Optimization of Goods Incoming Process

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Optimization of Goods Incoming Process

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Alona Golovatova                                                Jinshan Zhou
Summary

Increasing interest to optimization of goods incoming process has paralleled the rise of product diversity and advanced warehouse management based on logistics support systems. Nowadays, companies are universally faced with the requirements to reengineer their business processes starting with goods incoming operation, aiming to significantly reduce total operating costs and quickly respond to ultimate consumer. Previous academic research has provided many alternatives to attain the expected results. Nevertheless, an enormous gap still exists between theoretical research and practical operations. The purpose of this paper is to bridge this gap from operation level.

We introduced a theoretical framework which was organized around earlier studies, latest findings and established literatures associated with overview of goods incoming process, flows management, seven wastes, logistics support systems etc. Meanwhile, an online fashion retailer, Nelly.com goods incoming process has been mapped from goods receiving, packing and sorting, warehousing to data input. As a result, intermittent material flows and information flows has been realized. Later on, a sensitivity analysis was performed to observe all wastes in the process through precise timing of each detailed activity. As the weaknesses and opportunities have been identified within Nelly’s goods incoming process, some heuristic solutions were proposed in the paper.

Generally, flows should be smoothed and accelerated, particularly material flows and information flows related with goods incoming process. The interruption and miscommunication should be avoided to streamline the whole operation. Whilst, we inferred that all wastes within every sub-process have to be aware of. Consequently, some techniques such as scheduled delivery, cross-docking, goods classification, improved logistics support systems were proposed to eliminate wastes. Further on, the prevailed business process reengineering should be conducted as the next step to reallocate some resources or operations.

Lastly, we simulated an expected goods incoming process based on Nelly’s status quo and heuristic suggestions. And some future research issues have been presented at the end to extend the vision to relevant domains.
Content

Summary ................................................................................................................................. i

1 Background ......................................................................................................................... 1
  1.1 Problem .......................................................................................................................... 2
  1.2 Purpose .......................................................................................................................... 2
  1.3 Limitations ..................................................................................................................... 2

2 Methodology ......................................................................................................................... 3
  2.1 Literature Review ......................................................................................................... 3
  2.2 Qualitative Methods ..................................................................................................... 3
  2.3 Quantitative Methods .................................................................................................... 3
  2.4 Data Collection .............................................................................................................. 3

3 Theoretical Framework of References ................................................................................. 1
  3.1 Continuous flows .......................................................................................................... 1
    3.1.1 Monetary flow .......................................................................................................... 2
    3.1.2 Material and resource flow ..................................................................................... 2
    3.1.3 Information Flow .................................................................................................... 3
    3.1.4 Flows smoothing .................................................................................................... 5
    3.1.5 Flows Integration .................................................................................................... 4
  3.2 Operations in Goods Incoming Process .......................................................................... 6
    3.2.1 Goods Receiving Process ....................................................................................... 6
    3.2.2 Quality control ......................................................................................................... 7
    3.2.3 Packaging and sorting ............................................................................................. 9
    3.2.4 Storage .................................................................................................................... 9

3.3 Wastes ............................................................................................................................ 10

4 Empirical Work .................................................................................................................... 12
  4.1 Company Profile ............................................................................................................ 12
  4.2 Mapping Goods incoming process .................................................................................. 15
    4.2.1 Structure of goods incoming corridor .................................................................... 17
    4.2.2 Goods Receiving ..................................................................................................... 18
    4.2.3 Packaging and sorting ......................................................................................... 19
4.2.4 Storage ........................................................................................................... 21
4.3 Observations in Goods Incoming Process .......................................................... 23
  4.3.1 Observation story 1 ......................................................................................... 23
  4.3.2 Observation story 2 ......................................................................................... 23
  4.3.3 Observation story 3 ......................................................................................... 24
  4.3.4 Observation story 4 ......................................................................................... 24
4.4 Investigations ...................................................................................................... 25
  4.4.1 Investigation 1 .................................................................................................. 25
  4.4.2 Investigation 2 ................................................................................................ 26
  4.4.3 Investigation 3 ................................................................................................ 27

5 Analysis .................................................................................................................. 29
  5.1 Good receiving area ........................................................................................... 30
    5.1.1 Problems Analysis ....................................................................................... 30
    5.1.2 Suggestions for goods receiving area .......................................................... 30
  5.2 Packaging and sorting area ................................................................................ 32
    5.2.1 Problems analysis ....................................................................................... 32
    5.2.2 Suggestions for packing and sorting area .................................................... 36
  5.3 Transfer or ABC area ........................................................................................ 38
  5.4 Storage area ....................................................................................................... 39
    5.4.1 Problems analysis ....................................................................................... 39
    5.4.2 Suggestions for storage area ....................................................................... 39

6 Conclusions ............................................................................................................. 43

7 Future Research ...................................................................................................... 44

References ..................................................................................................................
Figure 3.2-1 The requirement – verification cycle (WEELE, Arjan Van, 2010) ......................... 8
Figure 4.1-1 Nelly’s organizational Chart .................................................................................. 14
Figure 4.1-2 Amount of garments received (weeks’) ................................................................... 15
Figure 4.1-3 Amount of garments received (months’) ................................................................. 15
Figure 4.2-1 The corridor of incoming goods process ............................................................... 17
Figure 4.2-2 Marking purchase order ......................................................................................... 20
Figure 4.2-3 Layout of high frequency warehouse (WH2) ......................................................... 22
Figure 4.2-4 ID number on the storage rack .............................................................................. 22
Figure 5.1-1 Material flows from goods receiving area to packing and sorting area ............... 31
Figure 5.2-1 Manual sorting of plasticized goods (investigation 1) ........................................... 33
Figure 5.2-2 Manual sorting of plastecised goods (investigation 2) ........................................... 34
Figure 5.2-3 Manual plasticizing and sorting (investigation 3) .................................................. 35
Figure 5.2-4 Process in the Goods Packaging and Sorting Area through Corridors
Interpretation .......................................................................................................................... 37
Figure 5.3-1 Time of activities in the transfer area .................................................................... 38
Figure 5.4-1 Time-consuming from transfer area to warehouse of high frequency (WH 2) ....... 39
Figure 5.4-2 Information flow in the new module of vacancy identification in warehouse
management .......................................................................................................................... 41

Table 4.2-1 Interview: the whole goods incoming process .......................................................... 16
Table 4.2-2 Interview: goods receiving process .......................................................................... 18
Table 4.2-3 Interview: packaging and sorting process ............................................................... 19
Table 4.2-4 Interview: warehousing process ............................................................................. 21
Table 4.4-1 Tracking of one box of garments (same clothes type) and their movement through
the incoming goods corridor ................................................................................................. 25
Table 4.4-2 Tracking the same box of garments (back to the transfer area) because of mistake
.................................................................................................................................................. 26
Table 4.4-3 Tracking of the box with different kinds of garments, starting from T2 ............... 27
Table 4.4-4 Tracking manual plasticizing and sorting of garments (location - T3) ................. 28
Table 5.1-1 Goods classification in goods receiving area ........................................................... 31
Table 5.4-1 Vacancy identification model interpretation ............................................................. 40

Appendix 1: Interview with Nelly’s Operational Manager and Leader of Purchasing
department .............................................................................................................................. 48
Appendix 2: Nelly’s warehouse for goods incoming process - Original ................................. 50
Appendix 3: Process in the Goods Packaging and Sorting Area through Corridors
Interpretation .......................................................................................................................... 51
Appendix 4: Nelly’s warehouse for goods incoming process - Adjusted ............................... 52
1 Background

With the development of ICT many opportunities for optimization of business processes appeared. New technologies to great extend benefited supply chains and their design as well as demand chains which all together resulted in transparency of the network increment. More and more companies invested in costly resources planning systems development and their implementation. Somewhere successful in it, another – were not. But very often having just one system is not enough. This is especially relevant for clothes retailing companies. Clothing is a product with a short life cycle and very often it is like mirage in the desert, the fashion tendency might exist just for a couple of weeks and then disappear. Thus time becomes of crucial importance. Electronic systems, no matter how well designed they are, cannot move goods by themselves. Still, manual work will be required to be done. Although it might be treated as less-time consuming process, still, it is important to organize it in an efficient way.

Four interrelated flows such as material, resource, monetary and information, found their existence within the supply chain. It is a matter of all participants in the chain to ensure the continuousness of these flows. An efficient work of one participant will foster positive results for the rest. From this perspective, collaboration with suppliers, as well as tier-one and tier-two suppliers plays its essential role. A collaborative relationship based on trust and respect will provide a solid background for continuous flows creation not just for links in the whole chain, but in internal processes of the company as well. Strong connection between goods incoming process and suppliers’ collaboration might be seen through the prism of its benefits. Thus if suppliers notify about days of deliveries, about what exactly will be delivered and in what amount, supplying sorted goods will help to structure incoming goods process, will help to plan space of occupation in the warehouse and the structure level of the process will increase.

Collaboration with suppliers is one important side of the coin. By the other side - the internal processes of the organization are considered to be. Even all those activities performed by suppliers in order to smooth the process will not be a panacea if there is a mess and chaos within organization. Hereby goods incoming process and the way it is organized start to play its essential role. It consists of different activities which can vary from company to company, but the basic ones will be receiving, sorting, quality control and placing in the warehouse. All these steps are considered to be the areas where possible optimization could be done.

Optimization of goods incoming process can be conducted in different ways. It can be achieved with the help of ICT, which in most of cases is related to costly optimization. Sooner or later, companies will come to that. But what the company can do on the stage of its rapid development and when ICT implementation is a tool which it cannot afford? Does it mean that everything should stay in its common status quo position? The definite answer is – no. The processes should be still optimized according to the amount of resources available. Thus, optimization can be achieved through wise organization of working environment and conditions, when a person can concentrate just on exact work he or she should do and not distract the attention on other activities. Areas for improvement will be found all the time due to “I.NOW.HERE” approach (SARV, Hans, 2009). Investigating the place for improvements and individual initiative will bring its beneficial results. Small changes in the process at the
beginning might foster a disruptive innovation and the development of best practices at the end.

1.1 Problem

The problem might be outlined as an essential amount of time-consuming activities within incoming goods process which due to well-organized and structured process will be eliminated. If the right product is not available when customer needs it – the company will have low service level and will continuously lose its customers. How to smooth incoming goods process and create continuous material and information flows? This issue will go as a red thread through all of the paper.

1.2 Purpose

The purpose of this paper is to investigate and map goods incoming process with the focus on different inbound flows, starting from goods receiving and ending up with storage in a warehouse. In addition to that, the paper aims for identifying the areas of wastes and smoothing flows through process restructuring.

1.3 Limitations

The paper is limited to the scope of theoretical references. Another limitation is related to suppliers’ involvement because it was difficult to get in contact with more than 400 hundred of Nelly’s suppliers. In addition, our field of research is ended in the area of warehouse as interaction point between goods incoming and outgoing flows of goods.
2 Methodology

Research approach can be outlined in the term of deduction when the theory is learnt firstly and after that testing of this theory is done in reality. The order of methods was as following. Firstly we conducted a deep literature review which was followed by interviewing of the employees of the company. Having understood the basics of company functioning, we moved on to investigation part which was done through observations. The approaches for data collection were chosen as both primary and secondary techniques of data collection.

2.1 Literature Review

An essential amount of time has been devoted to searching and outlining the basic ideas and the newest concepts for goods incoming process. In order to succeed on this stage of our work the following sources of information have been of great importance: books, research papers, Internet and journals. The main purpose of this stage was to get the insights and understanding of goods incoming process from different perspectives. Thus, the goods incoming process will be seen as a corridor, and it will be represented as the one consisting of different areas like receiving, sorting, quality control and warehouse. The issue of waste existing in every process which is described by many authors gave us an inspiration to develop the ways of waste reduction on each stage of the incoming goods process which can be seen as a mean for optimization of the process and a tool for increasing its smoothness.

2.2 Qualitative Methods

Qualitative method of conducting the research was primary related to interviews. We interviewed different range of employees starting with operational manager and ending up with warehouse employees, as Appendix 1 indicates. This helped us to see the differences and matching points of incoming goods process and understanding of its problems on different levels.

2.3 Quantitative Methods

Quantitative Methods of conducting the research where chosen in the form of investigations and observations. These two processes supplemented each other. We observed all areas of goods receiving process and investigated three cases of moving goods from the starting area and all way long to the warehouse where goods incoming and outgoing processes intersect. In this way we obtained quantitative information in the form of time needed for each operation on each stage of the process. This enabled the analysis to be done as well as pointed wasting time activities from the very beginning.

2.4 Data Collection

Merriam (1998) divides data collection techniques into two categories: primary and secondary. In our research approach we referred to both of them. Secondary collection of data was conducted after the interviews with the representatives of the company when we analyzed the
information gained from interviewees. Primary data collection took place as an investigation of the incoming goods process and keeping track on boxes until they reached the warehouse.
3 Theoretical Framework of References

3.1 Continuous flows

Business networks are developing and expanding all the time and this factor stressed the importance of continuous flows creation with the purpose of value chain efficiency and effectiveness increment. The logistics concepts of transparent supply chains and seamless connections together tend to improve the continuousness of flows which are considered as a key enabler in achieving enhanced supply chain performance. Business opportunities occurred both from the inbound logistics flow and outbound logistics flow. Mendonca (2003) while describing the inbound logistic flow refers to procurement and purchasing of input resources for the output of finished-products or services. And the outbound logistics flow is related to the way products or services are delivered to ultimate user, including returns. This paper will focus on the inbound flows and to some extent connect with outbound flows.

There are four different types of flows in the supply chain which boost the thinking of seamless connections through continuous flows. These four different flows are monetary flow, information flow, material flow and resource flow. The overview of all kinds of flows can be denoted as Figure 3.1-1.

![Figure 3.1-1 Different types of flows](LUMSDEN, Kent, 2009)

Materials and resources are delivered between sender and receiver, and these processes are accompanied with monetary flows. Lumsden (2009) proposes the division of information flow into two kinds of flows which are horizontal flow and vertical flow. The four types of flows will be explained in the following sessions.
3.1.1 Monetary flow

Each commodity has its own exchange value which is represented by price and the price is measured by monetary tools, like cash and financial stocks (XU, Shoubo, 2009). The order-to-delivery-to-cash cycle is presented by Walker et al. (2005) and it consists of order-to-shipment and shipment-to-cash periods. The first process creates value for consumer because it moves products or services downstream. The latter adds value for the owner of products or services through paid invoices. The reasons to represent cash flows are not only to integrate with the other three flows, but also indicate the relevant goal of reducing costs through monetary flow.

3.1.2 Material and resource flows

Substantially, both material and resource flows are physical flows which have actual departures, routes and destinations. The inputs and outputs of those two flows are visible through the entire supply chain from the upstream to downstream and also from downstream to upstream in reverse logistics.

Material flow is acknowledged as one of the most important tools to analyze a system or network. Material flow facilitates to describe systems which take inputs from nature into the anthroposphere in the form of materials, and pay back outputs (PESONEN, Hanna-Leena, 1999). Since the early of 1960s, material flow (MF) prevailed and brought the concept of material administration (MA) which was defined as “planning, development, coordination, organization, control and review of the material flow from raw materials supplier to the ultimate user” according to Ericsson (1998). Organizations’ internal and external material flows under the environment of MA can be discerned as Figure 3.1-2 from three different levels: strategic level, tactical level and operation level.

![Coordination of internal material flow and external material flow](ERICSSON, Dag, 1998)
Xu (2009) makes a study on commodity material flow from the operational level, which highlights the process of “input-production-circulation-consumption” and “reinput-reproduction-recirculation-reconsumption” in social economic development. These processes point out the route to analyze micro environment, manufacturing process or warehouse operation for instance. The discussion in this paper will concentrate on the operational level from the perspective of goods incoming process in the warehouse, distilling the sub-processes and improving it.

### 3.1.3 Information Flow

The head of the World Economic Forum, Klaus Schwab, summarized the steadfast attitude to e-information: “We are moving from a world in which the big eat the small to a world in which the fast eat the slow”. Walker et al. (2005) states: “Information technology is the glue that makes a distributed supply chain network possible”. For decades, the concepts of information and communication technology (ICT), e-commerce, business to customer (B2C), business to business (B2B) and virtual enterprise have been exploited by extensive research and prevailed in practical supply chain management.

The most common way to define Value of information (VOI) is the added value emerged from continuous information flow through the supply chain. Recently, 2010 National Federation of Advanced Information Services (NFAIS) redefined VOI as a new revolution which is incompatible with the old thinking. VOI is also confirmed by many academic researches which identify information flows as an important factor of supply chain management (CHEN, Injazz J and Paulraj, Antony, 2004) (CARR, Amelia S and Kaynak, Hale, 2007). As the rise of e-commerce and the development of ICT which lead to more timely and precise information transformation, the attention on VOI increased. This trend invokes companies to highlight the importance of information by showing the benefits of relevant strategies to better implement transformation. Thus, more and more enterprises tend to improve the continuousness and efficiency of information flows in order to streamline the entire supply chain and at the same time significantly reduce costs, time and miscommunication.

As it aforementioned, information flow can be divided into horizontal flow and vertical flow. Horizontal information flow runs among different organizations through the supply chain, while vertical information flow goes among different processes happened within the same department.

Lumsden and Mirzabeiki (2008) list nine different information elements which compose the information flow. They are:

1. Location of the products in supply chain. It is set as one of the most significant information which helps to trace and track on the products.
2. Condition of products in shipment. It relates to temperature, pressure which may indicate the actual quality of transportation.
3. Position and sequencing of products in shipment or inventory. It can help to quickly respond to the customer orders.
(4) Inventory level and point-of-sale of retailer (or stores downstream). The bullwhip effect will be decreased by this information.
(5) Different suppliers available for each product. It facilitates the efficiency of supplier selection by balancing of demand and supply.
(6) History of sales. The statistical information about the historical sales is helpful to improve the accuracy rate of customer demand forecast.
(7) Warehouse operation information.
(8) Offers of companies on their websites.
(9) Sharing quantitative information in the supply chain.

All of the data forms the information flow alike different nodes compose the whole network. The nodes are tightly connected by relative information which should be collected, shared, transferred in order to streamline the value chain and create more value of information (VOI). The authors’ research and discussion will focus on the information associated with goods incoming process in the warehouse.

### 3.1.4 Flows Integration

The relationships among all of the flows are contradictory but complementary to each other (XU, L and Li, L, 1989). In the process of “input-production-circulation-consumption” and “reinput-reproduction-recirculation-reconsumption”, monetary flows, physical flows and information flows exist at the same time. And they are susceptible to each other. The integration of three flows is needed in streamlining supply chain (HOEK, Remko I.van, 1998) (VANPOUCKE, Evelyne et al., 2009) (XU, Shoubo, 2009). Figure 3.1-3 denotes the flows integration in ecommerce environment based on Xu’s research.

![Figure 3.1-3 Principles of “three flows integration”, “three flows combination” and “three flows incorporation” in e-commerce (modified)](image)

Logistics support system becomes an important tool to facilitate “flows integration” and improve the performance of logistics operations in a comprehensive range by smoothing the information flow. It shares supportable analysis, supportable data through a supportable designed platform and obviously characterized by supportability, reliability, maintainability,
testability and transparency. In most of cases, logistics support systems are software-based systems. This emergence in such an e-world intensifies the adhesive force among different nodes and boosts the growth of overall supply chain management. Through logistics support system, all users can create and share relative information on the common database, which cut extra documental processes and enhance the information efficiency and information quality. The graphic description can be shown by Figure 3.1-4.

![Intermittent information vs Sequential Information](image)

*Figure 3.1-4 Consequences after employing logistics support systems*

Under the streamlined information flow, other flows might circulate efficiently and continuously at the same time. Integrated enterprise resource planning (ERP) system is one of the typical logistics support systems which are now commonly employed by companies to support logistics operations and decisions making. Moreover, a lot of attached functions started to be inserted into the system to “provide real-time data to support better routine decision making, improve the efficiency of transaction processing, foster cross-functional integration, and to provide improved insights into how the business should be run” (VOLLMANN, Thomas E et al., 2005). The discussion in this paper will refer to this approach of integrated information system to create more benefits for the company.

### 3.1.5 Flows Smoothing

Integrated flows of supply chain participants through utilization of compatible software create many opportunities for improvement of existing processes in the chain. One of them is smoothing of flows. Laraia et al. (1999) refer to smoothing flows by means of eliminating wastes, streamlining bottlenecks, resolving conflicting demands, and providing simple, effective management tools to communicate status and single actions needed. Oden (1999) outlines six steps which should be taken in order to smooth the flow of the process as following:

1. Eliminate buffers
2. Search for and correct discontinuities
3. Analyze flow for redundancies
4. Maximize process throughput rate
5. Identify bottlenecks and balance flow
6. Construct and ideal flow

“Companies strengthen each other by developing smooth flows that extend all the way from suppliers of raw materials to assemblers of finished products”.

5
A good example of smoothing flows in transportation industry is related to corridors concept. Connected highways, bus lines, cycle paths, sea and air connections, canals all together create a corridor. Premius and Zonneveld (2003) gives broader interpretation of corridor which encompasses ICT infrastructure, power lines and cables, pipes for drinking water, natural gas, crude oil, electricity and sewage. Savelsberg (2008) explained the corridors notion as certain well-defined routs through which freight is carried within Europe. In addition, the importance of transportation corridors is explained by Smith (1999), who concludes that transportation corridors are most needed to prevent destruction or loss.

3.2 Operations in Goods Incoming Process

3.2.1 Goods Receiving Process

Goods receiving process is the starting point of material flow in goods incoming process. It is treated as the most conventional and simplest part in the practical warehouse management according to Hompel and Schmidt (2007). Nevertheless, the faulty receiving process may invoke even worse problems than other processes. What’s more, it is a sort of connection between suppliers and buyers, which plays an important role in creating continuous flows. Many previous researches have demonstrated the importance of this process. Bolten (1997) points goods receiving becomes the basis of inventory states and reconciliation. Tompkins and Smith (1998) present the idea of problematical receiving process which might create as much trouble in a warehouse as poor order picking or shipping operations. Hompel and Schmidt (2007) also state that goods receiving process is the first important step in the materials flow in the warehouse. Therefore, it should be disaggregated into both routine work and suitable techniques, which should be studied carefully.

A model of goods receiving process with eleven sequential steps is established by Tompkins and Smith (1998). They are: “

1. Inbound trucker phones warehouse to get a delivery appointment and provides information about the cargo.
2. Warehouse receiving person verifies the Advance Shipping Notice (ASN) and confirms it with information received by phone from inbound trucker.
3. Trucker arrives and is assigned to a specific receiving door (similar dock location is selected for boxcar receipts).
4. Vehicle is safely secured at the dock.
5. Seal is inspected and broken in presence of carrier representative.
6. Load is inspected and either accepted or refused.
7. Unitized merchandise is unloaded.
8. Floor loaded or loose merchandise is unloaded.
9. All unloaded material is staged for count and final inspection.
10. Proper disposal is made of carrier damage.
11. Load is stored in an assigned location.”

Further on, Hompel and Schmidt (2007) summarize the main tasks in goods receiving process. They are: “

6
(1) Notification of goods receipt and delivery date.
(2) Goods acceptance.
(3) Goods receipts.
(4) Incoming goods inspection.
(5) Building of loading units.”

As Tompkins and Smith (1998) and Hompel and Schmidt (2007) suggest, information flows is seen as the first step of each model. Information should be continuously transferred from carriers to receivers.

There is an important variation during goods receiving process - cross docking which is created by the worldwide famous retailer Wal-Mart. Simchi-Levi et al. (2003) describe cross docking as goods arriving to warehouse from suppliers and are transferred continuously as rapidly as possible; goods spend very little waiting time in storage. According to Tompkins and Smith (1998), applicability of cross docking should be considered in the goods receiving process. By cross-docking they mean direct distribution of materials or their combination with other goods together to deliver. They concluded:

“The simplest kind of cross docking is one in which an entire inbound load is sorted and then reloaded into one or more outbound vehicles. However, in some cases the sorting was done previously, so the amount of additional handling by the warehouse is minimized. Sometimes material from more than one inbound vehicles must be assembled to complete the outbound loads. In other cases, cross docking involves the blending of materials on an inbound vehicle with other material that is already in the warehouse. In this situation, the material from the inbound load is staged in a particular spot where it can be married with other material moving out of one or more storage locations.”

Consequently, cross docking is proved to be a sage tool to reduce lead time and costs. Those goods which are already sorted might be sold even before arrival and delivered immediately after arrival. In short, the goods receiving process is the beginning of internal material flow and an exchange plant of information flow.

3.2.2 Quality control

The most powerful concurrent trends in the development of clothing supply chains are discussed by Popp (2000). The authors summarize that internationalization and increasing emphasis on the role of quality for achieving customer satisfaction are the most common tendencies.

Weele (2010), who is known as a famous consultant to many large companies on procurement and governance issues, gives a definition of quality control. “... Quality control entails all activities and decisions aimed at taking the organization’s products and services to the desired quality level and to maintain that level. Quality control therefore requires intensive consultation and sound tuning between the various departments in the organization and with outside suppliers and customers.” The important contribution of the author is the development of requirement–verification cycle which helped mapping the quality control process and
developing the future strategy (Figure 3.2-1). Weele (2010) argues that quality control process encompasses not just assurance that requirements are met but also company’s ability to demonstrate this objectively. He identifies the areas of complete agreement between suppliers and customers which should be applicable to every transaction between them:

- The basic requirements of the transaction
- The way in which requirements are to be realized
- How to check that requirements are fulfilled
- The measures to be taken when requirements or expectations are not met

Figure 3.2-1 The requirement – verification cycle (WEELE, Arjan Van, 2010)

Varley (2006) outlines the areas where quality control procedures might be done. She states that quality control can take place at any point in the supply chain, and it might involve retailer’s quality control personnel working closely with suppliers’ production technologists to resolve any problems. She continues with identifying “usual places” for quality control to occur. It might be factory, distribution center or store.

Matsson (2000) refers to quality control and inspection in supplying and buying companies as a reciprocal business process. He continues with seeing them as sub-processes which together represent one common cross-company business process. That is why when a need to reengineer these processes occurs one should consider those processes as one and reengineer them from that perspective.

The issue of managing quality from supply chain perspective was faced by Romano and Vinelli (2001). They conducted a case study within Mazotto Group, one of the most important Italian textile and apparel manufacturers, with a focus on menswear clothes division. The company’s relationships between both upstream and downstream partners were of great importance to the authors. The way Mazzotto managed its relationship with partners was divided by Romano & Vinelli (2001) into “traditional” and “co-ordinated”. “Traditional” way encompassed interaction upstream with textile suppliers and sub-suppliers and downstream with distribution chains. “Co-ordinated” way of managing the relationships within Mazzotto was about establishing partnership relationships with its largest customer (almost 15 percent of overall goods volume).
In addition, “co-ordinated” way of managing enabled “super-check” procedure. Rapid check for visible defects (holes, marks, loose threads) was replaced with more detailed and precise evaluation called “super check”. The idea behind this is designers’ identification of key quality requirements to new collection and meeting of these requirements on each stage of supply chain. Mazarotto’s experience has proved that garments which passed rapid check sometimes completely failed “super check” as described by the authors of the case study. The most important conclusion from the study of Romano & Vinelli (2001) is “…the specific application of quality procedures and the constant attention to quality parameters at every stage of production within the supply network have altered the way in which not only Marzotto, but also all the actors in the network, operate”. This case study has proved one more time that through collaboration measures quality defects will be eliminated on the earliest stages of the chain which will result in the decreased amount of unsatisfied customers.

3.2.3 Packaging and sorting

These activities enable material flows to be transferred to the last points of goods incoming process. Ebeling (1990) states packaging must be adequate for protection and containment of goods and materials through handling, warehousing, shipping and distribution operations. Johansson et al. (1997) stresses that packaging process plays a crucial part in making a logistics system efficient and packaging shall protect, identify and facilitate goods handling. Hellström and Saghir (2006) explain that packaging might help to communicate with consumers due to attractive box appearance. Overall, packaging performs the flow function, market function and environmental function. In this paper, the authors focus on the flow function of packaging. Constantly, packaging process might be integrated with production, sorting, distribution or other operations. Whilst, packaging, as one of the nodes in the whole goods incoming process should also maintain the continuity of the material flow.

Casson (1987) explains production process as a set of activities and each activity, according to him, has two distinct aspects: transformation and sorting. He stated that sorting occur when the output streams have compositions that differ from one another in some systematic way. As a part of goods incoming process, sorting fosters the division of material flow into sub-flows which as a result influences the efficiency of goods outgoing process.

3.2.4 Storage

Storage usually is the last step in goods incoming process and meanwhile is the temporary destination of material flows. Information flow will become more complex in storage area due to identification of storage bin and the variety of products. An important factor in this process is the transparency of flows. Hompel and Schmidt (2007) summarize the universal procedures of storage as:

1) Distribution to storage area. The material flow might be divided into two directions. The first way is called split-lot storage, meaning transport directly to the place of consumption or into shipping area after verification of back orders. Another term used simultaneously is cross-docking.
(2) Identification. The storage unit should be first identified. As a result, the material flow is synchronized with the information flow.

(3) Assignment of the storage bins and put-away. The most suitable storage bin should be determined according to quite a variety of criteria which result from physical, warehouse operational, technical, security and legal requirements.

3.3 Wastes

Flows circulation is a process not without wastes. “Companies are still in a world of batch and queue processing, with armies of expediters and progress chasers working to beat the system and cope with the chaos. These remedies do not dig deep enough really to transform the ways companies operate – they have too often been seen as bolt-on extras” (JONES, Daniel T et al., 1997). In order to overcome the chaos Genchi Genbutsu principle implementation is needed. By Genchi Gonbutsu collecting of all actual data about the process is meant. This principle is one of the main approaches at Toyota production System which is also known as Lean approach. Goldsby and Martichenko (2005) identified seven most common wastes in logistics:

1) The waste of inventory

Inventory contains 5 to 30 percent of manufacturers’ total assets and sometimes may even represent half of retailer’s total assets (GOLDSBY, Thomas and Martichenko, Robert, 2005). Thus, relying on actual demand rather than a forecast is widely used by the companies, especially those, which work with goods with unstable demand. The waste of inventory includes early deliveries, order the quantity of products bigger than it is actually needed.

2) The waste of transportation

The increment of costs due to unnecessary transportation can be treated as an axiom. Transportation represents the biggest single costs in logistics. Thus, the routs have to be planned in the most efficient way with the usage of the optimal modes of transportation most suitable for each concrete case. In addition, excessive transportation within internal process should be eliminated.

3) The waste of space and facilities

The layout of a warehouse, working places allocation should be designed in a wise way and specifically for each concrete case. Moreover, it is important to achieve highest possible truck filling rate as well as filling rate of the box, in case company store its goods in boxes in the warehouse.

4) The waste of time

Time is one of the most important metrics in evaluation of logistics performance. And the most universal requirement from all aspects is ultimately “on time”. That’s why companies strive to enhance their competitiveness by providing faster and more efficient service. Nevertheless, much “waste of time” has already been realized within
companies, including procurement, warehouse management and order cycle etc. Poor communication, faulty organization, and inappropriate decision will result in the waste of time and delay. Thus, this waste should be eliminated from every possible process.

5) The waste of packaging

Packaging as a source of waste generates from two aspects. Perhaps the most obvious waste occurs when the packaging failed to protect the goods adequately due to using cheap materials. This invokes the waste of damaged goods in quantity. On the other hand, when the acquisition cost of packaging exceeds its demonstrated value, waste of packing is found again. Moreover, packaging itself creates a lot of waste in practical operations. Many kinds of packaging are used only once and then disposed into waste stream. Sustainability becomes the key words when deal with packaging waste. Consequently, appropriate packing material should be selected and reusable packing should be taken into account first.

6) The waste of administration

Not only administration might be considered as a help, but also a hindrance in operation. Now and then, conventional communication causes some misunderstanding, leading to the waste of administration. And the unexpected outcomes will influence other aspects as well. However, information technology will breed the desired oversight and ease of administration.

7) The waste of knowledge

As a kind of resource, knowledge is possibly most often wasted within an organization and it is difficult to be realized due to its feature of invisibility. Knowledge from customers may help to develop right products and make customers aware of the offering. Knowledge related with suppliers may boost the coordination. Knowledge associated with competitors may facilitate to create competitive advantages. In addition, knowledge from employees may simplify the conduct of strategies. Hence, the waste of knowledge should be avoided to establish knowledge ecology in both external and internal operations.
4 Empirical Work

This chapter provides a collection of important data which is related to our research field at online clothes retailing company Nelly.com. All information presented below was obtained due to interviews with Nelly’s personal on different levels, starting with operational manger and ending up with shop floor workers and due to our observations. The passage starts with company overview: vision, operational activity, statistics data as well as organizational structure. Following this section, mapping of incoming goods process will be done. It will be suggested to consider incoming goods process as a corridor within organization which consists of different areas: receiving goods area, packing and sorting area, transfer area (ABC area) and warehouse or storage area. The information received due to interviews will be presented next. The rest of the chapter depicts the observations to be done on each step of incoming goods corridor. In addition, the results of three investigations with the purpose of tracking a box of garments will be exhibited.

Every generation laughs at the old fashions, but follows religiously the new.  
*Henry David Thoreau*

4.1 Company Profile

Nelly.com, previously known as Nelly.se, started its functioning in the year of 2004 with the office located in Boras. These 6 years of its successful existence proved that clothes industry is developing all the time. People want to look fashionable tracking the latest tendencies in fashion through different means of communication. Even thought in a couple of months or years they might find their look ridiculous, in present time, still, they are following the latest tendencies. The level of “clothes extremality” depends on personal characteristics and the environment a person is staying in. Thus, Nelly.com provides people with means to express themselves according to their current wishes and desires but at the same time following the latest tendencies of every minute changeable world – world of fashion.

Nelly’s vision is providing trend conscious men and women with inspiring range of fashion and beauty products. The target group is represented with boys and girls in the age from 18 to 35 years old.

Starting from 2007 Nelly.com became a part of media company Modern Time Group, MTG AB Business Online. MTG is known due to possessing the second largest geographical television operations in Europe. MTG service, Viasat Broadcasting, is the largest TV-operator in Scandinavia and Baltic Countries. In addition, it operates channels in Czech Republic, Hungary, Slovenia, Balkans and Russia – in general 24 countries in the world and is a place to work for 100 million people.

The company classifies itself with the following features: wide range of products, well-known and unique brands and quick delivery service. Nelly.com is a pure representative of e-tailing company. Its activity is done through the e-commerce site which proposes a wide range of products: for both men and women, children and clothing for pregnant. Bags, shoes, accessories, jewellery, watches, lingerie, swimwear, cosmetics and much more things can be found on its web site as well.
Promotion of the company is mainly done through Internet, TV and radio, journals and newspapers. The latest promo-campaign was related to participation in Fashion Week in Gothenburg. Upcoming event, which undoubtedly, will attract many customers - is live chat through Nelly website with the most famous blogger in Sweden – Kenza.

The organizational structure of the company is functional, and consists of 9 departments: customer service, warehouse, administration, IT, purchasing, marketing, Web, photo-studio and returns. The factors which foster the unitization of all departments into one entity are related to personnel’ understanding the company’s strategy and striving for achieving its goals. From another perspective, IT department besides its direct responsibilities also performs a function of unitization of all departments through maintaining the work of ERP system, which is called “Harmony”. The organizational chart of the company is presented in the Figure 4.1-1.
Figure 4.1-1 Nelly’s organizational Chart
Statistics Data about the amount of garments received each week at the end of the year of 2009 and until April 2010 is presented in Figure 4.1-2.

Figure 4.1-2 Amount of garments received (weeks’)

Months’ tendency of the amount of receiving articles is presented Figure 4.1-3.

Figure 4.1-3 Amount of garments received (months’)

4.2 Mapping Goods incoming process

Nelly’s entire warehouse department consists of two teams. One is goods incoming team, the other one is goods outgoing team. Both incoming process and outgoing process were keeping changing frequently in the past, thus, the scope of the research will be limited to the current
circumstances. Due to this limitation, the authors choose the research approach to be in the form of interviews with current relative employees.

In order to get an overview of goods incoming process, the authors interviewed the team leader of it. 35 full-time employees and uncertain part-time employees enable functioning of goods incoming. Table 4.2-1 depicts the main content in this interview.

**Table 4.2-1 Interview: the whole goods incoming process**

<table>
<thead>
<tr>
<th>Stages</th>
<th>What departments are involved in the goods incoming process?</th>
<th>What are they responsible for in goods incoming process?</th>
<th>How long does the whole process take?</th>
<th>Do you have some suggestions on how to improve the process?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Purchasing department</td>
<td>Make purchase order, sample inspection, photo shoot</td>
<td></td>
<td>Better cross-functional collaboration between purchasing department to exchange more information</td>
</tr>
<tr>
<td>2</td>
<td>Goods receiving</td>
<td>Receive goods, confirm actual quantity received</td>
<td>1-3 days</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Packaging and sorting</td>
<td>Quality control, pack and sort, measure and weigh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Warehousing</td>
<td>Put goods in store, take down the location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Data maintenance</td>
<td>Input all information collected by the previous steps into Harmony</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As the table depicts, goods receiving process is associated with purchasing department and warehouse department. Purchasing department will order products from suppliers, negotiate with them, inspect product samples and arrange photo shoot, while warehouse department will be responsible for goods receiving, packaging, sorting, warehousing and relative data input. Normally, the whole process will take one to three days, but will take more in problematic cases.

In order to optimize the process, better cross-functional collaboration between purchasing department and warehouse department is expected from the interviewee point of view. Sometimes goods incoming process may be postponed due to emerged questions. In particular,
workers don’t know when the goods will arrive and what kind of goods will arrive. Moreover, an essential problem is absence of purchasing orders in the “Harmony” system. Thus, the received goods cannot be identified by the workers and will stay in the receiving area until the purchasing orders appear in the system.

4.2.1 Structure of goods incoming corridor

Goods incoming process can be described in the form of corridor. It consists of such areas as receiving goods area, packing and sorting area, transfer area (ABC area), and warehouse or storage area. The layout of the corridor is depicted in Figure 4.2-1.

![Figure 4.2-1 The corridor of incoming goods process](image)

With the purpose of avoiding confusions in our work and making this part understandable for readers we named each area of this corridor as following:

- Receiving goods area
- Packing and sorting area
- Transfer area (ABC area)
- Warehouse or storage

The name “ABC” area was created because in that concrete area we saw letters on the wall. Each letter served as an indicator of some special part of the warehouse. The order of letters was not alphabetical that is why we agreed upon naming it in alphabetical order and we ended up on “ABC” area. In addition, Appendix 2 depicts more information about the goods incoming corridor.
4.2.2 Goods Receiving

Goods receiving process is the first important part to understand in the whole goods incoming process. The authors interviewed one of Nelly’s two goods receivers on the 28 of April. The detailed information is depicted in Table 4.2-2.

Table 4.2-2 Interview: goods receiving process

<table>
<thead>
<tr>
<th>Stages</th>
<th>Interview Questions</th>
<th>Do you have some suggestions on how to improve the process?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Count the box</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Check the Följesedel (delivery note) inside</td>
<td>Suggest suppliers print the number of purchase order on the boxes</td>
</tr>
<tr>
<td>3</td>
<td>Verify the corresponding purchase order in Harmony</td>
<td></td>
</tr>
<tr>
<td>4 (Y)</td>
<td>If exist, move on to the next step</td>
<td>In that case, 2 or 3 hours</td>
</tr>
<tr>
<td>4 (N)</td>
<td>If not, request an order to the purchaser in the system</td>
<td>In that case, approximately 1 or 2 weeks</td>
</tr>
</tbody>
</table>

The receiving goods process starts with the arrival of transportation trucks. But the receivers don’t know when the goods and what kind of goods will be delivered. They will firstly check the document from the drivers and ensure that the goods are unloaded with the right volume in the receiving area. Then all of the boxes should be opened. Normally, there will be a Följesedel - delivery note, with the details of the goods inside and they should check whether the information consistent with actual situation. For example, if it is said that there are three different kinds of shirts in the box, then it ought to be.

To move on, the goods receivers will enter “Harmony” system to seek out the matched purchase order in terms of the information provided on the delivery note, including article number, amount, color and size. Usually, it is convenient to search by the name of supplier, for example “10 feet”, to find out the purchase order within a smaller range. In case the order exists in the system, they can arrange all the goods to move to the following step. In that case, this process will be finished in minimally two or three hours. On the other side, if the order doesn’t exist, the receivers will move those goods to another area which serves as storage for the arrived goods without purchasing order, and at the same time make a note on a certain list.
The purpose of doing this is notification of purchasers about goods arrival and asking for the purchase order to be added into the “Harmony” system. After goods receivers get the order, the goods will continue to move in a normal way in the flow. In case “harmony” is missing the order, the whole process will take much more time, approximately one or two weeks, due to a long waiting state. When it happens to important and expensive garments, the situation will be different. Receivers of goods could go to purchaser directly.

Nevertheless, the interviewee also keeps thinking how to improve this process. It is difficult to again find goods after putting away or mixing them together. Because there is nothing can be recognized on the surface of boxes. Thus, the process can be significantly speeded up if suppliers might print the number of purchase order on the outer pack so that different goods could be identified easily and quickly.

4.2.3 Packaging and sorting

In the packaging and sorting area, there are three different working tables. One of them is mechanical plasticizing (Table 1) with one person working for both packaging and sorting. The second place is manual plasticizing (Table 3) with six persons doing the same work. Between those two tables, there is the other table – a sorting table (Table 3) with three persons only working on sorting. Whichever of three tables the process commences, the procedures are similar. The sole distinction is that some goods need to pack and sort; some of them just need to pack or sort. Sequentially, the authors made the following interview to comprehend the process of packaging and sorting on the 29 of April. The main questions and answers are depicted in Table 4.2-3.

Table 4.2-3 Interview: packaging and sorting process

<table>
<thead>
<tr>
<th>Stages</th>
<th>Interview Questions</th>
<th>Do you have some suggestions on how to improve the process?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Print out purchase order</td>
<td>It mainly depends on the mixability of goods. The regulation efficiency for the process of packaging and sorting is set as 800 pieces of garments per</td>
</tr>
<tr>
<td>2</td>
<td>Quality control and take two samples of each item to purchasers</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Packaging and then sorting</td>
<td></td>
</tr>
</tbody>
</table>
First of all, the workers print out the purchase order from Harmony. Before they start to pack and sort, they have to do a random inspection of 5% of the order with a purpose of identifying damages or inferiors. In addition, they will also put two samples into one special box and take it to purchasers so that they could check the garments as well as arrange photo shoot. Then the goods are packed with plastic bags and classified by different items, colors and sizes. Afterwards, the workers count the numbers of different garments and verify the information on the purchase order. If it is matched, they will mark on the corresponding figures on the order. If not, they will write down the actual number on it. Figure 3.1-1 shows how they deal with this.

![Figure 3.1-1 Counting and verifying purchase order](image)

First, they count the number of garments and ensure it is match with purchase order, then mark the purchase order person per day. Measure and weigh one piece of garment, then write down the results on purchase order. Move goods to "transfer area".

![Figure 4.2-2 Marking purchase order](image)

When the amount is right

When the amount is not matched, then change to the actual number
Follow on, the workers will go to an electronic scale to weigh and measure one piece of garment together with the plastic bag, and take down the results on the purchase order. Finally, they will put the order together with those goods and flitting to “transfer area” which links up this process with warehousing process. It is difficult to say how much time the process takes due to some uncertainties such as mixability of products. For example, sorting of one hundred garments with two different colors will take less time than sorting of the same amount of goods with five different colors. Nevertheless, Nelly presents a prescriptive efficiency of 800/person/day for both packaging and sorting. But if the work is single pack or sort, then the efficiency should be 1600/person/day.

At the end of this interview, the interviewee also assumed an ideal status in which suppliers are responsible for plasticizing and sorting.

4.2.4 Storage

In warehousing process, all the goods in the “transfer area” should be moved to storage areas which compose of low frequency area and high frequency area. In general, just arrived goods will be transferred to high frequency area. If the amount of shipments is very low, they will divert them to low frequency area. In order to know the concrete procedure, the authors interviewed a warehouse worker, on 30 of April. Table 4.2-4 summarizes the main content.

Table 4.2-4 Interview: warehousing process

<table>
<thead>
<tr>
<th>Stages</th>
<th>Interview Questions</th>
<th>Do you have some suggestions on how to improve the process?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pick goods from &quot;transfer area&quot; and move to corresponding place in storage area</td>
<td>It mainly depends on the velocity of seeking out vacancy for those goods</td>
</tr>
<tr>
<td>2</td>
<td>Search for vacancy on the shelf</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Put goods into the vacancy and write down the number of location</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Input all the data collected on the purchase order into Harmony</td>
<td></td>
</tr>
</tbody>
</table>

Date: April, 30

Place: storage area at Nelly

Interviewee: Jon Prtersson Hjärne

Interviewers: Alona Golovatova and Jinshan Zhou

Table 4.2-4 Interview: warehousing process
Nelly’s storage area related to goods incoming process consists of two main warehouses. One of them is low frequency warehouse (WH1) in which goods are sold slower with smaller volume. The other one is high frequency warehouse (WH2) in which goods are ordered quickly in quantity. So the latest arrived goods from goods incoming process will be located in WH2 which include eleven different divisions. The divisions are named by capital letters from A to F and also J, K, L, M, P. The layout of WH2 is denoted in Figure 4.2-3.

![Figure 4.2-3 Layout of high frequency warehouse (WH2)](image)

Goods with higher demand will be located in division A to E, including shoes and women’s clothes. F is a storage area especially for return goods. Men’s wear, Kids’ wear and accessories will be put in J and K. M is a division with clothes hangers. Standard units will be put in division L or E. And expensive garments will be moved in division P, the entrance of which will be locked all the time.

Firstly, the warehouse workers carry the goods on the handbarrow and move to storage area. Then they will seek out an empty box on the storage rack to put those goods in. There are ID numbers pasted on the edge of goods shelves, which indicate the exact location. The authors record one sample number as Figure 4.2-4.

![Figure 4.2-4 ID number on the storage rack](image)
The ID number will be certainly written down on the purchase order with the purpose of convenient identification. The last but not the least, all of the information collected on the paper should be input into Harmony. The time spent in warehousing process primarily depends on how fast the worker may seek out the vacancy for goods.

Likewise, the interviewee proposed an orientation to improve current operation. Because he feels difficult to find out empty boxes to put goods in, the situation might be changed by a better vacancy searching approach.

4.3 Observations of Goods Incoming Process

In order to understand all the processes which are done for moving garments from receiving goods area to the warehouse we observed all areas which compose incoming goods corridor. Our observation stories are presented in the following passage.

4.3.1 Observation story 1

Location - receiving goods area

We entered receiving goods area and we saw what we actually expected. Many boxes, some of them were located on the shelves, the other stood in the middle. There was one PC there and two workers who took care of boxes. What they actually did – opened the boxes, took the delivery note (notice from supplier about what was shipped, articles numbers and the amount), went to the PC and checked “Harmony” for purchasing order existing in the system. Then some boxes were left on the shelves, and another – moved to the next area.

4.3.2 Observation story 2

Location – packing and sorting area

The first impression we got - many people rush around. All this area can be visually divided into three parts: with machine packing table (T1), table for manual sorting of packed goods (T2), table for manual plasticizing and sorting (T3). In the corners there are a few tables with PCs, working places for warehouse manager, her assistants and team leaders. Along the wall boxes with clothes are allocated which actually wait for being processed. A trolley with carton paper just arrived and was left near the sorting table. Sorting personnel uses pieces of carton in order to separate sorted goods in the box. The thing is that after sorting of the goods they are putted into the box again and on this stage that piece of paper helps to avoid mixing of garments.

Sorting table (T2) – sorting of packed garments. Two persons stand near the table. Behind them – boxes with clothes. A girl starts sorting, before that she went to the PC and printed Purchasing order. After sorting is finished, she started counting and made some notes in the order. On this stage she also measured and weighted one piece of garment from each sorted pale. Then garments are putted to the box again (with separating piece of carton) and moved to the next area – transfer or ABC area.
Table for manual plasticizing and sorting (T3). This area looks much more crowded. Eight persons stand near the table. Being near them made us feel in a hurry because everything they did was in a fast pace. Boxes with unpacked clothes stood behind those people. The process which occurs here can be described as following: after taking a box, a person puts clothes on the table. Then workers start to put clothes into plastic bags. Usually two persons work on the same box. When they finish, garments are putted to the carton boxes without sorting. Boxes with plasticized garments, but still unsorted, are located on the other side of the table. When the whole bulk of clothes from boxes are plasticized, workers will go to find empty boxes. They relocate to the other side of the table and start sorting by putting clothes to those empty boxes (three boxes represented sizes XS, S, M). At this moment they had three filled boxes of sorted goods. But still garments were uncounted. The way to count them is to relocate to another box and at the same time to count. A mark on each box is done which indicates the number and size of garments in the box.

Table for mechanical plasticizing (T1). This work is doing by a female which uses special machine. Many boxes are around her. Automated plasticizing is applicable for goods the weight and dimensions of which are bigger than all other received goods. We observed jeans packaging into plastic bags. It took her 30 seconds to plasticize a pair of jeans.

4.3.3 Observation story 3

Location - Transition area or ABC area

In this area some letters on the wall are written. Each letter represents some part of the warehouse (men clothes, children clothes, etc). Workers from previous area come and leave the box with goods in the raw of right letter. After some period of time, a warehouse worker will come and pick the boxes.

4.3.4 Observation story 4

Location - Warehouse area

If a person spent a couple of hours in the warehouse he or she might notice that it plays a crossroad’s role. It is a place where incoming and outgoing processes cross each other. Workers with trolleys of boxes arrive and allocate goods on the shelves. At the same time, workers from outgoing process area come and pick the garments ordered by the customers. The whole warehouse is divided into two parts: warehouse for products with low customers demand and warehouse for highly demanded clothes. Each place on the shelf has its own number. Thus, the worker who picked up the box from ABC area knows approximate area in the warehouse where the goods should be located. Next task he or she should do – is to find an empty box on the shelf. As we observed, it can take more than 5 minutes to do that.

In addition to observations, we spent one day in the warehouse in order to investigate all processes which take place there. Firstly, our plan was to track one box of goods all way long from the time when it arrived to the receiving area and until the moment when goods are located in the warehouse and all necessary information added to “Harmony”. Our idea was not
realized to the hilt because no goods left the receiving goods area that day. Thus, our investigations started from the next area - as we called it, packing and sorted area.

4.4 Investigations

4.4.1 Investigation 1

*Manual sorting of goods packed in plastic bags (Table2) with one type of garments and their moving through incoming goods corridor*

We kept track on one box of packed men shirts (the same type) and kept track on time required to process this box. Results are presented in Table 4.4-1:

Table 4.4-1 Tracking of one box of garments (same clothes type) and their movement through the incoming goods corridor

<table>
<thead>
<tr>
<th>№</th>
<th>Operations, conducted by the worker</th>
<th>Time</th>
<th>Spent time, min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Start</td>
<td>Finish</td>
</tr>
<tr>
<td>1.</td>
<td>Checking the system</td>
<td>11.02</td>
<td>11.03</td>
</tr>
<tr>
<td>2.</td>
<td>Checking the system, another PC</td>
<td>11.04</td>
<td>11.05</td>
</tr>
<tr>
<td>3.</td>
<td>Printing order (including waiting for others to print)</td>
<td>11.05</td>
<td>11.07</td>
</tr>
<tr>
<td>4.</td>
<td><em>Sorting of one size, including</em></td>
<td>11.07</td>
<td>11.11</td>
</tr>
<tr>
<td>5.</td>
<td>Checking the order</td>
<td>11.08</td>
<td>11.10</td>
</tr>
<tr>
<td>6.</td>
<td><em>sorting of another size, including</em></td>
<td>11.11</td>
<td>11.14</td>
</tr>
<tr>
<td>7.</td>
<td>checking the order and making marks on the order</td>
<td>11.13</td>
<td>11.14</td>
</tr>
<tr>
<td>8.</td>
<td>Putting the product into the box, including</td>
<td>11.14</td>
<td>11.17</td>
</tr>
<tr>
<td>9.</td>
<td>*Went to find the separating paper <em>3 times</em></td>
<td>11.15</td>
<td>11.16</td>
</tr>
<tr>
<td>10.</td>
<td><em>Went to measure and weight the product</em></td>
<td>11.17</td>
<td>11.18</td>
</tr>
<tr>
<td>11.</td>
<td>Closed the box and moved it to the sorted area (ABC area)</td>
<td>11.18</td>
<td>11.21</td>
</tr>
</tbody>
</table>

| Overall Spent Time | 11.02 | 11.21 | 18               |

**NEXT STAGE OF MOVING THROUGH RECEIVING GOODS CORRIDOR – TRANSFER AREA (OR ABC AREA)**

<table>
<thead>
<tr>
<th>№</th>
<th>Operations, conducted by the worker</th>
<th>Time</th>
<th>Spent time, min</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Another person checked the order</td>
<td>11.21</td>
<td>11.23</td>
</tr>
<tr>
<td>13</td>
<td>Checking one more time and went away</td>
<td>11.23</td>
<td>11.34</td>
</tr>
<tr>
<td>14</td>
<td>Came and put the box to the trolley</td>
<td>11.34</td>
<td>11.34</td>
</tr>
<tr>
<td>15</td>
<td>Cutting the edges of the box including leaving it in special trolley (edges will be used as separating paper later)</td>
<td>11.34</td>
<td>11.36</td>
</tr>
<tr>
<td>17</td>
<td>Moving trolley to the WH2, goods are at the WH2</td>
<td>11.36</td>
<td>11.39</td>
</tr>
</tbody>
</table>
Starting from 11.46 the worker couldn’t find the place for leaving goods in the warehouse. This search had been lasting for 11 minutes. He explained that to us as “mistake in the order occurred”. At that time, we didn’t reach our goal. Goods were in the warehouse but nobody knew where to put them. So following our investigation, we continued to track that box, but this time in a wrong direction – back to the ABC area. We also kept track on time. The results are presented in Table 4.4-2.

### Table 4.4-2 Tracking the same box of garments (back to the transfer area) because of mistake

<table>
<thead>
<tr>
<th>№</th>
<th>Operations, conducted by the worker</th>
<th>Time</th>
<th>Spent time, min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Start</td>
<td>Finish</td>
</tr>
<tr>
<td>18</td>
<td>Search for the empty box to put the goods in</td>
<td>11.39</td>
<td>11.46</td>
</tr>
<tr>
<td>19</td>
<td>Went back to the computer and ask colleagues</td>
<td>11.46</td>
<td>11.57</td>
</tr>
<tr>
<td></td>
<td><strong>Overall Spent Time</strong></td>
<td>11.46</td>
<td>11.57</td>
</tr>
</tbody>
</table>

The box stayed at the ABC area for 1 hour. Some workers came and took other boxes to the warehouse, but the box of our interest still stayed on its previous place. Finally, in 1 hour and 19 minutes the box was picked up by another worker and 5 more minutes were spent for transporting and finding the place on the shelf.

#### 4.4.2 Investigation 2

**Manual sorting of goods with plastic bags (Table 2), the box contains various types of garments**

*The box of our interest in this investigation consisted of different types of products such as jeans vests and T-shirts of different colors and patterns.*

We observed a female worker doing her job at the table which was located in the area of packing and sorting. This box looked much bigger. We tracked every step of her working process and the results of our work are presented in Table 4.4-3.
Table 4.4-3 Tracking of the box with different kinds of garments, starting from T2

<table>
<thead>
<tr>
<th>№</th>
<th>Operations, conducted by the worker</th>
<th>Time</th>
<th>Spent time, min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Start</td>
<td>Finish</td>
</tr>
<tr>
<td>1</td>
<td>Open a box (mixed products, sizes, colors)</td>
<td>14.16</td>
<td>14.17</td>
</tr>
<tr>
<td>2</td>
<td>Put everything on the table</td>
<td>14.17</td>
<td>14.18</td>
</tr>
<tr>
<td>3</td>
<td>Put some garments back to the box again</td>
<td>14.18</td>
<td>14.20</td>
</tr>
<tr>
<td>4</td>
<td>Printing the order</td>
<td>14.20</td>
<td>14.23</td>
</tr>
<tr>
<td>5</td>
<td>Took empty box W1</td>
<td>14.23</td>
<td>14.24</td>
</tr>
<tr>
<td>6</td>
<td>Checking the order</td>
<td>14.24</td>
<td>14.26</td>
</tr>
<tr>
<td>7</td>
<td>Sorting of product A by sizes (24 pieces)</td>
<td>14.26</td>
<td>14.30</td>
</tr>
<tr>
<td>8</td>
<td>Sorting of product B by color and sizes, including</td>
<td>14.31</td>
<td>14.37</td>
</tr>
<tr>
<td>9</td>
<td>Went to find empty box W2</td>
<td>14.31</td>
<td>14.32</td>
</tr>
<tr>
<td>10</td>
<td>Finished sorting of product B color 1 by sizes and put to box W1</td>
<td>14.32</td>
<td>14.35</td>
</tr>
<tr>
<td>11</td>
<td>Finished sorting of product B color 2 by sizes and put into box W2</td>
<td>14.35</td>
<td>14.37</td>
</tr>
<tr>
<td>12</td>
<td>Sorting of product C, D, E, F</td>
<td>14.37</td>
<td>14.40</td>
</tr>
<tr>
<td>13</td>
<td>Went to find empty boxes W3 and W4, W5</td>
<td>14.41</td>
<td>14.42</td>
</tr>
<tr>
<td>14</td>
<td>Finished sorting of product C and put it to box W3</td>
<td>14.42</td>
<td>14.44</td>
</tr>
<tr>
<td>15</td>
<td>Finished sorting of product D and put into box W4</td>
<td>14.44</td>
<td>14.47</td>
</tr>
<tr>
<td>16</td>
<td>Finished sorting of product E and out into box W5</td>
<td>14.47</td>
<td>14.50</td>
</tr>
<tr>
<td>17</td>
<td>Went to PC to check the system and printed new order</td>
<td>14.50</td>
<td>14.54</td>
</tr>
<tr>
<td>18</td>
<td>Talking to staff, went to receiving goods area</td>
<td>14.55</td>
<td>15.02</td>
</tr>
<tr>
<td>19</td>
<td>Went to find box W6</td>
<td>15.02</td>
<td>15.03</td>
</tr>
<tr>
<td>20</td>
<td>Finished sorting of product F and put it to box W6</td>
<td>15.03</td>
<td>15.05</td>
</tr>
<tr>
<td>21</td>
<td>Making marks on the order</td>
<td>15.05</td>
<td>15.06</td>
</tr>
<tr>
<td>22</td>
<td>Went to ask something from colleagues</td>
<td>15.06</td>
<td>15.08</td>
</tr>
<tr>
<td>23</td>
<td>Went to weight and measure A, B, C, E</td>
<td>15.08</td>
<td>15.15</td>
</tr>
<tr>
<td>24</td>
<td>Moved the products to ABC area (L-place)</td>
<td>15.15</td>
<td>15.17</td>
</tr>
<tr>
<td>25</td>
<td>Boxes were still in the ABC area</td>
<td>15.17</td>
<td>15.25</td>
</tr>
<tr>
<td>26</td>
<td>General time of the process including moving to ABC Area</td>
<td>14.16</td>
<td>15.25</td>
</tr>
</tbody>
</table>

4.4.3 Investigation 3

Manual plasticizing and sorting of goods without plastic bags (location - Table 3)

Due to our investigations, described above, we had seen many operations which didn’t bring any value for the customers. And those two investigations didn’t include manual packing. So, we became very interested in the next area - a table where manual packing and sorting were done by the employees. As we observed, employees just packed garments into plastic boxes...
from the very beginning, without any sorting. They took clothes out from the boxes, packed it, and putted it back to the boxes. Those boxes, with packed goods, were moved to another side of the table. Sorting process didn’t start until all goods of the same type were packed into plastic bags. Thus, those boxes, waiting for sorting, created stops within material flow. The results of our observation are presented in Table 4.4-4.

Table 4.4-4 Tracking manual plasticizing and sorting of garments (location - T3)

<table>
<thead>
<tr>
<th>№</th>
<th>Operations, conducted by the worker (2 persons)</th>
<th>Time</th>
<th>Spent time, min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Start</td>
<td>Finish</td>
</tr>
<tr>
<td></td>
<td>PACKAGING, SORTING, QUALITY CONTROL AREA – 1 box consisted of 18 pieces of clothes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(shorts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Open a box (mixed products, sizes, colors)</td>
<td>13.36</td>
<td>13.37</td>
</tr>
<tr>
<td>2</td>
<td>Packing into plastic boxes (18 pieces from one box)</td>
<td>13.37</td>
<td>13.41</td>
</tr>
<tr>
<td>3</td>
<td>Putting packed garment into the box (18 pieces from one box)</td>
<td>13.41</td>
<td>13.42</td>
</tr>
<tr>
<td>4</td>
<td>Create new boxes</td>
<td>13.42</td>
<td>13.47</td>
</tr>
<tr>
<td>5</td>
<td>Observed goods stayed in the box until all garments were packed into plastic boxes</td>
<td>13.47</td>
<td>13.55</td>
</tr>
<tr>
<td>6</td>
<td>Sorting (all boxes)</td>
<td>13.55</td>
<td>14.06</td>
</tr>
<tr>
<td>7</td>
<td>Observed box (with already sorted clothes) stayed there and waited until the rest of</td>
<td>14.06</td>
<td>14.14</td>
</tr>
<tr>
<td></td>
<td>garments were sorted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Counting through replacement into the other boxes (one box)</td>
<td>14.14</td>
<td>14.15</td>
</tr>
</tbody>
</table>

**Overall spent time** 13.36 13.36 39

As one may see, from 39 minutes of processing the garments 16 minutes were spent just for waiting.
5 Analysis

In this chapter empirical findings are collected and analyzed. Analysis of findings is also conducted from theoretical frameworks perspective, described in details in the Chapter 3. Following this, the identification of problems on each stage of the corridor as well as suggestions to perform in more efficient way are presented in the rest of the paper.

Flow management takes a systemic view regarding all processes operated in supply chain. This view recognizes all connected nodes and links, and involves integrated business processes among those entities. Ericsson (1998) explains external material flow and internal material flow from the perception of Material Management. Lumsden (2009) states that four different flows exist in an organization, which are monetary flow, resource flow, material flow and information flow. Moreover, nine information elements are summarized by Lumsden and Mirzabeiki (2008). In Nelly’s case, material flows start from suppliers, go through warehouse and usually end up with ultimate consumers. As Lumsden (2009) presents, Nelly also operates with horizontal information flow and vertical information flow. Nevertheless, the flows are interrupted frequently by worthless activities and sometimes personnel are not aware of the resulting consequences. The absence of some information associated with goods incoming process postponed the goods circulation and increase the total operating costs.

It is acknowledged that flows are interrelated to one another. Hoek (1998), Xu (2009) and Vanpoucke et al. (2009) state the necessity of flows integration. The modified model based on Xu’s research outlines an expected integration of e-commerce market, which should be taken into consideration by Nelly’s executives in the future. Thus, logistics support systems such as ERP and EDI will facilitate integration by smoothing information flows (VOLLMANN, Thomas E et al., 2005). Nelly has already implemented its own ERP system – “Harmony”, which includes such modules as article management, purchasing management and warehouse management. But they should also keep tracking on system improvement in order to make it more appropriate with their progressing business. Thus, new modules might be added to Nelly’s ERP system in the future.

At Nelly interruptions in information flow caused by purchasing department are created when there is no purchasing order in the “Harmony system” and receivers will not allow those goods to continue moving through the goods receiving corridors. Those goods will stay at the goods receiving area and wait until purchasing order appears in the system. Thus, interruptions in the information flow don’t allow creation of continuous material flow at Nelly.com.

A concrete model of goods receiving process in warehouse operations is presented by Tompkins and Smith (1998). It consists of eleven steps which companies should follow in order to enhance efficiency and effectiveness. The first step starts with information from truckers, which means the deliveries of goods should be scheduled rather than random arrivals’ usage. It is emphasized that some preparations which might speed up the overall goods incoming process should be done during this lead time, especially in the peak season. Currently, Nelly’s goods receiving process has not been structured as this classical model proposes, which invoked some problems within the whole goods incoming process. Goods receivers couldn’t verify information and appeal absent purchasing order before goods arrival.
Suitable empty boxes couldn’t be ready for plasticizing and sorting. Moreover, vacancies on storage rack in the warehouse couldn’t be arranged earlier. Consequently, a lot of wastes have been created, particularly the waste of time.

Simchi-Levi, Kaminsky and Simchi-Levi (1998) think cross docking should be adopted in goods receiving area in retailing industry. It is also involved in Tompkins and Smith’s (1998) model and regarded as a sage tool to reduce lead time and gain more customer satisfaction. Yet, as a typical retailer in fashion industry, Nelly don’t implement cross docking. The goods which don’t need to plasticize and sort will stay in stock alike other goods, waiting for customer orders without any added value. On the contrary, it might create the wastes of value and time.

5.1 Good receiving area

5.1.1 Problems Analysis

According to the interviews, the problems in Nelly’s goods receiving area will be identified and analyzed. This area is a confluence of material flow and information flow oriented from purchasing department, delivery agents and warehouse department. Nevertheless, there are some problematic elements in the actual operations. They are as following:

(1) Lack of information. Even if goods receiving area plays a connectional role, Nelly’s goods receivers couldn’t get sufficient information from both purchasing department and delivery agents. They don’t know when goods are loaded on the truck, when the truck will arrive, and what kinds of goods are delivered. This situation directly leads to a passive waiting state in the whole warehouse. And it is impossible to positively prepare something without that information from truckers. Moreover, goods will be idled for a long time due to the absence of purchasing order in Harmony system, which means purchaser didn’t put order for every buying behavior. Although important goods will be coped relatively fast, it still impacts the efficiency of the warehouse.

(2) Mingled goods flow. After goods are received by Nelly, they are not divided in a distinct way. Suppliers mixed different goods in one box and receivers may blend different boxes again, which generates non value-added repeatable work.

5.1.2 Suggestions for goods receiving area

As suggested by Tompkins and Smith (1998), in their model of receiving goods, the following activities should be implemented within the company.

(1) Cross-functional collaboration. Purchasing department, delivery agents and warehouse department should exchange more information to progress a continuous information flow. Communication is a key word in the implementing process. In short, cross-functional collaboration is a prerequisite of future improvement.

(2) Responsibility institutionalization. Making purchasing order should be set as compulsive duty to purchasers according to the classic function model presented in
theory. If they are overloaded, it is better to hire more purchasers to work on such core position in the company or flexibly reallocate someone when needed.

(3) Scheduled delivery. Truckers should notify receivers by phone and at the same time inform the detailed data about the goods and time. Thus, the goods receivers will be booked equably. Moreover, they may verify the purchase order in terms of information provided by truckers and fix the absence of order ahead of arrival. If a big amount of goods will arrive, they may empty the goods receiving area in advance.

(4) Goods Classification. In goods receiving process, the goods are completely mixed together with different articles, packages, sizes, and colors in each box. Connected with the following steps plasticizing and sorting, the goods should be grouped as Table 5.1-1 in goods receiving area.

<table>
<thead>
<tr>
<th>Packed</th>
<th>Goods 1</th>
<th>Goods 2</th>
<th>Goods 3</th>
<th>Goods 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Sorted</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
<td>×</td>
</tr>
</tbody>
</table>

Therefore, four pallets should be put in the working area. When receivers check the purchase order in the system, it is easy to identify what kinds of goods they are. So they can put different goods on different pallets sequentially and also number these four pallets as Table 5.1-1. In that case, goods can be moved in a unit of pallet with corresponding categorization. Then the material flow starts to be branched into matched channels.

![Figure 5.1-1 Material flows from goods receiving area to packing and sorting area](image)

(5) Quality control. As the preceding theories, damages of goods may occur in any process in the warehouse. Varley (2006) concluded that quality control may appear at any point in the supply chain. So we propose to arrange a quality controller to work in goods receiving area before goods are moved to next step in order to identify the damages and inferiors at the first moment. Meanwhile, interruptions in next processes will be eliminated and the inspection will be more professional as well.
(6) Cross-docking and material flows. Tompkins and Smith (1998) emphasized the importance of sorting to be done as early as possible in the process with the purpose of minimization of additional handling. At Nelly after goods inspection, the receivers may move goods into different channels. Cross-docking should be implemented on Goods 1, because they don’t need to be plasticized and sorted, and Nelly may start to sell those products online before their arrival. Thus, it’s better to map out a special corridor for those goods from receiving area directly till outgoing area. In that case, goods might be quickly transferred to the end and distributed without any storage time. This is the first material flow. Goods 2 should be transferred to sorting table, and Goods 3 will be moved to mechanical packaging table. While, Goods 4 will be transported to manual packaging table. When one of the tables is overloaded, the receiver can slickly relocate the goods. However, big garments which are difficult to pack by hand should still be moved to mechanical plasticizing table. The material flows can be denoted as Figure 3.1-1

(7) Flexible work. Arrange these two goods receivers to be responsible for internal transportation from receiving area to packing and sorting area and from packing and sorting area to transfer area. In addition, they should also manage boxes flow which includes collecting of empty boxes and separating papers, and put them to the right place. However, the work is very flexible which can be done out of goods receiving hours.

5.2 Packaging and sorting area

5.2.1 Problems analysis

A person, who doesn’t know much about incoming goods process at Nelly will find the area of packing and sorting very unstructured. Although visual division due to three tables’ allocation exists, still, it is hard to get a clue about differences of what is happening on those tables from the very beginning. A well structured process requires to be implemented. Everything should be organized in a just-in-time way which will foster smoothing of the material flow and reduce the waiting time of boxes to be processed through different stages of the corridor.
Through investigations described in the previous part of this paper it became possible to outline problems and inconsistencies which exist within this part of the corridor. The main problem is a waste of time related to waiting for others to print the order, searching for boxes and separating papers, consulting with colleagues. As investigation 1 (sorting table T2) showed, from 18 minutes of processing goods 4 were spent just for sorting. The rest of the time was devoted to supplementing activities, among which wasting time activities mentioned above. The time of activities, which were done by the worker in order to process one box is presented in Figure 5.2-1. The activities in red cycles are directly related to those, which should be performed in packing and sorting area. All other activities are considered to be supplemented. If the process to be organized in more structured way then the elimination of

![Manual sorting of plasticized goods (one box), investigation1](image)

**Figure 5.2-1 Manual sorting of plasticized goods (investigation 1)**
most of the supplementing activities will be achieved. Much time will be saved and more work will be done by the employees.

![Manual sorting of plasticized goods (one box), different types of garments (investigation 2)](image)

**Figure 5.2-2 Manual sorting of plasticized goods (investigation 2)**

Investigation 2 proved once again that essential amount of time was spent for activities which could be eliminated. The main task of the worker here was sorting goods. The overall time for processing one box was one hour, from 14.16 and until 15.15. Such activities, done by the worker, as putting a part of garments back to the box, searching for empty boxes and bringing...
them not all together but one by one, reprinting the order, waiting until the printer became available because somebody else was using the PC, consulting with colleagues could be seen as the main reasons for interruptions in the creation of continuous material flow from receiving goods area and until warehouse shelf. Graphic interpretation of all activities and their time frames, which took place during investigation 2 are presented in Figure 5.2-2. According to the chart, a worker spent 22 minutes for sorting and rest 62 percents of time - for supplementing activities.

Investigation 3, which took place in the area of manual plasticizing and sorting showed how much time it took for the box to be moved to the next area-transfer area and is depicted as Figure 5.2-3.

![Chart](image)

**Timing of manual plasticizing and sorting (investigation 3)**

- Counting through replacement into the other boxes (one box)
- Observed box, waiting time until other boxes are sorted
- Sorting (all boxes)
- Observed goods stayed in the box until all garments were packed into plastic boxes
- Create new boxes
- Putting packed garment into boxes (18 pieces from one box)
- Packing into plastic boxes (18 pieces from one box)
- Open a box (mixed products, sizes, colors)

**Figure 5.2-3 Manual plasticizing and sorting (investigation 3)**

According to the chart, the box with goods stayed waiting for being processed for 8 minutes in both of cases: first time the box waited for finishing the plasticizing process of all garments, the other time – when the goods were sorted but not counted. Waiting time was 16 minutes from overall 39 minutes, which is 41% of overall time.
Thus, the problems which became visible due to our observations and investigations are the following:

1) Waste of time which occur when worker distract him- or herself from work in order to find an empty box;

2) Waste of time which occur when worker is run out of separating papers and tries to find it or just create a new one by tearing it from another boxes;

3) Waste of time when workers wait for others to print the order;

4) Waste of time when workers should reprint the order and sometimes to do it again, wait for others to print;

5) Previously mentioned individual activities create a “messy” atmosphere (when one is searching for box, another person waiting for PC to be free, another – can’t understand the problems in the order and consulting a colleague, and the other – mover to warehouse, cannot finds a right place and wants to clarify purchasing order, if the person doesn’t know the answer – he will ask another, and of distracting from work chain effect occurs)

5.2.2 Suggestions for packing and sorting area

Ebeling (1990) concluded that packaging must be adequate for protection of goods. Nelly’s approach to packaging is absolutely relevant in this case. Nelly’s plastic bags can be characterized with high level of water resistance, low cost, light weight, strength, and have less environmental effect. Thus, goods are protected from damages and cost savings are achieved.

Following the previous part of the paper, where it was suggested to divide material flow into 4 different flows, the same idea should be supported in the sorting and packaging area through corridors creation. The notion of corridors in transportation was realized by Priemus and Zonneveld (2003), Savelsberg (2008) and their benefits by Smith (1999). Corridors concept is widely used in the variety of industries, thus it might be possible to implement it within inbound logistics flows. We propose the corridors notion usage at Nelly.

(1) For Goods Flow 1 Green Corridor should be created meaning that this flow of garments will pass through sorting and packaging area without any stops and will be moved directly to the next area – transfer area;

(2) For Goods Flow 2 Yellow corridor should be created meaning that these goods will move directly to the sorting table;

(3) Goods flows 3 and 4 should move through the Red Corridor meaning to the table where they will be plasticized manually or mechanically depending on the type of the goods;
(4) Red Corridor will emerge with Yellow Corridor. This means when the goods are plasticized, worker puts them to the box and pushes this box to the sorting table which is located in the Yellow Corridor. This is possible due to small dimensions of the sorting and packing area;

(5) All paper work on this stage is eliminated;

(6) Workers don’t waste time searching for the boxes or separating papers because goods receivers keep track on those activities;

(7) Measuring and weighting are not performed on this stage.

The process might look as it depicted in Figure 5.2-4 or Appendix 3.

![Diagram of the Goods Packaging and Sorting Area through Corridors Interpretation](image-url)

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**Figure 5.2-4 Process in the Goods Packaging and Sorting Area through Corridors Interpretation**
5.3 Transfer or ABC area

Investigation 1 showed again, the waiting time for the box with sorting and counted goods to be moved to the next stage – warehouse area - remained essential (Figure 5.3-1). The box with men’s shorts stayed in this area for 18 minutes. 11 minutes from those 18 were spent for checking the order, going away, checking the order one more time.

Figure 5.3-1 Time of activities in the transfer area

The main problem in this area is an essential amount of waiting time. This is caused by different reasons among which checking purchasing order, asking colleagues about the place in the warehouse where the goods should be left, leaving goods in the transfer area in case when the right place in the warehouse could not be found, etc. To overcome this problem we come up with the following suggestions which support and develop the idea of previous passages:

(1) Garments in boxes stay in the transfer area for some period of time, so we suggest conducting measuring and weighting of clothes in this area

(2) Paper work was eliminated from sorting and packing area and we propose to transfer ABC area into paper work center meaning that workers who measure and weigh garments will be also responsible for counting and adding all this information into “Harmony”
5.4 Storage area

5.4.1 Problems analysis

As the preceding description of storage area, it composed of two different sectors. One (WH1) is for goods with low demand and the other (WH2) is for goods with higher demand. The problems identification will mainly concentrate on the process from transfer area to WH2, because the latest arrived goods will go this way. Reviewing the interviews, we may see the most prominent difficulty is searching vacancies for goods in the warehouse. Furthermore, if we eliminate the mistake with order in the investigation, it is also the most time-consuming operation in this area. This perception is graphed in the bar diagram (Figure 5.4-1).

![Time-consuming from transfer area to WH 2](image)

Figure 5.4-1 Time-consuming from transfer area to warehouse of high frequency (WH 2)

Therefore, the problems emerge from this phenomenon which indicates a faulty-structured warehousing process, location of goods in particular.

5.4.2 Suggestions for storage area

Compared with the core procedures summarized by Hompel and Schmidt (2007), Nelly should strive for effective integration of material flow and information flow during the step of identification. According to the problems identified in the warehousing process, suggestions will mainly focus on how to efficiently identify empty boxes on the storage rack from two perspectives: warehouse operations and IT department.

The suggestions from warehouse operations perspective might be implemented by hands as follow.
(1) Vacancy creation. Due to the implementation of scheduled delivery, goods details and arrival time will be informed in advance. During this lead time, warehouse workers should empty some boxes on the storage rack. If there are three boxes of accessories arriving in the coming week, they should check the accessories area to relocate some products. For example, sometimes there is only one necklace in the box. Then they can remove the necklace and put it into another box contained other products. Thus, more empty boxes will be maintained for newly arrived products. A sequential method is suitable in this case, meaning the workers might relocate the necklace into the following box or sectors of one box. Consequently, it will become more convenient for workers to relocate goods and update all necessary information.

(2) List of vacancies. Before goods arrival, warehouse workers can easily make a documental list of those created vacancies and then paste it on the entrance of WH2. Thus, all empty locations are visible to everyone.

(3) Goods from transfer area to WH2. During this process, the warehouse workers should check the list of vacancies when they pass by the entrance. Select anyone of the locations in corresponding division and write down the ID number on the purchase order. When one location is chosen, the worker should mark it on the list so that it will not be reused. Then put the goods there. Consequently, the goods flow will be more continuous and the waste of time on searching empty place may be eliminated.

Table 5.4-1 Vacancy identification model interpretation

<table>
<thead>
<tr>
<th>Vacancy Identification Module</th>
<th>List of Vacancies in WH2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>ID number of vacancy</td>
</tr>
<tr>
<td></td>
<td>Article number</td>
</tr>
<tr>
<td></td>
<td>Purchasing order</td>
</tr>
<tr>
<td>B11-12A-11</td>
<td></td>
</tr>
<tr>
<td>B11-13B-21</td>
<td></td>
</tr>
<tr>
<td>B12-15D-23</td>
<td></td>
</tr>
<tr>
<td>B12-17D-12</td>
<td></td>
</tr>
<tr>
<td>Party Dresses</td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>Accessaries</td>
<td></td>
</tr>
<tr>
<td>Makeup</td>
<td></td>
</tr>
<tr>
<td>Shoes</td>
<td></td>
</tr>
</tbody>
</table>

The function of ERP system explained by Vollmann (2005) is to provide real-time data to support better routine decision making, improve the efficiency of transaction processing, foster cross-functional integration, and to provide improved insights into how the business should be run. Nevertheless, Nelly’s ERP system couldn’t support vacancy identification, which creates an opportunity to improve through additional modules.
Alternatively from IT department perspective, Nelly may add a sub-module for vacancy identification in WH2 under the warehouse management in “Harmony” system. The list of vacancies will be detailed in this module. Then set a computer at the entrance which keeps staying in the window of vacancy identification module. When warehouse workers move goods to WH2, they can check available boxes in the computer. For example, they will transfer one box of women’s clothes and the list of vacancies is showed as Table 5.4-1.

Sequentially, “B11-12A-11” is selected by the worker. Then the worker should type the article number and the number of purchasing order in the sheet. After doing this, this vacancy will automatically disappear from the list and at the same time the location of the goods will emerge in related modules such as goods location identification module.

Consequently, the empty places can be quickly found and the information of goods location will be input in the system at the same time. The flowchart (Figure 5.4-2) below depicts the whole process with the assistance of IT department.

![Diagram](Figure 5.4-2 Information flow in the new module of vacancy identification in warehouse management)
In short, Nelly might improve the “Harmony” system by inserting the new module to achieve the integration of material flow and information flow. Moreover, the company should monitor, evaluate and renew the system continuously to make it more appropriate for new strategies implementation and control.

Lastly, the entire goods incoming process has been restructured on the basis of current scale and facilitates. Some wastes have been removed and flow transparency is enhanced. Thus, we got an adjusted warehouse as Appendix 4.
6 Conclusions

Goods incoming process is an essential component in warehouse management. Currently, academic researchers are striving to explore efficiency avenues from strategic level, tactical level and operational level. Yet, there is an enormous gap between theoretical research and practical operations. The aim through this paper was to bridge this gap to optimize the process. Consequently, relevant theories which take into account flow administration, disaggregated processes and seven wastes have been presented. Further on, an online fashion retailer’s goods incoming process has been described and analyzed through the operation of goods receiving, packing, sorting, warehousing and data input.

One clear conclusion is that flows should be smoothed when optimizing goods incoming process. In particularly, material flow and information flow should be integrated efficiently in order to streamline the whole process. It has to be understood that intermittent flows create a lot of wastes in warehouse management, invoke delays, and reduce the service level.

Thus, we conclude that seven wastes should be realized in every detail. A sensitivity analysis was performed to observe all wastes in Nelly’s goods incoming process. In this paper, worthless activities have been identified through the investigation of time-consuming in goods receiving area, packing and sorting area, transfer area and storage area. Meanwhile, some techniques such as scheduled delivery, cross-docking, goods classification, information technique were proposed to eliminate wastes.

Further on, business process reengineering should be taken into consideration after that. The problematical goods incoming process should be reorganized and restructured timely. For example, Nelly should be aware of precise quality control as it keeps growing all the time and launches more of its own brands. The process of vacancy identification in the warehouse should be simplified by logistics support system. Sometimes, a tiny adjustment within a sub-process may bring large surprises.

There are many influential factors which restrain the optimization of goods incoming process in warehouse operations. Nevertheless, companies should insist on this reformation to reduce total operating costs, accelerate circulation and enhance competitiveness when looking ahead.
7 Future Research

Goods incoming process based on common middle-sized warehouse has been presented through the paper. The vision of future research should be extended likewise Nelly’s expansion (see historical data from empirical work). Advanced information technique concerning warehouse management and information alliances will contribute to those researches. Applications of bar codes, Radio Frequency Identification (RFID) and electronic data interchange (EDI) are spreading everywhere (BOLTEN, Ernst F, 1997). Consequently, a set of challenges and business opportunities have been created. The thorough establishment of automated warehouse by using those logistics support systems should be involved in further discussions.

For Nelly’s future development, mechanized operating line for plasticizing and sorting can be used to simplify the operations and smooth the flows from goods receiving area to storage area. In addition, auto ID system in storage area may better optimize its goods location systems with paperless transfer and accurate identification. Goods will be quickly put into stock and picked from storage rack.

Further, warehouse management is composed of goods incoming process and goods outgoing process. This study focused on goods incoming process, including goods receiving, packing, sorting, warehousing and data input. Likewise, there are also interrupted flows and seven wastes found in goods outgoing process. Further studies, therefore, could turn to goods outgoing process which generally consists of (1) order transmission, (2) order processing, (3) order filling, (4) order staging and verification, and (5) order shipping and delivery (GOLDSBY, Thomas and Martichenko, Robert, 2005).

In short, the future research may address issues as “design and management of automated warehouse” with new capacity or “optimization of goods outgoing process” with existing capacity. More literature and successful cases should be studied in the domain of automatic warehouse and advanced information technique. While, the same research methods and data sampling will be still appropriate in the case of goods outgoing process.
References


HELLSTRÖM, Daniel and Mazen SAGHIR. 2006. Packaging and Logistics Interaction in Retail Supply Chain. [online].


Appendix 1: Interview with Nelly’s Operational Manager and Leader of Purchasing department

The contact persons from Nelly Company we talked to were Peter Eriksson, Operational Manager and shareholder, and Christoffer Ojerhed, newly employed to Purchasing department man. Firstly, we have to admit that both of them were very friendly and the atmosphere of the meeting was relaxed. We got a feeling that we are the one team which works in order to achieve the same goal.

We decided to hold our first meeting in the form of interview. In order to foster this process we prepared a question list, where we outlined the spheres of our interests within the company and formulated the questions. This question list was sent to Peter in advance. Due to this we received the information in very structured and continuous way.

Our first impression was that Peter is really devoted to Nelly, and it could be easily seen from his knowledge about the company and industry it operates in. Nevertheless Christoffer has been working at Nelly for 2 months it seemed that he had very deep understanding of processes, their weak and strong sides, possible areas for improvement. And it didn’t just seem - it really was like this.

What are the features of the market Nelly Operates in, asked Peter and started to draw a chart. From that simple drawing one could easily see that fashion industry is a special industry and you never know what wait for you tomorrow. Will the customer follow the latest fashion tendencies in clothes which showed up on the latest fashion weeks in London and Paris? What amount of that “trendy” stuff should we buy? Or it is better to concentrate on classical clothes, demand on which can be named as easy predictable? There is no one right answer. The only thing we can say for sure, is well, it always depends.

Peter gives a brief overview of the company. He mentions Nelly’s own production and external relationship with 400 suppliers all around the world. A big part of purchasing clothes goes to Danish brand Vila. Price and quick reaction to customer demand are the top priorities.

When it came to purchasing, Peter said that this function was done within separate department at the company. Executives realized that this area was very important and that is why purchasing personnel had weekly meetings during which they worked on the development of their skills in negotiating, e-sourcing, purchasing tools and techniques and supplier development partnership.

Another question was about sourcing and if some special strategies concerning purchasing exist. Peter’s answer made us think that Nelly is a unique company. He said that once somebody asked him “why can’t you check how you did purchasing in the past and use the same technique now?” The reply was “we are now all the time”. Old approaches cannot be applied to current situation. They should be developed and improved as our business grows.

From time to time Christoffer adds some important information which was not mention. He always wants to clarify if we understand everything because sometimes we talked about very
concrete things which require experience of working in the industry in order to get the main idea. This is a good example of team working which we were glad to experience.

We did not mention all of the information from the interview in this passage. We just wanted share our feelings about the meeting and some details which we consider to be useful to know about Nelly. The rest of the information we got from the interview is used in this paper.
Appendix 2: Nelly’s warehouse for goods incoming process - Original
Appendix 3: Process in the Goods Packaging and Sorting Area through Corridors

Interpretation

Green Corridor

Outgoing area (Cross-docking)

Yellow Corridor

Manual plasticizing table

Mechanical Packaging table
Appendix 4: Nelly’s warehouse for goods incoming process - Adjusted