of closing boxes and putting on pallets	Time of dropping off pallets on virtual locations	Conditions		
											Inventory	Outlet	Write-off
63.	OKAK150020516			Retail chains									
		1	3			00:00:05	00:01:32	00:01:00	00:00:03		3	-	-
		2	4			00:00:06	00:01:50	00:00:55	00:00:04		4	-	-
64.	2015/59			Retail chains						00:00:50			
		1	8			00:00:10	00:01:11	00:00:14	00:00:04		8	-	-
		2	4			00:00:05	00:01:23	00:00:13	00:00:03		4	-	-
65.	10088679			Retail chains						00:00:24			
		1	8				00:00:30	00:00:18			8	-	-
	Summary		**Total 2038**		**Average 00:04:29**	**Average 00:00:12**	**Average 00:01:18**	**Average 00:00:55**	**Average 00:00:09**	**Average 00:01:24**	**Total 1766**	**Total 54**	**Total 95**